Chapter 1
Upping Your Game: Transforming Teaching

Students frequently walk away from homework when it is too difficult, but difficult games are another matter–kids walk away from games when they're too easy.

–Devaney 2014

Abstract This chapter begins by introducing the game behind the book, including the mission and the first quest. The overall mission serves as the vehicle for designing and developing a curricular game while the first quest prepares the reader for any resistance he or she might encounter in the process of transforming his or her curriculum into a game. The chapter supports the reader in doing so by situating curricular games within the current context of education. In order to do this, this chapter outlines how this book conceives of game-based teaching both by describing it and by contrasting it with what it is not, building on deCastell and Jenson's (J Curric Stud 35:649–665, 2003) work. The chapter delves into the needs of the twenty-first century learners (Educ Res 29:4–15, 2000) and the workforce in the twenty-first century (The world is flat: a brief history of the twenty-first century, Picador, New York, 2007; Educ Leadersh 66:20–25, 2008) and uses learning theories (How people learn. National Academy Press, Washington, DC, 2000) to demonstrate how game-based teaching can help meet these needs. Each subsequent chapter begins with the next quest in the mission, i.e., steps in designing a curricular game, and ends with a worksheet to help guide the reader in accomplishing that quest along with a rubric. Activities called challenges within chapters are designed to help the reader apply and practice the concepts. The worksheets and rubrics along

Several sections of this chapter are taken from these previous works published under my former name with permission:
Jackson, J. (2009). Game-based teaching: What educators can learn from videogames. *Teaching Education, 20*(3), 291–304.
Jackson, J. (2011). Game changer: How principles of videogames can transform teaching. In M. S. Khine (Ed.), *Learning to play: Exploring the future of education with video games* (pp. 107–128). New York: Peter Lang.

J.J. Kellinger, *A Guide to Designing Curricular Games*,
Advances in Game-Based Learning, DOI 10.1007/978-3-319-42393-7_1

with other supporting materials such as further readings allow this book to be used as a textbook by teacher education professors as well as providing supports for teachers and professors using this as a manual to guide their own self-study in game-based teaching.

Keywords Twenty-first century learning • Twenty-first century learners • Twenty-first century workforce • Educational games • Commercial Off the Shelf (COTS) Games • Gamification • Standards • Gamers • Immersion • Transfer • Constructionism • Pro-social • Zone of proximal development (ZPD) • Scaffolding

YOUR MISSION:
As you clean up your classroom, ending another exhausting but exhilarating day of teaching, you put hardcopies of the latest educational standards you are expected to adhere to in your satchel as well as the book How People Learn, *required reading by your principal, and throw your satchel over your shoulder. You hear a noise and look up. Before you, an apparition appears, stating boldly: "You are needed in the future." You look around and pinch yourself to make sure you are not dreaming. Before you know it, you are transported to what appears to be a "messy closet" (Kaling 2011, p. 142) masquerading as an office. You look around and notice the walls are covered with elaborate maps and a desk is littered with blueprints and schematics. You find yourself thinking, "This is not the clean, sterile space-age buildings sci-fi movies promised!" A woman behind a desk peers at you intently and starts to speak in a manner that does resemble sci-fi movies, briskly and bluntly:*

> You have been transported in time. The year is 2180. World War III has devastated the planet. Since teachers were seen as cultural gatekeepers, all sides of the war targeted them. Because there are no more teachers left to teach the next generation, we are fighting to preserve our knowledge and skills. The Expert Elders have tried to pass on their knowledge, but their complete lack of teaching ability leaves everyone frustrated.[1] Due to chemical warfare and radiation, the next generation has a range of physical and cognitive impairments. In addition, a number of survivors have offspring who struggle to learn the predominant language of English. Out of desperation, I, the Commander of the Free World, commissioned an elite group of Engineering Elders to build a time machine to bring a teacher from the past into our time and a group of Historian Elders to decide who to bring back. After poring over the remaining historical documents, the Historian Elders have chosen you based on your superior reputation as a teacher. Your **mission** is to develop a curricular tool which will engage and teach future generations and serve as a model for the Expert Elders to emulate. This involves finding the elusive Holy Grail of learning—transfer, or the ability to apply a learned skill to a new context. Do you accept this mission?

"Whoah," you think, "Me, the savior of the future?" After the initial shock of being transported to a different time, you decide to approach this as you approach teaching—breaking the abstract notion of teaching into concrete, doable actions.

[1] "Though experts know their disciplines thoroughly, this does not guarantee that they are able to teach others" (Bransford et al. 2000, p. 31).

You think about the range of teaching situations which initially felt overwhelming but ultimately became fun. With renewed confidence you say, "I do." You feel as if you have just committed yourself to a marriage—a marriage of past and future, of learning and new technologies, and of yourself to the unknown.

I used to think "I don't have time to do discovery learning, I have to cover the curriculum," but I finally learned that it does not matter if I lecture until I am blue in the face if students do not learn anything. I can "cover" all the materials I want, but what really matters is what students learn. I too often fall into the trap of thinking that students cannot learn something unless I say it or show them. The truth, however, is that students do not learn something unless they say it or do it. What led me to this epiphany was one student's description of my traditional mode of teaching: "I found the class to be very long and boring and left with very little knowledge other than the fact that if you use AIM Chat on a different computer, it changes your buddy icon." Although this hurt my feelings (no matter what people say, teaching is personal), it prompted me to reexamine my teaching methods. After vowing never to teach that class again, I relented when I realized that educators had much to learn from game designers who seem to have tapped into ways to motivate people to challenge themselves. In the fall of 2006, I converted this same course into a game-like format based on techniques derived from video games. Student learning in my classes has never been the same since.

I suspect you picked up this book because you are unsatisfied with the current educational system in the United States. If not, you should be. The current educational system in the United States is built on a factory model where masses of students are processed through a conveyer belt of education with each teacher/factory worker[2] adding knowledge to their students/products. DING. The school/factory bell rings, and students/products are passed along to the next station. While educational systems across the globe vary widely, many are founded on similar dissemination models. In a world where knowledge is at everyone's fingertips outside of school, this old-fashioned model of education is not serving students at any point along the pipeline. Too many students in the United States (22 %) are dropping out

[2] This is not meant to denigrate teachers. Teachers in the United States are working so hard in a system that is more and more being crafted to thwart their best efforts (see Ken Robinson's *Changing Educational Paradigms* video). My critique is of the system—and the role of those in federal and state governments in creating that system, not of the individuals within the system who, in many cases, are merely trying to survive. As a former high school English teacher, I know this survival mode first hand. My hope is that this book creates a means by which individual teachers can transform that system, or at least find ways to make that system work for them and for student learning, instead of against them.

of high school (Stillwell and Sable 2013, p. 4), with some cities reporting dropout rates as high as 50% (Barab et al. 2012, p. 308). Too many students in the United States require remedial classes when getting to college (Shulock 2010). Too many businesses find their newly hired workers lacking in skills (Massachusetts Business Alliance for Education (MBAE) 2008). And too many of those students are students of color (Darling-Hammond 2010). Why are so many students so ill-prepared for the world of work? Because the achievement gap is really between how schools define achievement and how businesses do.

Business leaders have made clear the skills they need for the twenty-first century workforce: "creativity and innovation, critical thinking and problem-solving, communication and collaboration" (MBAE 2008, p. 14). These are the same skills identified by the Partnership for Twenty-first Century Skills, a group founded by business leaders in 2002 and by Friedman (2007) and Wagner (2008), both of whom interviewed a range of business leaders. Businesses are no longer vertical hierarchies like the factory model of the past, but rather have horizontal work flows with ad hoc groups from around the globe capitalizing on the various skills each bring to the table (Friedman 2007). Meanwhile, our schools are focused on standardized testing where students are passive consumers praised for regurgitating information and discouraged from risk-taking by grades which are used to reward compliance and punish mistakes. This industrial model of education does not prepare students for the world of work today.

Schools that prepared workers for the industrial age did not need to produce "big-picture" thinkers because the vast majority of workers just needed to know their part on the assembly line—whether that be in a factory or as a teacher of a subject in a high school. Now, however, workers need to be able to see connections and utilize systems thinking, i.e., see the big picture, in order to solve problems and accomplish the tasks of today's world of work:

> The world is effectively shrinking and getting more complex. For instance, we're confronted with problems of enormous complexity and global ramifications (e.g. nuclear proliferation, global warming, antibiotic-resistant microbes, terrorism, and unstable governments). When faced with such complex problems, the ability to think creatively, critically, collaboratively, and systemically and then communicate effectively is essential. Learning and succeeding in a complex and dynamic world is not easily measured by multiple-choice responses on a simple knowledge test. (Shute 2011, p. 506)

As early as 1987, Resnick pointed out the dangers of this gap between work and schooling:

> As long as school focuses mainly on individual forms of competence, on tool-free performance, and on decontextualized skills, educating people to be good learners in school settings alone may not be sufficient to help them become strong out-of-school learners. (quoted in Putnam and Borko 2000, p. 5)

As Crockett et al. (2011) point out: "It's ridiculous to continue to embrace standardized learning and standardized tests at the very same time our new economy is

eliminating standardized jobs" (p. 3). Schools in the United States and a multitude of other countries have not adapted to the new realities of today.

Not only is there a mismatch between business needs and school expectations, but there is a gap between the twenty-first century learners and schools. School life is in sharp contrast to what many students experience outside of school.[3] Prensky (2001b) quotes a student who says he has to "power down" (p. 3) when he goes to school. Meanwhile, many schools are still steeped in the old pedagogy of fact-based learning. It is no wonder that "In a national study, nearly half of recent high school dropouts said that a major factor in their decision was that their classes were not interesting" (MBAE 2008, p. 12). The consequences of this gap between experiences in school and experiences out of school have large implications for teaching and learning.

As educators, what can we do about these disconnects? Fortunately, two of the three elements described here do match: students' lives outside of schools and expectations of business leaders. For example, Raines (2002) found that the twenty-first century learners expect their workplace to resemble the global advances in business Friedman describes (2007) with the following characteristics topping the list: challenging, collaborative, fun, and flexible (cited in Schrum and Levin 2009). Because students' out of school experiences include being consumers and producers in their technology-rich worlds which are experiences they often do not have in school, Project Tomorrow found that less than forty percent of US students surveyed felt their education was preparing them for their future jobs (Prabhu 2009). The experiences that best prepare the twenty-first century learners for the twenty-first century workforce seem to be taking place largely outside of school. In fact, it could be argued that by and large the outdated modes of teaching still found in schools around the world will impede students' abilities to thrive in their professional lives: "All children are getting left behind, trapped in a deficient educational model that leaves them ill-prepared for the globalized workplace of the twenty-first century" (Joseph 2008, p. 258). One teacher calls this "educational malpractice" (Holt 2013).

Matchmaking

So what exactly is it that is so engaging in students' personal worlds that is largely excluded from schools? There are lots of answers to that question: social media, opportunities to be creative and showcase that creativity for a global audience, and chances to share opinions and be a part of public debate. In this book, however, I am going to focus on one—one that defies the stereotype of youth today as having short attention spans, one that can engage people for hours on end, and one that some people, myself included, can sometimes spend years trying to finish just one of them: video games.

[3] The video "A Vision of K-12 students today" is one of many that illustrate the contrast between students' lives, their futures, and their schooling.

A Pew Research Center survey reported that 97% of 12- to 17-year-olds play video games, with 50% stating they played yesterday (Lenhart et al. 2008, p. 8). Video games are not just mere entertainment, video games teach. Video games teach knowledge. Video games teach skills. Video games teach dispositions. This is why it is so important to pay attention to the video games with which youth are engaging. First-person shooter video games teach. They teach so well that the Columbine shooters used video games to practice their tragic plot, prompting one investigator to state they were "playing out their game in God mode" (Pooley 1999, p. 32). However, just as with any tool, video games have the potential to be good or bad or somewhere in between. For example, games can encourage pro-social or antisocial behaviors (Anthes 2009), although De Castell and Jenson (2003) point out that the impact of all games, including antisocial ones, must be examined within the larger culture of the players, which also may sanction violence.

Fortunately, there are more video games on the shelves than just first-person shooter games. Adventure games such as the *MYST* series require problem solving and critical thinking to complete them. Massive Multiplayer Online Role-Playing Games (MMORPGs), such as *World of Warcraft*, not only require problem solving and critical thinking but also communication and collaboration. Other construction and management simulations (CMSs) like *SimCity* and *MineCraft* require all of the previous skills plus creativity and innovation. Do these skills sound familiar? They should. These are the skills business leaders identified as necessary for the twenty-first century workforce.

PROPOSAL QUEST: *After being brought into the future and meeting with the Commander, you feel the weight of your mission—the future survival of the human race. You think about your most intense learning experiences, and you realize that the times in your life when you have been most engaged in learning, engaged to the point where "time does not seem to exist" (Rieber et al. 2008, p. 30), what you have heard some refer to as "flow" (Csikszentmihalyi 1990), is while playing video games. You know you are not the only one who has felt this pull: "One online game popular among college students,* EverQuest*, is jokingly known as 'EverCrack' because of the amount of time its 'addicted' players spend using it. . . . One college student recently confided to [a researcher that] he had skipped an exam because he was so close to 'beating' a video game" (Prensky 2002, p. 6). Despite being such powerful learning tools, you know that teachers rarely play video games themselves (Sandford et al. 2006), probably because they feel they don't have time, although interestingly the Greek and Latin words for school derive from "game" and teachers in Ancient Rome were called "*magister ludi *(literally,* Game Master*)" (Botturi and Loh 2008, p. 17). You ask yourself, "What is it about videogames that afford such deep learning experiences?" You decide to reflect on at least three different kinds[4] of*

[4] Just like literature, people have classified video games in lots of different ways. However, there are some generally agreed upon genres like first-person shooter, adventure, role-playing, racing games, etc. (for more, see "Video game genres" in Wikipedia). The goal of this quest is for readers to realize there are different kinds of video games, to explore some of them, and to realize that different types of games are more suited for certain types of learning. Van Eck and Gikas' Matrix

video games you have played in the past and play at least three new ones developed in this new era, in order to evaluate them as learning tools by analyzing their affordances, what a tool enables a user to do, and, constraints, what a tool restricts a user from doing, in terms of three ingredients of learning: content (something to learn), motivation (desire to learn), and pedagogy (way to learn). In order to do so, you start by consulting Bransford et al.*'s book* How People Learn*, particularly chapters 2 through 6, conveniently in your satchel.* **ACTION**: Play three new video games and fill out a chart listing the affordances and constraints of three new ones and three video games you have played in the past in terms of content, motivation, and pedagogy.

> ***You decide videogames can and should be used as a learning tool****. You then* **write a proposal** *to the Commander to persuade her that videogames hold the answer to her goal—and your mission—of teaching their next generation. You include in your proposal a description of the pedagogical advantages of videogames and explanations of how to counter any constraints.* **ACTION**: Write a letter to the Commander to convince her that videogames can be used as learning tools.
>
> ***OR***
>
> ***You decide that videogames should not be used as a learning tool****. You then, read on (particularly Table 1.1)… and either*
>
> *-return to this quest if you change your mind.*
>
> *OR*
>
> *-justify why video games should NOT be used to teach*

Pedagogical Uses of Video Games

There are lots of examples and articles written about schools using video games to teach. However, De Castell and Jenson (2003) point out that too many educational games are structured so that the learning tasks are unrelated to the overall game structure. Some call this the "broccoli and chocolate" approach, referring to educational games that have players learn something (the broccoli), and once they have mastered it, usually assessed by a quiz, then they get to play a short video game (the chocolate).[5] As such, the learning tasks get in the way of succeeding instead of providing the basis for success. Van Eck (2007) also reiterates the need for learning tasks within games to be "endogenous," or authentic and integrated parts of the game, and Klopfer et al. (2009) warn against games that are "little more than interactive quizzes (p. 2) that test isolated facts. As Klopfer et al. (2009) aptly put it: "If your spaceship requires you to answer a math problem before you can use your

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of Game and Learning Taxonomies (Table 1.3) outlines their assessment of learning in video games by genre based on Gagne's five types of intellectual skills.

[5] Brenda Laurel in 2001 referred to educational video games as "chocolate-covered broccoli."

Table 1.1 Pedagogical advantages of video games[a]

What are some of the best ways to foster learning?	How do video games do this?[b]
Creating a storyline (Gee 2007a; Simmons 2001; Brown 2000)	Having a back story (Turkle 1984)
Setting proximal and distal goals (Bandura 1997)	"Telescoping" (Johnson 2005), or a hierarchically organizing objectives
	Having a "win state" (van Staalduinen and de Freitas 2011) as the final goal
Inducing "flow" (Csikszentmihalyi 1990), or a state of total engagement	Through "total immersion" (Prensky 2006) leading to an "altered state" (Turkle 1984)
	"Sensory stimuli" (van Staalduinen and de Freitas 2011)
Achieving "fluency" or "automaticity" with routine matters (Bransford et al. 2000) through practice so working memory can be devoted to problem solving	"Automat[ing] knowledge" (Johnson 2005) so player can focus on higher objectives
Using "mastery learning" (Bloom 1980), or showing mastery of basic concepts and/or skills before moving on to more complex concepts/skills	"Leveling up" (Prensky 2006), or moving to a more challenging level after achieving mastery of the previous level
Having a reward system (Skinner 1953)	"Seeking" (Johnson 2005), or exploring an environment in search of further rewards
Providing instant feedback (Bransford et al. 2000)	Having "just-in-time" learning (Gee 2003), i.e., feedback that lets the player know how he/she is progressing
Using inquiry/discovery learning (Bruner 1961), a process of figuring things out often by testing hypotheses	Using "inductive discovery" (Prensky 2006)
	Involving a process where players "probe, hypothesize, reprobe, rethink" (Johnson 2005)
	Using "mistakes [as] learning opportunities" (Shaffer 2006)
Operating in the "Zone of Proximal Development" (Vygotsky 1978), i.e., challenging students without being too challenging	Using "adaptivity" (Prensky 2006), games adapting to level of player
	Operating on the "edge of regime competence" (Gee 2003), ability to play in challenge zone
Introducing knowledge when needed or relevant instead of disconnected facts (Bransford et al. 2000)	Supplying information "on demand" (Gee 2007b), i.e., when it is needed in game play
Employing "metacognition" (Bransford et al. 2000), or an awareness of one's own learning	Viewing mistakes as "opportunities for reflection and learning" (Gee 2003)
	Ability to take on multiple roles/identities (Gee 2003)
"Building on previous knowledge"/ "transfer" (Bransford et al. 2000)	Having an "action-domain link" (van Staalduinen and de Freitas 2011), i.e., applying lessons learned during game play to new situations
Fostering a "community of learners" (Lave and Wenger 1991)	Creating "affinity spaces" (Gee 2007a), or groups of people and tools on which players rely on for further learning

(continued)

Table 1.1 (continued)

What are some of the best ways to foster learning?	How do video games do this?[b]
Teaching "meaningful pattern recognition"—including recognizing disparities, identifying relevant details (and ignoring irrelevant ones), creating analogies, and understanding how elements relate to one another (Bransford et al. 2000)	"Probing" (Johnson 2005) or making meaning from one's environment
	Figuring out "rules" (van Staalduinen and de Freitas 2011) that govern how elements interact
	Solving "investigative puzzles" through pattern recognition and analogy creation (Squire 2011)
Providing "conditions of applicability" (Bransford et al. 2000), or learning when different rules apply	Employing the "principle of expertise" (Gee 2007a), once rules have been mastered, changing, or refining the rules
Employing "deliberate practice" (Bransford et al. 2000), or opportunities to tinker in ways that help the learner understand a system	Providing a "fish tank" (Gee 2007a) or "sandbox" (van Staalduinen and de Freitas 2011), simplified game spaces where players can learn the rudiments of game play through exploration
Providing "contrasting cases" (Bransford et al. 2000), or a series of cases designed to refine a concept	Constructing "well-ordered problems" (Gee 2007a), or problems that build on and refine knowledge and skills gained in previous problems
Providing "scaffolding" (Vygotsky 1978), or supports a student needs to learn something	Providing hints, tutorials, and other resources (Gee 2007a; van Staalduinen and de Freitas 2011), online communities, forums, or spaces outside and within the game space that provide supports for game play
Giving learners a "sense of control" (Csikszentmihalyi 1990)	Giving players a sense of "agency" (Squire 2011), i.e., active decision-maker
Introducing "cognitive dissonance" (Festinger 1957), i.e., when incoming information contradicts prior knowledge	Creating a "mystery" (van Staalduinen and de Freitas 2011), or encountering something puzzling
Providing a risk-reduced environment (Bransford et al. 2000)	A sense of "safety" (van Staalduinen and de Freitas 2011) that "allows for risk-taking and experimentation, thus providing players with more learning opportunities" (p. 42)
"Learning by doing" (Bransford et al. 2000)	Providing opportunities for "performance before competence" (Gee 2007a; Shaffer 2006), or doing something first in order to learn about it

[a]It should be noted that none of these elements operate in isolation, and it is the interaction of these elements that create pedagogical affordances (see Bedwell et al. 2012)
[b]It should be noted that not all video games have all of these elements

blasters, chances are you'll hate the game and the math" (p. 25). Klopfer et al. (2009) advise that instead of "making a game *out of* learning" (p. 27), educational game designers should "find *the fun* in that learning" (p. 27) or "find the game in the content" (p. 31). As situated cognition suggests (Driscoll 2005), learning should be embedded in an authentic context where interrelationships and systems can be explored. De Castell and Jenson (2003) provide a framework (see Table 1.2) for the qualities that make for better educational games. These qualities will be explored

Table 1.2 Guidelines for educational games adapted from de Castell and Jenson (2003) originally printed in Jackson (2011)

Games should	Games should not
Allow players to construct knowledge	"Extrinsically reward correct answers to simple factual questions"
Be interactive	Simply be "display and exposition"
Be based on a storyline	Consist of a series of random facts
Allow user to "negotiate an immersive environment"	Be a "stand-alone task completion"
Allow for "role enactment"	Limit role exploration
Enact consequences based on player's actions	Have limited feedback
Enable learning to be a "by-product" of a player's actions	Have learning be incidental to game play
Encourage exploration of an environment with multiple paths to success	Presents tasks in a "linear and lock-step fashion"
Allow for collaboration and creation of a "community of practice" (Lave and Wenger 1991)	Limit resources
Be voluntary	Be compulsory
Provide instant feedback	Provide no feedback
Have problem solving be a part of the game structure and story	Have problem solving be incidental to the narrative structure
Have built-in rewards that are intrinsic to the game	Have rewards that have nothing to do with game play
Allow the player to define and redefine his/her goals	Focus on measuring "learning outcomes" based on prescribed standards

more in depth throughout this book since they will serve as guideposts for your own classroom game.

"What's that?" you say. "My own classroom game?" This book addresses one of the main problems of using commercial off-the-shelf (COTS) video games in the classroom: they are not geared toward specific learning objectives and often lack academic content (as you may have discovered in your quest) so teachers have to bend the curriculum to fit the game instead of bending the game to fit the curriculum. Well, perhaps the curriculum needs to be bent some, or at least be a little more flexible, but a teacher's reality in today's culture of standards is "coverage, coverage, coverage." There are some video games that allow users to modify or "mod" them, in other words to change the source code to alter the game. However, few teachers have the time to learn the skills needed to do so. Instead, this book focuses on how teachers can convert their curriculum into a game. In fact, game-based pedagogy has been around for thousands of years: "Using games for learning and teaching is not new. In ancient China more than 4000 years ago, *weiqi [Go]* . . . was used to train military strategists, chief executives, high-rank officials, advisors in think tank[s], and profound intellectuals" (Jin and Low 2011, p. 396). This book is not about playing video games in the classroom and it is not about one-shot game lessons like using a *Jeopardy* format to review for a test or having problem-solving races, this book is about the "transformational possibilities" (de Freitas and Maharg 2011) of using techniques of video games to revolutionize curriculum.

Gaming, however, has largely been regarded as something students do outside of school; some even label it a "waste of time." I propose educators leverage the affor-

dances of games by "gaming the system," in other words incorporating gaming into the current educational system. I use this phrase intentionally as it implies working within a system in ways that system did not anticipate in order to "exploit it for your own personal gain" (McGonigal 2011, p. 19). In this case, our own "personal gain" as teachers is increasing student learning and the system is that of traditional schooling whose conventions in many ways lie in direct opposition to some of the conventions of gaming. For example, using "distributed cognition" (Gee 2008, p. 32) by relying on tools and others to solve problems common in MMORPGs is a strategy traditional schooling would punish as "cheating." Intentionally making mistakes to find out what happens like gamers often do is an act that traditional schooling discourages through bad grades. Despite these contradictions between schooling and gaming, this book suggests ways teachers can use the principles of video games to transform their teaching by redesigning their curricula using game design principles and to do so within the current constraints of conventional schooling.

This book takes you through the steps to design, test, and implement a curricular game without technology (no tech), with the technology you (probably) already know (low tech), with technology you can easily learn (medium tech), and with (for most) new technologies (high tech). You do not need to learn how to program (although you can). You do not even need to learn how to turn on a computer. You can convert your curriculum into a game without any technology whatsoever. For example, the mission and accompanying quests in this book required no technology outside of the word processor I typed them on to create them. No matter what level of technology you use, your curricular games will leverage common techniques from video games in order to promote learning. For a sneak peek into ways to do this, I excerpted some "ready-to-use" teaching practices below from Mecoli (2013), practices she developed based on Gee 2005 article "Learning by design":

1. **Opportunities to Codesign**: In the game world, players are often given opportunities to help determine what will happen in the game and what direction it will take. When there are opportunities for choice in the classroom (choice of project, choice of reading, choice of day's activities), we might be able to draw upon this principle.
2. **Identity**: In the game world, players immerse themselves in certain identities. They fully take on personas. Thinking about ways we can authentically get students to see themselves as writers, as scientists, and as consumers may encourage them to more fully try on engaging identities.
3. "**Just-in-Time**" **Instruction**: James Gee has talked about playing video games for the first time and trying to read the game's manual *before* playing the game. He remembers how much more useful it was once he was deep into playing and could reference the sections he needed at that specific point in time. Immersing students in a task and then providing them with lessons or resources when they reach a point of need utilizes the same principle.
4. "**Fish Tanks**" **and** "**Sandboxes**": In the gaming world, both of these phenomena are common. A "fish tank" is a simplified environment of the game where a player can gain practice. A "sandbox" is a practice world where the gamer can play around and experiment before taking on the actual level without fear of conse-

quences. In the education world, finding ways to let our students first play around with the content of a lesson without fear of failure would accomplish the same.

5. **Skills as Strategies**: Video game players know why they need to develop certain skills. They're used in service of completing some segment of the game. Contextualizing skills in service of accomplishing authentic goals that are clear and explicit to students follows the same logic.

I do have a word of caution, however, about converting your curriculum into a game. Beware of just layering superficial aspects of video games onto your already existing curriculum, such as using badges, which can lead to the opposite of the intended outcome:

> "We're really missing out on some of the elements that make real games compelling when we just boil it down to the leaderboard and achievement levels and badges. If you don't have the fun factor in there, I'm not sure that it really qualifies as a game." [G]amification, [Gillispie] proposes, is "really just getting back to the old gold star on the chart…. You need unexpected things, you need hard, difficult choices … telling a story that sucks people in, the continuous feedback, giving kids a challenge at just the right level, where it's tough, but not frustrating" [DiCerbo adds] … [whereas] games-rewards structures are really "behaviorism in a disguised form" … [which leads to students thinking], "Oh, I'm just doing this to get the reward." The result: a decrease in motivation. (Schaffhausser 2013, p. 33)

The process described in this book involves a total transformation of curriculum into a game, not piecemeal additions of badges or leaderboards that just dress up curriculum as a video game, what some call "gamification." However, some use the term "gamification" and its verb form "gamify" to simply mean converting something into a game, which is how those terms are used in this book.

Can gamifying your curriculum be done in the context of standards? It already has been. Some educational video games, like *Lure of the Labyrinth*, have been aligned with common core standards. The *Quest to Learn* schools, located in New York City and Chicago, are based on game design and tied to standards. The description of their curriculum captures the linkage between games and learning: "drop [students] into inquiry-based, complex problem spaces that are scaffolded to deliver just-in-time learning and to use data to understand how they are doing, what they need to work on, and where to go next" (Salen et al. 2011, p. xi). Although this book argues that schools should move beyond standards, standards are the reality of today's teaching. However, standards do not dictate *how* teachers have to teach those standards. Instead, standards can be used as launching pads for creativity, or, in *Quest to Learn's* case, creativity can be used to help students both meet and move beyond standards:

> Test scores, an admittedly conventional metric, show the Quest kids have outperformed peers in the New York City school system in each of the last three years, in both English Language Arts and Math, according to data provided by the school. The only exception was 2010 math scores, when the school averaged 671 compared to 675 for the city… [However] Salen [the school's founder] says how she measures performance isn't quantitative: It's the engagement she sees in students at the school—the attentive look kids have on their faces when they're playing the games; the way they're able to speak clearly about what they're learning and why it's important. (Sutter 2012)

Table 1.3 Matrix of game and learning taxonomies by Van Eck and Gikas (2006) from Van Eck (2007, p. 274) (Copyright IGI Global, Reprinted by permission of the publisher)

Taxonomy of games	Explanation of genre	Gagne's intellectual skills
Action	Keeps the player moving and involved at all times. Primary skills are eye/hand coordination and quick reflexes. Deep thinking is generally not required	Defined concepts
		Concrete concepts
Role playing	Revolves around characters, story, and combat and takes place in large, expansive worlds. Usually collaborative, often online	Problem solving
		Rules
		Defined concepts
		Concrete concepts
Adventure	Story based on exploration and puzzle solving where the player is the protagonist. Player must determine best path through storyline and obstacles on own or with others	Problem solving
		Rules
		Defined concepts
		Concrete concepts
Strategy	Emphasize strategy and theory, often in recreations of historical or other human events	Problem solving
		Rules
		Defined concepts
		Concrete concepts
Simulations	Simulation of processes, events, or phenomenon. Emphasis is on realistic representation	Problem solving
		Rules
		Defined concepts
		Concrete concepts
Sports	Allows players to play simulated sports activity	Problem solving
		Rules
		Defined concepts
		Concrete concepts
Fighting games	Players engage in combat individually or in teams. Story is present but ancillary to fighting skills	Rules
		Defined concepts
		Concrete concepts

Patrick Welsh (2013) writing about his experiences as a teacher through four decades of school reform concludes: "All of [the school reforms] failed to do what I believe to be key to teaching: to make students care about what they're studying and understand how it's relevant to their lives." Motivation, a key ingredient in learning that is often ignored, is where game-based teaching holds the most potential as it has the potential to provide what Pink (2011) lists as essential to motivation: autonomy, mastery, and purpose.

More important than being able to meet standards, games have been found to improve student learning (see Table 1.3). Johnson (2005) tells of his 7-year-old nephew suggesting he "lower his industrial tax rates" (p. 32) to solve a problem he was having in *SimCity*, and Joli Barker (2013) describes how turning her second grade classroom into a "living video game" increased her student scores by 58 % (reading comprehension), 71 % (reading fluency), and 76 % (math). The Center for

Game Science at the University of Washington found that 95 % of K-12 students who played *DragonBox* for 90 min mastered basic algebra concepts (Greenberg 2013).

But a couple of anecdotes do not prove a rule. A meta-analysis (a study of studies) of research on using academic games in the classroom found an average of a 20 percentile gain in student achievement (Marzano 2010). Other meta-analyses have found longer retention, increased cognitive gains, and better attitudes to subject matter when compared to traditional modes of teaching (Adcock et al. 2010; Clark et al. 2013; Kapp 2012; Tobias et al. 2011). The studies in these meta-analyses had participants who ranged in age from preschoolers to senior citizens and covered a wide range of subject matters. It should be noted, however, that some studies found mixed results.[6] One reason is because all video games are often lumped together, particularly in these meta-studies, including those that are the "electronic equivalent of worksheets" (Dempsey 2010, p. 85). As we will see, not all video games are equal in terms of pedagogical power.

First Things First

Before we get into the nuts and bolts of how to create a curricular game, we need to further explore what it is about video games that is so compelling that gamers will invest hours and hours of their time into solving difficult, complex, and challenging problems—with no monetary rewards and no grades attached. This is what gamers call "hard fun" (McGonigal 2011, p. 32). Most educators only dream of their students spending the amount of motivation, attention, passion, and critical thinking on their classes that some students do playing video games. Although many of the pedagogical techniques that video games employ are not new to the educational scene, teachers and teacher educators can learn from the new and innovative ways video games use these techniques. While in some cases video games are uniquely suited to leverage certain pedagogical techniques, teachers can still take advantage of lessons learned from video games. For example, just as video games can readily adjust to the levels of individual users to provide the optimal amount of challenge, what Prensky (2006) calls "adaptivity" and Gee (2003) terms the edge of "regime competence," teachers can provide students with options for different levels of achievement to emulate this in the classroom by targeting students' "zones of proximal development" (ZPD) (Vygotsky 1978), i.e., when learning is challenging but attainable. On the other hand, it would be rather labor-intensive for educators to provide a traditional curriculum as individualized as video games have the potential to be.

There are other ways video games succeed where educators struggle. Successful students learn to set and manage short-term and long-term goals; video game players do this, what Johnson (2005) calls "telescoping," without having to be told to do

[6] Aldrich explains that "part of the trap, of course, is that any new approach to education has to pass a theoretical, ideal, and rigorous standard that no traditional approach could" (quoted by Becker 2010, p. 43).

their homework. Similar to Dewey's (1938) experiential education, i.e., learning by doing, and Papert's (1980) constructionism, i.e., learning by making, Cazden (1981) argues for "performance before competence," a technique that often lies at the heart of video games. By embedding the "learning" into the "doing," learners employ discovery learning (Bruner 1961) where learners use problem solving and critical thinking to construct their own understandings of the material. As Prensky (2001a) points out, "discovery learning is what many games, and certainly all adventure games, are all about" (p. 160). In other words, video games rely on constructivism, the idea that learners build their own knowledge structures.

Hypothesis testing and discovery learning have long been used in the classroom (Mayo 2009), but video game players, who also use "inductive discovery" (Prensky 2006) or "probing" (Johnson 2005), can take risks and learn from their mistakes because they can make multiple attempts instead of a one-shot paper that is due Tuesday. When that paper is turned in, the student does not receive feedback instantaneously, and often not immediately, unlike video games, because it requires time for the teacher to grade all the papers and write individual comments. When playing a video game, though, feedback is on the spot and often "just in time," i.e., "when the learner can use it" (Gee 2007b, p. 24) and/or "on demand," i.e., "when the learner is ready" (Gee 2007b, p. 25), thus providing the assistance, or "scaffolding," necessary to help learners learn within their ZPD. When feedback is received in the classroom, students often interpret it as a "judgment" from the teacher (Gee 2007a, p. 63), whereas video games sometimes have humorous or engaging feedback, which can encourage players to make "mistakes" on purpose to find out how the game responds (Prensky 2001a, p. 159). In the classroom, mistakes result in punishment—a lower grade. When playing video games, risk-taking is encouraged due to decreased real-world consequences, or "psychosocial moratorium" (Erikson 1980), so mistakes are seen as learning opportunities (Gee (2003); Prensky 2001a; Shaffer 2006). In addition, immediate positive feedback in the form of rewards helps cement the learning: "each time the child is rewarded, his brain secretes such neurotransmitters as dopamine and acetylcholine which help consolidate the map changes he has just made. (Dopamine reinforces the reward, and acetylcholine helps the brain 'tune in' and sharpen memories)" (Doidge 2007, p. 71). Of course, as studies in behaviorism have shown us, the reward needs to be intrinsic to the task and for doing something challenging. Immediate feedback and rewards allow video game players to remain engaged in the game while still invested instead of receiving feedback after losing interest or becoming discouraged after receiving negative feedback, unfortunately what happens all too often in school.

In addition, the potential for immersion that video games offer is difficult to rival in a traditional classroom setting. This immersion contributes to what Csikszentmihalyi (1990) calls "flow," or total engagement, and what Turkle (1984) describes as an "altered state" (p. 83) that people experience while playing a video game. Csikszentmihalyi (1990) asserts that "The more a job resembles a game—with variety, appropriate and flexible challenges, clear goals, and immediate feedback—the more enjoyable it will be regardless of the worker's level of development" (p. 152). To keep players in their ZPD, video games often require a certain level of mastery before players are allowed to move to the next level,

similar to what educators call mastery learning (Bloom 1980). When these elements and others are combined, video games can capitalize on human beings' natural desire to learn, or "achievement motivation" (McClelland, cited in Driscoll 2005, p. 311). A great potential lies in this intersection of best teaching practices and the capacities of video games.

Although some may argue that emulating video game players is the last thing a teacher should want his or her students to do, playing video games can foster positive qualities:

> Surveys of gamers show that they have an increased appetite for risk, a greater comfort with failure, a stronger desire for social affiliations, a preference for challenges, a capacity for independent problem solving, and a desire to be involved in meaningful work when compared with nongamers (Beck and Wade 2004). Underlying Beck and Wade's argument is a notion of changing literacies. Gamers have grown up with a medium built on assumptions unlike those in print cultures (e.g., a game engine can be tinkered with, a text is not necessarily print based or defined by book covers); game players are coauthors along with game designers, co-constructing the game-as-text through their own action (cf., Robison 2005). Gamers have grown up in simulated worlds, worlds where anything is possible, and where learning through trial and error is expected, information is a resource for action, and expertise is enacted through both independent and collaborative problem solving in self-directed tasks. (Simpson 2005) (Squire 2008, p. 658)

Gee (2003) describes video game players as being able to: take on new identities and perspectives, see themselves as active problem solvers, view mistakes as "opportunities for reflection and learning," undo a previous way of solving a problem in order to learn new ways, and take risks. In addition, gamers "regularly exhibit persistence [and] … attention to detail" (Klopfer et al. 2009, p. 1). All of these qualities Friedman (2007) argues are necessary for the changing needs in a global marketplace that relies less and less on vertical hierarchies and more and more on ad hoc horizontal groups working together to solve problems.

Pelletier and Oliver (2006) studied people playing video games in action. They found that gamers developed and revised rules and strategies for game playing based on hypothesis testing and actively worked to resolve "cognitive dissonance" (Van Eck 2007), or contradictions between their own predictions about how objects in the game might react to their actions and how the objects actually reacted. Once a video game player has mastered one skill, however, Gee (2007a) argues that good games rely on what he terms the "principle of expertise," adding a twist to something that has become routine in order to make it more challenging. It is this cycle of "pleasurable frustration and routine mastery, a cycle of storm and calm" (p. 62) that continually engages the player.

In addition, Pelletier and Oliver (2006) found some evidence of transfer of skills between games, which Gee (2007a) also found in his own self-study of learning to play *Rise of Nations*, suggesting that video games may translate into real-world applications. Certainly, the military banks on this transfer in its use of video games to train soldiers (Annetta et al. 2009). Some early research does point to such outside transfer, such as a study that found that a range of cognitive skills of senior citizens who played *Rise of Nations* increased (Anthes 2009). Shaffer (2006) reports on several independent studies that found that students not only

exhibited greater content understanding after using computer simulations but were able to apply this understanding to real-world situations, even ones outside of the original domain. Studies of simulations have found that those with high fidelity do promote transfer to real-world situations, although optimal learning occurs with moderate fidelity—when limits are placed on real-world variables (Grabe and Grabe 2007)—what Gee (2007a) calls a "fishtank," or a simplified version that provides just enough for the player to see how the system fits together. The advantage of computer simulations is that as learners progress, more and more real-world variables can be introduced. In addition, simulations "make certain experiences practical and other experiences possible" (Grabe and Grabe 2007, p. 129), such as "performing potentially dangerous science activities" (Annetta and Cheng 2008, p. 5). As one of my students pointed out, "it's better to make a mistake in a chemistry game than in a chemistry lab." Even when simulations are more game like, transfer can occur, such as teaching engineers a new design software tool by having them play *The Monkey Wrench Conspiracy*—a game where they have to save the Copernicus Space Station by repairing parts (Prensky 2001a). In contrast, some studies show that traditional school learning does not promote transfer: "We have known for years now that most of the kids who can pass these tests . . . cannot actually apply their knowledge to the real world" (Gee quoted in Shaffer 2006, p. x). Because video games and simulations can provide real-world context, students make connections, see relationships, think in new ways, and see the whole instead of learning isolated or abstract facts, which increases the likelihood of skills and knowledge transferring to real-world situations.

Whether gamers are playing a real-world simulation or a fictional game, when they encounter difficulties, they seek help from their "affinity spaces," groups, and other resources that supply a "distributed intelligence" and take advantage of "cross-functional affiliation" by finding other players who have a variety of skills (Gee 2007a). This happens particularly in multiplayer games, but even in single-player games, players consult online communities and walkthroughs to scaffold their learning. In other words, gamers take advantage of teamwork, communicating across age groups and geographical boundaries based on others' skills and knowledge and thus transcending race, gender, and other demographic variables to create a "gaming culture" (de Castell and Jenson 2003) where expertise-based on mastery is recognized and honored.

Gee (2003) has written much about video game players' identities and games and asserts that taking on a new identity is a powerful learning tool. One reason is because "The ability to take on multiple roles allows players to gain multiple perspectives of a given scenario" (Annetta et al. 2006). Some games establish their game play based on attributes chosen by the player. Others allow the players to replay the game from a different character's perspective. Gee (2003) points out that taking on different roles has the potential to challenge video game players' assumptions and expand their understandings, particularly when the player is faced with choices that challenge the player's values. Annetta and Holmes (2006) (cited in Annetta 2008) found that "students who had a choice of which avatar they would like to be reported greater course satisfaction and felt closer to their classmates and instructor than stu-

dents who only could choose a male or a female avatar" because it gave students a "sense of individuality" (p. 235). As one of my students noted, creating an avatar allows students to "fly their freak flag without suffering social suicide." Inhabiting a role and making choices about that identity can make learning more powerful by giving students ownership and have the potential to teach valuable lessons about multiple perspectives.

Because of these changes in thinking and behavior that technology has encouraged, Prensky (2001b) points out that "Today's students are no longer the people our educational system was designed to teach" (p. 1). To accommodate this, educators need to learn to adjust their teaching to new generations of students. Turkle (1984) describes video games as opportunities for people to "learn… how to learn." In our rapidly changing world, that should be the goal of school.

I am not the only one arguing for the use of video games and video game techniques in education, nor is it limited to those cited in this chapter. The Federation of American Scientists issued a report in 2006 "stating their belief that games offer a powerful new tool to support education" (Clark and Martinez-Garza 2012, p. 279), and the National Research Council in 2009 commissioned a committee to explore ways in which to do this (Clark and Martinez-Garza 2012). However, I do have personal experience testifying to the impact of game-based teaching from my course evaluation ratings increasing (from 2.6 out of 4 in the traditional mode to 3.9 out of 4 in my most recent game-based teaching class), to the success of my students (from 40 % receiving less than a B in the traditional mode to nearly 0 % in the past several years, including online courses), to student comments (traditional mode comments indicate that I was "nice" and "tried hard" but that I needed to "make class more interactive" and that students wanted "more time to explore" and to "experiment with technology" whereas game-based learning comments speak to my class "meeting students where they are" and "forcing students out of their comfort zones" while being "fun" resulting in my students "integrating technology into [their] own classroom[s], even [in] urban schools with little funding" and their students "getting really excited about using computers").

Why convert your curriculum into a game? Not to compete with outside entertainment–that has always been a challenge that teachers tend to lose whether it be to sports, television, or video games–but because games enable students to *experience* the curriculum in ways that traditional instruction does not (de Freitas and Maharg 2011). When students experience the curriculum, they do more than memorize facts or practice skills; it becomes a part of their life story and a part of their brain structure (Bransford et al. 2000, p. 116).

> *Anyone who makes a distinction between games and learning doesn't know the first thing about either.*
>
> –Marshall McLuhan, 1964

Appendix: Proposal Quest Worksheets

Video game	Genre	Pros and cons	Of supplying content	Of providing motivation	Of teaching (pedagogy)
1 (previously played)		*Affordances*			
		Constraints			
2 (previously played)		*Affordances*			
		Constraints			
3 (previously played)		*Affordances*			
		Constraints			
4 (newly played)		*Affordances*			
		Constraints			
5 (newly played)		*Affordances*			
		Constraints			
6 (newly played)		*Affordances*			
		Constraints			

	Affordances	*Constraints*
Content		
Motivation		
Pedagogy		

Suggested Proposal Quest Rubric

Criteria	"Wow! I mean, I think this might work" (3)	"Hmm, this might be acceptable" (2)	"I need more convincing" (1)	"Go back to the drawing board" (0)
Affordances	Affordances put in context of learning theories	Affordances described	Affordances listed	No affordances listed
Constraints	Constraints turned into affordances	Constraints countered	Constraints listed	No constraints listed
Student impact	Explanation includes ELLs, students with special needs, and other types of learners	Explanation includes ELLs or students with special needs	Explanation includes impact on student learning	No mention of range of students
Evidence	Research studies analyzed	Research studies cited	Evidence is all anecdotal	Little to no evidence provided
Grammar, **organization**, **and style**	Sophisticated and creative persuasive writing in context of gaming scenario; APA used correctly	Clearly written and organized; APA style used correctly	Grammar or APA style mistakes; stylistically awkward	Grammar mistakes and style makes paper difficult to follow; APA style not used
Techie (one extra point)				
Table of affordances and constraints of video games by genre included				
Tech Savvy (two extra points)				
Analysis of percentage of standards addressed				
Tech Guru (three extra points)				
Learning theory diagram that demonstrates pedagogical affordances of video games included				

ELLs English Language Learners, *APA* American Psychological Association citation style

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