LEARNING, EDUCATION & GAMES

VOLUME TWO: BRINGING GAMES INTO EDUCATIONAL CONTEXTS

Edited by Karen Schrier | *Written by members of the Learning, Education and Games (LEG) Special Interest Group (SIG) of the International Game Developers Association (IGDA)*

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Table of Contents

SECTION II—Community Considerations

SECTION III—Tool and Platform Considerations

Introduction

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I am very excited to present the second volume in the book series, *Learning, Education & Games*, which examines the latest research and design techniques for creating and using games for learning. This is the second book in the series, which was written, edited, and reviewed by members of the Learning, Education & Games Special Interest Group (LEG SIG), a subset of the International Game Developers Association (IGDA).

The **first book** focused on curricular and design considerations, and **this second book** focuses on practical, technological, institutional, theoretical, and contextual challenges to consider when creating and implementing games for use in formal and informal educational settings.

To do this, we first look at the relevant issues with designing and using games in formal learning environments, classrooms, and school-based programs. This includes chapters on (1) using games in the classroom, (2) how to choose appropriate games for the classroom, (3) using gamification (or game-related techniques in non-game settings) in the classroom, (4) creating a playful curriculum, and (5) using games to support ADHD and autism spectrum students.

Next, we delve into the needs of community constituents and informal learning spaces, such as libraries and homeschools, and parents and policy-makers, who are also intricately involved in guiding and implementing educational practices and initiatives.

Finally, we investigate the platform, technological, and other logistical considerations associated with designing and using games in educational settings. We discuss the merits and drawbacks of using LARPs (live action role-playing) as a tool for learning, and we also detail the latest software, engines, tools, platforms, and programs for making games. This is particularly useful for educators who are considering the pros and cons of various development tools to teach their students, or for educational game developers thinking about options for creating their next game.

Although this book comes only a year after the first volume, new practices, questions, examples, and approaches have already begun to emerge, and the landscape of educational gaming and what it means to learn through games continues to evolve. New educational games continue to pop up in all shapes,

sizes, genres and styles, whether a coding MMO (*Screeps*), a puzzle platform about grief (In Between), or a motion tracking game about plate tectonics (*Geomoto*). People have begun to find innovative ways to expand inclusiveness and support more empathetic exchanges and interactions online, particularly with regard to game-related harassment and cyberbullying. Using large data sets to analyze and assess learning has become more widespread and applied to games—for better or worse. Live gaming on Twitch and YouTube and competitive eSports have become increasingly popular and may be untapped potentials for education. The MacArthur Foundation has spun off a new nonprofit called Collective Shift, which has created a new ecosystem of digital media and learning called LRNG. Newer platforms and technologies, such as the Oculus Rift, and DIY tools, such as littleBits, Arduino, and Raspberry Pi may grow the types of educational experiences we can have—and who has access to creating and participating in them.

And I have started to systematically question not only how we can become more skilled problem solvers through games, but how games themselves can actively help us solve real-world puzzles and create new knowledge about humanity and our world. These games have variably been called crowdsourcing games, applied problem solving games, and games with a purpose (*GWAP*), and they are on the cusp of upending what we know about learning and how we create new knowledge as a society. I write about them in a new book, *Knowledge Games* (Johns Hopkins University Press).

At the same time, the previous questions about educational games and education in general remain. How do we properly assess learning through games? Under what conditions are games effective in education? When are games appropriate for a particular learning context or goal? How do we balance fun and accuracy, facts and skills, content and context, and innovation and tradition in games? What are the potentials, limits, and pitfalls? To what extent can mainstream games, or games whose primary goal is not learning, help teach us? How do we make learning meaningful, significant, thick, rich, and relevant?

How To Use This Book

The second volume of this series on learning and education games is divided into three different sections: classroom considerations, community considerations, and tool and platform considerations.

The eleven chapters are typically divided into a number of segments:

1. **Introduction**, which covers the major questions and terms related to the topic;
2. **Key Frameworks**, which introduces the primary theoretical frameworks related to the topic;
3. **Key Findings**, which relays the major recent findings in the field;
4. **Assessment Considerations**, which discusses specific assessment challenges or opportunities;
5. **Future Needs**, which lays out the open questions and gaps;
6. **Best Practices**, which summarizes the key takeaways and most effective techniques and findings.

Each chapter includes two to four **case studies** to illustrate the theories and findings in practice. You can read the case studies individually or in the context of the chapter. Every chapter also provides a list of useful **resources** and relevant further reading (and gaming!).

In the final section of this book, we also have created one appendix that provides additional resources and details about the latest available tools, engines, and software programs for game development.

Acknowledgements

Many people helped out in the preparation of this second book in the series. I want to thank the authors: Katrin Becker, Mark Chen, Paul Darvasi, Brock Dubbels, Richard Ferdig, Zack Gilbert, Elisa Gopin, Jennifer Groff, Randy Kulman, Jeremiah McCall, Scott Nicholson, Matthew Nolin, Andrew Peterson, Katherine Ponds, Lee Sheldon, Deborah Solomon, Aaron Vanek, and Charlotte Weitze.

I want to thank the founding director and president of the Learning and Education Games (LEG) SIG, Stephen Jacobs, and the LEG SIG steering committee members. I want to thank Katherine Ponds for her editorial and organizational assistance.

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Finally, I want to thank my family, including my husband, David Shaenfield, my daughter, Alyssa, and

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Katrin Becker is an internationally known expert in the design and analysis of Serious Games. She holds two degrees in computer science and a Ph.D. in Educational Technology with a focus on instructional game design. She has over 30 years of teaching experience in science, engineering, education, and art, and she has taught computer science, video game design, digital game-based learning, and technical writing. Her teaching innovations have been internationally recognized and she is widely published in the areas of computer science education, educational technology, and digital game based learning. She designs and develops eLearning in all sectors, and has consulted for various organizations on the use of digital games for instructional purposes. She has designed and developed several educational and advertising games. She is also the author of a book on the technical aspects of simulations and games written for non-technical people. Finally, perhaps as counterpoint to her work in and with digital technology, she runs a small farm where she has been raising waterfowl and other animals for over twenty years. This farm forms the basis for her "Ducks in the Classroom" program, which has been providing eggs for hatching in classrooms locally since 1988, and information on school hatching projects globally since 2001.

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content, creating engagement with learners, and investigating ways people approach learning. He has also worked as a Fulbright Scholar at the Norwegian Institute of Science and Technology; an NIH Fellow at the University of Minnesota, at Xerox PARC and Oracle. He teaches course work on games and cognition, and how learning research can improve game design for return on investment (ROI). He is also the founder and principal learning architect at www.vgalt.com for design, production, usability assessment and evaluation of learning systems and games. He is currently editor in chief of the *International Journal of Games and Computer-Mediated Simulations*.

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Zack Gilbert is currently teaching 6th grade social studies and language arts at Parkside Junior High School in Normal, IL. He is a technology coach and an advocate for educational technology in central Illinois. Zack is a graduate of Eastern Illinois University with a B.A. in History with a secondary teacher certificate and has an M.S. in Instructional Technology and Design from Illinois State University. His master's research looked at the impact of educational games and how the knowledge gained through these games is stored into long term memory. Zack is the host of the EdGamer podcast, the longest running podcast dedicated to Games and Learning. Since 2011, Zack has interviewed the leaders in the Games and Learning field which include Dr. James Paul Gee, Joel Levin, Lucas Gillispie, John Hunter,

and many more. Zack has built collaborative relationships with University of Wisconsin-Madison, MIT, and IlliniCloud. He is on the advisory board for Playful Learning through the Learning Games Network and he is the Project Lead for the Games and Learning projects within the Illinois Shared Learning Environment (ISLE). Zack is a chapter co-author of the book *TeacherCraft: A Guide for Teaching and Learning with Minecraft*. Zack's chapter discusses how to start, maintain, and manage a successful after school game club. Zack's favorite games for his classroom are *Civilization IV*, *MinecraftEdu*, BBC Interactive History Games, and any games on BrainPOP. Games are an important part of Zack's life, in and out of school.

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Elisa Gopin is an educational game designer with a passion for STEM education. As founder of the educational multimedia development company Lifelong-Learner.com she works on projects that promote creativity and problem solving skills, and teaches online courses that train teachers in the use of Web 2.0 tools in education, digital storytelling, and games in the classroom. Elisa was the driving force behind the development of BackPackGames.com, a website that provides quality educational games categorized by academic content, cognitive skill, grade level, and educational standards. Prior to entering the field of Edtech she worked as a project manager in web development for over 10 years. She is currently a doctoral candidate in educational technology at Boise State University where her research focuses on the challenge of integrating gameplay mechanics with educational content to create a truly intrinsic learning experience.

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For the past five years Lee Sheldon was Associate Professor in the Games and Simulation Arts and Sciences program at Rensselaer Polytechnic Institute. There, he was co-director of the GSAS program for three years and created the first full writing for games program in the United States. Lee wrote the bestselling book *The Multiplayer Classroom: Designing Coursework as a Game* (2011); his book *Character Development and Storytelling for Games* (Second Edition, 2013) is the standard text in the field. His recent applied game projects include two games at Rensselaer: *The Lost Manuscript 2: The Summer Palace Cipher*, a virtual reality game teaching Mandarin and Chinese culture; and *These Far Hills*, a video game teaching engineering and science for an NSF proposal. He wrote *Crimson Dilemma*, a business ethics video game for Indiana University that debuted fall 2014; and wrote and designed *Secrets: A Cyberculture Mystery Game*, an online class designed as a game teaching culture and identity on the Internet for Excelsior College that goes live fall 2015. His most recent entertainment game is the AAA Kinect title *Disney Fantasia: Music Evolved* for Harmonix, released in October 2014. He is currently writing a reboot of a popular Facebook game. Before his careers in games and academia Sheldon was a television writer-producer with over 200 produced shows ranging from *Charlie's Angels* to *Star Trek: The Next Generation*.

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Chartlotte Weitze was trained as a pianist at The Royal Danish Conservatory of Music and earned a M.SC. from the IT University of Copenhagen, focusing on digital design and communication. In her master's thesis, she developed a model of how to develop motivating and engaging learning game as well as a concept for a music learning game, which she has described in the article, *The Smiley model—Concept Model for Designing Engaging and Motivating Games for Learning*. She is interested in design of learning games—both professional design of learning games, as well as learners' design of games as a way to become subject experts. In addition, she is interested in methods for competence development of teachers when they need to be innovative in respect to the use of IT in teaching. She is also interested in the development and measurement of students' and teachers' motivation and engagement in learning situations. She is a Ph.D. student in the Department of Learning and Philosophy and ILD-lab: IT and learning design at Aalborg University in Copenhagen.

SECTION ONE

Classroom Considerations

CHAPTER 1

Using Games in the Classroom

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Key Summary Points

1. Many games purport to teach, practice, or encourage interest in STEM subjects; however, many fail to do so in ways that can be statistically shown to be effective. The potential benefits of such games are often overstated. All parties should be more cognizant of realistically achievable outcomes.

2. Designers and educators should establish parameters to determine what constitutes a successful game experience and design usability tests that measure the degree of improvement in students' aptitude and performance following engagement with STEM games.

3. Progress is being made both in building STEM games and assessing their effects. Analysis of some successful games is helpful in determining how to include games in curricula and demonstrating how they support educational goals.

Key Terms

Game-based learning
Classroom
Implementation
Lesson plan
Pedagogy
Barriers

Introduction

Should games be used in the classroom? Despite the tremendous instructional power and opportunity for game-based learning, this question has had a polarized history.

Game-based learning, as an approach and as a field, is at an all-time high, with more educators than ever using games for learning in their classrooms. Unfortunately though, games still carry a stigma for some educators and the idea of "games in the classroom" is frowned upon in some schools. Even for those educators who want to leverage game-based learning, they can face a high number of barriers, including insufficient access to technology, educators' lack of general understanding and experience with games for learning, and the lack of data and assessment feedback from games. Despite these challenges, games are becoming a key tool used in many learning environments today (Richards, Stebbins & Moellering, 2013).

Convincing all the stakeholders to support the use of games as instructional tools can be more challenging than other materials: teachers need assurance that the games provides a quality learning experience and will give them back some understanding of student performance; administrators and parents need to understand the pedagogical benefits of playing games; and even students need support in understanding how games can be used as learning tools (SIIA, 2009).

Today there are thousands of games and apps that can be accessed by teachers—from small free apps, to large immersive 3D worlds. For educators, such opportunity is part of the problem:

1. How do you find the right game for your needs?
2. How do you know how to use it effectively?
3. How do you know what students learned from it?
4. Who do you go to for help and support just in time when you need it?

This chapter will discuss the opportunities and challenges of using games in the classroom, and describe some of the basic frameworks and methods for such. Finally, we will explore three case studies of how games have been used powerfully for deeper learning in the classroom, along with several resources to support an educator seeking to use games in their own classroom.

A Brief History: 30+ Years of Learning Games

Although paper and board games are a commonly featured element in many classrooms, the presence of digital games has seen a slower uptake. This has been the case for both educational games (those specifically designed for learning and education) and commercial games, or COTS (Commercial Off-The-Shelf games, which were built for entertainment but at times have been used as instructional tools in the classroom).

Digital games first entered the classroom in the 1980s during the CD-ROM era. Adoption was slow, but growing steadily. However, in the 1990s a number of factors led to a tarnished image of the market, and ultimately to its consolidation to just a few key players, which prevented rapid adaptation in schools (Shuler, 2012). Over the past decade, we have seen a growing number of teachers who have demonstrated outstanding and powerful learning experiences with students by leveraging digital games, demonstrating deeper learning and engagement of students, proving to others that games can have a place in the classroom. In a recent survey conducted by the Joan Ganz Cooney Center, 32% of the K-12 educators sampled reported they use digital games 2-4 times per week in their classrooms, with 18% reportedly using them every day (Millstone, 2012). A majority of this usage is with educational games, with just 18% reporting the use and adaption of commercial games for classroom instruction (Millstone, 2012). But with all of the available games, and all of the different types of classrooms and learning goals, what exactly does it look like to use games effectively in the classroom?

Key Frameworks

Before exploring how games have been, and can be, used in the classroom, it is helpful to understand the landscape games and game-based learning. In this section we will look at the various types of games available for use in the classroom, the benefits to using the various types of games in the classroom, as well as the potential barriers and challenges to implementing them.

The Games Landscape

There is an extensive variety of games, which makes it difficult to select one versus another for a particular classroom or curricular need. To help with this task, Squire (2008) offers a taxonomy of game types through two educator-centric lenses: timescales and modalities. These two lenses for choosing classroom content are often primary for educators, as time available for instruction and the type of learning method or pedagogy they want to use are drivers for designing instruction. Note that the timescale offered roughly estimates what is typically encountered through game play for entertainment, not necessarily for the classroom.

GENRE	Time to Completion	Timescale	Open-endedness	Modes of Creative Expression	Examples	
					Commercial	Educational
Targeted games (puzzle, mini-games)	1-4 hours	weeks	Low	Style of completion: level creation	Angry Birds	Supercharged!
Linear games	20-40 hours	month	low	Style of completion: machinema	Viewtiful Joe, Ninja Gaiden	DragonBox
Open-ended sandbox games	100-200 hours played over multiple months	2-24 months	high	Style of completion: multiple solution paths, modding	Civilization, SimCity, Minecraft	SimCityEdu, MinecraftEdu, Making History
Persistent Worlds	500+ hours	6-48 months	high	Modding; social engineering; game play	World of Warcraft, Everquest	Quest Atlantis

Figure 1.

Targeted games are designed for a specific topic or concept, such as adding fractions or photosynthesis. These types of games are more easily integrated into the classroom because they more easily align with curricula and fit into class timescales.

Linear games can be short or long, but generally include a storyline and pathway through the game. For example, *Lure of the Labyrinth* is a digital game for middle-school pre-algebra students that includes a wealth of intriguing math-based puzzles wrapped into an exciting narrative game in which students work to find their lost pet and save the world from monsters.

Open-ended or sandbox games, which offer tools and a context to construct items and/or outcomes in the game, are gaining popularity in the classroom, as they offer a rich context in which to target specific learning objectives. For example, *Civilization V* is a commercial game that leads the player through the growth of a civilization and empire; there are many examples of the use of this game in the classroom to target numerous learning goals, including trade routes and ethical thinking (McCall, 2011; Fitzgerald & Groff, 2010). *Making History* is offers a similar open-ended world to explore dynamics in history that was built specifically for education.

Finally, persistent worlds, virtual worlds that are on-going, such as many of the popular massively multiplayer online games like *World of Warcraft (WoW)*, are often the most complex to integrate into the classroom, but can offer some of the most rich learning environments (McCall, 2011).

Squire's framework also can be distilled into a simple classification as seen in Figure 2.

	Commercial Built for entertainment	**Educational** Built for learning and instruction
Short Form Shorter games that can be played in a brief amount of time, often puzzle or linear games	Examples: • Angry Birds • Mario Kart	Examples: • Lure of the Labyrinth • Quandary
Long Form Longer games that typically are more complex and take longer to play, such as open-ended and persistent world games	Examples: • SimCity • World of Warcraft	Examples: • Minecraft • Making History

Figure 2.

Short-form games include the previously defined targeted games and some linear games, such as *Angry Birds* or *Mario Kart*. Games in this category are easier to integrate into the classroom than long-form games, and are seeing a surge in numbers due to the growth of apps and purchases of mobile devices in K-12 education (Richards, Stebbins & Moellering, 2013).

Long-form games extend beyond one class period. They require more planning and preparation by the teacher, and a deeper commitment to curriculum time and alignment. However, they can be leveraged in a "flipped classroom" model, where play occurs outside class time and serves as the context for further classroom instruction (Richards, Stebbins & Moellering, 2013). Although more work may be involved to leverage these games successfully, they also offer the potential of developing 21st century skills, such as problem solving, decision-making, planning, strategy, and collaboration (Klopfer, Osterweil, Groff & Haas, 2009).

Case Study One: *The Ward Game*, A Living Video Game

The Ward Game is a pervasive educational game designed to teach Ken Kesey's classic novel, *One Flew Over The Cuckoo's Nest* to high school seniors. *The Ward Game* has been played twice at Royal St. George's College, and each iteration lasted 30 days and involved about 60 students. A pervasive game employs communications platforms such as mobile devices, desktops and laptops to carry out gameplay in physical spaces in the real world. In the case of *The Ward Game*, the school was transformed into a psychiatric hospital, and each senior English classroom became a ward analogous to the one in the novel. The game echoes the novel's critique of post-industrial institutions and students assume the roles of patients who are subjected to systems that playfully induce conformity and control that mirror those used by the tyrannical Nurse Ratched in *One Flew Over the Cuckoo's Nest*. An atmosphere of mock-oppression and mild paranoia pervaded but, paradoxically, players were conferred a high degree of choice, flexibility, and self-determination. Game mechanics such as missions, role-play, mini-games, lotteries, surveillance, points and achievement were employed extensively to engage players and externalize some of the novel's key narrative features. QR codes, propaganda videos, Twitter feeds, Facebook pages, and a host of other online tools all contributed to creating an immersive environment.

Evidence gathered during gameplay and post-game surveys indicated that the majority of players reported being engaged, interested, and productive, with many observed instances of intrinsic motivation. Notable examples include: players who requested more work after they had already achieved the maximum allowable points; students with a history of apathy who came alive and worked tirelessly to complete tasks; and groups of players who organized themselves to creatively challenge the game's authority. Many of the artifacts created through self-selected tasks emerged as some of the best work produced all year, even though they were not graded. Finally, players quickly realized that progress in the game was hastened by knowledge of the novel's content, which encouraged higher book completion rates than in previous units. There were a few students who were observed behaving disengaged during the game, but most participants reported enjoying themselves, and, in many cases, unwittingly worked harder than they had in the past, despite it being played during the scourge of senioritis!

To successfully implement an educational pervasive game, a series of logistical and curricular hurdles must be cleared. Schools need to align their curricular goals and regional standards with the game's

open-ended dynamics and diverse outcomes. In addition, more work has to be done to develop methods of assessment to accurately gauge pedagogical benefits and reconcile them with curricular mandates. A school's technology resources must also be considered, as pervasive games generally require and are greatly enhanced by access to computers, mobile devices, wifi-enabled devices, and other communications platforms. There should also be some thought to gender as *The Ward Game* was carried out in an all-boys school, so any documented successes may not be replicated in a co-ed or all-girls environment.

A teacher who runs a pervasive game is rewarded with a unique and creative experience, but it is a demanding enterprise. Despite the broad constraints of the narrative arc, the freedom afforded players causes the game to evolve organically, which forces the teacher to negotiate significant unpredictability. Furthermore, a teacher must be able to improvise and maintain constant vigilance to compensate for the current absence of dedicated software that might track scores and achievements, increase feedback loops, and manage more complex and responsive game mechanics. Regardless, even in the most sophisticated pervasive games, gameplay depends on the designer, or "puppet master," rather than artificial intelligence.

Finally, the novel on which to base an educational pervasive game must be carefully selected. *One Flew Over the Cuckoo's Nest's* structure and institutional setting transfers well to a traditional school environment, but not all novels lend themselves to become activated as a game. It would be worthwhile to research what literary structures and forms concede a game-based dynamic.

The challenges posed by implementing literary educational pervasive games like *The Ward Game* are far outweighed by the exciting pedagogical opportunities and rewards they present. Using a game can breathe new life into the study of literature at a time when reading, especially by boys, is in decline (Whitmire, 2010).

Key Findings

Despite the often-cited lack of evidence of the impact on learning with games, scientists have conducted a considerable amount of research in support of game-based learning and its effectiveness. For example, we have a cursory understanding of the valuable skill development that playing games can support. According to a review conducted by McFarlane et al. (2002), these include:

1. Strategic thinking
2. Planning
3. Communication
4. Application of numbers
5. Negotiating skills
6. Group decision-making
7. Data-handling

Recently, the Gates Foundation funded SRI International to do a sweeping review of the research on digital game-based learning, and their initial findings were quite promising. In a meta-analysis of over 77 studies that met review criteria, they found that digital games could enhance student learning, as measured by cognitive competencies relative to traditional instructional approaches (Clark, Tanner-Smith & Killingsworth, 2013). These results support the sentiments of many educators—according to the Joan Ganz Cooney Center's 2012 Teacher Survey, more than 60% of teachers reported that digital games help them personalize instruction, better assess knowledge, and collect helpful data for lower-performing students, as well as promote deeper engagement and collaboration among all students (Millstone, 2012).

Barriers

As with any new instructional tool, there are barriers to digital game use in the classroom. Some are physical barriers, some are cultural, and some are perceptual. These barriers include (Richards, Stebbins & Moellering, 2013; Groff & Mouza, 2008):

1. **Cost:** The cost of the game as well as the technology and resources needed to implement the game.
2. **Access to required tech resources:** With limited resources in a school, it often can be difficult to schedule access to the computers and technology when you need them.
3. **Emphasis on standardized tests (perceived lack of space for such pedagogies):** An emphasis on high-stakes testing in many educational contexts limits the time and ability for an educator to explore new methods and tools.
4. **Standards alignment:** It is not always clear what a game is teaching, or can teach, which makes it more difficult for an educator to use and justify what standards it is targeting.
5. **Platform compatibility:** Games require various technology and platforms to run, all which not be accessible in a given school.
6. **Professional development:** Training and support are often needed and requested by many educators before using new types of tools.
7. **Research on effectiveness:** The lack of research on effectiveness of games has cause some to argue they are not demonstrably effective learning tools yet.
8. **Teacher beliefs and attitudes about learning:** The constructivist nature of instruction needed for game-based learning can be orthogonal to a teacher's prior practices and beliefs on teaching and learning.
9. **Student beliefs and attitudes about learning:** Likewise, new exploratory and constructivist ways of teaching and learning with games may be very different than a student's prior classroom experiences and expections.
10. **School norms and professional perception of game-based learning:** Attitudes and beliefs by peer teachers and administrators about games as classroom tools can be an inhibiting factor as well.

Kirriemuir & McFarlane (2006) explain that the most frequently encountered perceived or actual obstacles include:

1. **Assessing the appropriateness of the game:** It was difficult for teachers to identify quickly how a particular game was relevant to some component of the statutory curriculum, as well as the accuracy and appropriateness of the content within the game.
2. **Stakeholder support:** There is difficulty in persuading other school stakeholders as to the potential/actual educational benefits of computer games.
3. **Time:** There is a lack of time available to teachers to familiarize themselves with the game, and methods of producing the best results from its use.
4. **Irrelevant content and functionality:** The amount of irrelevant content or functionality in a game, which could not be removed or ignored, thus wasting valuable lesson time.

A central component of the movement to help game-based learning be a central tool in today's classroom is to provide educators with the knowledge, resources and support necessary to overcome these barriers.

Approaches to Game-Based Learning in the Classroom

Just as there is a diverse range of games, there is also a range of different approaches to using both commercial and educational games in classroom settings. Below are a handful of approaches that fall in the range of both pedagogical as well as logistical approaches, which are not mutually exclusive.

1. **Preparation for future learning.** Learning only has meaning, and can be retained, when there are prior frames onto which one can hook new knowledge (Bransford, Brown & Cocking, 1999). Games are rich, immersive environments that create context and frames upon which concepts of a discipline can then be explicitly unpacked and explored (Klopfer, Osterweil & Salen, 2009), and the nature of games themselves can also serve as discussion prompts. As such, the teacher can use the game as a collective, shared experience that sets the foundation for future instruction. For example, games have been used as a starting point for discussion based on a teacher demonstration, perhaps asking why the developers chose to portray certain elements in the way that they did or examining the content of a game to see if it matches with what the class has previously learned to be true about a certain concept or phenomenon (Sandford & Williamson, 2005).
2. **Game narratives as learning context and backdrops for project-based learning.** One of the most meaningful elements of games is the story. For example, educators have successfully used console games in project-based learning, where the game is used to set the context and narrative. An educator at Meldrum Primary School in Scotland used *Guitar Hero* as the backdrop for a six-week project, where students were placed in teams of four as "bands" and given various roles such as "band manager" and "accountant" as they completed various tasks such as managing the tour budget, travel schedule, and negotiating contracts. Over the course of the project, the actual game play dwindled dramatically, eventually stopping altogether because they students were much more

interested in engaging in the project tasks than the game play. As a result, the project was able to capture deep engagement and cover an array of educational standards (Groff, Cranmer & Howells, 2012).

3. **Extended learning experiences deepen inquiry.** Classroom instruction may be targeted directly at one or several learning standards. However, the reality of our world is that these concepts play out in a complex context. Long-form games such as *Civilization III* and *Europa Universalis II* are complex worlds, that allow learn extended time and multiple dimensions to explore many concepts as they relate and interconnect with one another. Although these long-form games do not necessarily fit into any single specific curriculum, they can often encompass multiple dimensions of the curriculum in a rich and meaningful way.
4. **Flipped classroom model.** The increasingly popular flipped classroom model of instruction, where students engage with a digital learning experience outside of classroom time so that collectively the class can then build on that experience during classroom time, offers possibilities for game-based learning as well. Game play outside the classroom can be a great way to give students a rich and meaningful experience that can be done individually on a student's out-of-school time so that classroom time can be leveraged for deeper, extended inquiry based on the concepts targeted in the game. This approach is generally more effective with smaller, puzzle-based games. It is also important to note that all students in the learning environments must easily have access to the games and technology outside of school for the flipped model to be equitable and effective.
5. **Concept reinforcement.** Games can be engaging ways to support skill development as students move from novice to deeper understanding. This is true of games that are not just "drill-and-skill" games, but also for many high quality educational games. In other words, the game can serve as the targeted instructional experience, or it can serve as the extended practice and reinforcement of concepts as the learner seeks to get stronger in their understanding of the concepts.
6. **Just-in-time learning.** Since games can serve as rich and meaningful environments and experiences, they can present opportunities to push on learner misconceptions. Just as educational games in particular can be useful tools for support students' concepts they may be struggling with, many rich game worlds present numerous teachable moments for concepts and topics that might not otherwise arise (SIIA, 2009).

Implementation Models and Logistical Details

So what does successful implementation of games in the classroom look like? This section offers some useful strategies and common practices to get started, and go deeper, with games in the classroom.

1. **Prep first.** Like any instructional tool, a teacher must have a good understanding of the tool to be able to use that tool effectively. So, taking some time to thoroughly explore the tool and prepare the lesson is valuable. This is particularly true of games that may not be so straightforward at first glance. That being said, it is important to have an understanding of the scope and dynamics of the game, although it is only critical to be an expert in the content, not the game itself. According to Sandford & Williamson,
   "It is clear that teachers need a detailed and thorough understanding of the game, both in to identify learning opportunities and to develop students' understanding of the game sufficiently for them to be able to learn by using it; the time teachers have to become familiar with the game therefore provides one important criteria to consider in selecting games for use in schools" (2005, p.11).
2. **Allow for extra time the first class period where the game is used.** For larger games, prep time can be significant, but the payoff can also be great. When getting started with a new game, build in extra time—more than you would for a traditional lesson or lecture—to enable the students, and you, to get familiar with this methdology in the classroom.
3. **Getting started: Quick trial versus full immersion.** Depending on the game and how familiar your students are with game-based learning, you may choose to start the game-based experience gradually using the "toe in the water model," where you first introduce the game in a short, 15-30 min session. This gives the students a no-pressure opportunity to explore the game, and for the teacher to gauge student interest and engagement with the game before embarking on the full lesson or unit. However, for games that require deeper immersion in the storyline and gameplay, blocks of several classes provide the opportunity for an immersive approach (SIIA, 2009). In such cases, you should design a set of lessons and activities that help students learn how to play the game. For example, a game like *Civilization IV* would benefit from several initial periods of game play to become familiar with the game. This may seem like a large commitment of classroom time, but typically there are a significant number of targeted learning goals for long-form games like this—so the benefits gained are worth the time commitment.
4. **Determine student grouping**. Depending on the game, it may make most sense to have students work individually or in groups of two to four. Some teachers report that they prefer grouping students for a variety of reasons, including that some games already enable collaborative decision-making and grouping can reduce barriers to learning by teaming proficient gamers with non–gamers (SIIA, 2009). Groups may be formed by mixing or aligning abilities; however, it is generally encouraged to mix gamers with non-gamers.

5. **Conclude by reflecting and debriefing to elucidate core concepts.** Returning groups or teams to whole-group discussion throughout a long-form game and/or at the conclusion of game play is critical to making connections to the learning goals and the larger world. Debriefing sessions allow students to reflect on the content of the game, and to share the knowledge that they have acquired. They also help them make links between the game and the learning outcomes (Sandford, Ulicsak, Facer, & Rudd, 2007; SIIA, 2009).

Putting these elements together in effective ways is not that different from traditional classroom instruction and management. Since many games are rich, immersive experiences, their implementation becomes an "instructional arc" that you are co-constructing with your students.

Figure 3 demonstrates what some of these arrangements may look like in your classroom. The teacher might start first with an introductory activity that discusses the concept at hand, then students engage in game play (individually or in partners/groups), followed by whole group debriefing and synthesis (strategy A). Or, the teacher might introduce the concept, have students observe him or complete a task or move around the game world, then students engage in game play in teams while taking turns engaging in other learning tasks targeted at the concept (strategy C).

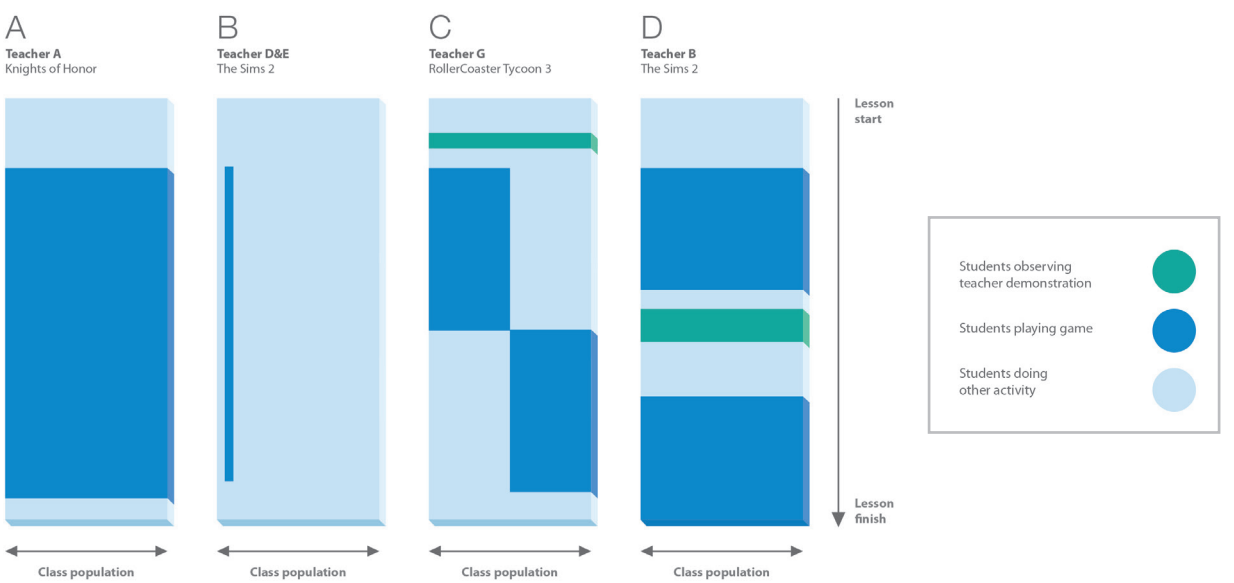

Figure 3.

These are just a handful of possible configurations and strategies. The manner in which a game is implemented in the classroom will in large part depend upon the type of game, but more importantly, how the educator decides to use the game. Figure 4 discusses a taxonomy of game implementation strategies. For example, games might be use as an "Authoring System", where the game is used as a tool to produce an artifact that demonstrates learning and/or understanding. Such an artifact could be building in *Minecraft*, an animation in *Scratch*, or a game in *Little Big Planet*. Or, a game could be used as a "Manipulating System" where the game essentially serves as a simulation that can be manipulated by the learner, as a way to explore a concept or even demonstrate understanding of that concept. Figure 4 offers an explanation and examples of a number of game implementation strategies.

Type		Description
AUTHORING SYSTEMS	Games as "engines" or authoring platforms.	In this scenario, students produce an artifact through game play—be it a game (Spore), a mod (Starcraft), a video (machinima in WoW, the Sims, Second Life, etc.), a visual text (Sims Family Album), an avatar (Miis), or a body of code (Alice, Scratch). Rubrics for evaluation of these artifacts come not from the game, but from the design domain to which the artifact is related, as well as from the kinds of understandings the artifact was produced to express.
CONTENT SYSTEMS	Games as content.	In this scenario, commercial off-the-shelf (COTS) or other games are used to deliver understanding about a particular subject or content area. For example, students play SimCity to learn about urban planning, or Civilization to learn about history. When games are used this way students must be provided with opportunities for reflection on and discussion of the content in spaces external to the game in order to allow students to see the game as part of a larger body of knowledge on that subject.
MANIPULATING SYSTEMS	Games as simulations.	In this scenario games are valued as dynamic systems with which students can test theories about how systems work, as well as how certain principles of dynamic systems can be observed and played out. For example, students may play Bridge Builder to learn about bridges as systems of engineering, or use Soda Play as a way to test out physics-based theories. Animal Crossing could be played in order to have students work with elements of a capitalist economy and theatre games can be played to have students reenact situations or scenarios as a way to see how the system can be affected by manipulating certain factors. Simulations often include their own internal assessment measures (data) that can be used to assess student understanding of both micro and macro elements.
TRIGGER SYSTEMS	Games as context.	In this scenario games are used to create an experiential context for understanding around a topic, issue, or principle that a teacher can build on. For example, a math teacher might have students play Dungeons and Dragons as a way to have them explore probability, or Pictionary as a way to introduce ideas about forms of communication. When games are used this way students must be provided with opportunities for reflection on and discussion of the content in spaces external to the game in order to allow them to see the game as part of a larger body of knowledge on that subject. Depending on the amount of time available, commercial, casual, and non-digital games can be used. This approach can be paired with the use of games as engines—students can be asked to design a game as a way to immerse themselves in research around a topic. Later learning experiences can then build on what was learned in order to build a game.
GATEWAY SYSTEMS	Games as technology gateways.	In this scenario games are used as a way to give students experience with technology, whether this is learning how to use a particular piece of software or platform (i.e. learning how to use a PC or browser) or kind of technology (mobile phones, wireless devices, writing, programming). Assessment models would be based on the effectiveness of a student with a system and their ability to use the system to do what they want it to.
REFLECTIVE SYSTEMS	Games as illustration.	In this scenario games are used as contexts for student reflection. For example, a teacher might ask students to play a game and then discuss the choices they made: why did they choose that avatar skin over another one? Why did they choose to attack that country and not another one? What made them uncomfortable and what were they surprised at having chosen to do? Commercial, off-the-shelf, web-based downloadable games can be used, as well as board games.
POV SYSTEMS	Games as exemplars of point of view.	In this scenario games allow students to take on certain identities and associated points of view. Students might play an RPG where they have to choose to play both a "good" and "bad" character and compare differences in strategy, choice, and values held by those characters. A teacher might ask students to use a theatre game to reenact a familiar scenario, but told from several points of view, with the goal of each character being to shift the outcome of the scenario on their favor.
CODE SYSTEMS	Games as code worlds.	In this scenario students use writing as the primary mechanic of game play, whether they are playing text adventures or designing or playing text-based mobile games. The emphasis here is in the use of writing as both a mode of action and expression. Because writing itself is produced as an artifact of the game play, this writing can be assessed to capture student understanding. There is an opportunity to connect this approach to games with the introduction of a programming curriculum that might use authoring platforms like Scratch or Alice, or virtual worlds that support object creation like Second Life.
DOCUMENTARY SYSTEMS	Games as documentary.	In this scenario the play of a game is used as documentary evidence of student ideas/understanding. For example, students may be asked to play the Sims in such a way as to recreate certain social scenarios that they are interested in. Machinima or storyboarding with screenshots can be used to capture the details of the situation, which then can be used as the basis for additional discussion or reflection. Commercial, off-the-shelf, web-based downloadable games can be used.
IDEOLOGICAL SYSTEMS	Games as text.	In this scenario games are "read" as texts that express certain underlying ideologies, values, beliefs, etc. In the same way that Uncle Tom's Cabin can be read as an expression of the antebellum South, Animal Crossing can be played and analyzed as an expression of late 20th century capitalism, Chess can be played and analyzed as a game about territorial conflict, or Diplomacy as a model of the intricacies of international diplomacy. When games are used this way students must be provided with opportunities for reflection on and discussion in spaces external to the game and ideally in relation to other media. Commercial, off-the-shelf, web-based downloadable games can be used, as well as board games and other kinds of non-digital games.
RESEARCH SYSTEMS	Games as research.	In this scenario students design games as a research activity, which produce material to be used in later learning experiences. Because a designer must be knowledgeable about the system he or she is designing, using game design in this way requires students to think through how their players are learning and what they need to know about the subject of the game. In this way, students not only research material to be used but also edit this material and are introduced to issues around credibility and point of view. Different kinds of research methods can be introduced as part of the work, as well.
ASSESSMENT SYSTEMS	Games as assessment.	In this scenario games can be used as environments for assessing student learning of curricular content or state standards. For example, students might play Quest Atlantis to show their understanding of certain science concepts or they might play a MiLK game that centers on answering questions around certain academic content. All of these uses of games integrate a 21st century skill critical to the design and play of games: systems thinking. While playing video games, young people perform complex tasks within rich and highly immersive multimedia-driven, interactive environments. Sample tasks include: running political campaigns (Political Machine) or football franchises (NCAA Football '08), building environmentally sensitive communities (SimCity), navigating virtual worlds they create (Second Life), managing complex social relationships (The Sims 2), or trying to find a diplomatic solution to the Israeli-Palestinian conflict (Peace-Maker). Don Menn (1993) claims that students can only remember 10 percent of what they read; 20 percent of what they hear; 30 percent, if they see visuals related to what they are hearing; 50 percent, if they watch someone model something while explaining it; but almost 90 percent, if they engage in the job themselves, even if only as a simulation.

Figure 4.

Case Study Two: Personal Classroom Study, Egypt Gaming Unit

The BBC has many educational games in the area of history. Two ancient Egyptian games are *Mummy Maker* and *Pyramid Builder*, which have been used by one teacher at Parkside Junior High School in Normal, Illinois. Ancient civilizations are taught in sixth grade and ancient Egypt is one of the major units. Parkside Junior High School has one-to-one Windows 7 laptops for all three grades of sixth, seventh, and eighth. These laptops are not the most powerful and are not capable of running the high-end graphics games of today. When looking for games and simulations to use within the classroom, web-based games are the easiest to implement and the BBC interactive historical games fit very nicely within the content taught at this grade level.

One of the main learning outcomes for the Egypt unit is to understand that religious beliefs were a driving force in ancient civilizations. The *Mummy Maker* and *Pyramid Builder* are great tools to demonstrate these beliefs. These games also focus on key learning standards for geography, invention, civics, job specialization, culture, science, and math. Connections are easily made to other core subject areas and examples from these two games are used throughout the year to reinforce new content.

Modifications are made to these lessons because the makeup of the classroom changes yearly. The academic level ranges from gifted students to students with severe learning disabilities.

In *Mummy Maker* students simulate the embalming process through decisions made within the game. The game is played by clicking through pages. Each page has content to read and decisions to make. Up to three clues can be given throughout the game to assist the player. Students are instructed to go to the website, read the instructions, make choices, and complete the mummification process correctly. Decisions concerning embalming, appearance, jewelry, and decorating are made throughout the game. If unsuccessful the game gives hints to incorrect choices. If the students are successful there will be a message displayed on a white background screen. This simple game can become difficult if hurried. If the students read carefully and think through each decision, it shouldn't take more than two attempts to finish the game correctly. It is rare that this game is completed on the first attempt. Once finished, they are given a blank paper to write down each step, in order, that was taken to successfully make a mummy. Completing the mummy correctly is difficult, but writing down the steps to make a mummy shows deeper understanding. Students need to play the game again and write down these steps on their paper. Writing down the steps becomes an arduous task because many turn in all information they can copy onto their paper, which includes extraneous details. One example to help guide the students is to ask for the recipe for making a mummy. This example cuts down on the extra information and usually leads to success. Eventually through guidance and collaboration, the students complete game and the written steps. The final lesson is a class discussion on what can be learned from Egyptian mummification.

Once they have completed the lessons for the *Mummy Maker*, the students will be assigned the second BBC game, *Pyramid Builder*. The students follow a similar procedure from before with *Mummy Maker*.

Students are instructed to go to the website, read the instructions, make choices, and complete the pyramid. In *Pyramid Builder* you are assigned to build the pyramid for the current pharaoh before he dies. Decisions concerning location, materials, alignment, angle, workforce, food, and worker incentives are made throughout the game. The *Pyramid Builder* is more difficult than the *Mummy Maker* because there are more decisions to make and those decisions require more reading and problem solving. The game also adds some random events that can make correct decisions look incorrect. The frustration level grows after each attempt, but failure leads to greater understanding. As with *Mummy Maker*, each student is given a blank paper to list the steps, in order, of how to build a pyramid. Fewer errors are made in writing down the steps of how to build a pyramid and this because of what they learn4.7 (d a)4d7 (e f)-19.5 (r)1

better have a good reason for doing it... the very act of completing a game should serve as an assessment of whatever the intervention was designed to teach or measure" (Gee, 2009). Yet this can only hold when a game has been purposefully designed for certain learning objectives. Therefore, just as in the case of other learning tools, teachers must work with the game tool and facilitate specific mechanisms to capture the learning and assessment data they desire. In this section we will explicate some of those mechanisms.

Data Collection In and Out of Games

Some games do already include mechanisms that capture data and information that can be used as a type of assessment or formative feedback about student understanding. Generally, these are thought of as internal assessments to the game, as they do not disrupt game play. However, if, how, and to what extent learning data is captured by a game varies wildly among available games and is one of the elements that should be explored when a teacher is first considering a game as a possible learning tool.

If the game does not capture learning data and/or the data reported is not of the type or quality sought by the educator, then external assessments can be used. These are assessment tools that exist outside the game itself (Eseryel, Ifenthaler & Ge, 2011). In classroom practice, games are often one piece of a wider set of group activities that form the curriculum, whereas strategies and tools for exploring student understanding of the concept being targeted are already at play. These might include observations, discussions, quizzes, and group problem tasks, among others. Group reflection is also a key structure of game-based learning that can facilitate higher order cognition and aid in the transfer between virtual and lived experiences (de Freitas & Neumann, 2009). Tasks given to students that are external to the game can be used to explore "near transfer" when the problems emulate the rules and relationships inherent in the game, as well as "far transfer" when the problem reflects real-life contexts with multiple solutions (Gosper & McNeill, 2012).

In a survey of educators using game-based learning in their classrooms, Sandford et al. (2007) provide glimpses of what it looks like in practice from the teacher's perspective, to use strategies for collecting information on understanding outside of game play. Sandford et al. (2007) explain that, "You need to guide the students to think. I think they can guide themselves through the game, but they need guiding through the learning, unpicking the game, to learn that little bit more….I was assessing their teamwork and ability to listen and respond to others, I think. So I've done an assessment on them based just on observations I've done" (2007, p. 11).

It is worth noting that in general, it is considered poor practice to interrupt gameplay with external assessments. The game is an immersive experience, and the flow and journey through the game is a key part of what makes the game such a powerful tool. If that is disrupted frequently it can be difficult for learners to stay engaged, interested, or even able to adequately apply their learning to challenge at hand.

In summary, Sandford et al. (2006; 2007) offer strategies for supporting learning and assessment in game play that include:

1. **Check for understanding:** Ensure that learners have understood the general goals of the game.
2. **Define assessment strategy:** Determine when and how you are going to assess whether you have achieved your lesson objectives. Consider various methods, including observation, essays where learners reflect on their experience, out-of-game problem tasks both very similar to game tasks and those that are more authentic to real-world, and so on.
3. **Review and reflect:** Check that learners' understand the underlying ideas or topics introduced by the game so that a link can be established between the game and the topic taught—both individually as well as through group reflection. Some questions to facilitate group reflection include:
    a. **What is the main topic of the game?**
    b. **Do the events that take place in the game remind you of something you know,** or something you have heard of from your friends, family or on TV?
    c. **Why do you think this topic is important?**
    d. **What did you learn from this game?**

A Note about Learning Environments

Although some games can be implemented fairly easily in any given classroom, some of the long-form games and those with more technical and support demands are much more likely to be successful when the classroom is situated in a larger learning environment where the school leadership is very supportive and external resources and supports are available (Groff & Mouza, 2008). This includes easy access to various technical as well as human resources such as technology integrators and IT staff to help with implementation issues. It also includes school leadership who are supportive of game-based learning and exploring various models of instruction. Teachers and learning environments have greater success with game-based learning approaches when the administrator has strong coaching and team building skills, and support their educators in taking risks and exploring new approaches (SIIA, 2009).

Future Needs

Game-based learning, with all of its potential and challenges, is at an exciting point—there are ever-increasing examples and discussions on the educational effectiveness of games in formal and informal settings. As the field continues to grow, it is imperative to address the needs and barriers of educators and students. To align with classroom requirements, more games must be available that target learning standards and direct curricular needs. They must provide formative data about student performance in-game to better support general instruction. Evidence of effectiveness and outcomes will be increasingly important as the market becomes more saturated and a larger range of options are available when selecting the right game for your learning needs. While we have seen a surge in support for educators seeking to use games, the barriers to entry can still be significant. We must continue to create better resources so more educators can afford to incorporate games into their curricula.

Case Study Three: *Civilization IV* to Teach Historical Thinking and Perspective-Taking

Civilization IV is a long-form game in which players settle and guide their civilization through 6000 years of simulated world history. Unlike learning games for history found on the web, the game is sophisticated and complicated. Cincinnati Country Day School has a one-to-one laptop program and has been experimenting with the use of *Civilization IV* in the ninth grade classroom for seven years. A number of missteps and successes have helped hone a strategy for classroom use of the game.

The most recent iteration involved a three-part strategy. The first part included setting up technology and familiarizing students with the game. The educator ensured that all computers had the game installed and ready to run. The students were then taught how to play. Because of *Civilization*'s complexity, the educator provided an overview of the game by running and projecting an instance while explaining key features. Once students had a vague understanding of the game, they began to play themselves. Having some initial goals for the students helps them learn (McCall, 2011). In the case of *Civilization*, each student was first tasked with settling at least 2 cities, improving at least one land tile with a worker, and researching iron working. These goals were important only insofar as a student had to have a basic understanding of the game to achieve them.

Once students acquired a basic familiarity with the game, it was time for them to start observing and recording actively. Students were put into pairs, with one person in charge of note-taking while the other controlled the game. Halfway through the play session, the students in each pair switched roles. The reasoning is that pairing the students and explicitly requiring note taking encourages students to collaborate and actively observe as they play. Active observation notes are critical for analyzing game models in the long term (McCall, 2011). Students were tasked with keeping track of the following elements:

1. The names and geographic settings of the cities
2. The units and buildings each city builds in order, with
    a. Year building started
    b. Year building finished
    c. Why the pair chose that unit/city improvement
3. Interactions with other civilizations, including their demands, what the pair did, and the results
4. What happened to any units exploring, including fights with animals/humans and the results, discovery of new things, villages found
5. The order of the research chosen, such as the technology the pair selected
    a. Year research started
    b. Year research finished
    c. Why the pair chose that research path
6. Any other good or bad events (running out of money; city revolts, etc.)

They were also instructed to save the game when they reached certain years in gameplay (e.g. 3500 BCE; 2500 BCE; 2000 BCE; 1500 BCE). Combined, the notes and the saved games provided a set of data that students could draw upon in the future. Though the particulars of the notes can vary, the emphasis on observation and notation has remained a core step for using historical simulation games (McCall, 2011).

Once students learned to play the game and had a partner for play and observation, the class resumed their study of the ancient world, but received assignments every so often to continue their partnered game. This is a useful trick with a complicated game such as *Civilization*: introduce students to the game, and refer back to it regularly as suitable opportunities arise. Most of these opportunities involved comparing the game models to historical evidence while learning vocabulary along the way. During the class, students engaged in: (1) defining all of the civic elements in the game, (2) choosing what each thinks is the best civic concept in a category, and (3) discussing whether the effects of the civic concept in-game are analogous to the effects of that civic concept in historical societies.

Charting the growth of one of their cities over time and establishing the correlation between availability of resources and city growth is a key aspect of game play and includes a number of activities:

1. Examining the characteristics of a leader in the game and comparing to the leader's real-world characteristics.
2. Assigning characteristics from the game to a historical figure.
3. Using the world editor to reconstruct the rough geography of a place and discussing the impact of the geography on the civilization.

By the end of the year, students achieved the broad objectives for the game. They practiced collaboration and observation, studied a historical simulation in detail, and taken a number of opportunities to consider how the models in that simulation could clarify our thoughts about historical systems.

Best Practices

No matter what type of game an educator can use, there are several basic strategies that will help you get started and better enable success with the game. This section offers a summary of teacher implementation strategies. These strategies include:

1. **Define your learning goals and instructional needs.** Games are no different than other instructional tools. Finding (and using!) the right instructional tool starts with being very clear in your content and instructional needs. With that in mind, identifying the right game will be much easier.
2. **Find one or more games that meet your needs**. With all of the games available, just finding the right one can be difficult. Thankfully that is getting much easier with the recent

appearance of numerous game portals (see "Resources" at the end of the chapter). On sites like these, you can search and sort games based on topics, learning goals, standards, platform, and many other variables.

3. **Select the right game for you.** Once you have found one or two games that interest you, explore each and make sure they are a good fit for your needs and your students. The following questions will help you narrow down the potential games.
    a. **Is the game you are considering suitable in terms of the technical difficulty and age of your students?** Is the content appropriate for them and will it motivate them?
    b. What elements of the game support your educational goals?
    c. Does the game match your learning goals entirely? If not, can you extract elements relevant to your learning goals and use these productively in isolation from the game as a whole?
    d. **Can you use the game easily in your classroom?** Think about barriers like cost and technical platform. (A quick worksheet, found at XXX, was developed by the Learning Games Network and can help you determine if a game coincides with your needs).
4. **Allow sufficient time for you and your students to become familiar with the game.** Once you have picked a game, make sure you play it! Play through the game a few times playing so that you become familiar enough with it to help your students. Let your students explore the game on their own before offering help. This is especially important for larger, long-form games that are often more complex and have more elements and game mechanics with which to become familiar.
5. **Identify the precise role of the game toward meeting your learning goals.** When planning how to use the game as a learning experience for your classroom, thoroughly understand the game's role as a tool and how you will use it as a learning context. Some high-quality educational games can be implemented easily and are already a packaged curriculum. Most games, however, need teacher support, which can be a significant burden. It is important to consider your options:
    a. *Use the parts of the game that work for you:* You do not have to use the entire game. Identify the parts that fit your needs and build the lesson around it.
    b. *Use the game as preparation for future learning:* New learning has to be hooked onto prior knowledge or a conceptual frame, and games can serve as an excellent 'shared experience' that can later be referenced and leveraged during formal instruction.
    c. *Use the game as pre-assessments:* Games are a great way to help students demonstrate prior conceptions, background knowledge, and vocabulary. They can even be revisited later as an opportunity for practice
    d. *Allow the game to be played outside of school:* Like the "flipped classroom" model, web-based games that can be accessed students can often be played on students' own time, with game elements and concepts addressed in

class. Although this approach prevents educators from performing informal observations of student play, students can play for hours at home and do not have to worry about classroom limitations. See the Game Review Tool at http://playfullearning.com/wp-content/uploads/2015/08/Game-Review-Tool.pdf

6. **Let the students demonstrate their expertise.** When it comes to actually using the game in your classroom, let students shine on the tasks they excel, such as using technology and helping others use it. Let them provide technological answers and troubleshoot game setup. They will appreciate you deferring to them about something that many students know so much about; be sure to provide support for those students who are less confident, which may include support from peer students.
7. **Build in time for review and reflection.** Much of game-based learning research has demonstrated that the reflection and review activity is what produces the largest impact in learning gains (Sandford, et al, 2006). Be sure to structure and allow group time for review and reflection on play, particularly as it relates to the learning goals.

Resources

Books, Whitepapers, and Articles

Klopfer, E., Osterweil, S., Groff, J., & Haas, J. (2009). *Using the Technology of Today, in the Classroom Today: The Instructional Power of Digital Games, Social Networking, and Simulations and How Teachers Can Leverage Them.* An MIT Education Arcade whitepaper.Am(e C)Tuer 110eato7 (a)--7.9 4--7ei4.ducation9ikti1e4.d32.6 (u85./)2(u

Websites

Playful Learning (www.playfullearning.com)
Education Arcade (www.educationarcade.org), "Using the Technology of Today in the Classroom Today"
BrainPOP's GameUP (www.brainpop.com/games)
BBC Mummy Maker (http://www.bbc.co.uk/history/ancient/egyptians/launch_gms_mummy_maker.shtml)
BBC Pyramid Builder (http://www.bbc.co.uk/history/ancient/egyptians/launch_gms_pyramid_builder.shtml)
Civilization (www.civilization.com)

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Squire, K. (2008). Open-ended video games: A model for developing learning for the interactive age. In, Salen, K. (ed.), *The Ecology of Games: Connecting Youth, Games and Learning,* 167-198. The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning. The MIT Press.

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CHAPTER 2

Selection Criteria for Using Commercial Off-the-Shelf Games (COTs) for Learning

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Key Summary Points

1. To use COTS games in the classroom effectively, teachers need to be familiar with both the subject matter, and the game.
2. Reference and support materials surrounding a COTS game are essential to the game's in-class utility.
3. The ability of the game to fit in with the topics being taught is more important than the game's popularity.

Key Terms

Instructional Design
Pedagogy
COTS (Commercial Off-the-Shelf)
Edutainment Era
"Big G" games
Short Form Games
ESL (English as a Second Language)
HE (Higher Education)
K-12 (Kindergarten to Grade 12)

Introduction

Digital games are being used more and more often as teaching resources in the classroom (Habgood & Ainsworth, 2011). Some are games designed specifically for educational purposes, and others—commonly known as COTS (commercial off-the-shelf) games—are commercial games that were designed for

entertainment, but have educational value as well. Some of these, like *The Sims*, *Civilization*, and *Portal*, have come to be seen as educational games despite having commercial success outside of education. COTS games may be free to download or play, or games that must be purchased. They can be for any platform, including mobile.

While there appears to be a gradually growing acceptance of the use of games for learning, this acceptance is largely focused on games designed specifically for learning, in other words, serious games where the educational purpose of the game is explicit and was likely part of the design goals right from the start. When it comes to using COTS games in the classroom, acceptance is still often replaced with skepticism (Van Eck, 2006). Some have proposed their own theories about which attributes of COTS games make them suitable candidates for use in a formal learning context, and while the body of research on the use of games for learning continues to grow, there is still no definitive evidence that any specific theory carries more weight than any other. What is clear is that the use of games for learning holds sufficient promise to warrant continued inquiry (Perrotta, Featherstone, Aston, & Houghton, 2013).

To avoid the negative backlash against games that occurred in the "Edutainment Era" we need to adopt a more moderate approach supported by evidence that our efforts are at least as good as traditional approaches, and preferably better (Wilson, 2009). The so-called Edutainment Era, which started in the mid- to late 1980s and lasted to the mid-1990s, was the first time that computer games for education became popular, and they were promoted by some as a panacea. All one needed to do was wrap a game around a lesson, and it would magically become fun. This, of course, is not true, and the fall from grace for many educational developers left them reeling.

By once again preaching that games are effective and useful for learning we give the impression that all games are good for everyone to learn everything (Van Eck, 2006). Clearly, this is an overstatement of fact and it is understandable how this message might turn people off to the idea of using some games to teach certain things. It is important to emphasize that whether a game is intended for use in formal education (e.g., preschool, K-12, higher education), corporate training, or other professional development, the context and activities surrounding the game are key to reaping whatever potential benefits a particular game may offer. The size of the game, that is, the amount of time it takes to learn how to play the game as well as the expected length of play are also important factors when considering games for learning.

Ultimately, the fitness of any particular game, like any other instructional technology, will depend not only on the game itself, but also on the requirements, features, and limitations of the environment in which it will be used and the people who will be using it. This chapter provides a snapshot of where we are now in our understanding of the issues and ways to address them.

Key Frameworks

The early stages of a new field are always exciting, and game-based learning generally as well as learning with COTS game specifically are still relatively new fields. Theory building and the development of new frameworks is a part of any field, but a new field typically offers especially fertile ground. There are a growing number of digital game-based learning theories and frameworks, such as James Gee's "36 Principles" (Gee, 2003) and the use of playability development techniques (Sánchez, Iranzo, & Vela, 2013) and the list grows almost monthly. We could already fill an entire volume with the theories and frameworks that have been proposed to date, but instead we have chosen to highlight a few that have a particular focus on or application to COTS games, as there are some differences between COTS game and those specifically designed as games for learning. Table 1 outlines some of the main differences between COTS games and serious games with respect to how the games are designed.

Table 1. Commercial vs. Serious Games

Differences	Commercial Game Design	Serious Game Design
Concept Catalyst	Amusement and fun	Performance or knowledge gap
Key Question	Is it fun?	Does it meet learning objectives?
Focus	Player experience (how)	Message (what)
Content / Method	Method is primary (content may be irrelevant)	Method secondary to content (game often seen as receptacle)
Vantage Point	Entertainment and software engineering	Special Interest Group (SIG) (e.g.,medicine, military, social change,)
Fidelity	Self-consistent, otherwise irrelevant	Faithfulness to message is essential
Credentials	Industry	SIG (and industry

Because of these differences, COTS games will rarely contain any explicit ties to required curricula, nor will the scoring mechanisms be usable without interpretation or translation, and this is an important issue for games to be used in formal education. To complicate things further, depending on the game, a losing score can sometimes be just as valuable for meeting educational objectives as a winning one, and the actions required to achieve a positive score in a COTS game may have little to do with what players are supposed to be learning. When a COTS game is used for leaning, the connections to the educational objectives will almost always be externally imposed, even when there is authentic and relevant learning taking place within the game. With serious games designed specifically for learning, these connections are usually much more obvious and in-game scores may even be directly usable by teachers for student assessment. This places COTS games in a separate category with distinct requirements.

"Big G" vs Small "g" Games (Gee)

Many of the most successful commercial games are what Gee (2012) refers to as "Big G" Games (Gee, 2012). He explains that "Big G" games include not only the actual software of the game, but also the social interaction around that game. Big "G" games also include a very long list of attributes such as collective, intelligence, crowd sourcing, innovation, social and embodied intelligence, cultural models, modding abilities, critical/design/systems thinking, and others, many of which relate to his original list of 36 principles from his seminal work, "What video games have to teach us about learning and literacy" (Gee, 2003). "Small g" games, on the other hand include just the game itself, or the software you use to play the game, and presumably lack the other attributes of "Big G" games, though it is not clear how many of the required attributes a game must have before it can be considered "Big". What is clear is that according to Gee, the game by itself is not enough to create the best learning environment, but must include the social interactions around the game.

Gee describes "Big G" games as being good for learning, but there are still very few examples of commercial Big G games being used effectively in a formal educational setting. Perhaps the best-known example is that of *Civilization III* as used by Kurt Squire in a Boston area high school, where he determined that games need to be understood as a socially-mediated phenomenon (Squire, Gee, & Jenkins, 2011). Squire's results are discussed in more detail in case study one.

Simon Egenfeldt-Nielsen (2005) also conducted a classroom study as part of his doctoral work. He used the game Europa Universalis II in a Danish school to teach history over an eight-week period and found that external elements such as reflection and instruction are necessary to facilitate learning with COTS (Egenfeldt-Nielsen, 2005). Like Squire's study, Egenfeldt-Nielsen's study emphasized that games could foster information-handling and problem-solving skills, but there is also a need for instructor mediation when COTS games are used in a formal learning context.

Using a COTS game in a formal learning context is, in most cases, analogous to an "off-label" use. We use them knowing that this is not what they were designed for and so we must accept that the efficacy of these games will inevitably come from a well-matched pairing of learning design outside of the game and directed or goal-oriented play within the game. The aim of this chapter is to provide a framework for educators to guide them on how to achieve this pairing between COTS and the classroom.

Case Study One: Language Learning

What follows are actually two brief case studies, both of which focus on language learning, and both take advantage of the language settings available in many commercial games. All games present various elements, such as settings, labels, and sometimes even dialog in multiple languages. Players may choose which language to use when they first start a game, and if they choose the language they are trying to learn, the game can help.

The Sims (Electronic Arts, 2000)

Teaching a second language is a unique field, in that the way language teachers learn the language they are teaching bears little or no resemblance to the way they will be teaching it. Often, they learned the language as children growing up, either as their first language, or as one of multiple languages in common use. This is rarely true of the sciences, or history, for example. Further, teaching a language to an adult is quite a different proposition from teaching language to a child and so it requires quite a different approach.

Purushotma (2006) used *The Sims* in language learning and found that it contains many of the elements useful when teaching a language. For example, it includes a cast of characters who represent many characters from real life. Players have families, hold down jobs, build and furnish houses, and they must manage everything from what to wear to work, to how to keep their loved ones healthy and entertained. The language used in *The Sims* can be changed in the settings and many in-game objects can be looked up in the game, so the player can read about them in the target language. Objects also allow annotations, which is where translations and further explanations can be placed (Purushotma, 2006). Since the game focuses on everyday activities, it is a good match with a typical approach to language learning both in K-12 and in post-secondary courses, and could even be used as a supplement to traditional language learning textbooks (Purushotma, Thorne, & Wheatley, 2009).

FIFA World Cup Soccer (Electronic Arts Inc., 2004)

This game was to be used in an Adult Education English as a Second Language (ESL) class. Soccer is a sport that the adult students taught would be familiar with according to the lesson designer and therefore the in-game commentary has a ready-made context. Even though the game is presenting commentary in the target language, the players know what is normally said and can form connections between the situation they see and the words they hear. Additionally, as is typical for many games, certain moves within the game trigger certain predictable reactions and comments from the non-playable characters (NPCs) within the game. When the game is played in English, these comments (phrases) can be elicited at will. This repeatability can be a big advantage to someone struggling to learn a new language (Wang, 2006).

Games as Ideal Learning Environments

Gee (2009) explains that games present an ideal learning environment for players, guiding novice players with no knowledge of the game through increasingly difficult levels until they have mastered the game. Good game designers follow learning principles, whether they realize it or not. In fact, he says that game design practice is applied learning theory (Gee, 2009). It is beyond the scope of this paper to explore every learning theory that is relevant to game based learning, but Table 2 summarizes a few key theories to show the connection between learning theory and game design practice.

Table 2. Learning Theory and Game Design Connections

Learning Principle or Technique	Game Design Practice	Educational Advantage
Activity Theory: This is based on a learner's interactions with objects, rules, and community to achieve certain goals.	Players interact with obstacles and characters (PCs and NPCs) according to game rules to achieve goals.	Learners actively engage with the content; Information is presented in context; Learners can experiment without consequence; These factors increase learning transfer.
Discovery Learning: Learners grapple with questions or challenges by drawing on experience and prior knowledge and experimenting with various solutions.	Players have to overcome game challenges by drawing on previous experiences in the game and knowledge about the game world.	Learners practice problem solving through an iterative cycle of attempting a task, receiving feedback, reflection on the outcome, and reassessment of the strategy.
Scaffolding: Teachers provide support for a task or skill that is just beyond a learner's capabilities to help the learner master the task or skill.	Games provide help in the form of slower pace, power ups, extra lives, in-game tutorials, etc. the first time a player is presented with a new challenge.	With reduced cognitive load learners can process problems more deeply.

Gee describes the properties that games have that make them "good," such as incorporating good gamification, smart tools (inside the game), good media convergence (i.e. merging of media technologies), and taking advantage of collective and distributed intelligence. Good games have assessment built into the game, progress in the game is proven through mastery; and gameplay is contextualized and includes meaningful problem solving. However, just because a game possesses all of these properties does not mean that the things that make the game good are actually focused on elements of value in the intended educational context. For example, achieving a high Happy Home Academy (HHA) score in *Animal Crossing New Leaf* is a complex undertaking and can require all of the properties just outlined, but what players learn to earn that high HHA score is not especially useful in a real life context.

Gopin (2013) therefore proposes a framework for evaluating the educational potential of COTS games that takes problems like this into account. The framework evaluates games from three different perspectives:

1. Define the learning goals of the game.
2. Analyze the motivational strategies
3. Analyze the learning strategies

Gopin's framework offers a series of questions that can be used to analyze the game from these three perspectives. For example:

1. **Define the learning goals of the game:** What new skills and/or knowledge should players have when they complete the game?
2. **Analyze the motivational strategies:** Is the core mechanic satisfying? Does the game provide interesting, meaningful choices to the player? Does the game provide clear goals? Are players rewarded when they do something right? Is there feedback when players make a mistake? Does the game fantasy reinforce the learning goals?
3. **Analyze the learning strategies:** Does the game reflect how newfound skills and knowledge can be used in real life? Does the game require players to master lower level skills before progressing to harder challenges? Does the game promote critical thinking/ problem solving? Is the core mechanic inherently connected to the learning content, or can the player succeed at the game without learning anything new? Does the game provide help "on demand" and "just in time?"

These questions give an educator a better understanding of how a specific game can be integrated into a learning experience. The guiding principle underlying this framework is whether or not a specific game can support a specific learning experience; no one game is either "good" or "bad" for learning, it really depends on what a teacher wants to teach with the game.

Gee's description of what makes a game "good," as well as Gopin's framework, could potentially be applied to any game that might be useful in a learning context, whether it requires many hours of play or can be completed quickly, and whether it has been designed specifically for learning (i.e., a COTS game), provided we can connect the principles with the learning goals. However, the real potential for COTS games, at least in the near future is short-form games and casual games (games with levels that are playable in 10 minutes or less) because they fit better within the natural time constraints for formal education, where activities that span more than a single class or period can be difficult. The challenges of typical classrooms (see below) are not normally conducive to the use of games that require longer playing times or have a long lurning curve (Van Eck, 2012).

Challenges of a Typical Classroom

1. **Game format (gameplay length):** Many games do not lend themselves for use in a period-oriented format and simply need more time than is traditionally available to be effective. Some COTS games can be broken up into shorter playing sessions, but many cannot.
2. **Technology requirements:** Many COTS games assume up to date equipment; schools often don't have that.
3. **Buy In:** Administrators have been identified as a potential barrier to the use of games in the classroom generally (Becker & Jacobsen, 2005). Many administrators have yet to be convinced that there is sound pedagogy behind the use of games in the classroom.

Adapting the NTeQ Model (Van Eck)

In Van Eck's *Guide to Integrating COTS Games into the Classroom* (2008), he uses the NTeQ model (Lowther & Morrison, 1998) for technology integration as a starting point for the development of a template for using COTS games in the classroom, that addresses at least some of the concerns outlined above. NTeQ stands for iNtegrating Technology for inquiry, and the model includes the following elements:

1. **Specify Objectives:** What learning objectives will your students achieve from completing this lesson?
2. **Computer Functions:** Match objectives to computer functions/activities.
3. **Specifying a Problem:** What problem will your students be solving?
4. **Data Manipulation:** How will data be used? Briefly describe each manipulation activity.
5. **Results Presentation:** How will students present their results?
6. **Activities During Computer Use:** What will they do while at the computer?
7. **Activities Before Computer Use:** Prepare for computer use (e.g., brainstorming).
8. **Activities After the Computer Use:** Reflection on learning
9. **Supporting Activities,** including review of prior learning, required research and reading, and enrichment activities.
10. **Assessment:** Rubric to describe performance standards.

Van Eck adapted the basic elements of NTeQ to the use of COTS games in the classroom and some key considerations emerged, such as the challenge of finding and evaluating COTS games, which can be very time-consuming. Additionally, once we have a game and are familiar with it, we must design the lesson as well as its evaluation. In most cases, the majority of the time spent with a lesson that uses a COTS game is actually spent around the game rather than in it (Van Eck, 2008).

In other words, in an educational context, more time is typically spent in activities leading up to and following the game than actually playing it. When the game being used is a COTS game, we have already seen that the design of the lesson around the game is crucial and therefore the ability of the game to fit into the larger lesson context is an essential part of the selection process.

Essentials of Curriculum Integration

One of the biggest deficiencies when it comes to the use of COTS games in formal education as compared to games specifically designed for learning is that most COTS games lack at least one of what the author calls the Essentials of Curriculum Integration. Table 3 below outlines these essentials.

Table 3. Essentials of Curriculum Integration

Aspect	Definition	Example
Main Objective	The game is connected or connect-ABLE to formal educational objectives	The lesson will use Angry Birds as a digital manipulative to illustrate the concept of potential energy
Curricular Ties	There is a direct relationship between what the game does and what the curriculum (or syllabus) says needs to be done	Students will develop a deeper understanding of the connection between potential and kinetic energy by comparing trajectories when they pull back on a bird half-way vs all the way
Assessment Connections	There is a clear way to map assessment in the game onto formal educational assessment	After playing the game and then reflecting out loud as a class, students will successfully pass a paper-and-pencil test on the topic of energy
Teacher Support	There are available resources to help teachers locate relevant games and design effective instruction around a selected game	This could include teacher's guides, study guides, lesson plans, and suggested activities, among other things.

Since games are still novel educational technologies in most formal educational contexts, teachers who wish to use them will be required to justify their use in ways not typically necessary if they decide to use a more traditional technology. As a result access to resources such as curricular ties, ways in which assessment can be used to inform student progress, and lesson plans can make the difference between a game being approved for use and not. To further complicate matters, most teachers simply do not have the time to create these resources for themselves, so if these resources do not exist, it will not matter how good the game is.

4PEG: The Four Pillars of Educational Games (Becker)

The 4PEG review template was created to address the need for a structured and consistent mechanism that could be used to analyze games intended for use in educational contexts. It consists of four parts that are each assigned individual scores, which are then combined to create an overall numerical rating. This rating can then be used as one element of a larger selection process, which should include information on instructional strategies employed by the game and the results of efficacy testing when available. The four scored parts are outlined below:

1. **Game Overview:** (30%) How satisfying is it as a game?
    a. **Gameplay:** What can you do in the game? Are the controls logical and easy to use? Does each "level" fit the overall style of the game?
    b. **Art & Audio:** How does it measure up aesthetically? This includes visual and auditory components.
2. **Teacher Support:** (20%)
    a. **Guides:** How to use it.
    b. **Plug'N'Play:** How much work is involved in fitting this game into a lesson? This

also includes operation: Is installation & basic functionality explained?

c. **Resources:** Supplementary materials a teacher can use to better understand how to play the game, or create a lesson around the game.
d. **Community:** A community exists where teachers can go for help, support, to share. It is clearly identified and easy to find.

3. **Educational Content** (30%)
    a. **Instructional Strategies:** Are the instructional strategies appropriate for the learning outcome(s)?
    b. **Instructional Design:** Is the design in keeping with Merrill's 1st Principles of Instruction?
    c. **Objectives:** Does it appear to fulfill the stated objectives?
    d. **Inclusion of Learning Objectives**: Are they obvious (either in the game or in the support materials)?
    e. **Integration:** Are the objectives integrated into the game? In other words, is it necessary to master at least some of the stated learning objectives to get through the game?
    f. **Accuracy:** Is it correct?
    g. **Assessment:** Is the scoring/assessment in the game connected to the learning objectives (or is it easy to connect them)?
4. **"Magic Bullet" Rating** (Becker, 2011) (20%) (This rating is a bit more subjective and is based on a teacher's "gut feeling" about whether a game is appropriate or not.)
    a. **Overall Balance:** Is the relationship between the what the player can learn and must learn, both inside and outside of the game appropriate for this game given its intended use?
    b. **Can vs. Must:** Is it possible to get through the game without learning anything (i.e. without meeting any of the educational objectives)?
    c. **Operational vs Educational:** Is the required operational learning appropriate for the game's intended purpose?
    d. **Educational vs Discretionary:** Is there an appropriate balance of learning and fun?

The 4PEG review is intended to form part of a resource that would also include specifics on curricular ties (such as appropriate grade levels, formal goals & objectives with which the game connects) and also lesson plans. Providing a truly objective review of a game is exceptionally difficult, but using simple number values attached to specific aspects or components being reviewed provides for the possibility of comparing different games against each other as well as contrasting different reviews of the same game.

Key Findings

In spite of the growing body of literature on the use of games in education, there are still relatively few resources that help people select COTS games for use in the classroom. A survey by Kafai, Franke, & Battey (2002) conducted at the turn of the century found that reviews of educational software tended to focus on the ease of use of the software rather than its efficacy, and while the situation has improved in the ensuing decade, it remains difficult to locate for games the kinds of teaching resources that are relatively common for other educational media.

Many existing educational reviews of COTS games mention potential subject areas or topics for which the game might be useful, but most still do not provide much in the way of specifics, so teachers are still largely left to figure out lesson plans for themselves. Also, educational reviews tend NOT to be critical enough. There are plenty of reasons for this, including:

1. Teachers are not necessarily gamers and they may not know what makes a good game.
2. The current culture of education does not foster critical reviews; instead it just celebrates and gives accolades. As a result, even ineffective games often get positive reviews.
3. Reviews rarely mention what is else could be possible (perhaps because the reviewers are not trained in technology and so they do not actually know what is possible).

Teachers must be prepared to help their students by connecting the dots between what they are learning in the game and how that relates to the topics at hand. Egenfeldt-Nielsen's study (2005) emphasized that games could foster information-handling and problem-solving skills, but there is also a need for instructor mediation when COTS games are used in a formal learning context. Teacher familiarity with the game is important, but not as important as familiarity with the curriculum being taught and general teaching competence. The best way of integrating gaming into teaching is by using it within a clear pedagogic process (Sandford, Ulicsak, Facer, & Rudd, 2006).

While it is important for students to receive appropriate guidance to get the most out of learning sessions with COTS games, designers must also ensure that teachers are not left on their own when trying to enable game-based learning. Beyond the video game itself, teachers should have the time and the resources for offline activities to support learning. These include time to organize collaborative tasks, and the ability and the skills to provide timely guidance while students play the game.

Finally, Squire (2003) made the following suggestions as a result of his experiences with Civilization in the classroom:

1. Teachers must know the game. Ideally, they will have spent time actually playing it.
2. Gameplay drives learning. Teaching and learning activities should be in direct response to the game challenges.
3. Use just-in-time lectures that relate to issues the players are currently having in the game.
4. Make use of gaming communities to support learning.
5. Facilitate inquiry in and around the gameplay by compiling and comparing data.

Case Study Two: *Portal 2*

Portal 2 (Valve Corporation, 2011) is a sequel to the original Portal (Valve Corporation, 2007) both of which are enormously popular first-person puzzle-platform games where the player moves around the environment by shooting starting and ending portals into otherwise disconnected surfaces, thereby creating a link through which the player may move objects, including themselves. The game requires extensive spatial acuity and was quickly recognized for its potential use for learning physics, problem solving, and critical thinking.

Valve Corporation developed a customizable version of *Portal 2*, a popular COTs game, which allows users to develop their own rooms and portals. They also created a website to support teachers wishing to use the game and to encourage them to develop and share content (http://www.teachwithportals.com/). The site includes a wiki and forum for discussion and sharing of resources as well as a separate space where teachers can submit lesson plans. All of the content is publicly available, allowing teachers to access the resources at their convenience.

Assessment Considerations

This chapter focuses on selection criteria for using COTS games for learning, and so the assessment considerations really center on assessing the assessments. Are we taking the appropriate criteria into account? Are there gaps in the templates or models we are using? Do favorable scores in the assessment template lead to the selection of the right games for the right courses and lessons? These kinds of questions require a collection of reviews/assessments that can be compared. The resultant games should then be tested in educational settings. While there is a growing body of research on the use of games in the classroom including both COTS and serious games, the research on selection methodologies is still in its infancy. However, there are several groups working on the creation of reviews that will be comparable, including Becker's 4PEG template, and one being developed by the International Game Developers Association (IGDA) Special Interest Group (SIG) on Learning and Education Games (IGDA-LEG).

Future Needs

There are still relatively few resources for those wishing to use COTS in the classroom, and no consistency among the few resources that make any effort at all to provide guidance on choosing and using COTS games. Teachers need to know not only which games are out there, but also how they can be used in the classroom and how they tie in to the curriculum. They also need ready-made, accessible support materials like lesson plans and activities. Some companies, like Valve (creators of *Portal* and *Portal 2*), do offer online resources geared specifically to teachers to encourage them to use the game in the classroom. However, much more needs to be done in this direction.

In addition to resources helping with game selection, teachers also need access to "canned" lesson plans that help them use a COTS game. To see what kinds of support might be easily accessible to teachers,

we performed a Google search (on April 29, 2014) using the search phrase "educational game" + flight. There were over 250,000 links, but they consisted of links to a fundraising campaign, articles, research papers, a few flight simulators, and various bits of things to do with flight OR games. However, there was nothing available that would have been of any use if I had wanted to use a game for tomorrow's class. By contrast, we also performed a search using the phrase "web quest flight." This search resulted in only 71,000 hits, but the very first page of hits included several ready-to-use web quests about flight. These resources included grade level suggestions, activities, and evaluation ideas, which are the basics needed to be able to use that lesson in a classroom tomorrow. It took a total of three minutes to find them, have a quick look at them, and pick one that could be used. These are the kinds of resources that make the incorporation of new approaches in the classroom possible, and they are still missing for most types of games.

While there are quite a lot of COTS games out there that have educational potential—both big and small—almost none of them are useful immediately in the classroom. Many of them require the teacher to either play the game or watch someone playing the game, analyze it, and then build a lesson from scratch, including assessments that the school will approve of and explicit ties to the required curriculum so that the use of that game can be justified to administration.

This poses a problem for teachers who are not comfortable brainstorming ways to connect games to curriculum. Sandford et al. (2006) conducted a year-long study using three COTS games: *The Sims 2*, *RollerCoaster Tycoon 3*, and *Knights of Honor* and found that teacher familiarity with the game was important, but not as important as familiarity with the curriculum being taught and general teaching competence (Sandford, Ulicsak, Facer, & Rudd, 2006). One possible inference that can be drawn from this study, which supports findings from other studies regarding the need for active teacher involvement in the process, is that while commercial games can enhance classroom experiences with learning, they cannot compensate for the general lack of knowledge or skill on the part of the teacher in dealing with games—at least, not yet. Available resources for integrating games and curriculum would go a long way to solving this problem.

Case Study Three: *Minecraft* with Second Graders (Written by Charlotte Weitze)

Minecraft (https://minecraft.net) is a sandbox game. In the game, the player is allowed to build with different kinds of textured cubes, creating her own world, buildings, etc. in three dimensions. It is a game with possibilities to explore, to gather resources and to craft in, to combat in, and it is what feels like an infinite game world. *Minecraft* has become a very popular game with 100 million registered users (according to Wikipedia, February 25th, 2014), and it is simple to play both as a multiplayer game in the game like survival mode or the creative mode, as well as on your own in creative mode, giving the possibility to build your own worlds.

The following is a description of a session with four students, all of them familiar with playing in *Minecraft* in advance. In this hour session, there was only one computer that could be used.

The session began with the group searching on the Internet for "The Seven Wonders of the World." The assignment was to choose one of the seven wonders and build it in *Minecraft*. The students found pictures and stories and decided that they wanted to work on a Taj Mahal theme.

The students found a picture of Taj Mahal that they wanted to use as a model. While one of the students started building the Taj Mahal, originally built as a mausoleum, inside *Minecraft*, the other students sat beside and contributed with ideas on how to shape the building. I, the teacher, read aloud the story about the Shah Jahan, his wife Arjumand Bano Begum, their many children, and why the mausoleum was built and under what circumstances.

After hearing the story, the students worked in the following shifting roles: 1) Builder: building the Taj Mahal in *Minecraft*; 2) Instructor: instructing fellow students in how to act out the story of Taj Mahal; and 3) Actor: acting out the story of the Taj Mahal, as retold by the current instructing student. The students performed each role for about 10 minutes and then shifted to the next role, which gave the students an opportunity to personalize and internalize the Taj Mahal story.

After building a version of the Taj Mahal inside *Minecraft*, and having settled on a version of the story, the students now started discussing how they could continue to play inside *Minecraft*. They had built a small village around Taj Mahal and started creating and placing relevant story characters inside the village, including the emperor and his wife and all their children. Next, the students acted out the Taj Mahal story inside *Minecraft* with the characters. We screen casted it, making a small film, and one of the students narrated the story for the film. This could now be shared and discussed with the other groups in class.

The students were very motivated throughout, reported they were having fun, and experienced a personal relationship with the story of the Taj Mahal. It was a very creative and playful process for the students, and turned out to be a very collaborative learning environment.

Best Practices

Assessment strategies for the selection of COTS games are still very much in the early stages, so it is not yet possible to declare a list of best practices. However, based on experience with selection of materials for use in learning contexts, there are a number of rules of thumb that could be applied here as well.

1. **Get specific:** Game reviews should include details about which subjects and grade-levels are appropriate venues for a specific game. In those cases where a game does not fit naturally it is even more important to provide such details. Many people could imagine using a game like *Angry Birds* to teach certain aspects of physical forces, or *Scribblenauts* for spelling or vocabulary, but using a game like *Animal Crossing New Leaf* for data gathering, graphing, and charting would need more explanation.
2. **Include numerical ratings:** While game reviews cannot really be quantitative or truly objective, associating something like a straightforward Likert scale allows for a mechanism to compare assessments. Given a sufficient number of assessments, the trend can start to become predictive.
3. **Include measures of the game as a game:** We must not neglect the nature of the object we are assessing. The game's value as a game is key. If it is not a good game to begin with, then why is it being used in the classroom?
4. **Educational aspects must be heavily weighted:** Very few teachers have a great deal of spare time. This is true for the time they have available for preparation, but it also includes the time they have available in the classroom. Using a game that takes a considerable amount of time but does not provide much in the way of educational value is not a good use of time.

Resources

Websites

Scratch website (http://scratch.mit.edu/)
SNAP website (http://snap.berkeley.edu/)
Common Sense Media website http://www.commonsensemedia.org/
Games and Impact.org website http://gamesandimpact.org/games/
Learning Works for Kids website http://learningworksforkids.com/playbooks/ .
Playforce.org website http://beta.playforce.org/ (Institute of Play http://www.instituteofplay.org/)
Playful Learning website http://playfullearning.com/
Teach with Portals website http://www.teachwithportals.com/

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Games

Angry Birds
Civilization Series
GIRP (http://www.foddy.net/GIRP.html)
Kerbal Space Program (https://kerbalspaceprogram.com/)
Line Rider
Little Big Planet
Minecraft
Portal (http://www.learnwithportals.com/)
QWOP (and its sequel CLOP) (http://www.foddy.net/CLOP.html)
Scribblenauts
SimCity
SodaPlay (http://sodaplay.com/)
Tycoon Games (e.g., Roller Coaster, Zoo, Railroad)
The Sims 2
RollerCoaster Tycoon 3
Knights of Honor

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CHAPTER 3

Gamification in the Classroom: Old Wine in New Badges

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Key Summary Points

1. Gamification is a term for a collection of activities that use game elements for non-game purposes.

2. Teachers have already been using game-based activities to engage students for centuries, so while some of the methods and mechanisms used are different, the underlying concept is not novel.

3. There are two levels of gamification that teachers can use. Reward-based gamification is the use of reward-based systems to accompany or replace grades as a way of measuring progress in the classroom. Meaningful gamification is the attempt to use game mechanics to engage students more deeply in the concepts in the classroom.

Key Terms

Gamification
Gamify
Leaderboards
Motivation
Games in the classroom
Badges

Introduction

The term "gamification" is relatively new, but its exact origins are not known. The first recorded use was in the digital media industry in 2008 and it has become popular in the last couple of years (Deterding, Dixon, Khaled, & Nacke, 2011). A search performed in October 2012 on Google Scholar using the term "gamification" turned up over 1,000 publications, and the same search in May 2014 produced over

7,000 publications. 80,000 people were registered in the Coursera Gamification course in Sept/Oct 2012 (Werbach, 2012). The attention that gamification gets from industry, as well as from the public, makes it one of the newer concepts of the use of games in the real world to surface in recent years. This chapter analyzes the potential and limits of gamification for learning and classroom use.

Gamification can be broadly defined as the application of game features and game mechanics in a non-game context, but does not typically include using actual games. In the most commonly promoted approach to gamification (Zichermann & Cunningham, 2011), designers seeking to create a gamification system first identify behaviors that are to be encouraged, and then assign rewards to that behavior. These reward systems can take different forms—points, achievements, and badges are three typical tools for motivation and manipulation.

The concept of using rewards to modify behavior is nothing new to teachers in a classroom setting. Teachers often use point systems for both learning and behavioral goals. If one takes into account the concept that the absence of a punishment is the same as a reward (Kohn, 1999), then teachers have used reward-based systems as the core of classroom management for centuries. The syllabus in the classroom is a gamification layer that is used to motivate students' involvement in course content.

If we consider the concept of levels in games, then certainly the grades (K-12) and years (freshman, junior, senior, sophomore) of formal education are the very embodiment of "levels." There are known requirements for completing one level and just like in games, each new level opens up new content and additional options. The idea of earning badges within a game as a means of marking achievement is also not unique to games. Children in elementary school often get stickers for completed work; both the Boy Scouts and the Girl Guides (as well as a great many other organizations) use badges to symbolize various achievements, and of course, medals and badges have been a longstanding tradition in militaries throughout the world. The notion of leaderboards is also not unique to videogames, or games of any sort for that matter, as they can be found in many businesses as ways to highlight sales records for example, and in schools to commemorate a myriad of achievements academic and otherwise. Even the concept of a letter grade is remarkably similar to a badge, as it indicates achievement in a standardized way that has meaning outside of the learning environment.

Some applications of gamification go beyond merely using rewards such as points, badges and levels to motivate. Meaningful Gamification is the concept of using elements from games to help participants find a personal and meaningful connection within a specific context. Many of the theories behind meaningful gamification are educational theories such as Universal Design for Learning and motivational theories, such as Self-Determination Theory. These theories provide ways to use concepts of play, reflection, and narrative (instead of rewards) to engage learners (Nicholson, 2012a).

Teachers have used game-based elements for the real world application of teaching content for decades. While the term of gamification is new, the underlying concepts for both reward-based and meaningful gamification have been explored in the classroom for some time. In this chapter, we will review different

models for gamification in the classroom, explore some of the benefits and hazards to using it, and present some case studies and best practices for instructors to use.

The goal of this chapter is to explore gamification in the classroom from different perspectives and present guidance to instructors looking to use elements of games and play to improve learning motivation.

Key Frameworks

In this section, some frameworks useful in thinking about gamification in the classroom are explored. First, the elements of a game are presented in line with the elements of the course. This leads into a comparison of the 20th and 21st century classroom and ways that gamification can be integrated. After this, the frameworks of reward-based gamification and meaningful gamification are compared along with theories of self-determination theory. This framework review concludes with the discussion of importance of reflection in classroom gamification.

At its heart, gamification is about taking elements from games and applying them to non-game settings (Deterding, 2011). While many look at modern video games as a key inspiration for gamification, central elements (see Figure 1) such as points and levels come out of tabletop roleplaying games. While no one has yet succeeded in coming up with an undisputed definition for "game," most would agree that to be considered a game, it must include at least the following aspects:

1. **Interactivity:** If there is no way for the player to affect change on the system; if there is nothing for the player to actually do, then it ceases to be a game.
2. **Rules:** A mechanism to constrain the behavior of players in pre-specified ways.
3. **Goal(s):** One or more objectives that players pursue while interacting with the game
4. **Quantifiable measure of progress (or success):** This can be as simple as a binary acknowledgement of completion, or as complex as a set of cricket scores.
5. **Definite ending:** While some applications commonly referred to as games do not have clear endings (*The Sims*, for example), most games have a clear endpoint.

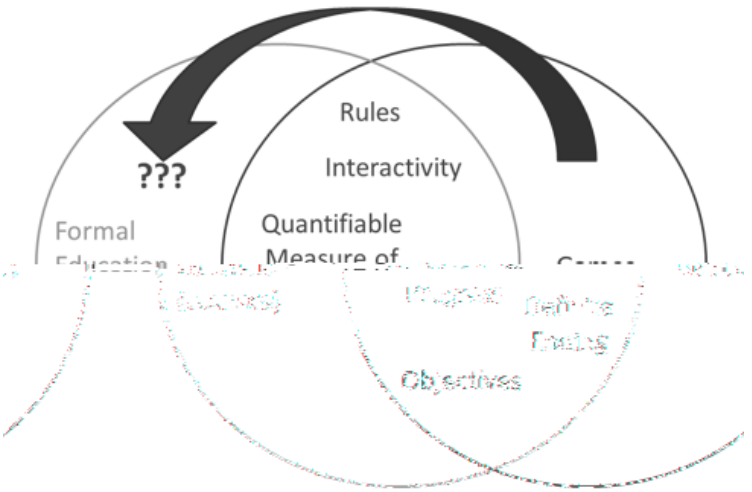

Figure 1. Essential Game Elements

By this measure of game, it could easily be argued that a formal educational course meets these criteria. Does that mean that all formal educational courses are games? We will leave that discussion for a different venue, and suggest that there is more to a game (and a course) than this. However, this list offers a convenient starting point for our discussion. In a conversation about computer science as a discipline, Kurt Guntheroth explained that, "CS may be more than programming, but it is not less than programming" (quoted in Crawford, 2004). The same can be said of both games and of formal education. Both are more than these criteria, but neither is less. Thus, if the elements listed above are insufficient to describe either a course or a game, then what are we adding to education when we are gamifying it (see Figure 1).

Like most new approaches, gamification has both champions and detractors. Critics such as Ian Bogost (2012) complain that gamification often takes "the least essential aspects of games and presents them as the most essential" (p.2). He describes it as little more than "pointsification" designed to motivate participants with superficial rewards and refers to it as exploitationware (Bogost, 2012). Nicholson (2012) provides the term BLAP to describe the set of Badges, Levels and Leaderboards, Achievements, and Points that can be easily applied to many settings in educational, corporate, and non-profit sectors alike, while Charles et al. (2011) simplify the term gamification even further to convey awarding "points to students for the successful completion of tasks throughout the course of study" (p.638).

What most of us see when we play a game is simply the veneer—in other words, what we see are the graphics and the visualizations of the player's progress. Appropriating this veneer of video games and applying it to formal educational settings is novel, but is that all there is to gamification? To highlight the novel approaches to education that can be accomplished through gamification, it helps to compare it to the current thinking on 21st century teaching and learning. Each one of the approaches listed in the right-hand column of Table 1 can be embodied in a meaningful gamified course design.

Table 1. Comparison of 20th vs 21st Century Approaches to Teaching & Learning

20th Century Classroom	21st Century Classroom
Time-based	Outcome-based
Focus: memorization of discrete facts	Focus: what students Know, Can Do and Are Like after all the details are forgotten.
Passive learning	Active Learning
Learners work in isolation	Learners work collaboratively
Teacher-centered: teacher is center of attention and provider of information	Student-centered: teacher is facilitator/coach
Little to no student freedom	Some freedom toward meeting common goals
Fragmented curriculum	Integrated and Interdisciplinary curriculum
Grades averaged	Grades based on what was learned
Numerical or letter grades scores averaged over all work.	Grades can be cumulative based on performance.
Typically one chance for assessment per task.	May allow for resubmission; repeatable tasks.
Teacher is judge. No one else sees student work.	Self, Peer and Other assessments. Public audience, authentic assessments.
Literacy is the 3 R's – reading, writing and math	Multiple literacies
Driven by the NCLB and standardized testing mania.	Driven by exploration, creativity and 21st century skills

Adapted from Shaw, A. (2008). What is 21st Century Education? Retrieved from http://www.21stcenturyschools.com/what_is_21st_century_education.htm on Mar. 2, 2015. Used with permission.

One of the recent guidebooks to gamification in the classroom is Lee Sheldon's *The Multiplayer Classroom* (2012), which takes many elements from massively multiplayer online roleplaying (MMORPG) games. These include:

1. Flexible point systems, where students can take on different tasks to earn points.
2. Solo and team challenges and quests that allow students to choose different ways in which to engage with course material.
3. Duels where individual or groups of students are in direct competition.
4. Boss fights, where the entire class needs to work together to accomplish a challenge.

While some of the specific mechanics presented in Sheldon's book are new ideas, the underlying concepts are those of the 21st century classroom. The novelty of presenting a system with a narrative layer will excite students at first, but unless that system is meaningfully connected to course content, the students will quickly realize that the underlying activities are the same as in a traditional classroom (Nicholson, 2013). This concept of meaningful gamification is presented later in this section.

Many of the claims about the motivational effects of a game-based system can also be accomplished and have been done in the past through good educational design. For example, the rubric-driven classroom uses challenge-based learning, where each topic, concept, or skill is described and students are given points as they demonstrate proficiency (Becker, 2004; Wiggins & McTighe, 1998). Stickers, reward and incentive charts have been used in elementary schools for decades.

The educational theory of Universal Design for Learning is based upon the concept that different learners use different methods to demonstrate competency, based upon their own skills and abilities (Rose & Meyer, 2002). In her first year computer programming courses, Becker (2006) facilitated that by setting up assignments that not only allowed for students to choose from among numerous tasks, but also permitted a potential total score that was above 100%. Thus, the use of points, repeatable assignments/quests, resubmission of assignments for a better score—hallmarks of gamification—are not new to education. Even levels are not unique to games: the one-room schoolhouse model had students at different levels working in the same learning space.

Many of the elements of gamification are just new names for traditional concepts:

1. course requirements = game objectives
2. policies / regulations = rules
3. assignments = quests
4. grades = experience points (XP)
5. passing course = winning the game

While the term gamification offers a convenient and potentially powerful means of organizing a collection of design elements, techniques, and approaches, many of the ideas and underlying educational concepts that are part of gamification are not new to classroom teachers.

Meaningful vs. Reward-based Gamification

Much of what has been discussed so far is reward-based gamification, in other words, gamification where the underlying instructional concepts remain the same as in the traditional classroom and where the game elements are used as a reward or motivational tool. Reward-based gamification is also seen in many bad quiz-based educational game designs that use bits of the story or other game mechanisms as a reward. Some examples of these poor models are:

1. Players travel through a maze, and must answer a question to continue.
2. Players roll a die and move on a board and answer questions from cards.
3. Players answer questions to then play part of a driving or shooting game.

Meaningful gamification, on the other hand, is the use of game elements to help participants find a personal connection to a non-game setting (Nicholson, 2012a). This concept is based on Mezirow's model of transformative learning, which hinges upon the learner taking an experience and connecting that experience to previously-held beliefs. This is how the user finds meaning in the external context. It is

through making these connections that the learner can then be opened to change (Mezirow, 1991), and it is this long-term change that is the goal of meaningful gamification. While reward-based gamification is about extrinsic motivation, meaningful gamification is about developing intrinsic motivation so that the interest in the subject may continue after the learner is no longer motivated through game elements.

Instead of relying upon rewards, meaningful gamification is about using concepts like player-created narratives, authentic play-based experiences, and reflection through debriefing, to help build meaning for the student. Some of the aforementioned concepts, such as allowing players true choice in developing their paths of learning and creating failure-safe spaces, can create opportunities for meaningful gamification. The underlying concept is that the system needs to create affordances for different types of learners to find personal connections to the underlying context.

While meaningful gamification is a new term, it is built upon concepts and educational theories that teachers have been using to engage students (Nicholson, 2012a). To guide those wanting to use meaningful gamification, the pneumonic RECIPE can be used for six ways of creating game-based layers (other than rewards) that can be used to motivate learners:

1. **Reflection:** Provide learners with opportunities to consider what they have been exposed to and how they can connect it to their past experiences.
2. **Exposition:** Use narratives, either generated by the gamification designer or by the participant, to help the students find connections between the context and their lives.
3. **Choice:** Provide learners with decisions as to how they will explore the content.
4. **Information:** Provide learners with context and information about their decisions and actions to help them make a stronger connection to the real world.
5. **Play:** Create spaces where learners can try, fail, and try again as a way of exploring.
6. **Engagement:** Develop connections between users to help them learn why other students find the context to be engaging, thus making it more likely they will make their own connections.

Rather than using reward-based game elements as extrinsic motivation, meaningful gamification is about creating game elements that motivate the user by building his or her intrinsic motivation (Nicholson, 2012a). When meaningful gamification employed properly, learners are able to connect the course material in ways that are personally relevant and meaningful to them and will want to learn instead of being manipulated through rewards to perform.

Learning in the 21st century requires that learners recognize the importance of their own learning and are motivated to achieve and value their learning. They must take an active role in meaning making and the process of learning. In particular, learners need to:

- Want to learn,
- Become aware of themselves as learners, and
- Able to take responsibility for their own learning both in and out of school over their lifespans.

"Without a serious focus on students' ownership of their own learning processes, there is always the danger that the focus will be on curriculum delivery and teacher strategies which are less likely to stimulate the sorts of intrinsic motivation for learning which is so necessary for life in the 21st century" (Deakin-Crick, et. al., 2005).

Self-Determination Theory and Potential Problems with Gamification

At the core of meaningful gamification is the concept of Self-Determination Theory. Self-Determination Theory states that for a learner to have a positive mental outlook toward engaging with something, they need to feel like they believe they are able to make choices based upon their own values and interests, that they confident and effective in engaging with the world, and that they feel that they are connected to other people and have a sense of belonging (Deci & Ryan, 2002).

One of the problems with gamification in the classroom is that students who do not like this approach may not have a choice to engage in the gamification. While gamification systems can be developed to give students a choice of paths through the classroom content, not all students want to engage with a game structure when they are learning. A key aspect of the concept of play is that play is optional, so for something to truly be play-based, a learner needs to be able to choose not to play. This concept falls in conflict with many classroom settings. If an instructor chooses to add a game layer to the classroom, it can be difficult for a student to opt out of the game layer and participate in class in a more traditional way. Forcing all students to engage with game elements can run counter to the flexibility the game-based system can provide.

Many games are based around the concept of direct competition, so some gamification elements, such as leaderboards are built around putting the players in competition with each other. These game elements highlight the fact that some students succeed while others fail. The same ranking that drives some students to push on and succeed can also demotivate students who realize they are not making progress and do not have a chance to catch up compared to the other students. In fact, it is these students—the demotivated ones—who need the most support; leaderboards tend to support the students who would do well in the class without one. The same can be said for a public display of badges; students who are doing well can be driven to continue to gain more badges, while students who are struggling watch as their classmates accumulate more and more accolades while they are just trying to get started (Kumar & Herger, 2013).

Case Study One: Meaningful Gamification Course (Written by Scott Nicholson)

The Meaningful Gamification course, taught by Nicholson, was a split-level non-required course with graduate students and undergraduate students, and was conducted via Blackboard.

The Meaningful Gamification course was taught as part of the School of Information Studies at Syracuse University in the fall of 2012. The goal of the class was to help students explore reward-based gamification and meaningful gamification. It was an optional class, so was taken by students in different departments, such as Education, Computer Science, Design, and Information Studies.

When students started the class, they were greeted with a course model based off of the one developed by Sheldon (2012). Students started on the "Quest for Mount Gamification" at the base of the mountain, and their points in the class equated with gaining height (levels) of the mountain. At certain levels, the students moved into a new grade bracket. The students had a variety of tasks they could choose to take on each week to earn points; most tasks were optional, although some were required. During the first six weeks, the readings for the class focused on reward-based gamification and students learned how to create a reward-based system using points, levels, leaderboards, achievements, and badges. Students created avatars, and a leaderboard tracked the progress of their avatars up the mountain. Tasks with unknown rewards were given to students; students only learned what the reward was (if any) after the due date for the task, much like a slot machine gives out random awards.

During this part of the class, the leaderboards showed a disturbing trend: while a few of the students were highly motivated and competitive, most of the students stopped doing any optional assignments after a few weeks. The chart below shows the progress of the students over the first six weeks where each student is represented by a single line (Nicholson, 2013). The number of lines that flatten out between week 4 and 6 indicate the number of students who did nothing for the class during those weeks.

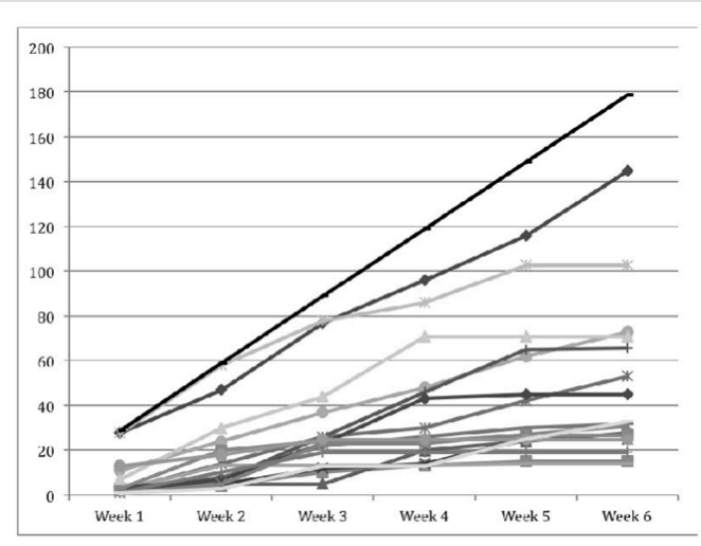

Figure 2. Grades of students over the first 6 weeks of class (Nicholson, 2013)

At this point, students were given a choice. The instructor appeared by candlelight, and in a video inspired by *The Matrix*, asked the students if they wanted to keep going or "come down the rabbit hole" and start a new voyage that they would help create. All but one student (the top performer) voted to start the voyage over. Students were also given an open-ended survey and allowed to reflect about their experiences, and many students indicated the de-motivating effect of the leaderboard. As the few high-performing students earned more points, the low-performing students did not see any reason to continue and were planning to drop the class.

Students were greeted with a blank syllabus, put into groups of three, and had three weeks to develop a new narrative, set of assignments, and method of assessment for the last month of the class. The class would then vote on which syllabus to use and the class would finish out with that syllabus. During this time, the tone of the readings also changed. The class moved into reading McGonigal's *Reality is Broken* and Kohn's *Punished by Rewards*, while exploring the concepts of meaningful gamification.

The winning narrative put the class in the position of lab rats, with the evil Dr. Nicholson running experiments on them. The Quest for Mount Gamification was nothing more than a mental simulation designed to stress the rats, and they had decided to form into rat packs to make an escape. To help with the narrative, Nicholson donned a lab coat and created weekly videos in his role as a mad scientist with the camera placed in a maze to support the narrative created by the students.

One challenge for the students was how to balance the work that students did (or did not do) with the remainder of the class. The solution was to have each student negotiate an assignment plan with the instructor. Students would identify the grade that they wanted, what they had done so far, and what they would do to earn that grade from a long list of possible assignments (or making up their own assignment).

The class finished out on a very positive note, as each student was in control of his or her learning. Every student except for one completed every assignment described on the learning agreements, some of which required a major paper or project each week of the semester. The class experience was truly transformative for these students, as they got to experience the differential effects of reward-based versus meaningful gamification firsthand.

The key lesson from this experience is the power giving the learners control. As suggested by Self-Determination Theory (Deci & Ryan, 2002), autonomy is a strong motivator for students. In the semesters since this class, Nicholson has continued to use this method of allowing students to create their own syllabus, and each time, the class ends up with a different assignment and motivational structure. This creates a more playful classroom and students are more inspired to complete assignments that they had a hand in creating for themselves.

Key Findings

In this section, some key findings about gamification in the classroom are discussed. First, concerns about the use of leaderboards and the impact of competition in the classroom are explored. After this, the concept of using badges as signposts instead of a reward is presented. The concept of using narratives to help students engage with course content is then proposed, and finally the ever-important topic of assessment is discussed.

The Importance of Reflection

Gamification can provide short-term motivation to get students engaged with a topic that they might otherwise avoid. But without encouraging reflection on the topic, some students may not ever connect what they are learning to the real world (Mezirow, 1991). Students who are chasing badges and achievements briefly engage with an activity and then put it aside as they rush toward the next goal.

It is important to create moments where learners stop and reflect upon what they are learning. Reflection creates a moment for a learner to become self-aware of content and then consider why that content is meaningful. This can be done by helping learners to connect this new material to something they are already familiar with. Many of today's games can teach real world skills like resource management, planning, communication, and economics. Without some trigger to help players recognize how what they are learning applies to the real world, many players will engage in the narrative and the created world and not make that external connection (Nicholson, 2012b). As the learning theorist Dewey said, learning comes from doing something, and then reflecting upon what has been done (Dewey, 1916).

Leaderboards and Competition

Both Nicholson (2013) and Becker (Becker & Perri, 2013) have explored the use of leaderboards in courses as a way of motivating students through creating a competitive environment. In both cases, the identities of students were not disclosed on the leaderboards. Nicholson (2013) required each student to create an avatar for the class while Becker presented a list of scores with no identification information attached. Both found that those students at the top of the leaderboards were also top performers in the class without the leaderboards, which may suggest that the use of the leaderboards did not appear to have an effect on motivation or performance of the high achieving students.

There was a distinct difference between these two experiments for the lower performing students. Becker (see the case study by Becker) found that leaderboards helped all of her students to succeed in the classroom and pushed many of them to work above and beyond class expectations. Nicholson (2013) found that the leaderboards demotivated about half of the class to the point where many students had stopped turning in any weekly assignments by the sixth week of the class. In talking to his students, Nicholson learned that many of them felt that they had no chance of catching up with the high-performing students and were planning to drop the course. Some of the mid-performing students noted that there are low-performing students who had stopped engaging with course content, which then discouraged the mid-performing students to continue working.

Both classes were online classes consisting of mostly or all graduate students. The major difference was the identification of individuals in the leaderboards, as Nicholson's model allowed students to identify themselves easily by tracking their avatar. This drew focus to the competitive nature of the leaderboard in a way that Becker's model did not. As it was more difficult for students to identify their own position in Becker's leaderboard, it served more as an overall measure of class performance.

Badges: Signposts Instead of Goalposts

One of the gamification elements that has drawn significant attention are badges. The fourth Digital Media & Learning (DML) Competition, sponsored by HASTAC, the MacArthur Foundation, and others, focused on the creation of badge systems for lifelong learning (2011). Another badge system that has gained attention is Mozilla's OpenBadges, which is designed as a way for people to receive and display badges granted by different organizations (Mozilla, 2013). The Mozilla concept is that a learner has a Badge Backpack that can collect and hold badges that have been granted by different systems and groups. The learner can then share the contents of the backpack with others as a certification tool or a way to demonstrate a pathway of learning.

As previously mentioned, the letter grading system can be seen as a type of badging system. Teachers assign letter grades and these grades have meaning outside of the classroom. Students share these "badges" with other schools and future employers to demonstrate their skills. The importance of letter grades has created a system where it is difficult to get students to work on something that does not lead to a grade; this is one of the problems that gamification is purported to address. Will gamification just end up creating the same problem as grades, where students will not engage with coursework unless they can earn a badge?

One of the advantages that badges have over letter grades is that they can be more specific in reflecting what the student has learned. Instead of just an overall grade of "B" in math, badges can show the specific pathways that a student has followed. Earning badges of different levels for topic areas also allows learners to demonstrate areas of strength and areas of competence. The badges can thus be

Narratives can be used in ways that are much more meaningful, however. A well-chosen narrative can deepen the student's understanding of a topic by providing the "why" to the "what" he or she is learning. Narrative can also be used as analogies or parables, but for these to be effective, the student must be led through a reflective exercise where connections between the narrative, the content, and the real world are drawn. For example, a grade four unit on flight might include a narrative that makes the students members of a design team tasked with creating a particular kind of airplane, or as explorers attempting the first trans-Atlantic crossing.

Another way of using narrative in a meaningful way is to allow the student the ability to write some of the narrative. Nicholson teaches a class on presentations, and the class was initially designed to teach generic business-style tasks of giving talks and making basic documents. To incorporate a narrative to the class, he greeted the students on the first day as new employees to the company and had them create a short video introducing themselves and speaking on a randomly-selected topic. Students then needed to select the company for which they pretended to work all semester; companies like Microsoft, the NBA, and Chipotle were quite popular. To take this narrative further, in a future semester, students will need to identify their favorite company, and then start a competing company (with appropriate budget) and work on presentations and design elements that will successfully compete with their favorite company. In this way, all of the assignments in the class have meaning, and the use of narrative creates an expectation as to what level of quality is expected in the assignments.

Case Study Two: Digital Game-Based Learning (Written by Katrin Becker)

Digital Game Based Learning taught by Katrin Becker was offered on two separate occasions, once as a two-week intensive face-to-face (F2F) class, and once as an online full semester (14-week) course.

The course was a graduate level course in digital game-based learning for a cohort of course-based Master of Education students at the University of Calgary, all of whom were completing their studies primarily by distance. Almost all of the students were professional educators working full-time. Most were classroom teachers, but there were also administrators from both the school and district board level. Part of the course requirements for the degree was the completion of a number of face-to-face courses offered in a compressed format over the summer, which is why one iteration of the course was a three-credit course that ran for two weeks and met daily for three hours, with an additional week after classes to complete and submit coursework. The second iteration of the course was completed entirely online in a regular semester.

Initially, the gamification of a section of the course assessment was meant to be a "throwaway" piece. The gamification component was added at the last minute to demonstrate a hands-on example of gamification, which was part of the syllabus and comprised 20% of the overall course grade. As the course progressed, the topic of gamification, as well as the details of how the course itself was gamified, became a focus and a touchstone to which the class returned again and again. In the second

iteration of the course, the gamified component was increased to 50% of the overall grade. Most of the increased weight came from moving grades normally awarded for peer assessments into the gamified portion of the course.

Typically courses of this sort include required readings and reflections that often also include requirements to post on blogs and comment on each other's work. There is one or more major assignment and a final paper. The gamification portion of this course was implemented primarily in the management and assessment of student work. The instructor provided an assortment of readings and response activities for which students could earn points. They included blog posts, but also longer editorials and shorter annotations, among other things. An accumulation of points related directly to percentage points toward an overall course mark (10 XP = 1%), and they were given minimum and upper limits on how many tasks of each kind they could submit for points. Each kind of task had to be attempted at least once, but the upper limits were such that if they submitted the maximum possible number of items in each category, they could earn more than the number of points required for a perfect score. Any "extra" points earned could be applied to the course grade as a whole, which meant that students could make up for less than perfect scores in one part (such as their design project) by completing and submitting more work in another (such as providing additional annotated resources to share with the class).

The instructor created individual scorecards made from spreadsheets (one for each student) to keep track of everyone's points. Existing course management systems do not support this kind of scoring so points and grades needed to be tallied elsewhere.

On the whole, the students liked the approach, but found there to be a substantial learning curve due to the complexity that resulted from the increased choice of both the number and variety of learning tasks as well as the more complicated scoring scheme. The second iteration of the course went far more smoothly in spite of the fact that the scoring was in fact more complex. A number of students reported that this was the best course they had ever taken, and that they had learned more in this course than in any other. On the other hand, the marking load was extreme, so some combination of automatic and personal scoring and assessment would have been useful.

A leaderboard was posted, but it consisted only of scores sorted in numerical order, which were not associated with individual names. Although students were encouraged to create avatars, only one or two did. Given that this was a graduate level class, a minimal pass was 70%, which was also necessary on each individual component. The work they had to do consisted of two major projects as well as the gamified activities. The gamified activities were referred to collectively as "The DGBL Game"). As is shown in Figure 3, not only did all students meet the minimum requirements, but 75% of them earned more than a perfect score.

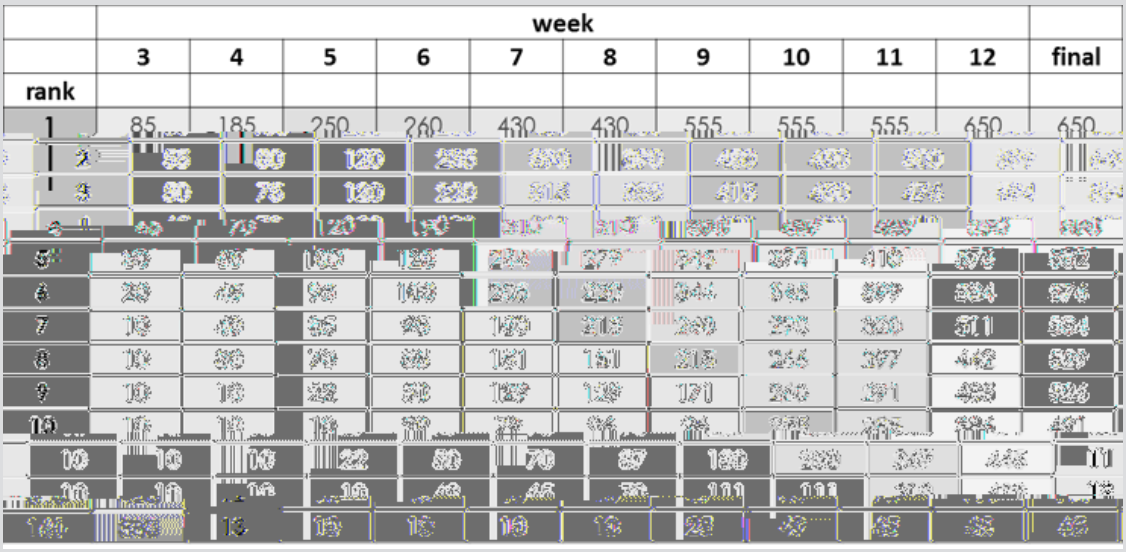

Figure 3. Leaderboard for EDER 679.17, 2013

This phenomenon is not unique to gamification. Becker has been using a bonus point system in her classes since 1999 where students could earn points over and above those required for a perfect score on an assignment by adding various embellishments to their submissions. These "extra" points could then be used to bump a student's grade up a portion of a letter grade. In other words, a student who had earned a B in the course could increase that to a B+ if they had sufficient bonus points (Becker, 2003, 2006). It is interesting to note that those students who earned the highest bonus scores had also earned high scores on all other components of the course. In most cases, the extra points had no effect on the students' score. In other words the extra work was not reflected in their grades, and they knew this but did the extra work anyway.

Assessment Considerations

Assessing the efficacy of a gamification system and course design is always difficult. Student reviews are one way of assessing whether our course design has made things better or worse. Retention and attrition rates are another method, as are measures of student success in subsequent courses. We can also attempt to measure whether students learn better using this approach than they do in traditional classrooms, but unless the learning tasks are identical, it is difficult if not impossible to obtain a reliable result. We rarely have the luxury of a control group against which we can compare results, although occasionally such an opportunity presents itself. At Mount Royal University in 2013, one of four sections of a first year introduction to computing course was gamified, while the other three sections were taught using a more traditional approach. The gamified section was too small to conduct a statistical analysis, but informal student surveys conducted approximately mid-way through the term indicated that students in the gamified course showed greater confidence in their ability to be successful in the course than students in the non-gamified sections (Becker & Perri, 2013).

There is a growing interest in using gamification itself as part of the assessment tools in a class. As a tool for formative assessment, or assessment used to monitor student learning, gamification can be valuable, especially when using concepts like signposts instead of goalposts, as discussed in the previous section on badges. Instructors can then more easily grasp the progress that students have made through the class and the students can get a better understanding of why they are learning the current topic and where it can lead. Using a badge as a reward for the end of a content unit is similar to summative assessment, while having a series of badges for smaller steps that lead toward a larger goal is similar to formative assessment.

Some instructors, such as Sheldon (2012), use the concept of a Boss Fight (like a final exam) as a way to use a game element as a summative assessment. In video game terms, the Boss Fight is a challenge at the end of a chapter of a game that requires the player to demonstrate competency in game skills to continue on with the game. This idea of encouraging students to play a game, and then use the results of the game as the students' grades is an attractive idea, but has a significant problem that is rarely stated related to the aforementioned concepts of play and failure.

The power of play and games comes from the freedom to fail. Using games for a high-stakes grading moment in a class creates a conflict between "game as failure-safe play space" and "game-like thing that actually matters." In the video game model from which the idea of the "Boss Fight" emerges, players are able to re-attempt a big battle until they succeed; however, this is not true if the game is being used as the summative evaluation for a course. This break in the analogy is something that should be addressed explicitly with the students. One concept in games that might be useful is that of "hardcore mode" or "permadeath." In these game modes, the players' actions have permanent consequences. This creates a more intense game experience for players who are ready for a challenge, and this moment in a game can be similar to the moment in a class where the students face an important challenge.

In the approach used by Becker in 2013, the "Boss Battle" was simply the name given to the final exam, but because students had had the opportunity to earn more points all through the term than were needed for a perfect score, the "Boss Battle" did not carry the same significance as an exam normally does, and in fact of the three students who already had sufficient points to earn an A+ before the final, one student opted not to write the final exam at all, while the other two wrote the exam just as a way to check their own knowledge and just to see how high a score they could earn (Becker & Perri, 2013).

Future Needs

The biggest challenge to an educator using gamification in the classroom is time. Gamifying classroom activities can add on additional time to create and maintain a narrative; to track the students' progress in many different ways; to communicate these different points, levels, and badges to the students to provide the depth of feedback needed to allow students to successfully re-do an assignment; and to re-grade assignments. Just as the novelty of a reward-based game layer can engage students in the short term, the novelty of creating these game layers can engage an instructor in the short term. But in the long term, many instructors will tire of the extra workload that gamification in the classroom creates.

To aid with this, there are learning management systems being developed with gamification elements already integrated into them (Holman, Fishman and Aguilar, 2013). One of the challenges of using a non-traditional grading system is helping students understand where they stand in the class. If the instructor uses the Multiplayer Classroom system where students start at 0 and work their way up through the letter grades (Sheldon, 2012), then they will have an F for a large portion of the class; this can cause an issue with mid-semester grade reporting. To deal with this, LMS gamification systems present students with the ability to see different future scenarios. Students can adjust values and sliders based upon how they think they will do, and can see what this will do to their grade. Nicholson (2013) found that the students' frustration with understanding their class standing was not worth the gains in having a grading system that started students at 0 points, while Becker (2013) developed her own grading system using spreadsheets, and students had no difficulty understanding their class standing. Additionally, Becker's students reported that they appreciated being able to see where they stood in detail any time they wanted, however, a key requirement was that the students' scores be updated frequently.

One advantage of a learning management system designed for gamification is that the system can assist teachers in the design of a course. By embedding different types of reward-based and meaningful game-based and play-based layers, teachers can more easily try out different gamification techniques in their class. The system can also provide information as to what types of game elements might be good for different types of class activities and what risks the instructor and students may face when using the system.

A well-designed gamification system can also add to the game-like feeling of a course environment. If students see a system that looks like a traditional LMS or outdated Web site, then the teacher will have to work harder to help students realize that the class experiences are different and exciting. If the students come into a graphically gamified system that looks like a game, they are more likely to approach the class with an open mind and a playful spirit.

These systems can also help instructors deal with the logistics of a complex assignment system. To provide students choices between assignments, it means that the tools needed to track these assignments will have to be flexible to allow different grading structures and class situations where different students are working on different aspects of the course at the same time. These systems can also help with situations where some assignments allow students to work alone or in groups alongside classroom situations where the class comes together to take on a large-scale challenge.

Case Study Three: Beyond the Multiplayer Classroom: A Story (Written by Lee Sheldon)

When I first began designing my classes as real world, real-time multiplayer games it was enough to translate the various elements of game mechanics into teaching and learning. These including grading by accretion (XP and leveling up); learning by failing (allowing students to redo assignments); intrinsic rewards (such as dividing students into guilds and rewarding an entire guild for the achievement of one member); peer teaching and so on.

For several years I experimented and honed the basic building blocks of the design. I was content to emulate the sandbox style of game design of current MMOs, concentrating on gameplay rather than story. There was no clear reason not to. Grades and attendance already benefited tremendously from the multiplayer classes over traditional teaching methods. Indeed today *The Multiplayer Classroom* is used by hundreds of others to teach everything from Biology to Latin Prose Composition to the Holocaust.

It was not until I taught a course called "Designing Interactive Characters for Digital Games" at Rensselaer Polytechnic Institute that I decided to add a continuing role-playing game with NPC characters that the students interacted with and a single ongoing story to provide a structure for the entire class. I was in the middle of this class when my book, *The Multiplayer Classroom: Designing Coursework as a Game*, was published.

That first excursion into the type of storytelling I routinely used in entertainment video games was only partly successful. The students were co-creators of the ongoing story and they also played characters within it. We reached a critical point in the story where the students had to decide whether an NPC they had traveled with for weeks on the long road of the quest should be allowed to live or die. When I asked the question we were all confused: should they answer in character or as game designers. This speed bump led to an enlightening philosophical discussion of the roles of designer and player.

But other parts of the experience were so gripping that the students were far more focused than in my earlier classes: they leveled and learned. On the last day of each class I hold a post mortem, allowing students to comment on what went well and giving ideas on what could be improved. Two items stood out here: a midterm exam prep (outside the scope of this short story) and narrative. The ongoing story involved them to a much higher degree—and therefore ratcheted up their learning—than the sandbox games of the past. It was also at Rensselaer that I had the opportunity to take the *Multiplayer Classroom* and storytelling to a new level.

Two colleagues and I were awarded a seed grant to develop what I called the Emergent Reality Lab, a 3D mixed-reality space. The first project destined for that lab would teach Mandarin and Chinese culture. Due to a variety of circumstances the lab took much longer to realize than initially planned. So, with the help of a huge number of people from across the campus and beyond, I designed an eight-week dress rehearsal for the kind of teaching to be carried out in the lab. Twelve students were selected from

over fifty applicants. One dropped out almost immediately, so we had a class of eleven divided into four study groups. None had had any previous experience with Chinese, although several had taken other languages in traditional classes.

While there were many game-like puzzles and we occasionally used Microsoft's Kinect to solve some, from the very beginning storytelling was transcendent. The game was called *The Lost Manuscript*. The class was the game. The physical classroom was the game space. Without leaving that classroom the students were transported to locations in Beijing including Capital International Airport, a tearoom and the Forbidden City. They were immersed in a story involving several characters (portrayed by native Mandarin speakers) hunting for the priceless manuscript to a classic work of Chinese literature, *Outlaws of the Marsh*.

In only their fourth week they were to arrive in class where desks and chairs would be positioned to replicate Beijing International Airport.They would be required to clear customs, exchange currency, acquire maps to the city, use a virtual kiosk manipulated with the Kinect to locate their hotel, call the hotel, order transportation, then recognize the traditional Chinese characters for Public Transportation on one of many signs scattered about the "airport" and stand beneath it. The actors were instructed to only speak Mandarin. The students had the entire class period, an hour and fifty minutes, to do everything.

The week before, as they were practicing the vocabulary and syntax to perform these tasks, they were told by their teacher (our Instructional Designer as well as a fictional character) that they need not worry. They would be met in Beijing by a Dr. Chen who would guide them through what they needed to accomplish. But when they arrived they found only a crumpled sign on the floor that read, "Welcome Rensselaer Students." No sign of help at all. Or so it would appear.

They immediately began to collaborate. They were so successful they completed all the challenges I had designed in thirty minutes. Class was officially over, but instead of taking off, they continued to play. In halting Mandarin and with the aid of an English/Chinese dictionary they spent the remainder of the class time questioning the actors if they had seen Dr. Chen or knew anything about him. In game design we describe this as emergent behavior. They went beyond what I had designed because they a) did not know where the edges of the design were, and b) they wanted to know what would happen next. They learned more than intended, almost without realizing it, a state I call *collateral learning*.

Any competent storyteller knows that unexpected twists to the plot are always useful to heighten suspense and engagement. Another twist I incorporated into *The Lost Manuscript* began with a series of text messages from each of the game's five main characters. At first each of these were sent to all eleven students. But in the fifth week—when the students were fully engaged in the mystery—the messages changed. Each character began sending messages only to one study group. Among other things the students in each study group were told not to trust the characters texting the other groups. This created suspicion between the study groups. They had to decide whether to exchange information or compete

to be the first group to unravel the clues to the manuscript's location. They began collaborating, became competitive, only to settle again on collaboration in the end. This tension increased their focus and learning even more.

Their final exam was a police interrogation. They all passed. According to our instructional designer they learned a fifteen-week semester's worth of Mandarin in eight weeks.

Other narrative-heavy games include *The Lost Manuscript 2: The Summer Palace Cipher*, currently being developed for the Emergent Reality Lab. Some characters exist both in the virtual world and in the real world. *Crimson Dilemma*, a story-driven video game teaching business ethics for the Kelley School of Business at Indiana University has gone live.

These Far Hills is the prototype for an engineering game video game created for an NSF grant proposal. It is the story of an extended Irish family that emigrates to a new land as in the nineteenth century. However, the story is set in the near future, and the new land this family journeys to is Mars where they will build a biosphere for other families to follow. A single-player game, students will play a 48-year-old mother of four mentored by the NPC leader of the project, her father. That powerful emotional hook already promises to heighten players' connection to the story and the learning. Infused with Irish music, conflict, comedy and drama, *These Far Hills* is interwoven with the highest pedagogy.

The first online Multiplayer Classroom, *Secrets: A Cyberculture Mystery Game*, debuted in the fall of 2015 for Excelsior College. It features another design idea I am interested in exploring: which is that two of the students in the class are not real. This is easy in an online game. They will function as the game's hint system, drive discussion, and finally be revealed as characters in the story of the class concerning two opposing factions struggling for control of the Internet.

There are many examples in the literature on the benefits of using storytelling to teach. More recently, scholarly study has centered on using games to teach. There has been next to nothing about combining multiplayer gameplay and an ongoing story, although all of my current projects—whether multiplayer classrooms or video games or online games—are now a balance of the two.

Each is another chapter in my own story to explore how the most ancient of human experiences, gameplay and storytelling, can be used in brick and mortar classrooms and online to recapture, captivate and teach students of all ages.

Best Practices

Providing authentic, meaningful learning is at the core of all good instruction, gamified or not (Merrill, 2002). Gamification can manipulate students into taking on tasks, but it can also motivate them to engage more deeply with course material. Adding gamification to a class adds a significant amount of instructor workload overhead, and instructors need to decide whether their time is better spent developing a mechanics-heavy gamification system for class management or creating more engaging game-based learning activities within a traditional structure.

Some of the best practices drawn from research and examples discussed in this chapter include:

1. **Setting clear goals.** Gamification can add many different approaches to course content, learning tasks, and the assessment of students, but without clear goals, students can spend considerable time on side topics or elements that do not help them earn the desired grade while missing the key course content. This can be a concern in classes that lead to a standardized test or classes that are prerequisites for other classes. Setting goals for the students or negotiating the goals with the students allows them to understand what they are trying to accomplish throughout the class, and while this is important in all classes, it is especially important in a gamified class.
2. **Providing administrative support.** Most students are used to one specific grade-based game in classes. There may be slight differences between instructors, but the basic concept of grading on an A-F scale is the same. On the other hand, some gamification systems are fundamentally different from the grading system, and these differences can frustrate students who are not gamers and who do not have the experience in taking on different rule systems. Instructors should have regular reality checks with the students to ensure they understand what is really going on and what is necessary for the students to do to reach certain grades in the class.
3. **Providing additional feedback.** A benefit to students in most gamified systems that allow students to re-do work is that such a system requires the instructor to provide detailed feedback so that the student can re-do the work. In addition, this feedback must be provided quickly so that students can re-work the assignment before the next assignment is due. If this cycle breaks, the student can be frustrated as he or she is trying to re-do several older assignments while keeping up with new assignments. Instructors need to be willing to take on the additional challenge of providing timely feedback to help a gamified classroom to succeed.
4. **Using a student-created narrative.** Allowing the students to create all or some of the narrative for a gamified system engages the students and encourages them to think deeply about the topic of the class and the real-world applications of the topic. Moreover, it helps them to understand why what they are learning matters, and empowers them to engage more deeply with the activities throughout the semester.

5. **Many of the elements of gamification have already been done in classrooms.** Instructors seek ways to engage students, and the language of game design provides many ways to increase engagement. The benefit of grouping pedagogical concepts together under the gamification umbrella is that it draws the attention of others constituents, such as those developing learning management systems. The result is that an instructor wanting to add game design elements to the classroom does not have to start from scratch; instead, there is now a growing body of tools and resources that makes this process easier for an already overloaded instructor.

Resources

Related Researchers

Sebastian Deterding
Karl Kapp
Lee Sheldon
Scott Nicholson
Barry Fishman
Clayton Ewing
Katrin Becker
Gabe Zicherman
Ian Bogost
Jane McGonigal
Kevin Werbach

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CHAPTER 4

Pedagogy and Play: Creating a Playful Curriculum for Academic Achievement and Engaged Learning

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Key Summary Points

1. Using instructional techniques based upon play can improve achievement
2. Standardization has created more problems than it solved
3. Three case studies are presented as demonstrations of the framework

Key Terms

Play
Assessment
Learner Centered Practices
Instructional Communication
Curriculum
Cognitive
Affect
Classroom
Instructional Design
Learning

Introduction

Welcome to the playful classroom. This chapter will present ways to increase academic engagement and achievement through play. The following outline provides a map:

- A review of the research on the relationship between play and academic achievement
- Background and implications of standardization vs. play
- Key frameworks for constructing a playful classroom
- Three examples of playful classroom activities
- Key Findings
- Best Practices
- Future Needs
- Resources

The Benefits of Play

Play is not only an imaginative activity of amusement. Play and games serve important roles in cognitive, social, and affective development (Dubbels, 2014; Fisher, 1992; Frost, 1998; Garvey, 1990). In pre-industrial times, pastoral and foraging societies, children did not learn sequestered away from adult contexts (Thomas, 1964). Instead, children participated in playful variations of adult activities, where they could observe adults at work, and were able to imitate and emulate these activities through play without the danger of failure and consequence (Bock, 2005; Rogoff, 1994).

Rubin, Fein, and Vandenberg provided a thorough psychological overview of the early role of play in their chapter in volume four of the Manual of Child Psychology (1983). They observed that humans play longer relative to other mammals that play. Lancaster and Lancaster (1987) built upon this position and state that this extended period of play is essential for development. Bjorklund, (2006) expands upon this view, and states that humans play longer because they are adaptive organisms, and, that extended play is essential, allowing humans the skills and knowledge to become independent in complex environments.

When children engage in complex peer play, they exhibit greater gains in levels of symbolic functional and oral language production, as compared to if they are interacting with an adult (Pellegrini, 1983). Additionally, when a learner experiences learning through play, where they can experience and role-play adult work, they report the activities are more meaningful, and that the activity did not feel like learning (Dubbels, 2010). This aligns with Winkielman & Cacioppo, (2001), who found that when learning new information is experienced as easy, processing is experienced as pleasant and effective.

Play has been Removed from Schools by Non-Educators

It was not psychologists, educators, or child development researchers that removed play from schools. According to McCombs & Miller (2007), the emphasis on performance testing and standardization was led by a campaign of politicians and corporate interests to influence what happened in the

classroom. With government reports such as Nation At Risk (1983), the National Governors Association (1989) worked to create Goals 2000 (1994) and called for greater levels of accountability for student achievement and rigorous academic standards. They called for more focus on standardized content, standardized content delivery, and standardized tests. This campaign to standardize schools worked to change classroom curriculum, but it contradicted and ignored 100 years of psychological research about human learning (McCombs & Miller, 2007).

The new standards and assessments became mandated performance indicators on how schools were evaluated. For a school to be rated as competent, their students had to meet federal and state performance guidelines, and school funding was tied to student performance on standardized assessments. This situation became so desperate for some schools, that entire school districts (superintendents, principals, and teachers) committed fraud by falsifying assessment data (Dayen, 2015).

Political Reasons for Standardization Over Play

Elected officials and journalists reported that American students had fallen behind other industrialized nations in math and science, and the proof was in American student performance on international testing tests called PISA and TIMMS. They warned that without improvements in student performance in math and science, the USA would no longer be competitive on the world stage (US Committee on Prospering in the Global Economy of the 21st Century, Science, & (US), 2007).

Reports such as these were political in nature. When American student scores are compared to students of the same income level, students in the United States did significantly better than all other countries:

> For every administration of PISA and TIMSS, when controlling for poverty, U.S. public school students are not only competitive, they downright lead the world. Even at home nationally, when controlling for poverty, public school students compete with private school students in Lutheran, Catholic, and Christian schools when analyzing NAEP data (Ravitch, 2013).

Poverty plays a central role in student performance. Schools serving lower-income students tend to be organized and operated differently than those serving more affluent students. Poverty is the most significant impact on academic performance. It does not matter if these schools are big or small, private, or religious. Poverty is the most significant predictor of poor academic performance (McNeil & Valenzuela, 2000; Rumberger & Palardy, 2005). Students in poverty often come to school without the social and economic benefits held by many middle-to-high SES students, such as access to books, food, parental support with schoolwork, and financial stability (Sirin, 2005).

In wealthy schools, students are more likely to experience playful activities and learner centered pedagogy (Anyon, 1980). Schools that serve children in poverty, not only struggle the most, but are also often the first to get the standardized education, reduction in play, and elimination of electives such as music, arts, and training. We may be compounding the problem, rather than offering a solution by removing these things from children in poverty.

Children in poverty also experience greater exposure to threat and violence, which contributes to play deprivation. Play deprivation has arisen as a medical diagnosis. It means that children do not experience the essential cognitive, social, and affective benefits of learning through play (Milteer, Ginsburg, Health, & Mulligan, 2012). Play is an essential element of learning and development. Removing play in favor of standardization is a mistake.

Standardization is Profit-Centered, not Student-Centered

If anything was learned from the standardization campaign, it was that the creation of standards and content has proven to be very financially lucrative to testing companies, and very destructive for school districts (Dayen, 2015). These policies have led to change of control, where classrooms are now legislated through national education standards, and this legislation is often influenced, if not written by, lobbyists that work for the companies that profit from selling tests and curriculum, rather than the people who have experience working with children and child development research (Leistyna, 2007).

The shift to standardized assessment and curriculum has also led to instability. It is very profitable to have standards change. When standards change, schools are required to meet those new standards, and this is often accomplished by paying for new tests and new curriculum. State-based initiatives on Common Core—the standards and assessments—change every 4 years (Porter, McMaken, Hwang, & Yang, 2011). Each shift in standards constitutes a form of educational whack-a-mole, where districts are forced to purchase new curriculum, and states must create new assessments. This is a lucrative market, over $2 billion annually (Strauss, 2015).

To cultivate financial opportunity, educational publishers have been very involved in this process; Pearson Education, ETS (Educational Testing Service), Houghton Mifflin Harcourt, and McGraw-Hill collectively spent more than $20 million lobbying in states and on Capitol Hill from 2009 to 2014 (ibid). In many ways, standardization and accountability initiatives have exacerbated the "problems" they set out to solve, and instead, created a lucrative market for pre-packaged curriculum and tests, the deprofessionalization of teachers, and significant cost to American taxpayers.

Standardized methods of assessment often lack the long view, and do not pass the tests of time, retention, and adaptation. According to Atkinson & Mayo, (2010) focus on subject matter and facts only serve to limit student motivation, learning and choice, and reduce the potential for innovation. Additionally, high stakes tests, and the practice of evaluation during instruction is an unreliable index of whether the long-term changes, which constitute learning, have actually taken place (for review, read Soderstrom & Bjork, 2015).

Parents Opt-Out of Standardization

Interestingly, many parents and stakeholders have begun to embrace the long view, and begun to doubt the value of testing; they have begun to "opt-out", which is now called the "opt-out parents movement" (Layton, 2013). The opt-out movement indicates a trend towards more play-based and learner-centered

practices, advocated for by the American Psychological Association (APA) (Alexander & Murphy, 1998; Barbara, 2004; Cornelius-White, 2007; McCombs, 2001; McCombs & Miller, 2007; Weimer, 2013).

Key Frameworks

The Promise of Learner Centered Practice and Play-Based Approaches

If the goal is to take the long view, then learner centered practices (LCP), and play-based approaches offer great promise. In LCP, students are empowered in how they learn, and what they learn—the same conditions that enable play. Students engaged in play have been shown to feel more ownership and control over the learning process, and learn more (Pellegrini, 1983).

LCP and play both require skilled instructional communication to convey:

1. Positive teacher disposition
2. Process-orientation
3. Choices in assessment and content

1. Positive Teacher Disposition

What is important in the classroom is to motivate learners to engage, and sustain engagement. This can be done though play, even with the most reluctant and oppositional learners. What is essential in creating a positive classroom climate and interpersonal relationship is that fear of failure is removed. This can be accomplished when communication with students are grounded in unconditional positive regard. When students are exposed to happiness and play through activities and feedback, rather than fear and criticism, they tend to perform better, may experience trait change, from being oppositional to participation in classroom activities.

When this practice was used with oppositional children for forty-four days, the oppositional children exhibited trait change, and showed a greater likelihood of accepting new tasks and participating in on-task behavior (Peed, Roberts, & Forehand, 1977). Similarly, Parpal & Maccoby (1985) showed that this technique also reduced opposition, and increased prosocial behavior in children with no diagnosis for opposition. The key here is that play is the opposite of fear. Children seldom exhibit playful traits in the face of fear and criticism (Sutton-Smith, 2001). Playful learning necessitates a sense of safety, as play can make one vulnerable (Dubbels, 2014). Positive communication can help change an individual's personality traits from being oppositional, fixed, and rigid, to being playful, open, and tolerant, similar to what Dweck (2006 fr ashanaœriabbd pshe iSre ne oet27-2.1 (e)-8.4 (c)-1.5 (n)-18xednd rioeh nindaetbbs8Tm[(t)4.L.6 (s

which may be a symptom of what Brown (1998) has called play deprivation. Both fixed mindset and play deprivation present traits such as rigidity in outlook, oppositional behaviors, and fixed ideologies. This does not mean the individual does not think they are smart, it predicts the individual will look for situations where they can prove they are smart, and avoid new challenges from growth, and when faced with a challenging assignment, problem, and/or situation, are more likely to give up (Dweck, 2007).

Conversely, individuals with a growth mindset are more likely to persevere in challenging contexts, because they believe that with effort they will learn and grow to meet the challenge (Yeager & Dweck, 2012). Growth traits are created through play, because the learner is given a sense of control, and threat is reduced. This can be accomplished through playful instructional communication, based upon encouragement, opportunity, and unconditional positive regard (Reddy, Files-Hall, & Schaefer, 2005).

Emotions in Learning: Fear vs. Happiness

Where fear prepares the body to respond to threats, happiness can signal an invitation to play and interact. One can communicate a playful mood as an invitation to play, just as one can communicate threat as a warning (read Dubbels, 2014 for a review). Fear and happiness are communicated as emotions, they are brief in duration and consist of verbal, physiological, behavioral, and neural mechanisms (Fox, 2008). Regular exposure to these emotions can create changes in personality (as traits) and physiology.

Extended exposure to fear or threat can lead to neurocognitive degeneration called neurotoxicity, which causes measurable deterioration of the hippocampus (Gunnar & Quevedo, 2007; Lupien, McEwen, Gunnar, & Heim, 2009). The hippocampus is the area of the brain responsible for processing new memories and new learning. Conversely, exposure to happiness, and play response can be restorative, and lead to cognitive, physical, social, and emotional well-being (Ginsburg, 2007). When learning new information is experienced as easy, and processing is experienced as pleasant, learners are more likely to engage and seek out that experience again (Winkielman & Cacioppo, 2001).

Emotional Context of Learning Through Play

Play is often described as a pleasant experience; one might equate being in a playful mood as happiness. A mood such as playfulness can be encouraged or discouraged through exposure to happiness and feelings of safety and belonging. In contrast, fear of failure will undermine any attempt to engage a learner in play (Sutton-Smith, 2001). It can be said that many learners will refuse to participate in any activities where they fear failing in public (Kohl, 1992, 1994). One can increase motivation and engagement by emphasizing learning through play. It is essential to take the fear out of learning. The practice of high stakes testing, and standardization is in many ways, a fear-based pedagogy. Play happens in the absence of threat, and in the presence of feelings of safety and unconditional positive regard. Many learners have expressed a sense of pleasure and timelessness in play.

Timelessness in Play

The feeling of timelessness is not new to learning research. Timelessness has been reported in situations of both threat and play, where high levels of arousal lead to attention narrowing. Attention narrowing is defined as a decrease in the range of cues that an organism can take in and perceive from the stimulus and its environment (Easterbrook, 1959). This narrowing shuts out thoughts and feelings that are not related to the experience of the activity, allowing for greater acquisition and mastery of new information (Elliot & Covington, 2001; Elliot, Gable, & Mapes, 2006; Gable & Poole, 2012; Sackett). However, play seems to provide a greater sense of ease and pleasure in learning. This is an important distinction between fear and play, as students reported that when learning new information was experienced as pleasant and easy, processing was experienced as pleasant and effective (Dubbels, 2010; Winkielman & Cacioppo, 2001).

Setting the Mood

To create a playful mood, the teacher should expose learners to low-intensity feelings through images, words, and behavior related to the targeted mood. This can influence behavior and decision-making (Forgas, Burnham, & Trimboli, 1988), and lead to learner trait changes (Lay, Waters, & Park, 1989). Additionally, the teacher needs to reduce fear of public failure in learning activities. To do this, teachers must empower students by designing learning activities and assessment as a collaborative, developmental process (Alexander & Murphy, 1998).

2. Process-orientation

To design for play, we start with powerful ideas (Papert, 1980). Powerful ideas are concepts such as the idea of "feedback". Imagine you push a button, and something happens—that is feedback. Feedback

Learning Through Emulation

Emulation is an activity that promotes exploration, discovery, and creation (Whiten, McGuigan, Marshall-Pescini, & Hopper, 2009). Emulation is different from imitation (for a review read: Dubbels, 2014).

- Emulation happens when learners observe behaviors and strategies performed by others, but then recombine elements of these behaviors into novel variations. In an emulation, the learner creates the process or model that serves as evidence and constructs an outcome (Tennie, Call, & Tomasello, 2006; Whiten et al., 2009).
- Imitation happens when the learner is led through a process, and imitates the steps. Through imitation, the learner can experience key characteristics, behavior, and function of a selected physical or abstract systems, or process models (Banks, Carson, Nelson, & Nicol, 2001).

There are two major benefits to emulation:

1. New insight and innovation are produced (Bateson, 2005; Bruner, 1972; Fagen, 1981; Sutton-Smith, 1966).
2. Learning through emulation comes with minimal costs, because the learner constructs their own model/process. (Bateson, 2005; Burghardt, 2005; Spinka, Newbury, and Bekoff, 2001).

There is one major benefit to imitation:

1. Imitation does not require the creation of process by the learner. The learner follows a pre-constructed model, and experiences learning with limited range of choice. This can be advantageous for learners with little prior knowledge and problem solving experience, as the learner does not have to fill in the gaps, but rather explore and learn through trial and error.

Discovery through Practice

Numerous experiments in the domains of perceptual-motor learning and verbal-conceptual learning have shown that conditions that induce the most errors during acquisition are often the very conditions that lead to the most learning (for a review, read Soderstrom and Bjork 2015), which reinforces the importance of emulation and the experience of failure and recovery through play. Emulation is a form of play, that can be co-constructed between students and teacher.

To invoke play in learning is to invite and guide exploration, wrong answers, and discovery through practice over time. This is the core of innovation, and this pedagogy can help students understand that getting the wrong answers can lead to the right answer.

3. Choices in assessment and content

Informative assessment is a learner-centered practice and is the method of choice for promoting playful academic learning. Using informative assessment can minimize fear of failure. There are three major types of assessment, and they are defined by their usage:

- **Formative assessment:** Formative assessment is used as a performance indicator. It is an example of an external tool added on to the learning activity to gauge progress. It is often used as a pretest, or an external measure that happens during the lesson.
- **Summative assessment:** Summative assessment provides a final evaluation or summarization of learning. A typical summative assessment is a standardized test. Summative assessments are often tools external to the learning activity, and serve as an end marker in learning.
- **Informative assessment:** An informative assessment informs the learner during instruction. It acts as a road map, directing the learner towards instructional outcomes. It acts as a marker for learning as way finding.

Assessment theorists, Black and Wiliam (1998), Shepard (2000), Brookhart (2003), and Wiggins (1998), describe informative assessment as a moment of learning that can engage students in decision-making, and help them to invest in activities where they can exercise choice. The essential difference is that an **informative assessment** occurs within the flow of learning, and provides guidance like a roadmap.

There are four practical reasons to use informative assessment:

1. Data-informed, rather than data-driven evaluation.
    a. Students co-create learning goals from the assessment criteria
    b. Consider evidence about quality of their work based upon academic coaching.
    c. Create process, integrating the assessment criteria and qualities into their learning goal.
2. Can be aligned to build upon student interest
    a. Foundation – exploration of a powerful idea
    b. Low floor – easy to start
    c. High ceiling and wide walls—allows greater range and complexity
3. Organizes and focuses academic communication
    a. The instructor becomes a coach.
        i. Model the practice of a growth mindset and reflection
        ii. Summarizing, question generating, clarifying, and predicting
    b. Directs encouragement towards effort and understanding of criteria and qualities
4. Increases likelihood of play, and thus engagement and learning.

Informative assessment is a learner-centered practice. It helps teachers collect data about student learning, helping them to avoid assumptions or jump to conclusions, which is the basis for becoming an effective teacher (Danielson, 2009). Using informative assessment can increase feelings of playfulness, minimize fear of failure, and present the teacher and student relationship as a roadmap, with opportunity for discussion, and sharing that, *"I too am always learning. Right now I am learning about how you understand this activity, and what I can do to help you."*

Case Study One: Boat Racing as a STEM Engineering Unit

Context: This activity took place in a 9th grade course on engineering at Washburn High School in Minneapolis, MN. The curriculum was designed as direct instruction. There were hands on activities, but these activities were teacher-directed, and lecture-based. There was a clear scope and sequence, a textbook, prepackaged teacher PowerPoint's, and data-driven assessments. This was a scripted curriculum.

There was discord in this classroom. The teacher had been removed, and the new teacher (the author of this chapter) took over midway through the first quarter. In the beginning students were often oppositional and off-task. To counter this, the new teacher modified the prepackaged curriculum to be more play-like, with the intention of increasing on-task behavior, improved academic outcomes, and a reduction of academic disturbances.

Purpose: Learn the difference between design and engineering.

Description: To create this emulation students were given an initial general goal (build a sailboat), a role (boat designer), and shown a range of resources and tools to be used in service of designing and building the boat they were to race.

Key vocabulary: design, naval architecture, marine engineering, mechanical drafting, the engineering notebook, measurement, engineering and design principles, and scientific principles such as buoyancy, displacement, force, turbulence, reasoning, hypothesis testing, data collection and interpretation of the data.

The initial emphasis in the lesson was a boat race. Students were told that they would be designing and building a boat. There would be four different competitions:

1. Speed: first boat across the pool
2. Weight-Bearing: boat that could carry the most weight
3. Stability: boat that could handle rough water best
4. General Purpose: best average scores across competitions

In getting ready for design, students were asked, "What is the difference between engineering a boat, and designing a boat?" By building a boat, students began to learn about engineering and design, using rubric criteria, available tools, resources, and information to improvise a sailboat. In order to provide guidelines for assessment, a rubric was created for each station, which served as a roadmap (Table 1, next page).

Table 1. Station One Rubric Boat Building Emulation

	Purpose & Plan	Isometric Sketch	Vocabulary	Explanation
Level up	Has identified event and hull design for appropriateness	Sketch includes height, length, and depth by lines 120 degrees apart in scale.	Correct use of five key terms from the word wall to justify hull design	Clear connection between the hull design, event, sketch, and terms for building prototype and testing
Approaching	Has chosen a hull that is appropriate for event, but cannot connect the two.	Has drawn a sketch where height, length, and width are represented.	Uses five key terms but struggles to demonstrate understanding	Describes design elements, and execution, but cannot make the connection on how they work together.
Do it again	Has chosen a hull, but it may not be appropriate for event.	Has drawn a sketch, but height, length, and width are not represented	Does not use five key terms from word wall	No clear connection between design, concepts, and execution

For one of the first activities students created an annotated isometric sketch in their engineering notebook. This required knowledge of vocabulary, description of design goals, demonstration of an isometric sketch, and an explanation of how their initial plans were going to work. This included the dimensions, materials, and reasoning in the engineering notebook. Through this, the student could level up with review and assessment from the teacher. A passing score allowed the student to move to the next station, or resulted in suggestions of making changes to their boat, and improve their score on the rubric, and grade in the grade book.

Figure 1. Image of Boat Building Emulation Stations

A word wall informed each step of the process with key vocabulary. A word wall is a collection of words, which are displayed in large visible letters on a wall, bulletin board, or other display surface in a classroom. In this lesson, the word wall contained key vocabulary for the activity such as: design, naval architecture, marine engineering, mechanical drafting, the engineering notebook, measurement, engineering and design principles, and scientific principles such as buoyancy, displacement, force, turbulence, reasoning, hypothesis testing, data collection and interpretation of the data.

The assessments worked to inform students of criteria and quality to move forward; to focus student/teacher coaching, check progress, and provide encouragement directed towards progress on the assessment.

Students moved station to station by meeting the criteria and qualities on each assessment. To move to next workstation (figure 1), students had to check in with the teacher for a review and sign-off. The sign-off worked as a running record, where students would use the language of the rubric and word wall and explain how they had met the criteria, and make a case for their score. This negotiation led to improved comprehension of the concepts and terminology, and provided common understanding of quality (Dubbels, 2010).

When students received a lower score than they wanted, they were encouraged to make changes that were aligned with the rubric quality criteria. This process continued station-to-station. Once students had their plan approved, they leveled up, putting on their safety glasses and began to craft their hull based upon the plan detailed in the annotated isometric drawing. This included cutting and constructing the Styrofoam hull, creating the sails, and eventually participating in the competitions.

Key Findings:

Results from the STEM boat building activity were very positive. In a report presented at the National Science Foundation (Dubbels, 2010), data analysis showed a significant increase in engagement, a significant reduction in classroom behavior incidents (written referrals), and improved successful academic performance, including recall and comprehension. Additionally, the students reported enjoying the class, specifically the activities. They shared that they liked having more choice, and making the boats.

Instructor reflection indicated the activity was more fun to teach. The emphasis on playful mood made a difference in classroom climate. Changing the activity from direct instruction to emulation required more up-front planning, and required some practice maintaining the playful mood. At times it was a challenge to be responsive to students, rather than reactive. In the beginning, students could be challenging and test the limits of the activity—and the teacher's patience. It was essential to remain detached, and treat students with unconditional positive regard. The key was to always go back to the rubric, the system, and the stations. After a few students were getting through, and seeing the cool stuff other students were doing, there was a bit of a snowball effect, and most of the students engaged.

Central to this activity was identification and reinforcement of good behavior. This was done through identifying students on task, and praising them on their effort, and progress using the assessments as roadmaps for successful behavior. In the boat design activity, the assessment, classroom, teacher, and classmates all became resources to help facilitate ideas, and each learner could apply what they observed and build their boat. The assessments happened in the flow of the activity. This process integrates the assessment into the flow of learning, in what is called an informative assessment (Black & Wiliam, 2009; Forster, 2009; Wiliam, 2007; Wiliam & Thompson, 2007).

This approach removed the threat of assessment and learning, and positioned the quality of work as a negotiation, where the student developed the outcome and qualities through the process of trial and error, where the key processes and concepts were imbedded in service to building the boat. This removed the threat of judgment and evaluation, by allowing mastery learning, so that the student built their knowledge and skill, while building their boat. This activity depended heavily on improvisation and a playful approach, where observation, trial and error, and learning from mistakes were a natural part of the learning (Dubbels, 2013).

A successful strategy called a "sunshine call" was immensely helpful in creating and maintaining a playful learning mood. A sunshine call is when the instructor calls home and praises the student effort in class. The teacher does this in the flow of the classroom session. If the student agrees, the teacher calls home and asks if they can share a proud moment about the child with the child's parent. The teacher describes the positive academic behavior, and shares that they are proud of the student, and wanted to celebrate the student, and that the caretakers should be proud.

Although this might seem disruptive, and potentially embarrassing, it has been very effective in changing the classroom climate. When the author first did this, the classroom became oddly silent, and the atmosphere changed. Not only did students soften, they began to gravitate more towards the activity, and open to the teacher. The parents were surprised and expressed gratitude for the positive call. After just one of these public calls, other students asked how they might get such a call, and the author was able to direct the student to the rubric and show the roadmap for success. Sadly, part of the experience of making sunshine calls was that the author learned from parents and students that they had never received a positive call home. This simple act had a significant impact on class moral.

In addition to the celebration of positive behavior, if the adult can practice open-ended questions, take care in listening, and offer playful activities like role-playing, and then tap into LCPs, attachment formation and trust are more likely to occur. This kind of communication is in contrast to authoritarian leadership, which is composed of warnings, criticism, and directives toward children—which is antithetical to creating a playful mood. Playful communication style should be manifest not only in verbal interaction, but also in curriculum materials and classroom management (McCombs & Miller, 2007).

Students appreciated being data-informed in their work and progress. When rubrics and scales were used in an informative way, students were more likely to use assessments as roadmaps, and this helped to clarify quality performance. When the assessment was used as part of the learning cycle, students were able to:

1. Create and synthesize goals from assessment criteria
2. Consider evidence about quality of their work
3. Create process to integrate assessment criteria and qualities with their learning goal

This created greater engagement and ownership in the activity, and students were able to look beyond performance targets and the formal processes promoted by the school district, and help the students co-create activities for further development.

Additionally, students shared that they liked the emulation activity. They liked taking on the role of a marine engineer. Many students reported that they did not know there was such a profession. In reflection, it would have been exciting to have had naval architects and marine engineers visit, in the same way that Shaffer (2006) had engineers lead design groups.

Administrators reviewing the revised curriculum and approach had prior experience with a range of instructional approaches, and connected pedagogically with what the teacher was trying to accomplish with motivation, engagement, and play. By modifying the standardized curriculum with learner centered practices (informative assessment, emulation, unconditional positive regard), observational data, surveys, and assignment completion, students showed greater engagement, fewer behavioral incidents (written referrals), and improved academic performance (criteria referenced grades). For a more thorough analysis of this activity and outcomes, see (Dubbels, 2010).

Case Study Two: Language Arts (Rhythm & Flow)

Context: The activity was designed by the author to support ESOL students and reluctant readers. It was first taught at Green-Central Elementary School in Minneapolis, MN in a multiyear classroom composed of fifth and sixth graders. It was also presented the following year as curriculum for adolescent mothers at the Broadway High School, with the intent of training advanced college reading placement.

Purpose: To improve reading fluency and comprehension. Students were taught that in reading:

- *How you say it, is just as important as what you say.*

Description: In this unit, students learned powerful ideas in reading fluency and comprehension through performance reading. The students created poems, read selections of novels, and song lyrics, and were taught to trust their voices, make reading pleasurable by recreating the voices from the page during silent reading.

Key vocabulary: prosody, volume, pitch, emphasis, and composition.

The Rhythm & Flow activity is an emulation that trains students in reading fluency and oral reading. In Rhythm & Flow, the learner takes on the role of a media personality—they could be an entertainer like Kanye West, Jennifer Lopez, or Katy Perry, whomever the student feels an affinity. They use this media persona to interpret texts, asking questions like, *"How would Kanye sing this?"*

Not only does the student perform, but they also create lyrics, borrowing and interpreting from texts such as poems, newspaper clippings, and found texts. They learn that anything can be a lyric, and then they seek to perform and produce recordings, surrounding the vocal with sounds and instrumentation—they put a beat behind it.

In order to provide some structure, an informative assessment was used. A reading fluency scale was modified to be more playful and learner-centered to guide students in different qualities of oral reading and interpretation. The values of using this assessment tool is that it provided the student and instructor with shared language so they could describe aspects of their performance and eventually relate elements of that performance into silent reading.

Table 2. Modified Fluency Scale for Rhythm & Flow Emulation

	Scale for Fluent Reading
1	I have chosen a challenging book. I read with hesitation with emphasis on single words—I am trying to learn them in isolation from one another. The "flow" in my reading is a little clunky like a telegraph with word-by-word reading.
2	I just read with two to three word phrasing. My reading seems very hesitant, like I might be unsure, with considerable pausing. I am blending and decoding the words. I am naming the words rather than letting them flow.

This scale was modified to valorize the student effort. The original reading fluency scale is composed with formal, objective language, typical of standardized assessments, and serves as a curriculum based measure (Deno & Marston, 2006). In Table 2 (above) the formal language of the standardized measure has been translated to a more playful mood. This simple modification changed usage from a formative assessment, to an informative assessment—from a formal data-driven collection tool, to a tool capable of informing students of their progress, like a roadmap. This tool was used to enhance instruction, allowing the teacher to act as a facilitator, and allow the student to develop a vision and an ear for what success might look like, and sound like in oral reading, and to help them to make more dependable judgments about the quality of their own work.

The instructor starts by arranging a coaching session; sits next to the student and, talks about what each category in the scale sounds like. This provides two benefits:

1. The student gives permission
2. It provides guided practice for close reading of an assessment.
3. It provides reciprocal teaching, so that the teacher can provide an example that the student can emulate.

Close reading is a careful, sustained, interpretation of a brief passage of text. This is an important skill for students, but one that is not often taught or practiced. It emphasizes paying close attention to individual words, syntax, and the order in which sentences and ideas unfold as they are read (Fisher & Frey, 2012).

To make this into emulation, it was necessary to bring in playful activities, where the students might pretend to be a media personality. This allowed some distance between the student and the performance, and gives them permission to say, "I was just playing". Surrounding this oral interpretation fluency scale with emulation further reduces threat and increases engagement.

Learning as someone else provides some distance through pretense, so that failure is not seen as personal incompetence, but playing towards mastery. This approach is representative of play, emulation, and the growth mindset described earlier in this chapter. This idea is important, as the student is free to role-play, exaggerate and improvise, and make mistakes.

Additionally, the student learns the elements of oral interpretation and expression as powerful ideas. They learn the function of volume, pitch, and gesture in expressive reading, as well as how rhythm, emphasis, and punctuation can change meaning. They learn that how something is said, may be more important than what is said. How a word is expressed can change the meaning.

The unit was highly motivating, as it drew upon high interest activities like popular music and sound production techniques for composition. This emulation promotes the integration of comprehension and composition skills often emphasized in strategy instruction. Rather than composing for the teacher, the student can play the role of a popular music artist, and through role-play, produce music recordings as musical "hits" using easy-to-use software called GarageBand.

Figure 2. GarageBand User Interface from Gavenda (2005)

GarageBand is a music creation studio, which includes pre-recorded loops or musical instruments, Foley effects (everyday sound effect), or even creating their own (Gavenda, 2005). The student can add a guitar, a bass line, and use the microphone to add their voice. *GarageBand* captures the audio and turns it into digital files the student manipulates and shares using recording, mixing tools, and broadcasting tools.

Key Findings

The Rhythm & Flow curriculum structured the development of reading fluency and prosody through the use of key criteria mapped as informative assessment. Through this process, the student learns that there are different styles and genres in text, just like there are in music. They become familiar with a variety of genres, and record their oral interpretations as musical texts. The curriculum draws on role-play, epistemic games (Shaffer, 2006) and to some degree, construction and design. The unit uses a simple scale of oral interpretation as a roadmap toward fluent oral reading and performance.

The students were asked to take on roles and learn genre through the production of media from performance reading. The music production software and role-play made the learning fun and off-loaded the complexity, making the assessment and coaching work together as a roadmap for success and guidance of the learning process. The result of this emulation was improved reading outcomes.

This activity was identified and presented as a best practice by the Minneapolis Public Schools Professional in Practice conference. Along with an explanation of the activity, evidence was presented for improved engagement as on-task behavior, improved reading outcomes in fluency and comprehension. In the course of this activity, students were often able to improve their reading performance by at least one cut score of the scale, and reported improved feelings about their ability to read, and began to use the concepts and terminology in describing their reading (Dubbels, 2008).

Case Study 3: The Constitutional Compromises Emulation

Context: The activity was designed for secondary students taking remedial history courses at the General College at the University of Minnesota, and as part of a Freshman Composition course in the College of Liberal Arts at the University of Minnesota.

Purpose: The Constitutional Compromises Emulation provides experiences to help students understand the way that decisions were made in the creation and structure of the federal government.

Description: This classroom emulation brings together themes from critical readings about the issues surrounding the American Constitutional Convention of 1787. The students read a variety of genre prior to the simulation. Readings included the *Constitution*, and the 23rd, 47th, 51st, 72nd, and 78th in the series of *Federalist Papers*.

Key vocabulary: Constitution, Senate, House of Representatives, states, legislature, slavery, representation, voting, representation, delegates.

Students act as delegates at the Constitutional Convention. Each state has one vote in any decisions made by the convention. The student role is to negotiate and compromise with other states in an effort to secure the maximum number of votes for your state. The recipes for votes listed in Table 3 are an assessment of the relative benefit to the student's state for the possible resolutions on each issue. The points have no relationship to student grade, they serve as a game mechanic to motivate and guide negotiations with other states (student groups).

Representation: The best-known compromise at the Constitutional Convention concerned the method for determining representation and ultimately resulted in the current Congress with the Senate having equal representation for each state and the House of Representatives being based on population.

- Students must consider their state's concerns as a representative. States choose between methods for voting and representation. They can receive points for a one-house legislature with the number of state representatives based upon the state's population; points for a one-house legislature with every state having equal representation; points for a two-house legislature, one based upon population, and one based upon equal representation. Choosing the right voting structure will be important for small states to be the equals of large states in voting power and governmental decision-making.

Counting Slaves: This issue was much more complicated at the time than is usually portrayed in history textbooks. The issue of counting slaves for purposes of representation is usually focused upon with the infamous 3/5 compromises being the result.

- Slaves counted towards population, and could influence the number of possible representatives for each state. However, some states felt that slaves should not count as a "whole person". The student groups must consider their state's concerns about slaves, and how to count them. How slaves are counted will influence the state's representation for purposes of taxation. If slaves are counted as 3/5ths of a person, this will also influence representation and taxation.

Slave Trade: The New England states of Massachusetts, Connecticut and New Hampshire had abolished slavery in the wake of the American Revolution, but small numbers of slaves continued to exist in New York, Pennsylvania and New Jersey where various gradual emancipation plans had been enacted.

- Students must consider their state's concerns about the slave trade. Points will be vary based upon whether slave trade is abolished, restricted, or if a 20 year extension/limit is approved for trading slaves.

The Convention: Students then begin interacting with other state delegations, discussing alternate resolutions, negotiating compromises and concluding political bargains either openly or behind the scenes. Students or the instructor can initiate votes on any issue, in any order, using secret ballot or a simple show of hands. A two-thirds vote (eight of the twelve states) is required to pass any resolution. After the votes have been determined on each of the three issues, students assess how favorable these decisions are to their state by counting the number of points achieved. Students score the outcome of the convention using the Constitutional Compromises scoring table (table 1, below):

Scoring Table

Points listed on the Constitutional Convention scoring table (see Table 3) represent an assessment of the relative importance to each state of alternate resolutions to the three divisive issues explained above. Some compromise is necessary to achieve the required number of state votes and a 3/5 ratio (2 points) had been suggested in 1783. New England and the Lower South were on opposite sides of the slave trade issue (0 or 3 points) but the other two regions were more flexible. All four regions could accept the delayed abolition of the slave trade as a partial victory (2 points).

Table 3. Scoring Table for Constitutional Convention Emulation

A: Representation					B: Slave Count				C: Slave Trade		
State	Equal	Pop	EO/ Pop		Rep	Tax	3/5		AB	Tax	NR
NH	3	0	2		0	3	2		3	2	0
Mass	0	3	2		0	3	2		3	2	0
Conn	3	0	2		0	3	2		3	2	0
NY	0	3	2		0	3	2		2	2	0
NJ	3	0	2		0	2	2		2	2	0
Penn	0	3	2		0	2	2		2	2	0
Del	3	0	2		2	0	2		0	2	2
Mary	1	1	2		2	0	2		0	2	2
Vir	0	3	2		3	0	2		0	2	2
NC	1	1	2		1	1	2		3	0	2
SC	1	1	2		3	0	2		0	2	3
Geo	1	1	2		3	0	2		0	2	3

Description of Table 3 (legend):

Column A: Representation
Equal: means an equal number of representatives for each state
Pop: means number of representatives based upon population
Eq/Pop: means one house based upon population, and one house equal for each state
Column B: Slave Count
Rep: means slaves count for the purposes of representation
Tax: means slaves count for the purposes of taxation

(con't) **Column B:** Slave Count
Both: means slaves count as 3/5 of a person for taxes and representation
Column C: *Slave Trade*
AB: abolish slave trade immediately
20 Years: postpone issue for 20 years
NR: no restriction on the slave trade

Key Findings

The Constitutional Compromises Emulation provides a structured, game-like experience that provides an opportunity for students to play the roles of state representatives deciding upon how the government of the United States should be organized for policy making and enforcement. The checks and balances often seem to be arbitrary, until the students begin to negotiate for their state's best interests. This is a fairly simple activity to organize and provides huge insights to students as they negotiate for their state's future power. Students often need help in understanding how to debate and how to manipulate other states. The outcome is not guaranteed to simulate what happened in the real constitutional convention, but as emulation, it provides the experience of compromise, negotiation, and debate that created the current government of the USA. It is important that students are encouraged to present their positions, and why their view should be accepted by the other states. A turn–taking structure, along with the opportunity to respond and vote is important, so that each student is ready to know their position, as they get ready to present it to the groups, and persuade that their position, is the correct position. When the voting is done, the students can debrief to compare what happened in class to what happened in 1787 as a class discussion. Grading can be conducted through participation, such as the quality of proposal, alignment with state's actual views, and their persuasiveness.

Best Practices

This chapter summarized key research on play to make a model for designing learning activities. In summary:

- Play is an innate and powerful form of learning. It is not just for early childhood development. Evidence was presented in the key frameworks section of this chapter that indicate using a playful approach to designing and implementing learning activities lead to reduced opposition, increased compliance, on-task behavior, improved recall, comprehension, and an increased likelihood of unique, innovative solutions to problems.
    - The way one learns may be more important than what one learns.
- Play-based activities offer a strong contrast to threat-based activities and promote improved engagement and academic performance.
- Growth mindset, Learner Centered Practice, and Responsive Play share characteristics with play.
- Play increases recall, and reduces difficulty in learning new skills and content. By creating a playful mood through communication, and maintaining this mood with learners, according to the summarized research in this chapter, oppositional behavior, and "fixed mindset" can be changed to create compliance and openness, even in children with an oppositional /defiance diagnosis.
- To create a playful classroom requires activities that promote: unconditional positive regard, choice, trust, intrinsic motivation, control, and process orientation.

- Informative assessment is a powerful tool for developing a playful classroom and should work as a cycle.
    - Informative assessments such as rubrics and scales can provide a roadmap for student learning and teacher insights about their teaching practice.
    - These are constructed through:
        - Making the introduction to activities accessible, interesting and easy, so novices can get started (low floor)
        - Allowing for activities that can become complex and sophisticated so that as competency and expertise grew, learners can extend the activity (high ceiling).
        - Give students a variety of ways to explore the project through choice and effort (wide walls).
        - Build activities around key concepts, which help students to apply formal vocabulary to concepts of which they had previously had only an informal understanding (powerful ideas).
- A playful classroom requires a playful approach to learning on the part of the teacher.

Benefits of Play

Learning generated in the context of play, especially social play, can lead to greater engagement, improved recall, comprehension, and be more innovative. Juveniles can observe behaviors and strategies performed by adults but then recombine elements of these behaviors in novel routines in play (Bateson, 2005; Bruner, 1972; Fagen, 1981; Sutton-Smith, 1966). For example, the levels of children's symbolic functional and oral language production are more varied and complex in peer play, relative to when they are interacting with an adult (Pellegrini, 1983). More importantly, play is a low-cost and low-risk way to learn new behaviors and acquire new skills and knowledge (ibid). Conversely, one could suggest that a limitation of direction instruction, observation, and imitating adults is that this kind of instruction will only transmit existing practices.

Offering activities to children in a playful mood can increase a willingness to take direction, and on-task behavior (Moore, Underwood, & Rosenhan, 1973; Rosenhan, Underwood, & Moore, 1974; Underwood, Froming, & Moore, 1977). To create a more playful mood, participants engage in playful communication, with emphasis on reducing or eliminating all commands, questions, and criticisms.

Play acts as an important organizing principle during developmental growth (Brown, 1998). Play is not only an imaginative activity; play also allows children to imitate and emulate adult work activities without the danger of failure. Children role-play activities from the adult world, and learn to use the tools, rules, and language of adult work. Play is an important part of academic learning. When children play, they develop new strategies and behaviors with minimal costs (Bateson, 2005; Burghardt, 2005; Spinka, Newbury, and Bekoff, 2001).

Future Needs

Using a playful approach in the classroom represents a fundamental change in assessment, offering a philosophy of playful and data-informed assessment, as compared to standardized, data-driven assessment. To be data-informed, assessments are used to guide the way, not to indicate that learning is accomplished. In play-based assessment, one can inform and improve student learning, increase motivation and engagement, and improve our school's programs by learning from our challenges, progress, and performance.

A playful structuring of assessment using the model in this chapter allows one to integrate play, and utilize assessment as a form of instructional communication, reducing threat, and emphasizing play. The value of such an approach is that it provides support for a range of students, including specialized support to educationally disadvantaged populations, including economically disadvantaged students, English Language Learners, students with disabilities, and students who are at risk of not meeting state academic standards.

Resources

Books and publications

A Child's Work: Freedom And Play In Froebel's Educational Theory And Practice: Joachim Liebschner
A Child's Work: The Importance of Fantasy Play: Grace Paley
Animal Play Behavior: Robert Fagan
Animal Play: Evolutionary, Comparative and Ecological Perspectives: Marc Bekoff and John A. Byers
Free-Range Kids, Giving Our Children The Freedom We Had Without Going Nuts With Worry: Lenore Skenazy
Handbook of Child Psychology, Vol 4: Socialization, Personality, And Social Development
Language and Symbolic Power: Pierre Bourdieu
Man, Play And Games: Roger Callois
Media Use By Infants and Toddlers: A Potential For Play: D. Weber
Persuasive Games: The Expressive Power of Videogames: Ian Bogost
Play: Garvey
Play, Dreams And Imitation: Jean Piaget
Play-Fighting: Owen Aldis
Play: How It Shapes The Brain, Opens the Imagination, and Invigorates The Soul: Stuart Brown
Playing Their Way into Literacies: Reading, Writing, and Belonging in the Early Childhood Classroom. Language & Literacy Series: Karen Wohlwend
Play, Playfulness, Creativity and Innovation: Patrick Bateson
Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology: Gregory Bateson
The Absorbent Mind: Maria Montessori
The Ambiguity of Play: Brian Sutton-Smith
The Art of Failure: An Essay on the Pain of Playing Video Games: Jesper Juul

The Complete Book of Children's Play: Ruth Edith Hartley and Robert M. Goldstein
The Cultural Origins of Human Cognition: Michael Tomasello
The Genesis of Animal Play: Testing the Limits: Gordon M. Burghardt
The Montessori Method: Maria Montessori
The People in the Playground: Iona Opie
The Play of Animals: Karl Groos
The Play of Man: Karl Groos and Elizabeth Baldwin
Video Games and Learning: Teaching and Participatory Culture in the Digital Age: Kurt Squire
Women, Fire, and Dangerous Things: What Categories Reveal About the Mind: George Lakof

Games and websites

Video Games as Learning Tools
http://vgalt.com
Play and its role in the Mental Development of the Child
https://www.marxists.org/archive/vygotsky/works/1933/play.htm
6 Types of Play: How We Learn to Work Together
http://www.spring.org.uk/2008/07/6-types-of-play-how-we-learn-to-work.php
Meaningful Play Conference
http://meaningfulplay.msu.edu/
The National Institute for Play
http://www.nifplay.org/
Play England
http://www.playengland.org.uk/
Games Learning and Society
http://www.gameslearningsociety.org/

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CHAPTER 5

Classroom Use of Video Games for Children with ADHD and Autism Spectrum

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Key Summary Points

1. Video games have vast potential for helping with the academic, social, and emotional education of children with ADHD and autism.
2. There are legitimate concerns about negative outcomes for the use of video games and technology for children with ADHD and autism spectrum disorders.
3. Video games and technology can be useful for training executive functioning, adaptive and behavioral, and social/emotional skills through the use of short-form and long-form games.

Key Terms

Autism apps
ADHD and video games
Executive Functions Technology
Generalization of Game-based Learning
Video Games
LearningWorks for Kids
TeachTown

Introduction

Children with developmental disorders such as Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD) are characterized by difficulty in the generalization of learning from one setting to another. They often experience problems with sustained attention and effort; the capacity to connect classroom learning to the real world; and a variety of executive-functioning skills, including organization, planning, metacognition, social thinking, and flexibility. Traditional classroom methods

for teaching children with ADHD and ASD are often ineffective due to students' lack of engagement; difficulty with expressive and receptive communication skills; behavioral and emotional problems; or physiological difficulties, including sensory or fine-motor struggles.

Video games, apps, and other technologies have opened new opportunities to teach children with ADHD and ASD due to characteristics of digital media such as multimodal feedback and adapting challenge to mastery levels, as well as students' willingness to engage, practice, and master these tools. Teachers have increasingly observed the dramatic contrast between the enthusiasm and persistence for learning with digital tools as opposed to traditional educational strategies with special needs students and have begun to use games and apps in their classrooms. Educators are also recognizing the vast potential for using games, apps, and other interactive media to teach a variety of problem-solving, communication, executive-functioning, and academic skills to children with ADHD, ASD, and other social and emotional difficulties. At the same time, possibilities of addiction, overuse, and withdrawal from social relationships reflect legitimate concerns about the use of digital technologies with children with developmental disabilities.

The use of technologies in the classroom for children with ADHD and ASD is in its infancy. The majority of school-based studies (Whalen et al., 2010; Durkin, 2010) have focused primarily on software designed specifically for a particular population. However, the use of popular games and apps designed for all children, which are often more engaging in nature, is now a common source of instructional material. With the advent of mobile apps, the concept of using a variety of smaller or short-form games or apps as opposed to a single, large program is also being explored in the classroom.

Key Frameworks

Definitions and treatment of ADHD and ASD

ADHD is characterized by difficulty with inattention, distractibility, and/or hyperactivity that impairs performance in school, at home, or in other activities. ASD is characterized by developmental difficulties that can include problems with social interactions, communication, and restrictive patterns of behavior. The use of games, apps, and other technologies as treatment approaches for both ADHD and ASD is in its infancy. While there are generally not any accepted frameworks for using technology as an intervention for either of these psychiatric disorders, there are many widely evidenced-based interventions for children with these types of developmental disabilities. Traditional strategies that are successful share many characteristics with interventions that rely upon the use of digital media and technology.

What makes video games powerful tools for teaching children with ADHD and ASD?

There are widely accepted fundamental educational approaches for children with developmental disorders. Many of these constitute "strategic teaching" principles that can be used in the classroom and by parents and clinicians. Common to strategic teaching principles are procedures that use individualization, metacognition, and generalization approaches.

Traditional strategies for teaching children with ADHD involve the use of point-of-performance interventions that address a particular problem or skill right at that time. Immediacy and salience of the feedback are extremely important in interventions for ADHD (DuPaul & Stoner, 2004). Feedback needs to be powerful and meaningful to the individual. Multimodal feedback that includes multiple intervention agents; opportunities for movement; and the capacity to be able to talk, get feedback, or fidget may also be helpful. Given the disabilities of children with ADHD, it is evident how specific characteristics of digital media and video games can be very useful in helping them.

Table 1. *Video Game Characteristics and Children with ADHD*

Characteristics of Children with ADHD or Attention Difficulties	Characteristics of Video Games and Other Digital Media
May easily become bored and unable to sustain attention.	Good video games and other digital media are often multimodal, requiring ever-changing skills and employing a variety of stimuli, including video, sounds, words, and actions, that help keep children interested and engaged.
Often require reinforcement or consequence that is immediate to stay focused on a task.	Video games provide clear and immediate feedback, constantly letting players know what they are doing wrong and what they are doing right.
Often require their bodies or minds to be actively engaged.	Video games and other digital media are extremely engaging, and many require physical and cognitive involvement.
Usually have problems with following directions.	Video games teach by trial and error or through guided discovery, requiring players to understand instructions to succeed.
May struggle to learn new information and experience frustration or low self-esteem as a result.	Most negative feedback from video games and other digital media occurs privately. This causes less embarrassment and frustration while teaching players how to handle these emotions.

Traditional strategies for teaching and improving skills in children with ASD include direct instruction in social skills; occupational and physical therapy to help with sensory integration and motor-coordination problems; and training in communication skills such as listening, making eye contact, and reading nonverbal cues. Family and individual therapy may also be helpful, along with executive-functioning training to improve cognitive flexibility and adaptability. Some specific strategies and tools are used to train children who have more severe forms of ASD. These include approaches such as applied behavioral analysis (ABA) (Lovaas, 1987), which is a form of behavior modification that assesses the relationship between a behavior and the environment and develops strategies to reinforce appropriate behavior. Autism researchers (Whalen et al., 2010) have also identified motivation, attention, and flexibility as important tools to teach children with ASD. Given the disabilities of children with ASD, it is evident how specific characteristics of digital media and video games can be very useful in helping them.

Table 2. *Video Game Characteristics and Children with ASD*

Characteristics of Children with Autistic Spectrum Disorder	Characteristics of Video Games and Other Digital Media
May be inflexible or rigid and struggle with changes or making mistakes.	Video games help children practice being flexible in a safe and engaging environment through learning the rules of the game by trial and error and guided discovery.
Are often unaware of social cues and convention.	Massive Multi-player Online Games are particularly good for becoming part of a group and require that players learn the "customs" of the game world, allowing children with autism to socialize in a more comfortable environment.
Often display poor fine- or gross-motor coordination.	All video games practice some degree of fine- and gross motor-skills, particularly those with motion controls.
May become vulnerable to bullying and not understand when they are being teased or how to protect themselves.	Many online multi-player games contain the same types of social interactions children find at school, both the good and the bad. Parents can sit with their children (without the other players knowing) to coach them through any difficult social interactions that may occur.
Often do not share common interests with peers.	Most children play at least a few video games, so having a knowledge of gaming would give children with autism a topic of conversation to use with their peers.

Case Study One: Playing Smarter Program

Playing Smarter is the school-based curriculum of video games from LearningWorks for Kids, an educational technology website that reviews hundreds of popular video games and digital technologies to teach executive-functioning and academic skills to children. The games selected for the Playing Smarter program are a small subset of the larger set of popular video games and apps used by LearningWorks for Kids. Examples of Playing Smarter games include *Learn to Fly*, an action game in which players help a penguin fly by using rockets, gliders, and various aerodynamic tools; *Chuzzle*, a tile- matching video game; and *Red Remover*, a puzzle game in which players must make all the red blocks disappear from the screen without losing any green blocks. Each of these games demonstrates multiple, concrete examples of a particular executive function, allowing users to practice applying the skill, which can inspire thoughtful discussion about the skill after it is played. Playing Smarter focuses on the use of Internet-based games that do not require particular consoles.

Teachers are encouraged to play the games in a school environment for at least 30 minutes to become familiar with game mechanics and to experience how they use an executive-functioning skill. Playing longer can help in the development of a better sense of how to direct students. Because the program is school-based, issues regarding appropriateness for classroom, length and complexity of the games, and accessibility are also considered.

The popular, short-form games are accompanied by other learning tools that help promote generalization of the skill. Each game has its own web-based guide, referred to as a "Playbook." The Playbook consists of a preview of the game, called a "PrePlay," which describes the skills that will be practiced in the game. The PrePlay, presented prior to playing the game, informs students about how the executive skill is used in the game and asks them to make predictions and/or set personal goals. It is intended to direct the focus of game play toward discovering and practicing the executive skill rather than simply getting a high score. After playing the game students complete the Playbook "RePlay," which allows them to rate the game based on their enjoyment, cite examples of when they used the executive skill, and make connections between the game and real-world situations that require that skill.

Hands-on connection activities follow each game that require students to transfer the skill from the game to an activity such as *Memory Match* or *Scattegories*. Along with the RePlay, these activities provide specific, real-world situations of where students might use the executive skill they have practiced in the game and help to demonstrate their versatility. Classroom discussions (and Playing Smarter teacher guides) are directed toward generalizing the game-based skill to problem solving, academic study, and 21st century skills.

Each game in Playing Smarter can be used as a single lesson or multiple games can be grouped to create a customized series of classroom lessons that target a specific skill, as was done during the described (2011) research study. Playing Smarter can also easily be adapted for a differentiated instructional model where students work on an individual area of weakness and discussions are primarily between the student and instructor or special educator.

Two consecutive, three-week sessions of the Playing Smarter program were conducted during July and August 2011 with a population of students diagnosed with ADHD through a full neuropsychological battery. Playing Smarter targeted improving awareness and application of three executive functions particularly important in ADHD: focus, flexibility, and planning. Each session took place over a period of three weeks — one week per thinking skill —with eight hours of instruction a week. Challenges that were experienced during the first session were evaluated prior to the start of the second session, allowing the instructors to improve the delivery of the content. The goal of the pilot studies was to find the best methods to use the engagement of selected popular video game play to practice and understand executive-functioning skills and then to generalize these skills to academic or everyday-life scenarios where alternative learners tend to struggle.

At the conclusion of the Playing Smarter study students were asked to generate examples of each thinking skill in both the pre-testing and the post-testing. Students were given a point value based on the clarity of each response. Broad or generalized answers were given one point, while specific examples with context were given two. Irrelevant or repeated responses were not counted in the total. On average, students scored six points higher on the post-test, and collectively both sessions saw an increase in responses indicating that they were able to identify more examples of how each skill is applied outside of digital technologies. Parent pre and post measures were not significant for change, although this could be attributed to the small (ten students) sample size.

Overall, the experience gained from this research study indicates several important things to keep in mind when using digital games as teaching tools for children with ADHD. First, the games are exciting and motivating for students but have the ability to overshadow the bigger picture. Students were more likely to remain focused on the goal of practicing a particular skill and applying it elsewhere by using other engaging learning activities surrounding game play. However, the game cannot be used solely as a reward but should be treated as a valuable tool for learning so that students will see it as such. Modeling and think-aloud strategies can help eliminate confusion associated with adjusting to a new digital technology and help all students to start with the same level of background knowledge. In addition, learner-centered teaching strategies such as setting up teams of players had a positive impact on the motivation and focus of the students. Future research is planned with a larger sample of students and with materials available online.

Key Findings

Much of what clinicians and parents know about ADHD children's use of video games is anecdotal and observational in nature. Parents frequently report that their children with ADHD play video games too much and too intensely (Durkin, 2010). However, they also observe the capacity for sustained effort and attention to video games in their children with ADHD, sometimes calling into question whether the children do in fact have ADHD if they can focus so diligently on a video game.

Most of the data suggest that children with ADHD are similar to their typically-developing peers in their use of games and apps. For example, Bioulac (2012) found no evidence of a significant difference in the frequency or duration of play between ADHD and typically-developing children ages ten to 12 years old. However, recent data collected by Linginerni (2012) indicated that 90% of children with ADHD children spend more than one hour a day on the computer compared to only 80% of typically-developing children. Data collected by Kulman (2012) indicated that video games are the second most-used technology after television for children with ADHD, in contrast to typically-developing children, for whom they come third after music.

There is also evidence that children with ADHD may play games somewhat differently than their typically-developing peers. An early study by Lawrence (2004) indicated that children with ADHD completed fewer challenges and were less able to develop novel problem-solving strategies in video games and subsequently had fewer items named correctly on the Stroop Color Word Test. This was hypothesized to be related to slower processing speed, which is frequently a characteristic of ADHD.

A study that used the video games *Crash Bandicoot* and *Frogger* to investigate inhibitory performance of children with ADHD found no difference between ADHD and typically-developing children (Shaw, 2005). When neuropsychological tests were made into more video game-like tasks, children with ADHD were found to make significantly fewer errors (Shaw, 2005). Similarly, children with ADHD were found

to perform much better on working-memory training programs that use game-like elements to enhance motivation and training efficacy (Prins et al., 2011).

There are data that suggest that children with ADHD tend to perform better with video games or digital technologies than they do on paper-and-pencil tasks. A study that compared computers to analog technologies on versions of the same neuropsychological testing found that children with ADHD performed better on the Wisconsin Card Sorting Test computerized version as opposed to a traditional deck of cards. This finding is in contrast to that of typically-developing children, whose performance was the same on both measures. Children with ADHD were able to close the gap with typically-developing children when they were able to use the computerized version of this test (Oznoff, 1995).

There are also studies suggesting that video game play can be associated with negative outcomes for children with ADHD. Tahiroglu (2010) described the deteriorative effects of computer game play on children with ADHD, Inattentive Type in a correlational study of high- and low-duration players. Gentile, Swing et al. (2012) found that the amount of time spent playing video games was associated with greater attention problems in the same way demonstrated by previous research on television. Gentile's longitudinal study found that television/video game play was associated with attention problems in middle school and late-adolescent samples. It should be noted that the studies were correlational and that attention problems were measured by a three-item scale from teachers. A recent study of *SpongeBob Squarepants* (Lillard & Peterson, 2011) found that only nine minutes of viewing resulted in deterioration in executive-functioning skills, although this study was also very limited.

Video games and other digital tools have demonstrated promise in improving a variety of executive functions (brain-based self-management skills such as working memory, flexibility, organization, self-control) in children with ADHD. Tucha et al. (2011) utilized a computer training program called AIXTENT to train four different components of attention, including alertness, vigilance, and selective and divided attention, and found that there was generalized effectiveness in training on attention functioning. A number of studies indicate that video games can improve executive-functioning skills in children and young adults (Nouchi et al., 2013; Rueda, 2005). There is also ample evidence that video game-like technologies can improve working-memory skills, which are frequently identified as the single most important deficit observed in children with ADHD and are often a significant area of weakness for children with ASD. Studies conducted on Cogmed Working Memory Training, which utilizes a series of short memory-based video games (Klingberg, 2010), suggest that structural changes in the brain occur that lead directly to improvement in the symptoms of ADHD.

There are biological factors that make video game play such powerful for children with ADHD. Recent studies (e.g., Hoeft et al., 2008) suggest that video game play triggers dopamine release from the brain, which is consistent with how the neurotransmitter dopamine is important in rewarding behavior. Individuals with ADHD are described as having a dysfunctional dopamine system, resulting in problems in sustaining attention, oversensitivity to distractions in the environment, and difficulty with self-regulation skills. It has been hypothesized that they may seek out video game play in an effort to

increase dopamine release in their brains. A study by Hahn (2009) found slight reductions in Internet play over several weeks as participants with ADHD were treated with Methylphenidate. This study was interpreted to suggest that these individuals had a reduction in their need to be on the Internet because they had a diminished need for dopamine release as a result of the medication.

ASD and Video Game Play

As with our knowledge about ADHD children's involvement with video games, much of what we know about children affected by autism and their use of digital media is anecdotal in nature (Durkin, 2010). There are many reports that describe children with higher-functioning autism and Asperger's Disorder as being overly engaged in solitary technology and video game play. At the same time, there are also an increasing number of reports indicating that the use of apps and technology has dramatically improved the interactive and social skills of children affected by autism.

A ten-year prospective study conducted by Mazurek et al. (2011) indicated that the majority of youth with ASD (64.2%) spent most of their free time involved in non-social media, including television and video games, while only 13.2% spent time in using social media such as email, Internet, and chatting. The use of non-social media for groups such as those with learning disabilities and speech and language impairments was far higher among the ASD group compared to those with other disabilities.

A study by Shane & Albert (2008) indicated that children with ASD participated in screen-based activities with television and computer games more than other leisure activities and often did so to the exclusion of other activities. They found that 41.4% of children with ASD spend most of their free time playing video games and contrasted this to data suggesting that only 18% of typically-developing children in the general population were considered to be high users of video games. Mazurek & Engelhardt (2013) compared video game usage in children with ASD, ADHD, and typically-developing children. Their findings were similar to the anecdotal reports about the use of video games for children with autism or ADHD from many parents, that is, that many of these children become overly focused on their video game play, have difficulty transitioning from video game play to other activities, and may display argumentative behavior in an effort to have access to more video game play.

Swettenham (1996) suggested that there are three main reasons that children with autism are attracted to computers: computers involve no social factors, they are consistent and predictable, and children can

Interestingly, children with ASD may display specific visual-spatial strengths that draw them to video games, as well. They tend to find hidden figures more easily than typically-developing peers in an embedded figures test, suggesting that they might be better at video games involving hidden figures. This is in contrast to performing more poorly on tasks in which processing visual motion is necessary. Durkin (2010) also suggests that games involving planning, application of working memory and contextual memory, site shifting, inhibition of pre-potent responses, and fluency to adapt to change may hinder the performance of children with ASD.

There may also be biological and social factors that make video games such a powerful tool for teaching children affected by ASD. Mineo et al. (2009) describe research-based evidence of the strength of the visual modality among many individuals with ASD and suggest that the preference for visual stimuli, particularly those delivered via electronic screen media, may be better for teaching. Electronic screens may be ideal for teaching children with ASD because they have a relatively constrained viewing area that limits the attention frame, helping youngsters with ASD focus their attention on relevant stimuli and ignore irrelevant ones. Screens also provide predictability across repeated viewings, enabling viewers to anticipate upcoming scenes. When the auditory content is closely synchronized with the visual stimulation, multi-media information may assist viewers in the coordinated processing of information. Viewing electronic screens can also take place without the interference of another person, and this typically does not make social demands on those with ASD (Mineo, 2009).

Video games and other digital technologies also appear to be excellent tools for teaching social and communication skills to children affected by ASD. Bellani (2011) described using virtual reality and virtual environments to train children about social skills. This can be adapted to an individual child's needs and provide specific training, resulting in numerous improvements. Some recent apps have been identified as being extremely useful tools. Data related to Autismate indicate significant improvements in the understanding of social cues and development of specific communication skills.

Many children with autism experience difficulty with executive-functioning skills of flexibility, self-awareness, and self-control. Video games provide opportunities for developing fluid problem solving and cognitive flexibility due to the necessity to learn from mistakes. The skills of self-awareness and self-control required in many socially-based games may encourage children to want to learn these skills so that they are included with their peers.

Video games are also an excellent way for children with ASD to share interests with their peers. However, interview studies with children with ASD have indicated that their interest in video games may be somewhat more unusual than those of typically-developing peers. For example, they may have an interest in only one game that they play on a regular basis or play games that relate to their specific interests (Winters-Messiers, 2007). Anecdotal observations suggest that the games played by children with ASD are often less mature or of less interest to their same-age peers.

Classroom Use of Video Games for the Treatment of ADHD and ASD

The use of video games in the classroom for the treatment of ASD is becoming an increasingly accepted approach for improving communication and social skills. The games and apps used in the classroom are typically designed specifically for this population of children. Some of these tools are more game-like than others and may foster greater motivation and engagement in the part of students. The Center for Autism Research's FaceStation Project (2012), which requires repeated perceptual discrimination of facial identities and facial expressions, is an example of these types of games. Other games and apps such as *Go-Go* games, *ChoiceWorks*, and *Proloquo2go* were designed to help with tasks such as communication, scheduling, and learning visual-differential skills.

There is increasing interest in the use of popular, commercial, off-the-shelf video games for the treatment of autism, as well. Many schools have begun using the Microsoft Xbox Kinect for improving social and gross-motor skills. Because many video games require the use of and practice skills such as flexibility, self-awareness, and self-control, they may also be very powerful teaching tools for the development of these skills in children affected by ASD. Specific classroom strategies for using popular games to improve these skills can be found at websites such as www.learningworksforkids.com. Children's motivation, level of sustained interest, and willingness to overcome frustration to beat the games may make these powerful tools to improve the lives of children affected by autism.

Only a limited number of games have been developed that directly treat children with ADHD. Most of these specialized games and tools, such as *Cogmed Working Memory Training, Play Attention,* and *ADHD Therapy 360*, are available online. With the exception of *Cogmed Working Memory Training*, which is now being offered in dozens of schools across the country, there is very limited research that supports the use of these games for the treatment of ADHD.

An alternative approach that can be readily applied in the classroom is the use of popular video games (commercial, off-the-shelf games) for direct practice of the skills that are frequently core deficits in children with ADHD. Games that address skills such as working memory, planning, organization, time management, and focus have the potential to improve these abilities in children with ADHD, particularly if the skills can be generalized to transfer to real-world activities.

It is also important to consider the broader issue of the academic demands of today's schools in any discussion of the use of games in the classroom. Common core standards, availability of time to teach skills rather than content, and the degree of teacher knowledge and technology to use games in the classroom are vital considerations in this matter. Games and technology can offer opportunities for differentiated instructional approaches and novel teaching strategies in the classroom.

This chapter examines two strategies that can be employed to use different types of games in the development of these skills. Long-form games are more open-ended and may take place over many hours. The game *TeachTown* is explored as a long-form game designed specifically for the special needs population to teach social and communication skills to children affected by autism and other developmental disorders. Short-form games, which are often available online or on mobile devices

and can be played within a single class period, are also evaluated as a tool for teaching 21st century, executive- functioning, and creativity skills in the classroom. Short-form games are described by the Cooney Foundation report "Games for a Digital Age" (2012) as a potentially powerful tool for classroom teaching. The short-form program "Playing Smarter," which uses a variety of popular, casual games as teaching tools to develop executive-functioning skills, is appraised in its use in a classroom setting.

Case Study Two: *TeachTown* Basics

TeachTown is a computer-assisted instructional intervention that utilizes applied behavioral analysis to improve social/emotional, academic, and adaptive skills in children with ASD. The program is designed for students with ASD who are between the ages of two to seven years developmentally. *TeachTown* helps develop adaptive skills such as understanding household vocabulary and money identification, along with social and emotional skills such as understanding emotion synonyms, gesturing, and emotion causes.

TeachTown uses applied behavioral analysis techniques (ABA) for the development of social and language skills. The program employs computer-assisted instruction with computer-based rewards of playing with animated pictures in between trials. It uses a discrete trial model where students respond by selecting an image in response to an instructional cue. The correct response elicits a positive statement such as, "You did it!" An incorrect response is followed by a presentation of the correct response.

Some of the more powerful features of *TeachTown* are strategies for generalization of skills. Within the program is the use of multiple exemplars, with each skill or specific piece of content-based knowledge that is presented replicated with an array of images and words to describe it. For example, if children are learning to recognize an airplane they see a variety of images portraying pictures of airplanes to help them generalize the content or feeling. Perhaps even more important are the non-technology based activities to improve generalization of skills. *TeachTown* provides teachers with motivating activities that practice the skills being taught in the computer-assisted instruction with classroom or home-based activities.

Research conducted with *TeachTown* (Whalen et al., 2006) suggested that *TeachTown* enhanced social-communication skills and decreased inappropriate behavior. A later study (Whalen et al., 2012) that included 90 students in a special education classroom found that children who averaged 23 hours using the *TeachTown* software made a variety of social and emotional gains. The results suggested that students in the treatment condition made significantly greater gains than the control group on seven out of ten learning domains on the Brigance Inventory of Early Development II. Furthermore, the more time they spent on *TeachTown* basics, the higher the score was on this measure.

Overall, the *TeachTown* research describes the promise of using computer-assisted instruction for the improvement of social/emotional and learning skills in children with ASD. The data suggest that this type of program can reduce the need for one-on-one teaching with these children and be suitable to a variety of special needs students rather than just those with ASD.

Assessment Considerations

Assessment of ADHD is generally conducted through an extensive clinical psychological interview, the collection of parent and teacher rating forms, and a comprehensive neuropsychological evaluation. Using a limited selection of these tools in a pre/post fashion is helpful to assess the impact of game and app interventions.

Pre and post measures such as the Conners' Continuous Performance Test III (CPT III) are often used to determine the effectiveness of the treatment of ADHD, whether through the use of video games in the classroom or a behavior management strategy in the home. Given that interventions using technology to improve the symptoms of ADHD are often targeted at specific skills or subcomponents of ADHD, it can be more important to measure improvement in these selected skills, requiring assessment of executive functions such as working memory, sustained focus, organization, task initiation, and time management. The skills are defined in scales of executive functions such as the Behavior Rating Inventory of Executive Functions (BRIEF), which are currently the best methods to assess the impact of video games and apps to improve the symptoms of children with ADHD.

Similarly, assessment of children with ASD requires historical data, observations, parent-teacher reports, and neuropsychological testing. In this case, pre/post assessment necessitates a focus on very specific skills due to the variability of diagnostic criteria.

As in the case of ADHD, it is appropriate to assess specific skills that video games and apps might improve in children affected by autism. For example, social-awareness skills, communication, metacognition, and cognitive-flexibility skills are targeted by many of the apps and technologies that have been developed for children with ASD. Assessing improvement in these areas is best done through collection of pre and post test data. Tests that measure speech, language, and communication skills may be helpful as broad-based measures. Rating scales completed by parents and teachers such as the BRIEF, which looks at executive-functioning skills, or the Autism Spectrum Rating Scales (ASRS), which evaluates very specific symptoms of ASD, are currently the best tools to assess real change. Most neuropsychological test measures that assess similar concerns are generally less sensitive to short-term change, so instruments such as the Wisconsin Card Sorting Test, a measure of cognitive flexibility, may show very little change even though the child has developed a variety of new skills through his game and app use. No assessment tools have been developed to look specifically at the impact of video games and apps on the performance of children with ADHD and ASD. However, applying the available rating scales and targeted neuropsychological test measures can help in determining the impact of classroom-based use of games and apps for children with ADHD and ASD.

Future Needs

Cautions and Concerns

There are legitimate reasons to be concerned about the use of video games among children with developmental disabilities. While the evidence is overwhelming that many popular games and apps can be helpful in developing skills in children with ADHD and ASD, there are also data that higher rates of video game addiction, conflicts around transitions and stopping video game play, and high levels of frustration can be observed.

The perils and potential of video games for children with ADHD are evident in the current research in this area. The prominence of digital media in the lives of young people with ADHD is only likely to increase in the future, so further understanding of how to use technologies such as video games productively becomes even more important.

Children with ADHD often become hyper-focused on areas of interest, and this frequently happens with video games and other digital media. This may cause them to neglect other important responsibilities such as school and chores. Children with ADHD or other attention problems can become so absorbed in activities that they lose track of how much time they spend on digital play and display poor time-management skills. These youngsters may also choose to engage in digital play instead of the physical activities that are particularly important for them, as exercise leads to improved focus and concentration.

Because children with autism often struggle in social relationships they can be overly drawn to single-player games and immerse themselves on the Internet. They may also become so comfortable in online social settings that they lose sight of the importance of face-to-face communication and withdraw even further from their peers. Children with ASD are easily obsessed and may perseverate in many aspects of their lives, becoming overly engaged in playing a particular game beyond the point where they gain any benefit from it.

Video games for children with autism can present a host of dangers and the potential for problematic use. Mazurek & Engelhardt (2013) found that children with autism tend to have particular difficulty when they use role-playing games such as *Pokemon*. Role-playing games have particular game features such as high reward schedules (including virtual rewards such as scores, achievements, and game items) and social rewards such as peer attention that may foster a preoccupation or an intense interest in the game. In addition, role-playing games have the potential to be more time consuming than other games because players must create and maintain characters over time and have the option to explore open-ended virtual worlds, possibly increasing the likelihood of problematic use patterns. These role-playing games appear to be more closely associated with addiction.

Mazurek & Engelhardt (2013) also found a relationship between the amount of video game play for children with ASD or ADHD and inattention. This correlation does not indicate that video game play for children with ASD or ADHD causes inattention but that the more inattention a child displays the more likely he is to play video games for extended periods of time. They also found that boys with ASD or ADHD may have greater in-bedroom access to video games than typically-developing children. The authors hypothesized that children with ASD or ADHD are more preoccupied with games, resulting in their asking for more access to video game consoles or computers in their rooms, possibly leading to more problematic use. They also suggest the possibility that the parents of children with ASD or ADHD may offer increased access to these media "as a means for managing difficult behavior."

Best Practices

The potential for using video games and other digital media to improve social, problem-solving, and executive-functioning skills in children with ADHD and ASD is just being explored. The use of apps and games to help develop these skills in the classroom offers teachers an opportunity to engage these children in a way that traditional education cannot readily accomplish. These technologies improve the level of attention, effort, and motivation to learn. They also enhance communication among students, provide opportunities for differentiated instructional models, and may lead to practice and mastery of these behaviors outside of the classroom.

Games designed specifically to teach a population of children affected by ADHD or ASD can be very powerful. Alternatively, using popular games that children already enjoy and play can practice many of the problem-solving and executive-functioning skills that are areas of weakness in children with ADHD and ASD.

Ensuring generalization of skills from games to the real world remains the key for successful use of these technologies with children with ADHD and ASD. The current chapter explored two different methods that include generalization strategies on the part of classroom teachers to take the skills that children practice in games and use them more effectively in real-world settings. This type of instructional program will remain the best model until these types of generalization strategies are embedded directly into games and apps. By incorporating generalization tools into popular games, publishers can make many fun, engaging games into teaching tools for children with ADHD and ASD.

Resources

Books

Davidson, Cathy. *Now You See It*

Kulman, Randy. *Playing Smarter in a Digital World. A Guide to Choosing and Using Popular Video Games and Apps to Improve Executive Functioning in Children and Teens.*

Kulman, Randy. *Train your Brain for Success. A Teenagers Guide to Executive Functions*

Barkley, Russell. *Executive Functions: What They Are, How They Work, and Why They Evolved*

Goldstein, Sam., *Naglieri, Jack. & Ozonoff, Sally. Assessment of Autism Spectrum Disorders*

Websites

LearningWorks for Kids (learningworksforkids.com)
Edutopia (http://www.edutopia.org/)
Children and Adults with Attention-Deficit/Hyperactivity disorder (http://www.chadd.org/
Autism speaks: (https://www.autismspeaks.org/)
South County Child and Family Consultants (southcountychildandfamily.com)
Understood for Learning and Attention Issues (understood.org)
TeachTown. Educational Products for Children with Autism (teachtown.com)
Bridging the gap between technology and people with disabilities (http://bridgingapps.org/)

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SECTION TWO

Community Considerations

CHAPTER 6

Gaming in Libraries

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Key Summary Points

1. There are about 120,000 libraries in North America with representation in almost every community. Libraries reach a wide variety of different demographic groups, so a gaming program in a library can reach audiences not easily accessible to game designers.

2. Libraries have supported games since the 1850s in a variety of forms as a resource relevant to their communities. The concept of playing in libraries is not new, and most libraries are open to games that make sense for the communities of patrons they are funded to serve.

3. There are opportunities for game developers to partner with libraries to create games to help patrons learn how to use library resources. In addition, many libraries are adding services such as makerspaces that focus on the creation of resources instead of just the consumption of resources, which opens the door for partnerships to build a local community of those interested in game design.

Key Terms

Libraries
Communities
Gaming in public spaces
Informal education
Game facilitation
Game design
Makerspaces

Introduction

Libraries have served as one of the few free physical locations for informal learning in United States communities since the late 1700s. Libraries serve the information needs of a specific community and may be public or private, may be attached to a school or college, or may be affiliated with another institution such as a company, a museum, or a foundation. Because of their widespread popularity, there are about 120,000 libraries in the United States (American Library Association, 2013). As a point of reference, this is larger than the number of outlets of the ten largest fast food franchises combined (Oches, 2012). Since there are so many libraries servicing different aspects of society, libraries represent an excellent partnership opportunity for those who create games. This chapter describes some of the history of gaming programs in libraries, presents some results from studies about gaming in libraries, discusses the current state of educational games in libraries, and explores opportunities for those in game studies to partner with libraries.

To set the stage, it is important to distinguish between game collections in libraries and gaming programs in libraries. Just as they do with books, videos, and other forms of information, many libraries have built up collections of digital or analog games. These collections may be developed alongside toy libraries, where parents can check out games for their children, or may be developed with collections of other forms of media, such as DVDs and computer programs (Library Success, 2011). There are services such as Overdrive that allow libraries to circulate digital games using the same platform used for electronic books. Some academic libraries have collections of games to support a degree program in game studies, education, media, or art, and other libraries have collected a subset of games to preserve them in a special collection. This activity of building a collection of games is a natural extension of the activities associated with accumulating a shared collection of resources.

There is another way that games have entered libraries, and that is as an activity. Some library services and programs are designed to allow patrons to play games in the library. For example some libraries run tournaments where players come together to play board games, such as *Scrabble* or chess, or video games against each other (Neiburger, 2009). Other libraries run open gaming events, where participants come together to play both digital and analog games in an open and friendly environment without the tournament structure (Czarnecki, 2011). This concept of recreational gaming programs in libraries is the primary focus of this chapter. These programs represent an opportunity for partnership, as many of them thrive off of volunteers passionate about games assisting librarians with the facilitation of games.

This concept of gaming programs in libraries is not new; in fact, it has existed in the United States for at least 150 years. The oldest chess club that is still in existence in the United States continues to meet in the Mechanics' Institute library in San Francisco. This chess club was started during the gold rush in 1854 (Donaldson, 2011) and is representative of thousands of chess clubs that meet regularly in libraries all over the country. Along with chess clubs, many libraries host other gaming clubs that support traditional and modern board and card games, roleplaying games, or trading card games (Library Success, 2012). Tabletop gaming groups fit well as a library activity as they bring together different people from a community using a resource most libraries have—an activity room with tables and chairs.

Libraries also have a history with digital games. When the New York Public Library first got computers in 1983, they installed games to make it easier for people new to computers to learn to use them ("New York Library System Offers Computer Time", 1986). As CD-ROM-based educational software became popular, many public libraries made it possible for users to put on headphones and experience these multimedia adventures in the library. Some school libraries have computer centers that serve double duty as recreational areas during breaks and lunch (Gibbons, 2013). For example, I have fond memories of winning a *King's Quest* contest that was hosted at my high school library in rural Oklahoma.

Both tabletop and digital gaming programs continue today in libraries. In 2007, I did a survey of 400 randomly selected public libraries and learned that over 70% of public libraries support gaming in some way. Most commonly, this is through allowing patrons to play games on public computers, but about 40% of public libraries also put on some type of structured gaming program. The primary reasons for these programs, as reported by libraries in a follow-up study, were to provide a service for those not currently using library services (most commonly teenagers), to provide an activity for members of the community to engage with each other, and to provide a service alongside other library services for current library users (Nicholson, 2009).

Key Frameworks

One of the questions that is commonly posed about gaming programs in libraries is "What do games have to do with books?" Many people are surprised to learn that libraries are supportive of gaming and host gaming activities. Each library supports a specific user community that funds the library; therefore, each library has different goals and outcomes that can be supported by gaming activities. Here are a few different reasons why libraries support gaming programs:

1. Gaming is a form of recreational media that is culturally significant.
2. Gaming is a method of supporting the role of the library as a community hub.
3. Gaming programs can support other existing library programs.
4. Game creation programs fit well with the changing face of libraries as places of creation.
5. Games can be used to teach information literacy.

Gaming is a Form of Recreational Media that is Culturally Significant

Over the decades, libraries have added on to their offerings to support the desires of the communities that fund them. Originally, libraries did not support fiction, but as the interest in recreational reading grew, libraries added fiction to their non-fiction collections (Harvey, 2013). Music on albums, cassettes, CDs, and now in downloadable form can be found in most public and many academic libraries. Movies on laserdisc, videocassette, and now on DVDs are very common circulated items in libraries. For all of these forms of media, libraries offer ways for patrons to engage with the content within the library. As consumers are now spending more on game-based content than on any other single form of entertainment content (NPD Group, 2013), libraries strive to adjust their collections to reflect the changing content desires in their communities. Gaming in libraries has gone from something that raises eyebrows to just another library service.

Gaming is a Method of Supporting the Role of the Library as a Community Hub

Many libraries are striving to be a non-commercial community hub. In many rural communities, there is a need for a place that is not home and not work, known as a third place, for individuals to gather (Saltwater Connections, 2011). Gaming is an activity that allows members of the community from different demographic and cultural backgrounds to come together and engage with each other. An anecdote supporting this comes through a gaming program that ran over a summer at a public library in Fayetteville, NY. The gaming program ran right after the seniors' computer program, so the seniors were invited to try out the games. As the summer progressed, the teens and the seniors in the community engaged with each other and got to know each other by name over the game tables.

This role of libraries as a community hub is not new. In the 1850s, libraries in the United Kingdom added gaming rooms and billiard parlors to bring people out of the taverns and into the libraries instead (Snape, 1992). For libraries looking to serve their community by providing a social hub, gaming activities in the library are a perfect match.

Gaming Programs Can Support Other Existing Library Programs

Many libraries have discovered that gaming can provide a way of engaging patrons more deeply with existing library programs. The most popular program in public libraries is the summer reading program, which targets children out of school to encourage them to explore reading. Many libraries have found that games work well to generate interest in books; interestingly, the opposite also occurs, where books generate interest in games (Neiburger, 2009). For example, the Pima County Public Libraries has started a role-playing game club based on *Lord of the Rings* (The Escapist, n.d.), 20).

Game Creation Programs Fit Well with the Changing Face of Libraries as Places of Creation

As libraries change along with shifts in society, many libraries are developing makerspaces, which are places with shared resources such as 3D printers, green screens, video equipment, audio recording and podcasting tools, or even wood and metal shops, to encourage members of their communities to come together and create instead of consume. In communities where living space is a premium, the library can provide a valuable service for those wanting to create (Kenney, 2013). Game creation programs fit well within this makerspace movement in libraries (Nicholson, 2013). To create a game, a designer needs to bring together different forms of information and create an engaging experience through a combination of game mechanisms and interface design. Game creation workshops for teens struggling to find potential career paths can help them get interested in careers such as programming, art, and writing (Donald Dennis, Personal Communication, Dec. 12, 2012).

In sum, libraries are about more than books; rather, they offer services that their local community needs. Some libraries become points of access to the Internet for the many people in this country without regular Internet access at home. Other libraries, especially those in urban areas, have developed special

services that support small businesses and entrepreneurship. Some libraries seek to support those doing home schooling, while others focus on strengthening their role as one of the few points of free education after high school. There is no generic template of what a library looks like, as it is dependent upon the needs of the local community. Therefore, while gaming is an excellent fit for some libraries, it is not appropriate for others. Those wishing to partner with libraries on a gaming program need to first understand the goals of the library in relation to the community it supports.

Games Can Be Used to Teach Information Literacy

One of the concepts that libraries of all types teach is information literacy, which is the ability to search for information sources, select relevant resources from search results, and evaluate the trustworthiness of the resources. While attempts have been made to teach information literacy skills through games, most of these educational games have fallen short. The default form of library game is a scavenger hunt, where players travel around the library using clues to find library resources. Many libraries have used the scavenger hunt model in either print or online form to attempt to add fun to a library instruction class, but many of these hunts lack the depth to make them engaging. One reason for this failure is that these games typically manufacture a superficial reason for the players to perform a quick search. Without having any knowledge about a topic area, it is difficult for a player to find relevant resources in the short timeframe that most games allow. Markey (2014) has found that for a library game to be successful, it needs to be based on authentic information needs of patrons.

In addition, there are a variety of online games that have players organize books onto shelves and meet the needs of library patrons, but these games are more arcade-like in nature. The claims of *I'll Get It* and *Within Range*, both on the Carnegie Mellon Libraries website, are that they "develop research skills through entertaining and easy-to-repeat activities" (Carnegie Mellon Libraries Games, n.d., para. 1). *Within Range* involves a shelving activity where players have to find the correct place to put books in a Library of Congress-based shelving system (Carnegie Mellon Libraries Games, n.d.). *I'll Get I*t is a *Diner Dash* clone where the player searches the library catalog by clicking on the Library Catalog computer to meet the needs of patrons. The player does have to choose one of several possible resources, so it is the better of the two games for teaching something about matching sources to needs.

Markey, Leeder, & Rieh (2014) created a game called *Bibliobouts* that encourages players to analyze the quality of information resources. To play the game, which lasts over several weeks, students are assigned a broad topic and are tasked with finding high-quality information resources, such as peer-reviewed articles and books. Each student selects five resources to serve as the members of his or her team. Resources from different teams are picked to battle each other, and other students in the class analyze and compare the two resources to decide which is better for the topic. Throughout this process, students become more critical in analyzing information resources, and multiple tests demonstrate that students who play the game end up using more high quality resources when writing papers after playing *Bibliobouts* (2014).

Figure 1: *I'll Get It* from Carnegie Mellon Libraries (used with permission)

Frameworks for the Library Gaming Experience

To explore gaming in libraries, I have developed several frameworks that guided the writing of my book on the topic: *Everyone Plays at the Library: Creating Great Gaming Experiences for All Ages* (Nicholson, 2010). The first framework, shown in Figure 2, is of the elements in a facilitated gaming experience in libraries, focusing on points of engagement. It is important to consider more than the game; library staff must consider the entire gaming experience, which consists of the players, the game, and the context in which the game is played.

Each player joins a game with a different external knowledge base. Players interact through the game world by manipulating the game state, they verbally interact with each other to carry out in-game activities like trading and negotiating, and they interact socially about non-game topics. In addition, gaming in a library usually takes place in a public space, where spectators can interact with the players, library staff, and library resources. A librarian setting up a gaming program needs to take all of these aspects into account (Neiburger, 2009).

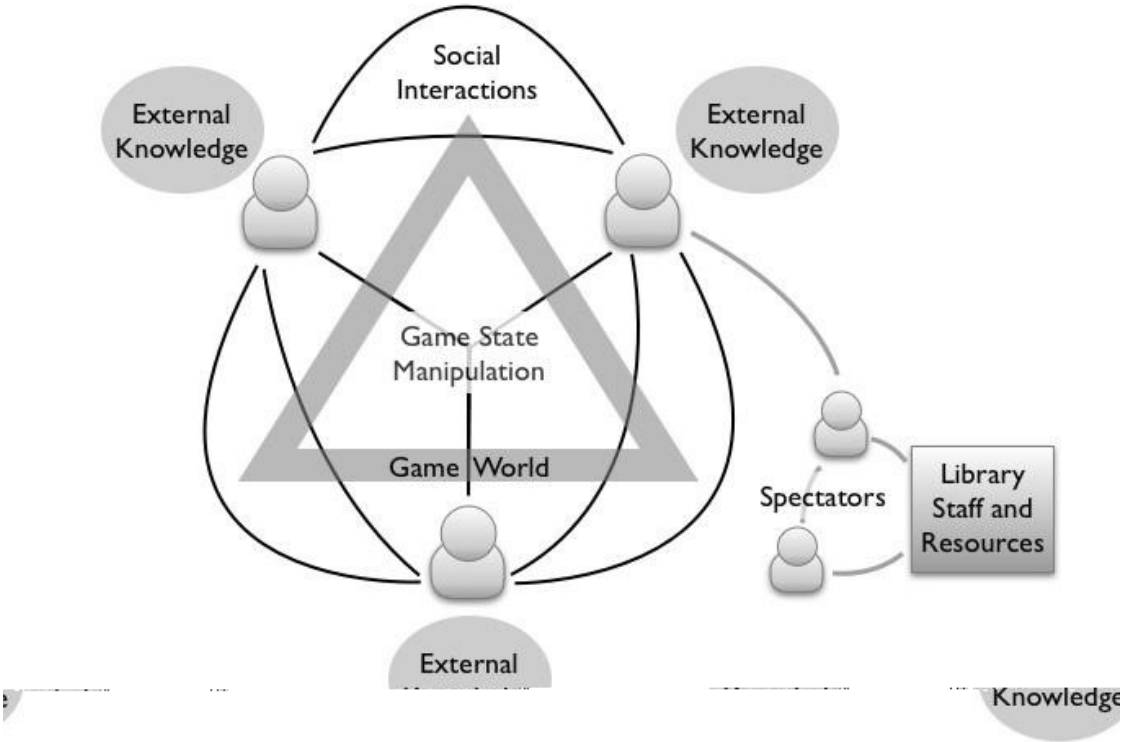

Figure 2: Framework for the library gaming experience (Nicholson, 2010)

This framework can be used in any gaming setting that is facilitated. In the classroom, the teacher may have some students playing a game while other students observe, reflect, and engage with other resources (including the teacher). This happens in chess tournaments, where a chess game in one room is broadcast to another room where attendees can discuss what is going on. In a sporting arena or a video game competition, the spectators are part of the event, as they cheer, boo, and yell advice from the stands. This fishbowl approach can be valuable when resources prevent an instructor from having enough copies of a game for everyone in the class to play.

Framework of Game Experiences

To help library staff with the process of choosing the correct game, I developed a model of game experiences known as SNAKS, which is an acronym for:

1. Strategy: Games that emphasize the decisions players make
2. Narrative: Games that focus on storytelling and roleplaying
3. Action: Games that require dexterity, hand-eye coordination and quick reactions
4. Knowledge: Games that explore outside information a player posseses
5. Social: Games that create moments of social engagement between people

This framework is developed from several common points of engagement that are important to libraries, and can help library staff make the transition from library goals to the selection of games (Nicholson, 2010).

Here is the SNAKS framework, consisting of five major types of gaming experiences:

1. **Strategy:** Strategy game experiences predominantly depend on the decisions that the player makes in changing the game state. *Chess* or the *Civilization* series fit here. Strategy games are good if the goal is to develop decision-making or analytical skills, and can serve to deepen relationships between players who come for a strategy game program on a regular basis.
2. **Narrative:** Narrative game experiences emphasize the story of the game, and allow players to deeply engage in a shared narrative. Tabletop roleplaying games like *Dungeons and Dragons* or *Mouse Guard* fulfill a narrative goal much better than most digital role-playing games. If the goal of the program is to improve literacy, then games that have a strong narrative component are a good choice. These games do not scale as well for many players and usually require more time to prepare than other choices.
3. **Action:** Action game experiences mainly rely on the ability of the player to change the game state quickly. Many digital games, such as *Mario Kart* or the *Halo* series emphasize this aspect of the game experience model. Action games tend to attract a younger and more competitive audience, so if the goal is simply to bring players into the library, action games work well for this. Many of these games can be set into a mode where multiple players compete over a few minutes, so this type of game can work well with a second social environment where players can engage with each other and library staff when they aren't playing.
4. **Knowledge:** Knowledge game experiences mainly take advantage of the external knowledge that the player brings to the table. Recreational games like *Scrabble* and *Trivial Pursuit* and many educational games fit in this category. These games can work well as family or classroom activities. If the librarian customizes the questions, then a trivia game can meet an educational goal as well. These games fit well in school libraries as they can easily support the activities of the classroom.
5. **Social:** Social game experiences emphasize the direct engagement between players. Most party games, such as Dixit, bring about this goal, as do team-based games such as Werewolf (Nicholson, 2010). Social games can serve to break down barriers between different patron groups, especially if teams are created with the goal of representation of different groups on each team. They also can handle large groups, and adapt well to situations where players come in and out of the gaming sessions.

It is important to note that games can fulfill multiple categories. Wits and Wagers, for example, is a trivia game where players bet on which player gave the best answer to a question. This game facilitates both a Knowledge and a Social game experience. Many fighting game and real-time strategy games combine both Strategy and Action. The framework is designed to help librarians select the type of gaming experiences they want to provide (based upon the intended audience and goals of the event), and then use that choice to select appropriate games. This flexibility is useful for a librarian looking to build up a collection of games that can be used in multiple types of gaming programs. My aforementioned 2010 book is organized using these five categories and helps the librarian make the connection between library goals and specific game titles.

Case Study One: Game Design Workshop

In rural South Carolina, Donald Dennis, a librarian who also has experience working in the game industry, created a series of game design workshops for young adults as part of the BYTES (Bunnelle Youth Technology Experience Series) program. This program targeted middle and high school students through four different public libraries in Georgetown Country and drew many disadvantaged students from the area.

Some of the goals of the project were to increase literacy, to develop new skills, to encourage creativity and innovation, and to help participants see some potential future career paths. Many of the participants had little ambition or vision for their future. A goal of this program was to help these students find their passion and learn how to use that passion to build an educational and career path.

The students engaged with many forms of media creation, one of which was game design. Participants started by playing a variety of tabletop and digital games to increase their awareness and knowledge of different game mechanisms. Students then worked with basic game creation toolkits such as MIT's *Scratch* and Microsoft's *Kodu*, which provide the basic components needed to create a game. Students can select different components, add their own graphics, sound, and logic, and create games. As they do this, they learn programming concepts, logical thinking, testing and revising, and the overall process that goes into creating a game. Over the course of the program, the library worked with 560 participants and 75% of these participants completed the program. This program was so successful that it has since been opened up to adults as well.

Throughout the course, Dennis worked with the students to help them not only create games, but also to understand where their skills might be useful in the gaming industry. Dennis shares an anecdote that many of these participants did not have college plans, but by the end of the workshop, they had discovered areas of interest and were starting the process of applying to the local community college. By tapping something that these students were passionate about—gaming—the library helped them take a step toward a career, even when they previously saw no future for themselves (Donald Dennis, Personal Communication, Dec. 12, 2012).

Key Findings

It is easy for a library to have a gaming program that is fun. It is more difficult for a library to have a gaming program that is justifiable to skeptics and funders. To have a program that is resilient to critics, the library needs to make sure that their program meets the goals of the library. One of the challenges for a librarian setting up a gaming program is deciding which games to use. A temptation is for a library staff member or volunteer to choose a game that he or she is enthusiastic about and build a program around that game. The problem with this method is that the game may not be the best match for the players and the context of the gaming program. For example, some libraries have run programs around *World of Warcraft*. While this is a popular game, it requires considerable effort to install, patch, create accounts, and get participants involved. Those who are experienced with the game can get frustrated using a computer without their favorite game modifications. Because of everything involved, *World of Warcraft* is not usually the best choice for a library, regardless of goals, patrons, or playing context.

Instead of starting with the game, libraries should start with their mission statement, goals, and target communities. By designing a gaming program to meet the reasons why the library is funded, it is easier for a librarian to justify its existence to skeptics in the community. Once the library has determined which of its goals a gaming program addresses, the library can look at the framework above to decide which interactions of the facilitated gaming event model are the most important. They can then choose games that emphasize those types of interactions. For example, if the library wants to use the gaming program to break down barriers between patrons of different age groups, then the game should emphasize social interaction instead of strategic brilliance. One way of creating opportunities around quiet strategic games is by providing other spaces that facilitate the desired outcomes. For example, creating a chess club where players are not allowed to speak loudly while games are going on will hamper players in developing new connections, but creating a second space where discussions are encouraged and even facilitated can make up for the lack of social engagement in gameplay.

In review, the process of creating a gaming experience for the library starts with library staff determining which aspects of the library mission and goals and which community groups will be served by the gaming program. The staff then considers the model of library gaming experiences and selects the type of engagement that they want to emphasize. They also determine other aspects of the program, such as if it is a tournament or for open play, if they want a cooperative or competitive environment, if they want to focus on analog or digital games (or both), and what age groups are going to be involved with the games. With all of these decisions made, the library staff is then ready to select the games for the program.

Some of the common outcomes that libraries doing gaming programs have reported can be found in Table 1. This list of outcomes can help a library designing an assessment for a gaming program as to what types of changes other libraries have found in patrons. This is not a complete list, and each library should create outcomes based upon their larger-scale mission and goals.

Table 1. Outcomes of gaming programs commonly reported by libraries (Nicholson, 2009).

Outcome	Percentage Reporting
The reputation of the library improved with participants.	77.97%
Users attended the gaming program and returned to the library another time for non-gaming services.	76.27%
Users attended the event with friends and improved their social connections with those friends.	73.45%
Users attended the gaming program and also used other library services while there.	68.36%
Users improved their social connections with other previously unknown members of the community.	65.54%
Users improved their skills/knowledge.	38.98%
Users requested new and changed services.	38.98%
Users attended the gaming program, but did not return to the library.	14.69%
Users not involved in the gaming program indicated annoyance regarding the activity.	9.60%

After spending years refining the information literacy game *Bibliobouts*, the authors wrote a book on how to make successful information literacy games. Some of their best practices include:

1. Integrating the game into the Learning Management System for a course.
2. Providing players with information literacy instruction before putting them into a game space.
3. Integrating the game into the course assignments and grading systems.
4. Creating opportunities in the game for students to reflect upon their learning.
5. Ensuring the new players to the game have a forum to get assistance (Markey, Leeder, & Rieh, 2014).

These findings enforce a key lesson for librarians looking to use games for information literacy—the games need to matter. Most information literacy games present the player with an information need instead of creating a game experience around an information need that the player already has. They are designed as "just-in-case" information literacy training. When players believe they already know how to search, presenting a training activity for an information need that they don't care about leads to unmotivated players. Taking the lesson from *Bibliobouts* suggests that library games for information literacy need to be thought of as "just-in-time" training. When users are seeking something and are frustrated, a game that builds its learning objectives dynamically around the topic area of interest to a user is more likely to succeed.

Case Study Two: Gaming in an Academic Library

Academic libraries are also interested in using games to engage patrons. Elzen & Roush (2013) report on a gaming program they created for outreach and information literacy instruction at Lawrence University in Appleton, Wisconsin. To avoid upsetting students who wanted to use the library during the semester, they created programs that ran during the weekend before finals as a study break activity. Students would take a break from studying, play a few recreational board or video games, and then go back to work. The librarians also put out carts with games, puzzles, and other game-related items from the library collection and found that this increased awareness and circulation of these types of items.

Marketing gaming programs at an academic library proved to be a challenge. The library's marketing channels, typically used to convey information about academic resources, were not very useful in conveying information about gaming events. They started with Facebook, but realized that most of the likes to their event pages were coming from library staff and colleagues. They found that more traditional word-of-mouth marketing and flyers in the residence halls proved to be the most effective of the different marketing channels explored (Elzen & Roush, 2013).

The authors also reported the usefulness of partnering with student organizations on campus. They worked with the *Magic: The Gathering* club on campus to host an event for students to come and play out of a shared pool of cards. They also worked with the Lawrence University Gaming Club to plan a large-scale *Super Smash Bros. Brawl* tournament during National Library Week. In both of these events, partnering with student groups allowed the library to reach new groups of attendees and gave the library the opportunity to raise awareness of other library services in a playful environment (Elzen & Roush, 2013).

The authors noted that students who attended these events developed new social connections with others, so they decided to do a survey to collect some data about the impact of the gaming programs. They learned that about 77% of the students who attended the gaming program reported that they came away from the gaming event with a stronger sense of being part of the University community. About 46% learned more about library staff members, and about 30% reported feeling more comfortable in the library. Only about 23% reported that the gaming program did not affect their previously-held views about the library (Elzen & Roush, 2013).

As students use more online resources, they are less likely to physically visit the academic library on campus. Gaming programs can serve as a bridge to bring students into an academic library, help them get to know other students and library staff, raise awareness about collections and services that the library offers, and can make students feel more comfortable in the library.

Assessment Considerations

Given that in some communities, gaming in libraries can be controversial, assessment is an important part of the planning process. If the library staff has followed the process presented here, then they can create assessment tools that measure if the original library mission and goals have been met. One challenge that library staff are always faced with is what assessment questions to ask that might provide meaningful information, so many turn to basic statistics, such as how many people showed up for the program. This data is not as valuable as understanding the difference the program made in the lives of attendees along the lines of the library's goals.

This is the point where programs that come out of the passion of a library staff member or volunteer are problematic. Since these programs were not developed out of the mission or goals of the library, it is difficult to assess them in a way that produces ample justification for skeptics. If a program is challenged by funders and there is no data or anecdotes demonstrating how the program meets library goals, the resulting negative publicity can make it difficult to receive future funding.

Given the importance of assessment, planning for an assessable library gaming program needs to be part of the overall planning process. This may change the games that are selected, what kind of marketing is used, how the games are presented to players, and how the games are facilitated. It can also change how the library staff engages with players and spectators and if other library resources are brought into the gaming program. By planning out how the gaming program will be assessed at the start, choices can be made to increase the likelihood of useful and meaningful assessments.

A typical library program assessment is to count the number of people who attend a program. This does not say anything about the difference the program made. While having many people show up for a program is a good start, it does not tell the whole story. To start with developing an assessment, the library needs to list out the desired outcomes for the program. These outcomes should be written from the viewpoint of the participant, and how the program will change the participant. Statements like "The library will attract 100 people to the gaming program" or "The library will put out 20 board games" are not outcomes based upon how the program changes the participant.

If the library staff cannot think of an adequate assessment, then perhaps that particular gaming program is not an appropriate match for the library. Gaming is not always appropriate for libraries, and following this assessment procedure will help library staff members decide if the program proposed by an eager volunteer is a good match for the library.

Future Needs

Those who are creating games for learning wanting to partner with libraries can use the information presented here to develop a program that can meet the needs of libraries. These models are appropriate in any type of library—public, academic, school, or special (such as hospital libraries, corporate libraries, or museum libraries). By learning more about the mission and goals of the library and the audiences that

the library serves, people seeking to partner with a library can pitch their ideas in line with library needs, rather than personal preference. Library staff members have limited space and resources, and have to decide what programs to promote and what programs to turn away. By making the connection between gaming and a specific library in the proposal, it is easier for a library staff member to understand how a gaming program aligns with library goals.

Case Study Three: Live Action Roleplaying in the Public Library

The community-based outreach program of the Because Play Matters game lab at the Syracuse University School of Information Studies that I run is called the Game Designers' Guild. This group is open to the public, and members create games for community organizations. The Liverpool Public Library in Liverpool, New York, was planning to create a life-size version of *Candy Land* to celebrate the donation of three dinosaur statues outside the library. When I learned about these plans to create a life-size board game where players would draw cards and move to spaces, I volunteered to lead the Game Designers' Guild to design something more engaging.

The target audience was children from kindergarten and up, so we wanted to come up with something that would have different types of activities for different age groups of kids. We also wanted to incorporate information literacy aspects, along with teamwork and narrative, so we used the model of a live-action role-playing (LARP) game. One model for a LARP is based upon a series of stations, where a team of players need to work together to explore the narrative. The initial brainstorming took place at the Game Designers' Guild, and then I wrote up the ideas and fleshed out the game.

The narrative was that a momma dinosaur had lost her eggs, and we needed to go back in time and help her out. The time tunnel that we had was weak, however, and could only send little people through. The plan was to transform the participants into dinosaurs and send them back in teams so they could work together to reunite the mother and her eggs.

Participants would first learn the need from a scientist in the library. They would then do research to figure out what kind of dinosaur they wanted to be. After this, they would be transformed with face painting, creating a tail, and choosing a special ability that fit their dinosaur such as Flying or Roar. They would then be put into groups, and head outside through the time tunnel. Outside, they would face a series of challenges, such as finding food for the weak (vegetarian) momma, crossing a sticky swamp, and scaring away predators. As they finished, they would end up in the common grounds to roleplay with other "dinosaurs" and enjoy refreshments. This game, Be the Dinosaur, is available online at http://scottnicholson.com/pubs/bethedinosaur.pdf.

This game script was handed over to the library, who began planning the event. As the day approached, I reached out to the library to determine what our Game Designers' Guild volunteers should plan on doing, and learned that the library had changed the event somewhat. They were afraid that the

narrative and game elements would be too complex for the participants, so they replaced most of the challenges with crafting activities. The event shifted from a game-based event to a play-based event, where children could play with dinosaur-themed activities, but the live-action game elements were lost. On the day of the event, the participants still had a good time, got to explore dinosaur books and activities, and the goal of celebrating the dinosaur statue was met.

The moral of this story is that game designers looking to partner with libraries need to realize that the goals and outcomes of the library are more important than the creation of a good game. Libraries have traditionally been more about play, in that they are spaces for a user to explore, instead of games with a specific goal. Recognizing how the play aspects of games can merge with library services can help for a smoother partnership that leads to a program that library staff will be comfortable facilitating.

Best Practices

What follows are some ideas for library gaming events or programs that those who make games for learning could partner with the library to run. As mentioned before, not all of these programs will be an appropriate match for all libraries, but these are examples of ways partnerships between those who make games and libraries have been explored.

1. **Presenting public talks:** The first, and most traditional, idea is for someone who makes learning games is to give a public talk at a library about an aspect of game design, game creation, or the gaming industry. This type of talk can be the first step in a longer relationship with a library, and serves as the catalyst to bring together library staff and library patrons interested in gaming. To those who are passionate about playing games, a peek inside the game creation or publication process can be fascinating. This type of talk can be used to judge interest and to recruit volunteers to help with other gaming programs.
2. **Enhancing existing library programs**: Many libraries have found success in starting with an audience and program that is already successful, such as summer reading programs, and adding games. The benefit of starting with an existing library program is that an audience and desired outcome is already defined. The game designer can work with the library staff to craft a game experience that will enhance the existing library program. The advantage of this approach is that it is less likely to draw scrutiny from those skeptical of gaming in libraries
3. **Developing information literacy games:** Many libraries see a significant challenge in improving the information literacy skills of their patrons. These skills involve defining an information need, searching library or publicly available resources, determining which resources are trustworthy, and combining those resources to meet the information need. As mentioned earlier in this chapter, many of these information literacy games are not well-designed educational games, so an opportunity for those making learning games is to create good educational games to help library patrons with information literacy skills.

4. **Running gaming events:** Another type of event that can be run as a one-time activity or an ongoing event is a recreational gaming event. At these events, analog and/or digital games are presented to attendees, and library staff and volunteers are available to facilitate the gaming experience for players. For this type of program to be successful, it is important to match the games to the age groups and the time available for play. For example, a single-player adventure game is not a good match when the desire is to have an event where people come to play a short game together to get to know each other. There is a temptation when running one of these programs for the gaming expert to choose games that he or she likes, but it is important that the input from the library staff be taken into account in deciding what games will be a good match.
5. **Facilitating game creation activities:** As libraries are adding Makerspaces with 3D printers and other creation tools, they are becoming more comfortable in being a place of creation. A game creation activity, such as a one-day game jam or a longer programming or board game development class, fits well with libraries seeking to encourage patrons to create instead of just consume. These game creation events can be themed by basing the event upon a special event in the community or a topic area of interest. These events can be focused toward children, teens, adults, or families, and can focus on digital or analog games. Someone who creates learning games could be very valuable in helping the library to run a game creation program.

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Researchers

Ron Brown
Karen Markey
Scott Nicholson
Angela Ramnarine-Rieks

Organizations, Online Classes and Podcasts

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CHAPTER 7

Homeschooling and Gameschooling

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Key Summary Points

1. Homeschooling is one of the fastest-growing forms of education in the United States.
2. The homeschool population is becoming more diverse, and families differ widely in their reasons for homeschooling as well as in their learning methodology.
3. Homeschoolers increasingly are using entertainment and educational games as part of their informal and formal curricula. "Gameschooling," which means using games for education, can help children who have alternative learning styles or are resistant to formal schooling.
4. Homeschoolers represent a growth market for game developers, as do "afterschoolers" who use games to enhance learning after school.
5. Educational games can better address the needs of homeschoolers by improving reporting and assessment, making it easier to switch between sibling accounts, making gamified rewards more meaningful, improving privacy and security, and providing increased opportunities for cooperative learning.

Key Terms

Homeschooling
Home education
Unschooling
Gameschooling
Afterschooling
Virtual school
Gamification
Rewards
Intrinsic & extrinsic motivation
Social learning
Assessment, reporting & documentation
Stealth learning
Cooperative learning
Long form games
Short form games
Analog games

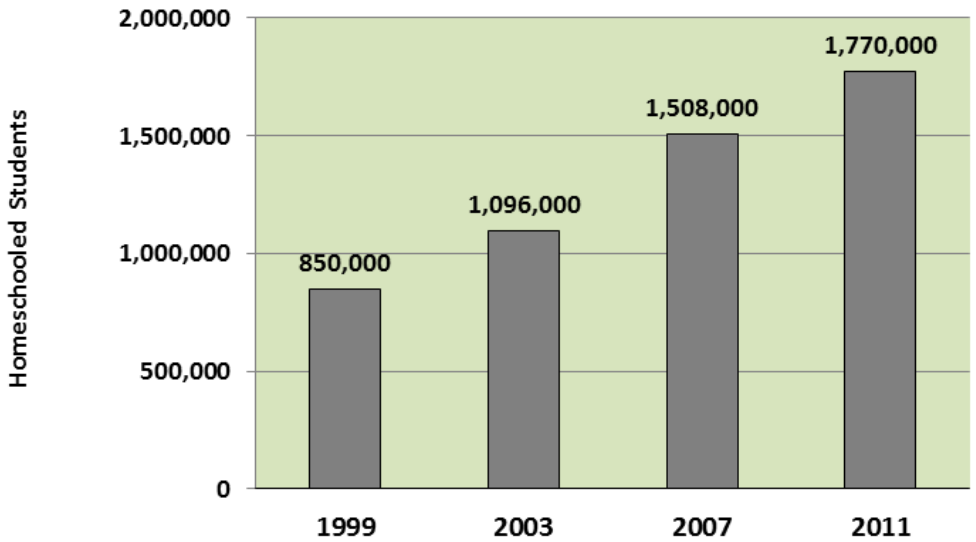
Introduction

What homeschoolers have in common is that they do not attend school *in person* and *full-time*. Other than that, there is very little that can universally be said to describe the diverse population of homeschoolers. They differ widely in school attendance, in methodology, and in motivation for homeschooling. Homeschoolers do not necessarily do all of their education "at home"—some attend school part time, some travel the world, some are professional athletes or actors who work with tutors on location, and some attend full time online virtual public school. What is clear is that homeschooling is on the rise, diversity within the homeschool population also is increasing, and homeschoolers represent a substantial market segment for educational games.

Fastest Growing Form of Education

Homeschooling has steadily grown in the United States, from less than 20,000 students in 1975 to almost two million in 2011. According to Education Week, "some experts argue that homeschooling is the fastest-growing form of education in the country" (Education Week, 2011). The U.S. Department of Education's National Center for Education Statistics (NCES) reports that, "The increase in the percentage of homeschooled students from 1999 to 2007 represents a 74 percent relative increase over the 8-year period and a 36 percent relative increase since 2003." (NCES 2009) The most recent NCES statistics put homeschoolers at 1.77 million in 2011, which is 3.4% of the school-age population (NCES 2013).

Table 1. U.S. Homeschool Enrollment from 1999-2011 (as reported by NCES)



Furthermore, state and federal homeschooling statistics omit large numbers of homeschoolers, because there is no agreed upon defininition of homeschooling. For example, some states (like California) consider homeschools to be small private schools. Some states count virtual school students as "public school students," especially when these online schools are funded by the state. A recent news article explains how some states fail to count homeschoolers:

> In California, the statistics are even fuzzier. That's because, technically, there is no such thing as home schooling in California. Here, it is done in several ways. Families that go it alone must establish what amounts to a miniature private school. They can hire a credentialed teacher to tutor their child. Or they can home-school through an independent study or online program sponsored by a public school…While the California Department of Education keeps a tally of private schools in the state, it omits from the count any private school with fewer than six students—and in so doing neglects to track the number of home-schoolers. (Kuznia, 2013, para. 17-18)

School districts can earn significant funds from increasing their enrollment by classifying homeschoolers as public or charter school students. This structural incentive reduces the official "counts" of homeschoolers. As one researcher notes, "School districts themselves are actively strategizing, employing such technological connections to enhance their revenue flow but maintaining existing enrollments or by actively recruiting home school parents to join a home school charter" (Apple, 2007, p. 117). Despite the lack of complete data, it is clear that the homeschooling population is substantial and growing.

Homeschooling also exists internationally but global statistics are difficult to find. According to the National Home Education Research Institute, homeschooling is growing in Australia, Canada, France, Hungary, Japan, Kenya, Mexico, South Korea, Thailand, and the United Kingdom (Ray, 2011). In other countries, such as Germany, homeschooling is illegal. An informal summary of international homeschool laws can be found on *Wikipedia* (http://en.wikipedia.org/wiki/Homeschooling).

How Does Homeschooling Work?

Some homeschoolers study at home, but others attend school for part of the day. In states like Idaho and Illinois, public schools allow part time attendance for academic classes and for after-school sports. NCES data shows that about 16% of homeschooled children attend school part-time (2009).

Other homeschoolers attend school full-time, but they do it online through virtual charter schools like Florida Virtual School, Calvert, Connections Academy or K12. (Many states accredit and pay for these virtual schools as part of their public school program and do not count these students as "homeschoolers"). A few travel the world while homeschooling—one family has taken their daughter to experience over 44 countries and five continents since 2006 (www.soultravelers3.com). Another family travelled by bicycle from Alaska to Argentina (www.familyonbikes.org). Some young actors and athletes use tutors on set or at training facilities. So, there is a huge variety in location, and not all homeschooling takes place at home.

Homeschoolers also differ widely in their methodology. Some do school-at-home—replicating a school like environment in the home with recess, bells, and desks. At the other end of the spectrum are unschoolers, who follow a child-led, interest-based lifestyle, generally without formal classes or academic structure (Thomas & Pattison, 2013). Some unschoolers do participate in classes and other structured activities, but only if requested by the student. There are as many different flavors of unschooling as of homeschooling itself. In between are a variety of other methods, such as reading original source literature instead of textbooks ("Charlotte Mason" method – see www.simplycharlottemason.com), or learning through the lens of a thematic unit—such as studying math, science, literature and history through Ancient Egypt (i.e., unit studies). Others methods might be based on a religious viewpoint or nature/environmental outlook, and some focus on special needs (e.g., a child's disability or giftedness), career needs (e.g., acting or athletics), or a family lifestyle (e.g., farming or world travel).

Games, Homeschooling, and "Gameschooling"

"I have always had a fancy, that learning might be made a play and recreation to children…" – John Locke, *Some Thoughts Concerning Education*

"Do not…keep children to their studies by compulsion but by play." – Plato, *The Republic*

A growing homeschooling methodology is called gameschooling, where students play games as an integral part of their learning (www.gameschooling.org). Most of the elementary curriculum can be taught through games, and much of middle and high school material can be learned through games or gamified learning applications. There are fewer educational games and apps, though, at the secondary school level. (Cooney Center, 2014). Games have always been used in education—whether board games, trivia quizzes, or learning skip counting through hopscotch—however, advances in technology have made digital games a key educational tool for many homeschoolers.

Some children learn best though games. This may be due to dyslexia, ADHD, emotional issues or simply due to the independence and immediate feedback that games can provide. Marino, Basham, & Beecher (2011) found that videogames particularly helped at-risk learners and students with disabilities. A growing group of homeschoolers initially attended school but left due to bullying, dyslexia, lack of academic rigor, too much academic pressure, food allergies, or a myriad of other issues. For some of these students, school was stressful or traumatic, or traditional learning methods did not work for them, so educational games may be a welcome alternative. Games can also give homeschool parents a way to keep one child productively engaged while focusing on a sibling. So games are becoming an increasingly important tool for homeschoolers.

Homeschoolers are a growing market for educational games, as are "afterschoolers" (families who use games to enhance learning after school). So how does the use of games at home differ from the use of games in the classroom? And do homeschoolers have specific needs that are different from afterschoolers?

For the most part, homeschoolers use games for learning and entertainment just as other families do. Yet homeschoolers have a few distinct needs that current games are not fully meeting. Volume One of this book series explored how to analyze specific games for a variety of subject areas. This chapter describes the size and diversity of the homeschool market in the United States, and explains how learning games in general can be adapted for the homeschool audience.

Case Study One: Social/Emotional Learning and Content Creation in *Minecraft*

As noted above, most homeschoolers have rich social networks (Murphy, 2012). Games provide additional social tools for homeschoolers. *Minecraft* is an open sandbox game where players can build elaborate Lego-like virtual structures and can play online with friends. A key element of this long form game is that the player is a "prosumer," i.e. not just a passive consumer of game content, but a producer who can actively create new content. The gameplay can be simple enough for a six-year-old, or complex enough for an adult—easy to play, but difficult to master. Since *Minecraft* online servers can be open to the public or restricted to friends only, parents can control who can interact with their children online.

Homeschool parent and author, Suki Wessling explains how *Minecraft* has helped her children with social interaction as well as social/emotional learning:

> One of the reasons I started homeschooling one of my children was that she had problems understanding social interactions. Forcing her to be in a classroom, which was stressful to her, just made the problem worse. Homeschooling allowed her to do her social/emotional learning in safer environments. *Minecraft* is one of those environments. In *Minecraft*, the children are somewhat separated from their physical selves, yet the same rules of social engagement apply. Kids with difficulties understanding social rules in the complicated physical world can act things out in the virtual world in a constructive and helpful way….
>
> Creative, visual games like *Minecraft* allow children with different abilities a place to be confident and skillful. In the oral culture of classrooms, highly visual kids are sometimes left out and made to feel slow or stupid. Inside a world that doesn't require words, they can develop their strengths along with self-assurance and confidence.
> (S. Wessling, personal communication, September 26, 2013)

Minecraft can thus be a learning tool for emotional growth, where children can safely practice social interactions. This application of game technology is useful for a wide range of children, from those who are simply lonely or shy to those with developmental delays and autism spectrum disorders. There is even a whitelisted *Minecraft* server for children with autism (www.autcraft.com).

Minecraft is popular with homeschoolers, and not just for social goals. *Minecraft* also can be used to teach topics from architecture to programming to quantum physics. *QCraft* is a free *Minecraft* mod used to teach quantum physics (www.qcraft.org). Wessling notes her son used programming skills to develop his own *Minecraft* mod, which won first place at a county science fair, and then honorable mention at the state fair. The *Minecraft* Homeschool website uses the game as an immersive environment for history classes, where students build structures related to their history lessons (www.minecrafthomeschool.com). Thus *Minecraft* is being used as a platform to support a variety of academic specializations.

Minecraft is also used as enrichment to supplement other structured classes for homeschoolers. *Athena's Advanced Academy,* is a website that provides online classes for gifted and talented homeschooled children. *Athena's* classes include philosophy, literature, mythology and other subjects. Students can talk (via chat) during class, and can also build connections in moderated online forums. *Athena's* also has a private *Minecraft* server where students can socialize and continue their studies with activities such as "creating virtual mathematic equations, scenes from literature readings, historical reenactments, geographical locations, famous sites, and more!" (www.athenasacademy.com/mod/page/view.php?id=25094, para 3). Thus *Minecraft* is being used to extend class learning and also to help a specific population (gifted students) connect with their peers. The open-ended, sandbox style gameplay gives unlimited hands-on experiences, making Minecraft an exciting platform for learning.

Key Frameworks

Numerous commentators have extolled the learning potential of games, both in educational and entertainment contexts (See e.g., Gee, Prensky, and many more). In his book, *Unschooling Rules*, game developer and unschooling father Clark Aldrich urges families to embrace technology for learning, especially high-quality video games. He notes, though, that not all video games are equally educational. In *Rethinking Education in the Age of Technology: The Digital Revolution and Schooling in America* by Collins and Halverson, the authors posit that public education in general may become "more like home schooling by emphasizing field trips, interacting with peers, playing computer games or even teaching others with technological tools" (Collins & Halverson, 2009, p. 129). Ian Bogost, a game designer, theorist, and also a homeschooling parent, argues that

> Videogames and education are at the cusp of commensurate revolutions. We have begun to recognize the need to create well-educated rather than well-schooled kids in broader numbers. We have begun to recognize the potential of videogames for educating; now we need to understand and embrace the ways they undermine schooling.
> (Bogost, 2008, p.170).

Thus games are not only useful in individual homeschooling and unschooling cases, but also have the potential to inspire broader educational reform.

Gamification, Leveling up, and Rewards

Gamification means applying game-like rules or rewards to non-game situations, i.e., making something more like a game to serve a non-entertainment purpose. Gamification has been used in education for years—even in a traditional classroom, teachers run word games or trivia contests for children to learn spelling words or history.

In the digital world, gamification often uses game-like rewards such as points, awards, or levels in an attempt to motivate player behaviors. These rewards are considered "extrinsic" or external versus "intrinsic" or internal rewards like the satisfaction of learning itself. Gamified learning may be motivating, but not always in the ways that parents intend. Extrinsic rewards can cause a student to de-value learning in favor of rewards (Kohn, 1993).

Another danger of gamified learning is that students may game the system itself, for instance by choosing easy lessons to quickly earn points, thus defeating the learning objectives. Educational game designers can learn from entertainment game designers regarding leveling up and quest design. In *World of Warcraft*, new players can complete easy quests to start leveling up their avatar. Advanced players must do harder quests to level up quickly because it would take too long for a higher level avatar to level up using these easy quests. Similarly, in a learning game, a typical high school student should not be able to earn rewards for kindergarten level work.

Furthermore, if the reward has little value to the student, it will not motivate learning. Just as small children love stickers but teens may find them worthless, sooner or later, kids will become bored by digital images like "badges" and "awards" that are really just virtual stickers. Game designers have the challenge of creating more meaningful rewards—or "badges worth bragging about" as *Khan Academy* claims (www.Khanacademy.org). Effective "bragging" requires meaningful social interaction:

> In order for status and reputation (levels, badges, leaderboards) to work, it is important to connect the user to a meaningful community with the same interests. An achievement is made to show it your friends with the same interests. If there is nobody whom you can show it to, your achievement will be nothing special.
> (Groh, 2012, p. 42)

Making educational games more social would increase the perceived value of gamified rewards. Methods to increase the social nature of games could include, posting achievements to Facebook, Xbox Live or other social media (for older students), enabling students to ask for assistance from peers or parents, and turn-based gameplay within the learning application (in the manner of the games *Word with Friends* and *Draw Some*). (See also "cooperative learning" below.) Social gaming can be made safer for children if parents are able to limit interaction with strangers and keep personal information private.

Alternatively, getting rid of artificial rewards and instead providing meaningful game outcomes that are focused on gameplay can make learning more internalized. In other words, "The dependence upon external rewards for motivation should be replaced by connections between the non-game activity and needs or goals in the user's life based upon information, which will allow users to have a positive internalized experience" (Nicholson, 2012, p. 242). Nicholson (2012) cites the example of the Toyota Prius' game-like dashboard that gives drivers meaningful interactive feedback on their fuel efficiency, instead of just a score or reward.

The game *Minecraft*, described in the case study, is a good example of the use of virtual rewards that are meaningful in that they provide actual gameplay value to the player as well as social status within a community of peers. *Minecraft* players have the option to play online on public servers, and many form communities and online friendships with others who play regularly on the same servers. On some servers, player actions can be incentivized with rewards like earning the ability to fly in the game or access new game worlds. In-game flying is a real benefit to players who want to escape hostile mobs (creatures that attack the player) or to build tall structures. Community status is increased for players with flying abilities, and their avatar names may also be listed on a leaderboard on the server's webpage. Meaningful social rewards such as these can be used to try to motivate game players to complete entertainment or educational goals.

Family/Cooperative Learning

Joint media engagement (JME) is a term used to describe parents and children using media together. JME is an "important way to enhance the impact of educational media" (Rideout, 2014, p. 5). Features that would enhance group learning or allow parents and children, or older and younger siblings to play together (each at their own level) can help games be more effective learning tools. Homeschooling website *Time4Learning* reports that two-player games are "one of the most popular parts of the entire *Time4Learning* service." (www.Time4Learning.com/playground.htm, *Time4Learning* is described in the case studies below). JME can be asynchronous (e.g., adding a button that would send an email to a friend or family member asking for help or sharing tips), or synchronous (e.g., a multiplayer co-op mode as in *Super Mario Galaxy*, where one player can perform easier tasks in the game alongside the more experienced player). Cooperative learning helps students stay engaged in learning because it is more social and players can get help quickly when stuck.

Furthermore, games and learning systems could better market to homeschoolers by permitting parents to save account information for multiple students (e.g., siblings or members of a small group co-op class). It is often cumbersome to switch between accounts, and games can streamline this functionality, minimize the number of steps involved, or put a visible "switch user" button at the top of the screen. Also, account switching at the operating system level could be made more user-friendly. Some devices, notoriously iOS devices, only allow one user profile, making it difficult for a family with three children to let each have an account with their own age-appropriate games and apps. It is unreasonable to expect a family to buy an iPad for each child.

Time Limits, Privacy, Content, and Internet Safety

Time limits and time tracking also help families who want to limit screen time or have the computer enforce taking turns among siblings or friends. Time limits could be managed within individual games or through the operating system, which could track multiple student accounts for different games and applications.

Parental controls and privacy settings can be tricky, especially across platforms. Many operating systems have limited protection for children, and some parents end up purchasing additional services. *Net Nanny* provides a suite of parental controls; however, parents must purchase separate accounts for each PC, iPad and other device, and the settings for each operating system and each device are also managed separately. This can become expensive, as well as cumbersome to maintain.

The full scope of Internet safety and privacy is too broad for in depth discussion in this chapter but is an important and troubling issue for families trying to protect their children online. Development of user-friendly, cross-platform parental controls is important but so is raising parental awareness about existing tools. Apple has greatly improved iOS website filtering, but few parents know how to use Apple's new tools (FOSI, 2011). Furthermore, multiple user account profiles still are not allowed, so parents with a four-year-old and a 14-year-old must block the same content for both children. Adding multiple profiles and time limit options would further improve iOS products for families. Windows also comes with family safety tools, and Mac has a set of parental controls, but parents often do not know these options exist (see more in the Resources section).

Many homeschooling families use mobile and web games for learning. Unlike console games, mobile and web games are not rated by the ESRB. Without age and content ratings to consult, parents have little guidance about potentially inappropriate game content. ⁋ Mark DeLoura, Senior Advisor for Digital Media at the White House Office of Science and Technology Policy thinks this should be changed: "Another key priority for DeLoura is to develop a consistent rating system for mobile games. It's not always clear whether mobile games and apps are safe for kids, even if they are marketed to this demographic" (Farr, 2013, para. 22).

Even within a single game, server settings and player behavior may determine whether the experience is safe and age-appropriate. *Minecraft* public servers can be restricted to a "white list" of approved players. Server extensions can be installed to prevent offensive language. Chat functionality can be allowed or turned off or set to public only (to prevent secretive or private communication between individual players). And players can be permanently banned for griefing, bullying and other rule-breaking. Alternatively, a server without any administrative control can be a free-for-all where extreme behavior and language is allowed.

Luckily, review sites exist to help parents decide which games are most suitable for their children. These sites, such as Common Sense Media (www.commonsensemedia.org) not only rate games based on appropriateness of the content for different ages, but also rate the quality of the content taught in the game. While dependent on user-submitted reviews and scores, in the aggregate these ratings give a good picture of many of the more popular games on the market. Other sites such as Educade (www.educade.org) provide game reviews with lesson plans created by teachers.

Increasing online safety would also help schools, libraries, and museums, not just families. Some libraries that provide games for pre-school and elementary school children have resorted to purchasing special

child-safe computers that completely lock out outside content (e.g., www.awelearning.com). While these services are great, they can be expensive and force libraries to pay for games that can be played online for free. It seems a shame that libraries must use their limited budgets to buy these expensive software/hardware packages, when better operating system controls—or better use of existing controls—could

Case Study Two: "Gamified Learning" with Khan Academy and Duolingo

Gamification means applying game-like rules or rewards to non-game situations, and has become a popular term for its application to digital environments and learning programs that are used by homeschoolers.

Online learning programs Khan Academy and Duolingo provide game-like rewards and badges to encourage students to progress through online tutorials and tests. Both Khan and Duolingo are widely used by homeschoolers due to their high quality of instruction and the fact that they are free. On Duolingo, students can learn Spanish, French, and other languages. Khan Academy started with math tutorials and has expanded to cover a variety of STEM and humanities topics.

Gamification works well for some homeschoolers but can be a source of frustration for others who may find the virtual rewards irrelevant or phony. (For a more in depth look, please see the chapter in this book on gamification). Wessling comments on how her children feel about gamified learning in Khan Academy:

> [O]ur highly techy kid positively hates it while our non-techy kid loves it. So I would say from our experience, gamification is hardly the all-around solution that some say it is. Our techy kid doesn't care about empty praise. He thinks it's just sort of dumb that *Khan Academy* gives him awards—other apps that are more blatant about it annoy him and he won't use them. Our other child, however, really likes seeing constant, incremental progress. She loves it when learning environments have some sort of score-keeping aspect, and will even print out the medals she receives. So I am hoping that the world of education doesn't blindly go into gamification without thinking about the fact that it's not the best thing for every kid.
> (S. Wessling, personal communication, September 26, 2013)

It is important to keep in mind that gamified rewards and badges are not uniformly motivating or uniformly worthless. Their relevance depends on the preferences and personality traits of the user such as competitiveness, diligence or need for feedback and reassurance. Likewise, when playing entertainment games, some gamers intently focus on their scores, achievements, leaderboard placement, or Xbox Live points, while others could not care less.

Key Findings

Key findings in the area of homeschooling and games show that homeschooling is now a mainstream choice that is no longer considered radical and that the homeschool population is becoming more diverse. Extensive research shows that homeschooling can be a successful educational option; however, there is still very little research on the homeschool use of technology, and of games in particular.

Homeschooling Becomes Mainstream

With the rapid growth in homeschooling, it is shifting in public perception from being a radical choice to being an accepted mainstream alternative to public or private schooling:

> Home schooling, once dismissed as a fringe activity practiced by head-in-the-sand reactionaries and off-the-grid hippies, is now widely considered an integral part of the mainstream education system. Growing more common every year, the practice has gained attention due to home-schooled students sweeping up scholastic and athletic honors at national competitions and high-profile politicians opting to teach their own children at home.
> (Education Week, 2011, para 1, citing Lyman, 2007)

Similarly, the tone of news coverage of homeschooling has changed over the years from minimal coverage and general lack of awareness to overall more positive reviews.

Studies of formerly-homeschooled adults are rare; however those that exist indicate that homeschooled students usually are well-prepared for college and adult life (Ray, 2014). As Joseph Murphy, author of *Homeschooling in America*, notes, "Homeschool students are successful and they don't perform worse than other students or seem to be disadvantaged in any way… If you have one teacher dedicated to one or two children, it's a success equation, and so it doesn't surprise me [homeschooling] works" (Wetzel, 2012, quoting Murphy, para 8). Thus homeschooling is becoming accepted by the media, researchers and the general public as a viable educational choice.

Diversity and Motivation in Homeschooling Populations

Homeschoolers differ widely in their reasons for homeschooling as well as in their methodology. Stereotyped caricatures of "head-in-the-sand reactionaries" or "off-the-grid hippies" perhaps describes some homeschooling families at the extremes, but in reality homeschoolers are much more varied and complex in their motivations, which include concerns about the school environment (such as safety, drugs, or negative peer pressure), to provide religious or moral instruction, to provide a nontraditional approach to education, dissatisfaction with academic instruction, health problems or special needs, and "other reasons" such as family time, finances, travel, and distance (NCES, 2013). What works best for one child might not be the best for a sibling, so it is common for homeschooling parents to have another child in a conventional school setting (Kunzman & Gaither, 2013, p. 8, citing Isenberg, 2006).

> In pursuit of a comprehensive knowledge of national education, therefore, we need to direct more attention to understanding the education of homeschooled children. Moreover, such studies will generate a wealth of information applicable to broader educational settings. Scholars interested in cognitive development may gain important insights from unschooling families, who tenaciously pursue child-led learning (see Holt, 1981). Scholars concerned with curriculum may gain important insights from the many homeschoolers who devote themselves to tailoring lessons to meet the individual needs of each of their children. And scholars focused on policy may gain important insights about market-based reforms. Homeschooling, after all, is the ultimate in school choice: not simply between schools, but whether schools.
> (Nemer, 2002, p.1).

Still, twelve years later, there are not many studies to be found, particularly on the use of learning games and technology by homeschoolers. Research on current homeschooling methods not only would illuminate the work of homeschoolers, but also might contribute to national discussions on public education hot topics, such as individualized and differentiated learning, flipped classrooms, and MOOCs, and provide "a context highly conducive to the discussion of how the American education system can fulfill the needs of our pluralistic society" (Nemer, 2002, p. 16). (Also see Bogost, 2008, Collins & Halverson, 2010, and Glanzer, 2013). As the most recent NMC Horizon Report notes,

> Movements such as "unschooling" are taking the idea of K-12 education in a completely different direction. Unschooling rejects conventional methods of learning and instead emphasizes education through natural means, such as gameplay, work experience, and household responsibilities, while encouraging the freedom for learners to pursue their personal interests…. Whether or not this model gains traction over the next five years, it is stimulating important conversations about the need to move to more progressive education paradigms that better engage all kinds of learners, even in traditional settings.
> (Johnson et al., 2014, p. 28).

Reliable research on how homeschoolers use games (or other technology) is very limited, so this area is ripe for academic study. A 2014 report explains, "Home school populations have been studied for socialization and academic preparedness, but there are few studies on the use of technology among home schooled families" (Neil et al., 2014, p.1). Research on homeschoolers generally falls into five themes: reasons for homeschooling, student achievement, social development, special needs, and legal and policy issues (Alias et al., 2013, p. 10. See also Kunzman & Gaither, 2013).

Existing game research usually focuses on data from schools and teachers, not homeschoolers. Some learning game research specifically omits homeschoolers. The Cooney Center's 2013 *Games for a Digital Age: K-12 Market Map and InvestmeA20.9 (i-10.75.6 ((o)3s 2)2 (l)-2-24.4 (m)-3.5 (c)-18.1 (sn)9.5 z-7.4 1)6Ø /S2an ØMCID*

One might then expect to see inclusion of homeschoolers in the Cooney Center's 2014 *Learning at Home*—a report on learning games outside of the school context. *Learning at Home*, however, does not include any references to homeschooling. It was based on a survey of 1577 randomly selected parents of children ages two to ten years old, and was "representative of the entire U.S. population." (Rideout, 2014, p.9) So, at least 3.4% (about 54) respondents likely were homeschoolers. Yet, the survey excluded use of learning games as homework or school assignment, making it unclear how a homeschool parent might classify the use of games in their households. When asked the following question about education, parents did not have the option to answer that they were homeschooling:

> During the 2012-2013 school year, was [CHILD] enrolled in:
> a. Day care outside the home 10%
> b. Preschool 13%
> c. Head Start preschool 4%
> d. School 53%
> e. None of the above 22%
> (Rideout, 2014, p.48)

Homeschooling was not listed as an option, so the 22% (approximately 347 parents) who answered "none of the above" likely included both homeschoolers and toddlers/preschoolers not in day care or preschool. It would be interesting to go back to this data to see which of the 22% were of school-age, and thus were likely to be homeschooling. This commentary is not intended to critique the Cooney Center's very useful reports; it is merely to show how homeschoolers are often invisible in the field of games research and not included in leading reports on either K-12 education or home learning. (For a discussion of why educational research overlooks homeschoolers, see Howell, 2013).

Recent research on homeschoolers and technology provide a good, but limited, starting point. A study of technology adoption by homeschoolers asked if they used the following technologies: internet, email, videos/DVD, educational software, productivity software, streaming, message boards, cell phones, TV, blogs, wikis, imaging software, and MP3's (Neil, Bonner & Bonner, 2014). It is surprising that games were not on this list, but perhaps they were included under the general category of "educational software," which was used by 68% of homeschoolers, or "internet," which was used by 96%. Likewise, an analysis of homeschoolers in Malaysia found that many used games, but did not explain further how the games were being used (Alias et al., 2013). (See the Future Needs section for suggestions for further research).

Long form vs. short form games

The Cooney Center report on K-12 education compared short and long form games. Short form games are brief, focused games that fit a 40 minute class. Long form games take longer, do not fit in a class session or school day, have "a stronger research base" and are "focused on higher order thinking skills." (Richards et al., 2013, p. 4). The report concluded that long form games "lend themselves to the development of 21st century skills such as critical thinking, problem solving, collaboration, creativity, and communication," but long form games are not practical for sale to schools. This is an ongoing source of frustration for developers of long form games (Richards et al., 2013).

In contrast, developing games for the homeschool market can be rewarding for developers because homeschool education is not limited by 45-minute classroom blocks or by the bureaucracy of curriculum development and complex contracting requirements. Homeschoolers are rapidly adopting digital games and other technology for education. While they do not have the budget of big school districts, homeschoolers have the advantage of flexibility and speed in making purchasing decisions. So while schools require quick games and make slow decisions, homeschoolers can enjoy long games and make quick purchasing decisions.

Some developers have been successfully targeting the homeschool and virtual school audience to increase their revenue. Filament Games describes its "Path to Commercialization":

> Filament Games is taking a two-pronged approach to commercialization. First, the games are sold via channel partners such as BrainPop, Edmodo, Learning.com, Florida Virtual School, and Carolina Biological, all of which have substantial user bases. Second, the games are sold directly on the Filament Games webstore, and marketed via social media, webinars, and presentations at industry trade shows.
> (SBIR Success Stories, 2013, para 4).

Florida Virtual School is a Florida public school that enrolls public, private and homeschooled students, who complete their coursework online. (These are mostly students who complete their work from home using a computer, but they may be classified differently depending on the state they are in, and whether or not the virtual program is funded by their state). Filament Games recognizes that these new virtual learning models (which are used by many homeschooled students) are a significant path to commercialization of their game products.

Online schools and homeschoolers do not have the same time limitations found in traditional brick and mortar schools with short class periods. For example, the 2013 Cooney Center report suggests that the success of long form games would require significant educational reform:

> Investors looking for long-form games to support will succeed to the extent that they can simultaneously be involved in education reform movements that will re-imagine the school day to promote in-depth study, provide longer class periods, involve open ended projects, and engage critical thinking skills.
> (Richards et al., 2013, p.9).

Improving schools is an important goal, and, as James Paul Gee explained in a recent interview, "if we want deep games and deep game-based learning we would have to change the policies in our schools" (Gee, 2014, p. 10). School reform is not the only way that long form games can succeed, though. By broadening their audience to market to homeschoolers and afterschoolers, game developers can increase their market and revenue. Conversely, by being an example of 21st century learning, homeschoolers can provide an example of success to motivate school reform. The NMC Horizon report on technology in K-12 education notes that institutional education must adapt to maintain enrollment, especially since

homeschooling provides an enticing alternative: "Learners have increasing opportunities to take their education into their own hands, and options like informal education, online education, and home-based learning are attracting students away from traditional educational settings. If the system is to remain relevant it must adapt" (Johnson et al., 2012, p.10).

Case Study Three: Learning Systems with Games: K12, Time4Learning, BrainPOP, WiloStar3D

Many homeschoolers rely heavily on online learning systems, particularly when students need to be able to work independently from parents. Independent learning is especially important in large families with many children, single parent families, or families where the parent(s) work while homeschooling. Online learning in homeschooling can vary from occasionally using a few web resources to full-time virtual schooling, and mobile technology enables students to complete academic work while traveling away from home (Bullock, 2011). Some online learning systems include games as a part of their product. This case study compares three learning systems widely used by homeschoolers, Time4Learning, K12, and BrainPOP, and examines how their use of games could be improved for the homeschool audience.

Time4Learning (www.time4learning.com) is a website with online lessons and tests for preschool through 12th grade. Most lessons are in the form of interactive, game-like simulations. Time4Learning keeps track of the student's progress, and students have access to three years of material at once. Since a 3rd grade student can choose 2nd, 3rd, or 4th grade material, they are not locked into a single grade. This flexibility makes Time4Learning useful both for gifted and for struggling students, since they can work above or below grade level.

Time4Learning also uses games as a reward. Students who finish their lessons are allowed to spend time in the game "playground":

> The Time4Learning Playground relies on a suite of licensed games as well as a white list of great online sites and activities like PBS Kids, BBC Interactive, Sesame Street, Pauly's Playhouse, VeggieTales, and Starfall. The games and sites are carefully chosen and the navigation between them is a fun simple and safe interface. …The children quickly accept the structure that they have to do their studies to get to the playground. Just like eating their meal before dessert. Or homework before TV. Time4Learning relies on and reinforces this basic principle. Children find this structure both comforting and motivating. (www.Time4Learning.com/playground.htm, para 5-6)

Similarly, K12 provides online lessons, quizzes and a curated list of games. K12 is a certified program; in some cases it is state-funded for homeschoolers as a virtual public school. It can be used as a complete kindergarten through twelfth grade curriculum, or individual subjects can be purchased separately. Depending on the options purchased, K12 classes may be entirely virtual or they can be taught and

graded by a live (online) teacher. K12 students are enrolled in one grade at a time, but there is some flexibility in how the grade level is assigned. K12 keeps track of a student's time spent on lessons, quiz results, and subject mastery. It does not keep track of time spent playing games, specifically, but games are interspersed with other learning content that is tracked cumulatively.

BrainPOP is another learning system with online, animated lessons, quizzes, and games. BrainPOP is structured more informally than Time4Learning and K12 in that there are no grade level restrictions, visitors may view any of the material on the site at any time, and there are no restrictions on time spent playing games. There is also no reporting or saving of student progress for homeschoolers, so it is difficult to keep track of what their children have completed. Quiz results can be printed out, but the results are not stored online. Game outcomes also are not measured or recorded. (BrainPOP recently launched "MyBrainPOP" for school districts, with increased reporting, but this is not yet available for families.)

WiloStar3D states that their accredited homeschool program is a "revolutionary new way to homeschool" (www.wilostar3d.com). Students create avatars and are immersed in an online 3D virtual campus. In this virtual world, students attend class, create 3D objects, role play historical characters, build virtual environments based on biology, history and social studies topics, and interact with the avatars of teachers and classmates. The educational content is similar to other learning systems – the difference is the interactive 3D worlds in which the content is taught. For example, WiloStar has an ocean virtual environment called "Sealab" that students use to research marine biology, oceanography and underwater archaeology.

WiloStar3D also has a special needs homeschooling program for students with physical or mental disabilities that may have prevented those students from achieving success in a physical school environment. Public schools are also exploring the use of 3D virtual worlds (which can be contracted from software providers like Protonmedia.com) to tutor students at home and to "keep school open" during snow days. Corporations are similarly using virtual worlds to run online meetings and trainings. Since the days of Second Life (an older online virtual world), there has been debate about whether or not a 3D world without explicit goals, quests or narrative is truly a game or merely a sandbox toy. However, the success of games like *Minecraft* shows that sandbox mechanics appeal to many game players and have potential for homeschool, school and corporate learning methodologies.

The above learning systems provide many advantages for homeschoolers: games as learning tools, environments, and rewards, and the ability to pick and choose individual topics and grade levels and to work independently. Some could be improved by providing greater integration with games (i.e., using games for teaching, not just for rewards, including more game mechanics in sandbox virtual worlds, and including game scores in overall reporting of subject mastery). Others, like BrainPOP, could be improved by adding optional documentation and reporting for homeschoolers.

Assessment Considerations

Since there is a dearth of research on games in the homeschooling context, specific assessment considerations for this population have yet to be developed. Furthermore, since homeschoolers are a highly diverse group, research and assessment may be difficult to generalize:

> Further research may continue to prove challenging because homeschool families often do not like to participate in research if the research organization is not one they trust. Also, many homeschool practices are so unlike public school practices that they are difficult to quantify and qualify. A particular philosophy of homeschooling (referred to as 'unschooling') does not involve objectives or promote the use of ordered curriculum for any subjects. These homeschool families reject organized attempts to formalize real-life learning. Another challenge to researchers, especially in states like Michigan, is the lack of documentation of homeschoolers. Where no registration is required, few databanks exist from which researchers can draw. True representative sampling might be impossible. Very small sample sizes can also prove a difficulty for researchers.
> (Hautamaki, 2011, p. 26).

The varied perspectives and diversity of homeschoolers makes them an interesting but challenging research pool. One solution is to narrow the research field to specific subgroups of homeschoolers, such as those in a local geographic area, special need groups, or users of a particular homeschooling methodology or virtual school program (see e.g. Ogburn, 2013).

The limited research that does exist on homeschooling and technology rarely addresses game technology. These studies oy (. g33 (g) (e)-6.6 (o(o)5.6 (l)6.6 .5 (y r)-6.5 (a)(g)-34)5.6 a)0.8<</MCID 6678 2 (s)-3.520.066 Tw 10 0 0h, spc

at the importance to homeschoolers of features like documenting/recording progress, cooperative learning, parental controls, profile and account management, meaningful social sharing of badges in gamified applications, and building community among subgroups of homeschoolers (e.g., gifted/talented, disabled, ethnic/racial/cultural groups, secular or non-secular, virtual schoolers, or unschoolers).

We have very little information about how use of learning games differs in a variety of formal and informal educational contexts like schools, libraries, museums, day cares, homeschooling, and afterschooling. In other words, does learning improve when students can choose their own games or spend longer than a typical school period on a single game? How are homeschoolers using games to

Case Study Four: Stealth Learning with *DragonBox*, *Ko's Journey*, board games

"Stealth learning" in games is where a game secretly provides an educational benefit. One might argue that stealth learning is simply good game design because learning should be seamless and secondary to the game's educational value. Certainly many children prefer games that are not overtly "educational," and to some extent all games include learning, whether stealth or obvious. In some homeschooling situations, stealth learning may be the only type of learning that a child can tolerate. Stealth learning is particularly useful for children who have had traumatic or stressful prior school experiences 0.8.9 (p)-8.9 (e)-2.6 (m)8.50

> They are complicated games that require the players to plan ahead and make decisions. Most games also require you to stick out a game even when losing. The kids want a *Warhammer* set which requires painting, rule negotiations, budgets, angles and geometry, community building, story telling, interpersonal skills, and again resource management. (M. Mason, personal communication, September 25, 2013)

Extensive lists of educational board games used in homeschooling can be found on the popular analog game site Board Game Geek (www.boardgamegeek.com) as well as on homeschooling blogs. Analog games can provide incredible learning opportunities as well as family time and a break from computer screens. Analog games range from quick battles like *Math War* (a variant on the card game *War*) and *Bananagrams* to complex, lengthy strategy sessions of *Risk or Agricola*. Homeschoolers have the advantage of being able to spend hours on a long game as they are not tied to 45-minute class sessions (see discussion of long form vs. short form games above).

Best Practices

The following are best practices for including games in homeschooling:

1. **Research:** When studying learning games, include homeschoolers. If your multiple choice survey asks about student enrollment, list "homeschooling" as a possible answer. Include homeschool experts on advisory boards for research organizations.
2. **Gamification:** Be aware that extrinsic rewards may devalue learning. Rewards should be tied to appropriate level challenge (i.e., do not reward a high schooler for kindergarten work) and meaningful (i.e., valuable and shared within a community of peers, not just virtual stickers).
3. **Content:** Make more games for middle and high school audiences. Develop more long form games, not just games that can be played during a 45-minute school class period.
4. **Cooperative learning:** Enable cooperative in-game learning between friends, parents and siblings.
5. **Parental Controls:** Help parents keep kids safe online with effective parental controls, and educate parents about how to use them! Also allow multiple profiles with their own settings on the same device, so safety settings can be different for younger and older siblings.
6. **Documentation:** Allow families the option of documenting game activities (time spent, progress, mastery) because some homeschool parents are required to keep records of their child's academic activities.

7. **Marketing:** Market your game to homeschoolers and families directly, not just schools. Put a "homeschool" page on your website that directly addresses homeschoolers, and get included in online compilations of games that are used by homeschoolers such as Time4Learning, BrainPOP, K12, and Florida Virtual School. Post reviews on Common Sense Media and Educade to help educate families about your game.
8. **Pricing:** Most homeschoolers do not have the resources of a school district. To reach this price-sensitive market, game developers can develop pricing structures that include multiple siblings, allow demos/trial periods, or arrange bulk pricing through co-operative buying sites, such as the Homeschool Buyers Co-op (www.homeschoolbuyersco-op.org) and CurrClick (www.currclick.com).

Resources

Books & Research

Aldrich, C. (2011) *Unschooling Rules: 55 Ways to Unlearn What We Know About Schools and Rediscover Education*

Collins, A. & Halverson, R. (2009) *Rethinking Education in the Age of Technology: The Digital Revolution and Schooling in America*

Gee, J.P., (2003) *What Video Games Have to Teach Us about Learning and Literacy*

Gathercole, R. (2007) *The Well-Adjusted Child: The Social Benefits of Homeschooling*

Kunzman, R. & Gaither, M. (2013) *Homeschooling: A Comprehensive Survey of the Research, (The Journal of Educational Alternatives)*

Murphy, J. (2012) *Homeschooling in America: Capturing and Assessing the Movement*

Prensky, M. (2001) *Digital Game Based Learning*

Rivero, L. (2014) *Creative Home Schooling: A Guide for Smart Families*

Wessling, S. (2012) *From School to Homeschool: Should You Homeschool Your Gifted Child?*

Research Websites

Coalition for Responsible Home Education (www.responsiblehomeschooling.org)

Family Online Safety Institute (www.fosi.org)

Gameschooling (www.gameschooling.org)

Home School Legal Defense Association (www.hslda.org)

International Center for Home Education Research (www.icher.org)

Joan Ganz Cooney Center (www.joanganzcooneycenter.org & www.gamesandlearning.org)

Journal of Unschooling and Alternative Learning (jual.nipissingu.ca)

Macarthur Foundation (www.macfound.org/programs/digital-media-learning-research)

National Home Education Research Institute (www.nheri.org)

National Center for Education Statistics (nces.ed.gov)

New Media Consortium's Horizon Project (www.nmc.org/horizon-project)

Virtual Schools and Online Learning

Always Icecream (www.always-icecream.com)

Athena's Advanced Academy (www.athenasacademy.com)

BrainPOP (www.BrainPOP.com)
Calvert School (www.calvertschoolmd.org)
Clever Dragons (www.clever-dragons.com)
Connections Academy (www.connectionsacademy.com)
Dreambox (www.dreambox.com)
Duolingo (www.duolingo.com)
Easy Peasy (www.allinonehomeschool.com)
Florida Virtual School (www.flvs.net)
K12 (www.k12.com)
Khan Academy (www.khanacademy.org)
ProtoSphere (www.protonmedia.com)
Time4Learning (www.Time4Learning.com)
WiloStar3D (www.wilostar3d.com)

Online Safety & Parental Control Tools

Android Parental Controls (www.android.com)
Mac Parental Controls (www.apple.com)
Microsoft Family Safety (familysafety.microsoft.com)
iOS Parental Controls ("Restrictions") (support.apple.com/kb/HT4213)
Net Nanny (www.netnanny.com)
Nintendo DS/DSi (www.nintendo.com/consumer/systems/dsi/en_na/settingsParentalControls.jsp)
Nintendo Wii (en-americas-support.nintendo.com/app/answers/landing/p/604/c/628)
Online safety contract (www.fosi.org/images/stories/resources/family-online-safety-contract.pdf)
Playstation (support.us.playstation.com/app/answers/detail/a_id/5097/~/ps4-parental-controls)
Xbox (http://support.xbox.com/en-US/my-account/security/xbox-one-manage-privacy-and-online-safety)

Games

Board games: *Agricola, Bananagrams, Chess, Compounded, Elementeo, Equate, Math War, Settlers of Catan, 7 Days in Africa, Munchkin, Once Upon a Time, Pandemic, Principato, Timeline, Resistance, Risk, Warhammer.*
Cell Craft (www.kongregate.com/games/cellcraft/cellcraft)
DragonBox and Element (www.wewanttoknow.com – algebra and geometry)
Gamestar Mechanic (www.gamestarmechanic.com)
iCivics (www.icivics.org)
Kerbal Space Program (www.kerbalspaceprogram.com)
Ko's Journey (www.kosjourney.com)
Mathtoons (www.mathtoons.com – upper level math)
Minecraft (www.minecraft.net)
Minecraft related sites (www.minecraft.edu, www.minecrafthomeschool.com, www.autcraft.com, www.qcraft.com)
Mission US (www.mission-us.org - history)
Prodigy (www.prodigygame.com – elementary math)
Reach for the Sun & You Make Me Sick (www.filamentgames.com)
Timez Attack (www.bigbrainz.com)

Games (reviews collections)

Board Game Geek (www.boardgamegeek.com)
Common sense media (www.commonsensemedia.org)
Educade (www.educade.com)
Educational App Store (www.educationalappstore.com)
Hoagies Gifted (www.hoagiesgifted.org/gifted_apps.htm & www.hoagiesgifted.org/software.htm)

Homeschooling Sites

www.a2zhomeschooling.com
www.currclick.com
www.gameschooling.org (the author's website)
www.giftedhomeschoolers.org
www.homeschool.com
www.homeschoolbuyersco-op.org
www.howtoworkandhomeschool.com
www.sukiwessling.com
www.welltrainedmind.com
(Local facebook groups and email lists are additional sources of information for homeschooling families)

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CHAPTER 8

Helping Parents Understand the Positives and Negatives of Video Game Use

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Key Summary Points

1. Much of the interest from parents on video games has focused on the positive and negative behaviors, knowledge, and skills that kids learn from video games.

2. The research has often focused on negative behaviors (e.g., do video games cause people to become violent?) or positive outcomes (e.g., can people learn content more efficiently or effectively with video games?).

3. Perhaps the best advice for parents is to get involved in their children's gaming. Involvement here does not mean simply purchasing or being unwilling to purchase a game but actual engagement with gameplay or conversations about the game.

Key Terms

Parents
Learning
Teaching
Violence
Engagement

Introduction

Parents often wonder about the impact of video games on their children. They might broadly consider whether games are good or bad, or they might do a more in-depth search to find how to best engage with their child around the topic of video games. Parents often turn to the Internet for answers and find two seemingly irreconcilable responses. The first set of results provides links filled, in graphic detail, with the connections between unwanted behaviors (such as violence or aggression) and playing video games. For example, one website begins a conversation about video games by referencing two high-

profile school shootings (Wilkins, 2013). The other typical result provides the polar opposite—websites that beg parents to pay closer attention to the potential learning benefits of video games. For example, one website cites research that kids who play video games are happier and more successful as adults (Trunk, 2013). There are three major problems with this dichotomy.

Problem One: Going to Extremes

First, parents who have children that play video games might feel a tension between what they feel their children want to do (and what is popular in their kid's culture), and what they are being told by non-gaming advocates. They are told that playing video games will lead to aggression, violence, and obesity. If these sources are to be believed, the end result of playing games will be a child that harms herself and potentially hurts others. Parents do not want to intentionally harm their child, yet certain headlines about video games make it seem like letting them play video games will do just that. Therefore, many parents may overreact by needlessly limiting video game use.

On the other hand, some parents buy so heavily into the notion that video games can be potentially useful, that they ignore the findings about how and when such games can be used for learning and when they should not be used. In the worst case scenarios, they use games as babysitting tools, or fail to get involved in any substantial way in their child's gaming experience (including game choices) because they have read that games can be good for a child's cognitive development (Olson, 2010).

The truth is that neither of the two results is 100% accurate. Not all games or gameplay experiences lead to unwanted behaviors and not all games are useful for cognitive, spiritual, emotional, or physical well-being. Research has provided evidence that under some conditions, gameplay can lead to unwanted behaviors. Often these conditions include unsupervised play of games that exceed the age and content rating of the player (Anderson & Warburton, 2012). Research has also suggested that playing video games can lead to cognitive growth (Annetta, Minogue, Holmes, & Cheng, 2009) and healthy physical behaviors (Lyons, Tate, Komoski, Carr, & Ward, 2012), particularly when done in moderation and with the oversight of a parent or mentor.

Problem Two: Parent Polarization

A second problem with the dichotomy is that it polarizes the parent. In this debate, the parent becomes the external gatekeeper deciding whether a child plays video games, what video game to play, for how long, or with whom, for example. This is problematic because it positions the parent as a non-gamer, and not as a participant in playing the game with the child, or talking to the child about the game. Given the resurgence of platforms and games that are more family-oriented (e.g. *Nintendo Wii*), and given the fact that we now have generations of gamers who are now becoming parents, it is more likely that parents will play with their children. Most pundits, educators, and researchers who provide advice on games, actually suggest that engagement and involvement is a key part of success for parents with video games (e.g. Melnick, 2011). Parents who play with their children are likely to have better outcomes (e.g. behavioral or cognitive). As such, a dichotomy that polarizes the parent is not only counterintuitive but it is also counterproductive.

Problem Three: Product vs. Process

A third problem with this dichotomy of video games being good or evil is that it places too much value or emphasis on the game itself. There is value in how a game is played; for instance, parental co-gaming can change potentially positive or negative outcomes (Ferguson, Olson, Kutner, & Warner, 2010). There is also value in what a software developer or game company does to support parental involvement. For instance, *Lego* has a website dedicated to parents (Lego, 2013). Understanding that video gameplay is a process rather than simply a product can change how we view the relationship between parents, children, software companies, and the games they produce.

Key Frameworks

There are two key perspectives that inform a conversation about parents and gaming. The first relates to the question of "no significant difference" (Russell, 1999). The basic idea behind no significant difference is that if you take a topic, like video games, you will eventually find enough studies that show both the effectiveness and ineffectiveness of the topic. In other words, regardless of whether the topic is violence in video games or cognitive growth through games, if you compared all the studies, you would find overall no significant difference. This can often leave parents, educators, and researchers unsure of the impact of video games.

Game researchers are working to resolve this problem by making sure that more specific research questions are being asked (Ferdig, 2011). Instead of asking a question like, "do video games make children aggressive?," we should ask "under what conditions do video games make children more aggressive?" The first question leads parents to lump all video games together and to assume that they are detrimental to children's wellbeing (Melnick, 2011). Asking the second question leads researchers and parents to understand that there may be certain conditions that impact behavior, and to explore these potential conditions. In one study, researchers found that the nature of play made a difference; girls who played video games with their parents behaved better and had better mental health outcomes than girls who did not (Coyne, Padilla-Walker, Stockdale, & Day, 2011). In sum, a major consideration in parents understanding the impact of gaming is to enhance the specificity of the questions being asked and the conditions that led to positive or negative results.

The second perspective deals with one potential positive aspect of video games: learning. Drawing from the first framework, under certain conditions, video games can help people teach and/or learn. An important question is to ask under what conditions this can happen. Video games can help young learners when parents are involved. Parental involvement is also tied to the design of the game. Gee (2003) developed 36 principles that good games incorporate, and which could be used to design games that encourage learning, to create school learning environments, or by parents in home environment to interact with children around a game. All of the principles are relevant; here are few example principles that might directly relate to this conversation:

1. **"Psychosocial Moratorium Principle:** Learners can take risks in a space where real-world consequences are lowered" (p. 67). Parents should look for games that challenge children while encouraging them to explore new ideas and concepts.
2. **"Identity Principle:** Learning involves taking on and playing with identities in such a way that the learner has real choices (in developing the virtual identity) and ample opportunity to meditate on the relationship between new identities and old ones. There is a tripartite play of identities as learners relate, and reflect on, their multiple real-world identities, a virtual identity, and a projective identity" (p. 67). Parents should look for games that allow children to self-explore and to try out new roles, likes, and abilities.
3. **"Self-Knowledge Principle:** The virtual world is constructed in such a way that learners learn not only about the domain but about themselves and their currhrn atentas

Case Study One: Children's Motivations Research

Cheryl Olson (2010) wrote a paper for the *Review of General Psychology* titled, "Children's Motivations for Video Gameplay in the Context of Normal Development." In the paper, she described a research study where she surveyed 1,254 middle school children to determine their motivation for gameplay. She found three overarching concepts that motivated children to play games: 1) social motivations; 2) emotional motivations; and 3) intellectual and expressive motivations.

Social motivations included the use of games as a focus for interacting with others. This included the enjoyment of competition. However, it also was as simple as having something to discuss with others. Playing games together or talking about games gave children opportunities for leadership, making friends, and teaching each other.

Emotions played an important role in children's motivations to play video games. In some cases, gameplay gave children a chance to regulate emotions, such as purging negative feelings. In other cases students experienced a sense of flow when playing games (Csikszentmihalyi, 1997). Flow here refers to being enjoyably absorbed by the gameplay.

Intellectual and expressive motivations involved expanding and challenges children's knowledge and perceptions. Children played for the mastery of a game (e.g., to beat it) or to experiment with different identities; they could change race, gender, or attitude (e.g., some wanted to be a bad guy) in a non-permanent and safe way. In doing so, they could be creative in their interactions while discovering, exploring, and learning about new worlds.

Olson ended the article with an important conversation about violence and motivation for playing violent games. She writes:

> Our research suggests that game consoles and computers in children's bedrooms increase the odds that they will spend more time with electronic games in general and games with violent content in particular (Olson et al., 2008). Routinely keeping game systems in common areas of the home allows parents to set sensible limits on play time, and to monitor for negative effects such as increased anger, irritability, or aggression. In our survey of seventh and eighth graders, 54.8% reported that they never played electronic games with a parent, and another 23.9% rarely did so. These data were collected in late 2004, so it is likely (with the advent of more family-friendly game systems such as the Nintendo Wii) that more parents and children play together today, as suggested by industry surveys (Ito et al., 2008). Asking your child to teach you to play a video game—reversing the usual parent– child role—may be good for parent–child relationships (Villani, Olson, & Jellinek, 2005). It also implies respect for the child's interests and skill in a culture that often dismisses video games as a waste of time.
> (Olson, 2010, p. 186).

Olson (2011) wrote an article aimed at parents for Parents.com called, "8 Reasons Video Games Can Improve Your Child." She uses her survey data as well as other research to suggest that video games:

1. Teach problem-solving skills and creativity
2. Inspire interest in history and culture
3. Help kids make friends
4. Encourage exercise
5. Let kids share the joy of competition
6. Give kids a chance to lead
7. Provide an opportunity to teach
8. Bring parents and kids together

Key Findings

In a chapter titled "The Impact of Violent Video Games: An Overview," Drs. Craig Anderson and Wayne Warburton wrote about both the potential positive and negative impact of video games (Anderson & Warburton, 2012). They suggested pain management, coordination, spatial cognition, pro-social behavior, education, and exercise were potential positive outcomes of games. Potential negative outcomes included addiction, attention deficits, school performance, and increased aggression. They summarize:

> Using the food metaphor can be helpful for parents and professionals when it comes to advising children on how to use media in a beneficial way. Through school education many children are interested in healthy eating and this can be extended to maintaining a healthy media diet. For example, children could be told that, as with food, there are media that are good to consume regularly (in moderation), media that are for infrequent consumption and media that children should avoid. Helping a child to self-regulate what they watch and hear in the media can be very important to a child's development in this media saturated world.
> (Anderson & Warburton, 2012, p. 77-78).

It is also worth noting that much of the research on video games has focused on use. Parents and educators who are considering video games pay attention to game consumption, rather than creation. Parents want to know the impact or potential outcomes of their children playing commercial or education games; however, there are important findings related to student game development. Research has suggested that having kids develop games through tools such as *Scratch* (2006), *Greenfoot* (2006), and *Alice* (1999), provides access to programming skills and content acquisition. In one study, Papastergiou (2009) found that game development was "both more effective in promoting students' knowledge of computer memory concepts and more motivational than the non-gaming approach" (p. 1).

Finally, findings suggest positive outcomes when parents are involved in their child's game play (Anderson & Warburton, 2012; Melnick, 2011; Schott & van Vught, 2013). Positive outcomes here refer to growth of cognitive or affective abilities, skill improvement, and improved behaviors (e.g., communication). Engagement and involvement could include actually playing the game with the child. However, it also includes having parents educated about the games their child is playing. It involves limiting the amount of time played each day (e.g., supporting moderation) and keeping consoles in public areas. It may include suggesting or promoting pro-social and educational video games in addition to other titles. Finally, it includes having conversations with the child. These conversations are not just about the dangers of game play, but include sharing a genuine interest in listening to the game play details from a child (e.g., how their character is fairing in an virtual world).

Case Study Two: Research on *Grand Theft Auto IV*

Schott & van Vught (2013) wrote an article titled, "Replacing Preconceived Accounts of Digital Games with Experience of Play: When Parents Went Native in *GTA IV*." The authors made the argument that perhaps many of the societal problems and/or perceptions of gameplay were due in large part to the fact that parents had not ever or rarely played those games. Given this argument, the authors set out to have parents actually engage in gameplay.

> It was postulated that should a user/nonuser distinction emerge, it should carry forward implications for the way in which games are publicly understood, managed, and regulated. The current research thus sought to address the potential shortcomings of the prior research by examining what might be gained from engaging participants more directly in an analysis of the impact and appropriateness of game text by activating and experiencing the text directly through play. Play required participants to act as agents, responding to the conditions of the game environment.
> (Schott & van Vught, 2013, p. 2-3).

Thirteen female and seven male participants engaged in the research study. Given the relative unfamiliarity with video games (regardless of their initial self-description), participants were given an opportunity to explore the rules, objects, and interactivity of the game through a sandbox environment with pre-determined goals and outcomes. Once those objectives were met, parents were asked to complete the "Ivan the Not So Terrible" mission in *Grand Theft Auto IV*. The *Grand Theft Auto* video game series is a set of games engaging the player in a fictional world. The player takes on the role of a criminal who moves up in the criminal underworld by completing various missions, such as stealing cars, transporting stolen goods, killing people, and avoiding police detection for one's crimes.

The researchers found that most of the participants knew of the game because of the negative headlines and the controversy surrounding it. They also reported that all of the participants found the game to be much more enjoyable than they had first expected. Many struggled with the realism of the game (e.g., wondering if and why they should stop at a red light). In the end, many of the participants found a new appreciation for a game they were prepared to dismiss out-of-hand.

The experience of playing *Grand Theft Auto IV* did not confirm or reinforce participants' negative expectations of the game as being a highly violent, sexually explicit, and verbally abusive experience. Instead, playing it

> prompted a radical positive reevaluation of the text and what constitutes an R18-classified game for all participants (gamers and nongamers). Experience prompted parents to acknowledge the sophistication of the game as a potential reason for its R18 classification, as the participants discovered how one needs to be able to comprehend the irony, satire, and intertextual references employed by the designer…Despite the disconnects, frictions, and clashes that are especially apparent in the existing concerns regarding games, parents remain well placed to better support their young players in developing forms of "critical" digital literacy, that is, "cultivat[ing] the habit of uncovering and critiquing both [players'] own constructed and contingent experiences and resulting worldviews, particularly those that influence society's relation[s] with technology"
> (Duffelmeyer & Muffoletto, 2001 quoted in Schott & van Vught, 2013, p. 9-10).

This type of research (parent participation) is important for at least two reasons. First, it provides parents with a deeper understanding of the literacy practices of their children. Second, it promotes parents' understanding of the importance of getting involved in the gaming practices of their children.

Assessment Considerations

Assessment considerations should focus on three aspects. First, researchers should ensure that they are asking the right kinds of questions. Asking which medium works better will often result in no significant differences or will produce findings that have no real world value over time. Researchers should focus instead on understanding the conditions by which certain games impact various factors. Conditions here refer to variables like the audience, the game type, the length of gameplay, the age, and the parental involvement.

The second factor that needs to be addressed is the survey method. Research using both quantitative and qualitative methodologies is useful in broadening the field. However, there has been a tendency to focus on using surveys of perceptions, rather than actual studies on the use of games. Researchers ask how parents or students feel about a certain topic; for instance, a recent survey found that 77% of parents blame video games for exposing children to violence (Commonsense Media, 2013b). Although

these surveys are potentially useful in exposing questions that deserve further exploration, they are not the end product of needed research in this field. More in-depth studies need to be conducted that explore cognitive and social-emotional outcomes of video gameplay and use.

The final factor is the audience involved in the research. Researchers have traditionally examined children's use of video games. Any interactions with parents have typically been to include demographics or to include surveys about their perceptions of video games (or the outcomes of the earlier research). Work has been emerging that has portrayed video game use from a family systems approach where parents are involved with the gameplay. This type of work will yield new understanding into how developers might build interactions between and within family structures (e.g. Stevens, Satwicz, & McCarthy, 2008; Bryant & Bryant, 2006).

Future Needs

Much of the research on video games and children has focused on the questions that parents want answered. They want to understand the good (can my children learn from video games?) and the bad (will my children learn negative behaviors from playing games?). There has also been some work done on parents' perceptions of video games and gameplay (e.g., De Vet, Simons & Wesselman, 2012). However, more research is needed that examines parents' interactions with children during gameplay. This is critical for at least two reasons. First, newer video game systems like the *Nintendo Wii* have been aimed at a multi-generational audience. It is not uncommon for grandparents to play games with their grandchildren. Second, there is a generation of gameplayers that are now grown up and having children of their own. Many of these children watch their parents play and are often invited to play with them (e.g., Melnick, 2011). Further research that attempts to answer the original questions about learning might be better understood by examining the nuances of family gameplay. Such research could draw on past and current studies on non-electronic games (e.g., Kritzer & Pagliaro, 2013). Schott & van Vught (2013) provides an exemplary model of this in their parent participation of *Grand Theft Auto IV* (2008).

Case Study Three: The Entertainment Software Rating Board (ESRB)

The Entertainment Software Rating Board or ESRB was established in 1994 as a non-profit entity by the Entertainment Software Association (ESA). Its self-defined mission is to empower consumers and parents in making informed media purchasing and use decisions. The ESRB is responsible for assigning age and content ratings to video games and other media. The most recent iteration of their rating system includes an overall rating category, content descriptors, and a designation for interactive elements (see: http://www.esrb.org/ratings/ratings_guide.jsp).

The following are the overall rating categories:

1. EC: Early Childhood
2. E: Everyone
3. E10+: Everyone ages 10 and up
4. T (Teens): Ages 13 and up
5. M (Mature): Ages 17 and up
6. A (Adults Only): Ages 18 and up with intense violence, graphic sexual content, or gambling with real currency
7. RP: Rating Pending

The games also have content descriptors that may contain one or more of the following (some preceded by the word *mild*): Alcohol Reference, Animated Blood, Blood, Blood and Gore, Cartoon Violence, Comic Mischief, Crude Humor, Drug Reference, Fantasy Violence, Intense Violence, Language, Lyrics, Mature Humor, Nudity, Partial Nudity, Real Gambling, Sexual Content, Sexual Themes, Sexual Violence, Simulated Gambling, Strong Language, Strong Lyrics, Strong Sexual Content, Suggestive Themes, Tobacco Reference, Use of Alcohol, Use of Drugs, Use of Tobacco, Violence, Violent References. Finally, parents can use the ratings to explore the interactive elements of a game, such as how much information is shared (e.g. personal or location), how much users interact (e.g., downloads or communication), and how those interactions are rated.

The ESRB is dedicated to further supporting parents by providing a collection of resources on their website. These resources include a video game search mechanism, a collection of websites geared toward family-friendly games or family-based reviews, mobile tools, information on parental controls, resources for online safety, a family discussion guide, and a section on tips for parents. In addition to checking their website and checking reviews, the ESRB encourages parents to get involved in their children's gaming. They ask parents to monitor situations where the ESRB cannot rate gameplay, such as online gaming environments or games where players install mods to the game.

The advice for parents to continue to monitor their child's use has been reiterated by existing research. For instance, Haninger & Thompson (2004) evaluated games rated "T" by the ESRB. They attempted to determine whether the rating systems were accurate in their portrayal of the actual gameplay. The authors reported that: "a significant amount of content in T-rated video games that might surprise adolescent players and their parents given the presence of this content in games without ESRB content descriptors. Physicians and parents should be aware that popular T-rated video games may be a source of exposure to a wide range of unexpected content" (Haniger & Thompson, 2004, p. 856). This content could include communication with other players that might not be appropriate for the teen age group. In sum, the ESRB is a great initial resource for parents, but it should be one of many factors in parents' decision-making processes for whether a game is appropriate for one's child.

Best Practices

There are a number of best practices for parents, and all of them revolve around the concept of engagement. Engagement here means getting involved in the video game practices of your child. This can involve actual gameplay, but it also means understanding which game your child is playing and talking to them about their gameplay. Listed below are best practices as suggested by authors and/or organizations (Kuchera, 2010; ESRB; 2013; Commonsense Media, 2013a; Olson, 2010).

1. **Game with your child.** This could literally mean playing a game with your child. However, it also involves being aware of the games that your child is playing. And, it includes talking with your child. These conversations should focus on maintaining safety while gaming and the importance of sharing things in the game or gameplay that make the child uncomfortable (e.g. language or bullying). To build a good relationship to support this communication, gaming with your child means being willing to listen to what adventures they completed or what level they are on.
2. **Set limits.** There are potential positive gains obtained by gaming. As with everything in life, gaming should be done in moderation. Parents need to set limits and to help the child set limits. This can be more easily achieved if gaming equipment is in a public space. Parents should also be on the lookout for negative behaviors during or after gameplay.
3. **Go beyond just checking game ratings.** Many of today's games include interactions with other players. In these situations, it is nearly impossible for the ESRB to give a proper game rating. Parents should begin with the box to make sure the game and game content is appropriate for a child's age and intellectual and social maturity. However, they should continue to monitor their child's play to ensure safety for their child.

Resources

Articles

Focus on the Family (2013). Parents' Guide to Video Games. http://www.focusonthefamily.com/parenting/protecting_your_family/parents-guide-to-video-games.aspx

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Websites

8 Reasons Video Games Can Improve Your Child (http://www.parents.com/kids/development/benefits-of-video-games)

Commonsense Media gaming tips (http://www.commonsensemedia.org/advice-for-parents/gaming-tips)

Entertainment Software Rating Board (http://www.esrb.org)

ESRB helpful tips for parents (http://www.esrb.org/about/parents_tips.jsp)

Raising a Healthy Gamer: Seven tips for parents (http://arstechnica.com/gaming/2010/12/parenting-and-video-games/)

Programming Tools

Alice (http://www.alice.org/)
Greenfoot (http://www.greenfoot.org/)
Scratch (http://scratch.mit.edu)

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CHAPTER 9

Policy Considerations

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Key Summary Points

1. Interactivity is a key driver behind current policy toward video games everywhere, from the national all the way down to the classroom level.

2. Creating an environment that is altogether learner-centered, knowledge-centered, assessment-centered, and community-centered maximizes effective learning potential and should be considered during the creation as well as implementation phases of policy.

3. Best practices are rooted in public awareness, collaboration, and social responsibility to self-regulate game usage.

Key Terms

ESA
EMA
ESRB
Interactivity
Learner-centered environments
Knowledge-centered environments
Assessment-centered environments
Community-centered environments

Introduction

With each passing year, video games become a larger part of society and are, by now, an inevitable component of childhood. Therefore, there are questions abound regarding the appropriate social policies for video games that did not exist for previous generations. This chapter will examine the policies that affect child consumers directly, particularly those associated with childrens' relationship with video games, including which games they have access to and how they are allowed to engage with them.

This chapter includes synopses of some of the latest state regulations that have limited child access to video games regarded as "mature" by the Entertainment Software Ratings Board (ESRB). Additionally, it reviews court cases that have been filed in response to these state regulations and claiming that they violated the Constitution's First Amendment.

In addition, the chapter will discuss the concept of interactivity, a learning framework that has guided video game policy at the state and national levels as well as in the classroom. This is followed by a framework for implementing effective learning in academic settings, which is learner-based, knowledge-based, assessment-based, and community-based. Together these two frameworks provide the basis for this chapter's policy considerations, which bring to bear the following questions: What are the most effective ways to integrate video games into classroom curriculum? How can video games be tailored to fit classroom needs? What government policies aimed at policing game use, if any, are viable tools to guide positive video game consumption?

Lastly, this chapter will take an in-depth look at three case studies. The first study is of one New York City school that has a unique policy of incorporating video games into every aspect of the school day. The second is of a publishing company that focuses on game-based learning. The company's policy is to produce quality game-based learning platforms to prepare today's kids for the 21st Century. The third and final case study focuses on one video game modification in particular that can be used to great affect in the classroom and equip children to work well within an open, self-regulating policy environment.

Key Frameworks

Two key frameworks (n)-1.5 (v)-35.3 (i)-5 (e)-8.4 (q)04indful of when discussing the creation of effective educational p
are interactivity and the Bransford et al. (2000) model for successful learning environments, which is explored here as a guide for implementing game-based learning in a meaningful way.

Interactivity

The concept of interactivity is integral 5 (v)-35.understanding video games, along with the culture they foster, and the policies surrounding them. Yet, at least for the past two decades, this term has 5 (e)-8en overused and commonly 4isunderstood. Todd Zazelenchuk (1997) acknowledges this point, as he likens the term

sale of video games deemed violent to minors (under 18). Michigan's act intends to accomplish this goal by prohibiting the sale of video games that are rated by the ESRB as Adult or Mature to anyone under the age of seventeen. Oklahoma's measures, however, go a little further. In this case, the state attempts to decide for itself what constitutes "violence" in a game. Based on this decision, a violent game is, then, not only restricted from being sold to minors but is, also, to be stored out of plain sight at retail locations that carry the product. Both Michigan and Oklahoma's state legislatures use the concept of interactivity to justify the need to regulate video games and not other media sales, such as TV or DVD. Both states believe that due to the interactive nature of video games, consumers take on a more active role in the violent or lewd behavior that is portrayed and, therefore, are affected more than if they were just passively observing this behavior.

The two states maintained this belief in the face of court cases filed against them following the implementation of their video game regulations. In *Entertainment Software Association v. Granholm* (2005) and *Entertainment Merchants Association v. Henry* (2006), respectively, the validity of the detrimental nature of interactivity was called into question, not to mention an entire regulatory framework that would ban speech so readily. In these cases, members of the gaming industry challenged the state policy on the grounds of First Amendment violation. The Entertainment Software Association (ESA) and the Entertainment Merchants Association (EMA) both vied for a more open policy towards video games that would treat the gaming industry equally under the law, providing them with similar rights and privileges allowed to their media counterparts in the movie industry. The new policy would employ the use of the rating system developed by the ESRB for the industry to self-regulate rather than have regulations imposed upon them by the state.

Similar legal battles have emerged all around the country, one even making it to the Supreme Court. This case, *Brown v. Entertainment Merchants Association* (2011), deals with the constitutionality of the California state legislation that banned violent video game sales to minors without a parent or guardian's supervision. The case set a federal precedent on violent video game policy and the perceived effectiveness of the ESRB rating system, as the court ruled that the state of California had no right to restrict video game sales to minors based on their arbitrary value judgments and unsupported claims that the interactivity involved in playing a violent video game causes children to act more violently in the real world. In his decision Justice Scalia writes that "[t]he video-game industry has in place a voluntary rating system designed to inform consumers about the content of games. The system, implemented by the ESRB, assigns age-specific ratings to each video game submitted…[t]he Video Software Dealers Association encourages retailers to prominently display information about the ESRB system in their stores; to refrain from renting or selling adults-only games to minors; and to rent or sell 'M' rated games to minors only with parental consent" (*Brown v. EMA*, pp. 15-16). Scalia goes on to point out that this voluntary rating system regulates the industry quite adequately and, in fact, outpaces both the music and movie businesses (*Brown v. EMA*, 2011, p. 16). Furthermore, California's crusade against violent video games is just "the latest episode in a long series of failed attempts to censor violent entertainment for minors" (*Brown v. EMA*, 2011, p. 17). Herein lies the crux of the decision. Scalia draws

a straight line between the video games of today and past forms of popular media that were once denounced by government officials, such as Saturday morning cartoons, movies, and dime novels. By making this connection the court attempts to show that nothing has changed and that even the concept of interactivity is not novel or applicable only to video games. Scalia writes:

> California claims that video games present special problems because they are 'interactive,' in that the player participates in the violent action on screen and determines its outcome. The latter feature is nothing new: Since at least the publication of The Adventures of You: Sugarcane Island in 1969, young readers of choose-your-own-adventure stories have been able to make decisions that determine the plot by following instructions about which page to turn to *(Brown v. EMA*, 2011, p. 10).

Scalia buttresses this point with an opinion given by a fellow judge in the decision in *American Amusement Machine Association v. Kendrick* (2001), a similar case on violent video games. Scalia asserts:

> As Judge Posner has observed, all literature is interactive. 'The better it is, the more interactive. Literature when it is successful draws the reader into the story, makes him identify with the characters, invites him to judge them and quarrel with them, to experience their joys and sufferings as the reader's own (*Brown v. EMA*, 2011, pp. 10-11).

In this way, Scalia takes the travails of interactivity off of the table, as he explains that even reading is participatory and, thus, would stand to be under fire by California's reasoning.

With all of this being said, interactivity, its meaning and its regularity within one's life experiences, is vital in the Court's reading of California's proposed gaming regulations. However, the Court's definition of interactive, as based upon user participation and ability to manipulate outcomes, would be considered by many experts as insufficient. Chris Crawford (2002), for example, penned a widely referenced definition of interactivity, asserting that the term entails "a cyclic process in which two actors alternately listen, think, and speak" (p. 3). This definition characterizes interactivity as a form of conversation. In this way, Crawford would describe Scalia's summation that great literature is interactive as incorrect. No matter how much a reader is engaged or immersed in a story they are simply reacting to it, even if they can participate in deciding a story's outcome, because the story cannot think, process, or work collaboratively with its audience.

Acknowledging that interactivity has a number of competing definitions, Salen and Zimmerman (2004) give a succinct overview of the tenets of each. But rather than rejecting any given conception, or refining them into a new one, the authors put forth a model that accommodates them all. This paradigm opts for four different modes of interactivity (Salen & Zimmerman, 2004, pp. 59-60), which are delineated below:

1. **Cognitive interactivity; or interpretive participation:** Engagement on the psychological, intellectual, and emotional level between a person and a system. The imaginative interaction between a player and his or her adventure video game is a prime example of this form of interactivity.
2. **Functional interactivity; or utilitarian participatio**n: The interaction between a person and the material elements of an experience. For example, the ease with which a player can press the buttons on a controller or read the text on the monitor.
3. **Explicit interactivity; or participation with designed choices and procedures:** This mode encompasses what is most commonly referred to when people speak of interactivity and describes the choices, occurrences, simulations, and other methods employed throughout the programmed experience of an interactive encounter. It speaks to the active participation that does not occur during non-interactive experiences, such as watching a movie. For example, clicking a link or controlling an avatar.
4. **Beyond-the-object; participation within the culture of the object:** The interaction outside of, yet based upon, the designed system. Usually communal, a prime example of this mode is fan culture, wherein fans come together to produce their own fictions and questions, using the designed system as raw material to create this new reality and level of interaction.

Salen and Zimmerman (2004, p. 59) argue that interactive activities employs most, if not all, of the above modes simultaneously. Additionally, these modes should not be looked at as distinct categories with finite boundaries. Instead, they are fluid in nature, overlapping in any given moment of interactivity and providing unique ways of understanding.

Framework for Implementation

Bransford et al. (2000) provides a framework for designing effective learning environments in his book, *How People Learn: Brain, Mind, Experience, and School*. Under this model, education policies should aim to create an environment centered around learners, knowledge, assessment, and community. Bransford (2000, pp. 151-152) argues that the successful alignment of all four of these environments will allow for the most effective educational setting. A brief synopsis of this schema (Bransford et al, 2000, pp. 131-149) is as follows:

1. **Learner-Centered Environments:** These environments acknowledge the individual learner's culture, knowledge, skills, beliefs, and attitudes. It employs teaching techniques referred to by Ladson-Billings (1995) as culturally relevant, responsive, appropriate, and compatible while aligning with Bell's (1980) concept of diagnostic teaching. Bell's method focuses on what students think of a given task by sensitively discussing their opinions and misconceptions on an issue as well as giving them further scenarios in which they can ruminate and possibly readjust their ideas about the subject. Overall, learner-centered environments diagnose the learner's entry point and work from there, respecting the knowledge a learner comes in with by meeting them at this place.
2. **Knowledge-Centered Environments:** Environments that take seriously what is taught and why it is taught, with a special eye towards what sufficient mastery of a subject looks like, can be categorized as knowledge-centered. This paradigm aims for, not only a learner's acquisition of information but, also, their full understanding of this information and its pertinence. Within this environment a learner's understanding is fostered by teaching in a natural progression so that information does not come off to the learner as disjointed facts to be memorized but, instead, part of a larger, interconnected landscape.
3. **Assessment-Centered Environments:** This type of environment employs two different forms of assessment; those that are formative and those that are summative. Formative assessments provide feedback for improving teaching and learning. An example of this form of assessment occurs when a teacher edits a draft of a paper or presentation. Summative assessments, on the other hand, reveal what learners have garnered by the end of a unit or set of activities and are exemplified by unit exams as well as state sanctioned tests. Environments such as these should assess frequently but not intrusively nor punitively. Instead, assessments can be both formal and informal and should always be learner friendly and for the purpose of further understanding.
4. **Community-Centered Environments:** These environments aim to improve cognitive development by allowing learners to work through problems collaboratively. Notably, community-centered environments do not just encompass the classroom. The paradigm also applies to parents, teachers, administrators, and even their surrounding businesses, regions, countries, and the world. Thus, Bransford vies for an inclusive setting in which learners look to others everywhere as potential collaborators, which fosters a shared sense of ownership in the learning process and communal progress.

When originally conceived, this four-pronged framework did not specifically have a landscape that incorporated video games in mind. At the time Bransford (2000, p. 230) saw the potential for video games as sources of interactivity as well as sites for learner, knowledge, assessment, and community centered environments. However, he believed both the technology industries, researchers, and education policy makers still had a long way to go in creating a communal learning environment of their own from which to harness the potential of video games in an educational setting. Since then, Anderson (2008) has applied this framework to 21st Century technology, specifically online learning. He argues that web-based learning facilitates Bransford's model while simultaneously promoting the framework of interactivity.

Case Study One: Quest To Learn

Quest To Learn is a New York City public school that teaches grades six through twelve. Its integrated curriculum, while compliant with state standards, is rooted in experiential and game-based learning. This methodology has the benefit of educating students in both traditional and 21st century skills.

The school year is split into three trimesters. Every trimester students are presented with new and more difficult "quests," usually games or narrative challenges, that require students to learn new material, share knowledge, reflect, and give feedback for the quest to be completed. This strategy presents information to students in a manner that underscores its utility. The school refers to this method as the cultivation of a "need to know" (Salen et al., 2011, p. 57).

Quest To Learn is partnered with Mission Lab, a group made up of both game designers and curriculum specialists. Mission Lab staff works in the school to help teachers design games and curriculum for the classroom. This model allows for an intersection between the school, nonprofit, and gaming industry spaces, taking principles from each to design a curriculum that is most beneficial to students. This collaboration accords precisely with Donovan's (1999) suggestions to create a culture of collaboration between researchers and educators. In so doing, Quest To Learn's educational approach is driven by scientific Mission Lab's research and Mission Lab's research is guided by Quest To Learn's specific academic needs. Hence, a symbiotic relationship is formed between research and policy while, at the same time, engendering a sense of trust and community. are engendered.

With the help of Mission Lab, Quest To Learn has developed a gaming policy that attempts to change the relationship students have with games. Students learn to relate to games not as products they consume, but rather as tools they manipulate. The school's policy is to present games as a variety of different systems, within a systematic world. For example, certain games are of value to students as "authoring systems" and others as "content systems." There are also manipulating systems, trigger systems, gateway systems, reflective systems, ideological systems, and code systems, to name a few (Salen et al., 2011, p. 85-90). By establishing a policy that requires students to think of games as systems that they control, children not only learn educational content, but they also learn to game responsibly. In this way, the Quest to Learn policy helps children orient themselves inside of a national policy framework that is trending toward openness and wide availability of games deemed to have inappropriately violent or sexual content by some.

Key Findings

Based on the frameworks for interactivity and implementation provided in the previous section, there are three areas of pertinent research findings to consider: (1) effects of interactivity; (2) success of the current ESRB rating system; and (3) key needs of the education community.

Interactivity

Due to its common usage and invocation in policy defining court cases like Brown v. EMA, a wealth of studies have been conducted to assess the effects of interactivity on the learning process. Studies done by the Vanderbilt Learning Technology Center on how math students respond to the integration of interactive adventure games into their curriculum found that students who played the interactive games had superior comprehension and complex problem solving skills along with a more positive attitude towards academic challenges when compared to their peers who were not exposed to such interactivity (Pellegrino, 1991). On the other end of the academic subject spectrum studies have shown that interactive multimedia can be used as effective tools to teach foreign languages, as their use in the study of vocabulary increases both word attainment and recall (Lin, 2015). Additionally, interactivity has been proposed as a way to increase learning outcomes for the distance and e-learning communities. For example, Palacious (2013) found that when e-learning systems incorporate interactivity the learning experience is enhanced. He observes that cognitive ability is increased often in the form of memorization or comprehension of the lesson's message.

With all of these studies demonstrating the positive effects interactivity can have on the learning experience it seems to suggest that perhaps those seeking to implement state policies to ban the sale of violent video games to minors are not so misguided. One could argue that it would seem to follow from the studies cited that since interactivity increases learning outcomes one might more readily learn violent behavior if they were practicing it in a violent interactive game. Yet, many studies have revealed that there are no grounds for the claim that violent acts and the playing of violent video games are related. The following are just a few examples pointed to by the ESA (2014) that go into proving this point:

- Lawrence Kutner and Cheryl Olson's *Grand Theft Childhood: The Surprising Truth About Video Games and What Parents Can Do*
- The work of Christopher Ferguson, Stephanie Rueda, Amanda Cruz, Diana Ferguson, Stacey Fritz, and Shawn Smith, entitled *Violent Video Games and Aggression: Causal Relationship or Byproduct of Family Violence and Intrinsic Violence Motivation?*
- Christopher Ferguson and John Kimburn's study, *The Public Health Risks of Media Violence: A Meta-Analytic Review*

Additionally, listed below are a number of studies that found the research and common claims supporting a connection between violent acts and violent video game usage to be faulty and bias-ridden. These studies are used by the ESA (2014) to further undercut video game alarmists and hyper-regulatory policy advocates.

- Thomas Grimes, James Anderson, and Lori Bergen's *Media Violence and Aggression: Science and Ideology*
- Karen Sternheimer's *Do Video Games Kill?*
- Beth Donahue-Turner and Amiram Elwork's *Constitutional Kombat: Psychological Evidence Used to Restrict Video-game Violence*
- Raymond Boyle and Matthew Hibberd's *Review of Research on the Impact of Violent Computer Games on Young People*

At first glance, the above findings, revealing no connection between engagement with violent interactive video games and users themselves learning to act violently in the real world, seem anomalous. It begs the following questions: How powerful is interactivity really? If it increases information attainment and recall how is it said that violent video game users are not attaining and recalling violence? Finally, why are states using interactivity as a basis to restrict certain video games if it does not cause users to learn and internalize the behaviors they employ? A recent study (Delen, 2014) seems to answer these questions, as it finds that interactive environments improve self-regulation skills among users. Moreover, interactivity has been shown to increase user mindfulness (Visser, 2000). In this way, it becomes clear that policy makers should not be afraid of video games. Instead, they should focus on promoting an environment that engages with video games and all media content, for that matter, with a thoughtful eye.

ESRB Studies

Recent surveys taken by the U.S. Federal Trade Commission, the Henry J. Kaiser Family Foundation, and Peter D. Hart Research Associates have all buttressed the Supreme Court's decision in *Brown v. EMA*. These studies have shown that the parents of video game users not only understand ESRB ratings, but also take them into account, and find them to be helpful.

- **Peter D. Hart Research Associates Findings:** The ESRB commissioned a survey of its own to understand the effectiveness of its rating system. This survey ("Parents Increasingly Using ESRB," 2007), conducted by Hart Research Associates, collected data from over 500 parents of children ages 3 through 17 who play video games. It found that a majority of parents use ESRB ratings to regulate what their children play. More specifically, 94% of parents find the ratings helpful and 91% believe such ratings to be accurate. Overall, the survey revealed a positive trend in the gaming world, as attitudes towards ESRB ratings are steadily improving and have never been better.

- **U.S. Federal Trade Commission Findings:** The Commission (2007) concluded that the video game industry outpaces both the movie and music industries in three fundamental ways: (1) disclosing rating information in a prominent and comprehensive manner; (2) avoiding marketing games rated "mature" by the ESRB to children; and (3) restricting the sale of "mature" games to children in retail settings.
- **Henry J. Kaiser Family Foundation Findings:** After a national survey of over 1,000 parents of children ages 2 through 17 in conjunction with six focus group meetings around the country, the Kaiser Family Foundation (Rideout, 2007) found that the majority of parents are very concerned about the amount of sex and violence in the media and would support government policies to ban this content from being aired on television. However, the study also reported that most parents believe that they themselves are doing enough to monitor their children's media usage and that they have more influence on their children than the media does. Furthermore, out of parents who use video game ratings, 58% of them found the current rating system to be very useful. This is a higher percentage of approval than received by music, movie, or television ratings.

Findings from the Education Community

In response to the conclusive frameworks proposed in *How People Learn: Brain, Mind, Experience, and School*, the education research community came together to produce *How People Learn: Bridging Research and Practice* (Donovan et al., 1999). This paper takes into consideration comments from both teachers on the ground and policy makers, in regards to what each group believes it will take to implement the framework proposed by researchers in the original *How People Learn* report.

According to the surveyed teachers (Donovan et al., 1999, pp. 26-27):

- Their relationship with the research community must become collaborative, as open lines of communication between teachers and researchers should be established, along with a foundation of trust.
- Detailed and sustained professional development programming for teachers must be put into place for them to effectively learn and apply the methodologies proposed by the research community.
- The community surrounding the classroom, i.e. parents and administrators, must buy into change. Research-based ideas to be used in the classroom have to be communicated effectively to this larger community, so as to dissuade parental skepticism and complaints often directed to administrators rather than taken up with teachers.

Education policy makers provided researchers with this feedback (Donovan et al., 1999, pp. 28-29):

- Research findings must be delivered in a comprehensible manner, without jargon.
- When research is presented it must be targeted to specific policy making groups because each group has different concerns and jurisdictions. For example, federal policy makers,

governors, state legislators, and school superintendents all have vastly different policy responsibilities and, therefore, separate research needs.
- Research findings should be reported not just as write-ups but directly and through dialogue.

Bridging the Findings

The three categories of research findings that have been described in this section go together to illuminate one larger picture. This being that in today's society, where gaming and digital media are inevitable, they are also beneficial to the learning process. As such, governments and educators should strive to implement policies that do not vilify video games but, instead, promote their proven constructive uses, creating an environment that engages with media in a mindful and productive manner.

Case Study Two: E-Line Media

E-Line Media is a for-profit publishing company that aims to publish games that "engage, educate, and empower" ("E-Line Media," 2014). The company believes that this is the best way to help prepare today's children for the 21st Century. This is based on the recognition of the gap between research that strongly supports game-based learning and the willingness of traditional commercial and educational game publishers to publish such games. E-Line intends to fill this gap by publishing game-based learning products and providing services while, at the same time, investing in game-based projects and educational initiatives.

E-Line has partnered with a number of corporations to publish and support game-based learning platforms that are suitable for use in the classroom, including TeacherGaming, The Institute of Play, HASTAC (Humanities, Arts, Science, and Technology Alliance and Collaboratory), and Fab Lab. These platforms include *Gamestar Mechanic*, *Talkers and Doers*, and *Fab*. It has also worked to create the popular modification of *Minecraft, MinecraftEDU*.

E-Line also provides services to organizations that have the common goal of creating viable games for the classroom. These organizations include the U.S. government, independent foundations, as well as universities. E-Line ("E-Line Services," 2014) services include:

1. **Advising.** E-Line acts as an advisor to organizations looking for help with specific projects, small or large.
2. **Publishing.** E-Line helps companies distribute their products through formal and informal learning channels. It acts as the distributor when its client's product aligns with E-Line's distribution expertise, but.it also finds and manages distribution partners for clients that require a different set of skills.
3. **Executive Producing**. Even where E-Line does not specialize in any aspect of a company's concept, they offer to act as Executive Producers by sourcing outside developers and managing the project through fruition.

4. **Design/Development.** E-Line helps to design and develop concepts that fall within their expertise. If a company's concept involves elements that are not E-Line's forte, they find a developer that does specialize in this area and will bring them in on the project as necessary.
5. **Concept Workshopping**. E-Line works with clients to take concepts from concept to successful support and marketing planning.
6. **Sector Orientation.** E-line helps companies new to game development understand the ins and outs of the game sector generally and the impact game sector, in particular.

E-Line's products and services have made it easier for schools to implement game-based learning policies and for teachers to incorporate gaming in the classroom because a game marked as supported by E-Line means that it was developed in accordance with game-based learning research for the purpose of preparing its users for the 21st Century. Knowing this, schools as well as individual teachers can incorporate E-Line Media supported platforms into the classroom without questioning their academic rationale or viability.

Moreover, E-Line, by simply publishing more game-based learning platforms improves policy by providing more opportunity to measure the effectiveness and viability of these types of games in the classroom and the marketplace, more generally. Commercial and educational game publishers become more comfortable investing in educational games as evidence of market success mounts. In this way, educational game publishing will come into the 21st Century.

Assessment Considerations

There are many levels of assessment that must take place to understand the effectiveness of video game policy. How do we assess policy on the state, community, and school levels? In answering these questions, evaluations of violence and the ESRB rating system should take place. At the same time, measures of satisfaction and academic success among students whose schools have a gaming policy must also be observed.

1. **State level:** One form of assessment that is constantly pointed to by the ESA are the national violent crime rates and how they trend as our policies toward violent video games become increasingly open. Another mode of state assessment is academic testing. Through these tests, academic outcomes of schools that incorporate interactive gaming in their curriculum can be compared to those that do not.
2. **Community level:** Implementation of annual surveys by the gaming industry monitoring parental use and awareness of the ESRB rating system, like those that Peter D. Hart Research Associates conducts, as commissioned by the ESRB, should be continued. Regular surveys monitoring the effectiveness of the same system should continue to be conducted by the Federal Trade Commission and reported to Congress to ensure that the

rating system is truly working and understood among consumers in our communities. Additionally, schools should implement mechanisms to receive feedback from the those they serve. This will assess satisfaction while introducing a dialogue that fosters and extends a sense of community.

3. **School level:** State test results should be monitored by schools that implement a gaming policy to ensure that gaming policy implementation does not detract from learning standards. Frequent individualized conferences and evaluations between teachers and students, such as those conducted at the 6-12 grade school Quest To Learn, can be used to observe how the school's gaming policy is internalized by each student.

Future Needs

There are many surveys and studies that reveal the effectiveness of parental education on ESRB ratings. Less clear, however, is the utility of rating systems for educators as they incorporate games in the classroom. A system of ratings that helps teachers identify games that align with the latest research on effective game-based learning would be useful, as would more peer-learning opportunities among educators. In addition, the field would benefit from more extensive collaboration between researchers and educators to create applicable game-based educational tools. The development of more games based on educational research is needed to provide proof points for policy makers and the video game industry to identify effective teaching methods. Finally, additional research needs to be conducted to reveal the types of games that fully utilize the principles of interactivity to promote the self-monitoring behaviors necessary for child development.

Case Study Three: *MinecraftEdu*

The game *Minecraft* was first developed by Markus Persson of the independent Swedish game development company Mojang. Within a few short years of being released, the game saw much success and is now played by millions of people ("*Minecraft* – Game," 2014).

It is reasonable to conclude that so many people find entertainment and utility through this game because of its sandbox format. This format allows for the user to make of the game what they will, essentially using it as a platform to create an almost endless number of virtual worlds. These worlds are created by the player using blocks made of material found in the real world, such as water, wood, metal, soil, and minerals. The blocks available for the player's use vary depending on the biome within which they choose to operate. Players are able to take their pick of more than ten biomes ranging from the desert to the ocean allowing not just for more creative options, but also for more realistic game-play.

Due to the open-ended nature of this sandbox game and the platform it provides for its users to create life-like scenarios, *Minecraft* became an instant hit among teachers. In response, TeacherGaming LLC and E-Line Media created the modification *MinecraftEdu*. This modification, or mod, is tailored specifically to educators. One custom feature is that *MinecraftEdu* allows an entire classroom to connect

to the server and begin playing easily, whether connected to the Internet or not. It also allows teachers to control the terms of the game and write their own instructions into blocks for the students to use. Additionally, a menu soley accessible to the teacher lets them easily control and monitor the students as they play the game.

This modification has become a favorite of teachers at all levels of education, from elementary to graduate school, because it is extremely user-friendly for teacher and student alike. Moreover, this ease allows an entire classroom to reach its learning goals without being bogged down by platform settings that are not meant for school use and may, thus, pose barriers to working efficiently.

While *MinecraftEdu*'s versatility makes it an attractive teaching tool for many, others have found the sheer amount of possible applications for the game to be daunting. A number of teaching resources have grown up around the game to address these concerns. For example, a community of teachers who use this mod has come together online to share their advice, experiences, and even lesson plans. This valuable information, is shared on the *MinecraftEdu* wiki as well as blogs like The *Minecraft* Teacher and Edutopia's game-based learning blog, to name a few, making *MinecraftEdu* accessible to even the most unfamiliar teacher. Another useful resource is The *Minecraft* Teacher Youtube channel. Through these various avenues for sharing information and teacher experiences, *MinecraftEdu* has sparked a collaboration and dialogue between teachers around the world and has expanded learning communities and fostered the type of knowledge-based, learner-based, and community-based environments that Bransford (2000) advocates for in effective education policies. Moreover, this new community facilitates the switch between non-game-based classroom policies and policies that incorporate interactive gaming. This is because a teacher new to game-based learning can refer to the policies outlined on various *MinecraftEdu* blogs rather than stumbling through the process alone, likely wasting valuable classroom time, in an attempt to acclimate themselves to the new environment.

MinecraftEdu is an effective teaching tool because of its conveniently modified features meant for the classroom. Perhaps more important, *MinecraftEdu* gives children the autonomy to create with ease. Its sandbox format is highly useful in an age where national policy does not restrict access to games based on content. By providing a platform for children to create and learn within a space that is almost completely open by nature, children exercise self-regulation out of necessity. In this way, *MinecraftEdu* fosters mindfulness in children.

Best Practices

Based on this chapter's findings, the following should be taken into account when attempting to create meaningful and equitable policies regarding video games and simulations:

1. **Government should be objective in policy making.** Although this seems like an obvious point, it is an important one. Objectivity is often assumed to be a principle of our fair government system, yet it is rarely practiced. This is evidenced by the continued efforts of state-level policy makers to regulate video games more harshly than other forms of media and ignore the First Amendment in the process. Given that our society is trending toward even more ubiquity in video games and simulations, it is unsustainable and unfair for government policies to reflect a bias against them.
2. **Parents and guardians should know what their children are playing.** The ESRB ratings system has been deemed an effective measure of which games are age-appropriate. This system, however, is only as effective as the parent picking the game for their child makes it. If parents do not take the time to understand the ESRB rating of a game, the whole purpose of the system is negated.
3. **The gaming industry should prioritize consumer awareness**. As with the previous point, if consumers do not understand the ESRB rating system, the system is meaningless. Thus, if the gaming industry wants to maintain relative autonomy by having its own rating policies rather than a government imposed system, it is in its best interest to educate consumers through continued PSAs and programs.
4. **Schools should teach students how to negotiate the media they are constantly absorbing.** The best school policies will teach students not just to consume media, but also to use it analytically and be thoughtful about what they learn from it.
5. **Collaboration should be fostered on all fronts.** Collaboration fosters interactivity and community-centered mindsets, which both increase learning outcomes. Therefore, teachers should make collaboration a key element of the classroom experience. While this best practice seems fairly obvious and commonplace it is important that the cooperative schema goes far beyond just individual classes. Entire school policies should be aimed at fostering collaboration between its students and, also, with their parents, the larger region, and the world. Additionally, researchers must work with these policy makers to inform them of their findings, help implement them in educational settings, and conduct further research that applies to educators' needs. In the same way, video game developers should work with both researchers and policy makers to create the most effective games for learners while meeting the demand for research-backed educational games and providing proof points for further research.
6. **School policies should promote interactive environments that are learner, knowledge, assessment, and community based.** The creation of these environments should take center stage when teachers and administrators are forming new policies that affect the school in any way. Furthermore, they should be revisited regularly while policies are being

implemented to ensure that these environments are being produced and fostered most effectively. This mentality will also help teachers create policies on game incorporation in the classroom, as video games can be vetted for use based on their potential for fostering the targeted environments.

Resources

Websites

E-Line Media's Website (http://elinemedia.com/)
Entertainment Software Association Website: (http://www.theesa.com/)
Entertainment Software Ratings Board Website: (http://www.esrb.org/index-js.jsp)
Entertainment Merchants Association Website: (http://www.entmerch.org/)
Edutopia's Game-Based Learning Blog (http://www.edutopia.org/blogs/beat/game-based-learning)
Institute of Play's page on Quest Schools (http://www.instituteofplay.org/work/projects/quest-schools)
MinecraftEdu (www.minecraftedu.com)
Minecraft Teacher blog. (http://minecraftteacher.tumblr.com/)
MinecraftTeachr YouTube Channel (https://www.youtube.com/user/MinecraftTeachr)
MinecraftEdu Wiki (http://services.minecraftedu.com/wiki/)
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SECTION THREE

Tool and Platform Considerations

CHAPTER 10

Live Action Role-Playing (Larp): Insight into an Underutilized Educational Tool

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Key Summary Points

1. Live Action Role-playing (larp) is a new name for an old, common pedagogical technique used throughout the world for centuries.
2. Educational live action role playing has a specific purpose and pedagogical structure.
3. Larp could be a powerful tool for education. However, more attention, awareness, and study is needed.

Key Terms

Live Action Role-playing (larp)
Role-playing
Educational larp
Edu-larp
Alibi
Table-top
Role-playing games (RPGs)
Intrinsic motivation
Emergent gameplay

Introduction

This chapter examines the use of live action role-playing, or larp, in education. It looks briefly at the difference between a "game" and "play," explains educational larps (edu-larp) and examines the problem of terminology for the practice of larp. Key perspectives and frameworks from around the world are briefly detailed, followed by the few key research findings. Suggestions for further research

are detailed. Tips for running and designing educational larps are offered in the Best Practices section, including a checklist to tell if an edu-larp is working. Finally, three case studies of educational larp are detailed, the first from Danish boarding school Østerskov Efterskole, which uses larp for their entire curriculum, the second an example from Seekers Unlimited, a defunct public charity founded to develop and produce edu-larps, and the third from Barnard College's Reacting to the Past program for history studies. The intent of this chapter is to introduce, or re-introduce, the readers to a pedagogy they are probably familiar with but have not studied. Ideally, educators will recognize and realize the powerful potential of live action role-playing to profoundly affect education on every level.

Key terms

Often when people see the term "educational games" they think solely of digital video games. The top Google hits for "educational games" brings up web-based games, software, apps, or academic theorists arguing the value and efficacy of games in schooling.

Rather than corroborating or contravening educational video games, this chapter presents another learning model that predates digital games. This model, live action role-playing or larp, asks students and teachers to take on character roles in a pre-written adventure and via improvisational acting, create a communal narrative. To make their way through the scenario, the players (students) learn the lessons (curriculum) embedded into the program. This simple act of play pretend has proven to be highly effective in motivating, engaging, and empowering students. With emotional attachment to a story, the lessons learned become much more important to the student, increasing retention and subject comprehension. Although computers and other technologies can enhance the immersion and engagement in an educational larp scenario, they are not required. All that is needed is a little imagination.

Game versus play?

Educational games defined by Wikipedia are "games explicitly designed with educational purposes, or that have incidental or secondary educational value." (Wikipedia, n.d., retrieved March 2, 2015) Using this perspective, many games have an educational benefit: chess exercises spatial, numerical, administrative-directional, and verbal aptitudes (Ferguson, 1995). Poker can improve risk assessment, situational analysis, and reading body language and social cues (Rivlin, 2007) Indeed, Raph Koster in his book *A Theory of Fun for Game Design* postulates that all games, all play, can teach something,

> If games are essentially models of reality, then the things that games teach us must reflect on reality. The very phrase 'it's just a game' implies that playing a game is a form of PRACTICE for a real-life challenge. From playing cops and robber to playing house, play is about learning life skills. (Koster, 2005, pp. 52-53)

The problem is not that games cannot teach, the problem is that not enough games nor different types of games have been used, studied or compared for their educational capability. Furthermore, the bulk of educational game research is currently concentrated on digital games, often ignoring centuries of non-digital games that could have significant positive effects on direct learning—at a fraction of the cost.

To understand larps, it is critical to understand the difference between "game" and "play." They are not the same thing, as a structured game with set rules and clear goals are not required for play. People (and animals) can play without a defined win state, points, stats, levels, or boss enemies. Not all larps are games, but all larps are play; it is inherent in the action. Whether they are a game or play, larps can be an amazing catalyst for classroom engagement, improved student focus, drive, motivation, and even understanding across a wide range of subjects. Additionally, larps exercise the soft skills of time management, critical thinking, teamwork, empathy, and one of the most important, accepting and learning from failure.

What is an Educational Larp?

An educational larp is a pedagogical activity where students take on character roles in pre-written scenarios designed to facilitate self-motivated learning, as well as teach pre-determined knowledge in a contextual framework. General 21st century skills, such as problem-solving, logical or critical thinking, creative and innovative processes, collaboration, communication, visual, scientific and numerical literacy, are robustly exercised. In addition, most educational larps are cross-disciplinary (see Case Studies for examples). Larps are a method for mental exercise through puzzles, dilemmas, open-ended challenges, physical exercise through activities, many with tactile components, and notably, emotional exercise. Through the alibi of a character role that is not you, emotions and social practices can be worked out in a safe, controlled environment. Larps can be considered ego gyms.

Most larp events are designed for entertainment purposes. Although self-discovery, self-improvement, and community building are common benefits of larping (Bowman, 2010), rarely are those benefits the primary purpose of the activity. Educational larps instead have a directive to teach; to create circumstances where students are motivated and empowered to pull the knowledge to them, whether that information comes from a teacher, a peer, a textbook, the Internet, or any other source. The opposite method is traditional education, which pushes information to a student and commands them to regurgitate semi-random portions of that content during a timed test.

Other Labels for Larp

The use of the word "larp" to describe the process of improvised role-playing dates back to the late 13lrovised dOthe -3.5

Larp has also been labeled interactive experience, simulation, experiential learning, theater games, story games, freeform games, live games, murder mystery theater, and more. Many people, these authors included, categorize childhood games such as cops and robbers and playing house as larps. Some of the activities in the preceding list have obvious educational goals: how to win a battle (military wargames), how to win a trial (mock trials), or fostering a deeper understanding of current socio-political events around the world (Model United Nations). Whatever the term, the purpose of teaching something to participants via full body role-playing between humans (not computer programs) is the primary quality of an educational larp. (While table top role-playing games such as *Dungeons & Dragons* use narration solely to tell stories, larps use the entire body and body language, as well as the voice.)

Malik Hyltoft, a founder of the Education Larper's International Network (ELIN) and co-founder of Østerskov Efterskole, a Danish boarding school where the entire curriculum across all subjects for all students is larp-based, writes:

> In order for a larp to be educational, we would demand that the organizers of the activity have a plan for acquisition of knowledge or skills or correction of certain behaviours in the target group through the medium of the larp. So whilst the participants may feel like it is, the activity cannot be solely recreational… To be classified as live action, the human element must be significant. There must be interaction between people as seen in opposition to interaction between person and machine or singularly machine-modified interaction between people… Finally there must be a role-playing component—a narrative element, the assumption of roles by the participants and the general consensus about the rules of engagement which characterizes any game.
> (Hyltoft, 2010, p. 44)

A special note must be mentioned for research larps, where the creator of the event seeks to explore a question or test a hypothesis. Here, the other participants are objects of study. Perhaps the most famous research larp—though not labeled as such—was Philip G. Zimbardo's Stanford Prison Experiment. Although research larps are ultimately useful for education, they are not designed to impart knowledge or create the conditions where participants can learn knowledge—though that may occur incidentally. They are larps, but they are not an "educational larp" by the above definition (see Table 1).

Table 1. Table of the design purpose of different larps.

Design Purpose of Different Larp Forms			
Characteristic	**Edu-larp**	**Research Larp**	**Entertainment Larp**
Larp designed specifically to teach participants	x		
Larp designed specifically to teach designers		x	
Larp designed specifically for fun for all			x

Bowman and Standiford explain some of the variation of role-playing in article titled "Educational Larp in the Middle School Classroom: A Mixed Method Case Study." They say:

> Several forms of experiential learning currently exist in pedagogy. Game-based learning is a form of education that includes systems for success and failure, but may not involve a role. Simulations attempt to replicate real world scenarios in low-consequence contexts and generally involve some degree of role. Drama is a form of theatrical enactment that avoids extensive scripting in favor of role-based, collaborative improvisation into a fictional situation. Role-playing refers to the act of adopting a new role for a long period of time in a bounded, fictional scenario that may or may not resemble mundane reality.
> (Bowman, S., & Standiford, A., 2015)

Case Study One: Østerskov Efterskole's *Serial Killer*

Teachers from this all-larp boarding school in Denmark presented their secrets at the Solmukohta convention in Finland in 2012. In addition, an open house tour combined with a lengthy interview with headmaster and co-founder Mads Lunau plus a few students revealed examples and underpinnings of the school's pedagogical curricular framework, summarized below.

Each school week has a different theme, such as World War II, running a cruise ship, or a CSI-like hunt for a serial killer. All teachers tie their particular subject lessons to the week's theme and they work together on one story. For example, for the police procedural theme, one of the victims was dissolved in a tub of acid. For one class period, the school's chemistry teacher presented a lecture in the chemistry lab about acids, bases, and the pH scale. By the instructor's reckoning, it was like any other lab-lecture in any other school except for one small detail: she did not think of herself as a high school chemistry teacher. Instead she role-played a subject expert called in by the Chief of Police to explain to the detectives (the role-playing students) information related to their case. In addition, she did not think of the students as students who had to take a test on the material, but as dedicated officers tracking a diabolical murderer. Other teachers performed similar roles: the physics teacher was a ballistics expert and the history teacher lent insight on the symbols left by the killer at the scene of the crime.

This simple patina of story on an otherwise mundane lecture changed the engagement and motivation of the students. They paid attention because they wanted to figure out the clues of the case and solve the mystery. Students learned about acids and bases in context—albeit a fictional one based on the real world. They had to apply the information to evidence gleaned from the reports and logically deduct a solution. Teachers could assess their progress by their case file and, ultimately, if they were able to catch the culprit. Only one team would complete this competitive task, but an allowance for failure keeps students focused on the task, and permits them to experiment and learn from their mistakes.

Key Frameworks

Mark Carnes provided the following quote when asked about educational games,

> From Plato through Piaget, philosophers, psychologists, and professional educators have endorsed educational games: that is, using the elements of play, however defined, to promote learning. But usually educational games are recommended for youngsters. The same theorists insist that for teenagers and older students, play should give way to work. This helps explain why so many college students are deeply disengaged from the academic enterprise. (M. Carnes, personal communication, May 22nd, 2015).

While larp perfectly describes what is happening in the classroom, adacemia has been slow to adopt the title. For a thorough perspective of the method and process of education by larp, papers using terms such as role-play, dramatic improvisation, drama-based teaching, active learning, simulation, and similar titles must be considered. However, if one renames larp as structured improvisational role-play or similar terms, many theoretical frameworks addressing its use pop up like a field of mushrooms to a trained mycologist. Following are some of the noteworthy frameworks mentioned or used by edu-larp designers, practitioners, scholars and theorists.

1. **Process drama:** Sarah Lynne Bowman, in her book *The Functions of Role-Playing Games: How Participants Create Community, Solve Problems and Explore Identity* writes ""*Process drama*", a term popularized by Cecily O'Neill, allows instructors to teach a subject matter or moral concept using drama as a vehicle. Instead of passively absorbing the sometimes dry content of school work, Process Drama allows students to enact the course material, making school work more relevant, alive, and unforgettable for students. Process Drama instructors utilize improvisation to create fictional worlds where participants take on roles, answering the important questions of who, what, where, and why a character exists… "Process Drama aids students in learning valuable critical thinking, problem-solving, and teamwork skills." (Bowman, 2010. p.43)
2. **Gamified drama:** Also using drama as the framework edu-larps, Michał Mochocki, Ph.D., an Assistant Professor at Uniwersytet Kazimierza Wielkiego in Poland, reported findings for his DEMOcracy Project, "a civic education programme with larps reenacting 17th century parliamentary traditions in junior high schools" (Mochocki, 2013, p. 64), which reached over 1100 junior high students over the course of 64 larps. His subsequent paper, "Edu-Larp as Revision of Subject-Matter Knowledge," posits that larp is a type of drama education and uses the framework outlined by Brian Way in 1967, indicating that drama in education has had a "long and glorious tradition in Polish educational studies. It has been researched and promoted for over forty years, mostly based on the theories and practices developed in the UK" (Mochocki, 2013, p. 56). The essay also includes structural design notes, troubleshooting tips, and suggestions on implementation of "gamified drama" Mochocki 2013, p. 55) into the classroom, ideally as "final revision of a large textbook unit" Mochocki 2013, p. 55), such as from a history class (Mochocki, 2013).

3. **Situated Learning and Problem-Based Learning (PBL):** In "On the Transmutation of Educational Role-Play: A Critical Reframing to the Role-Play in Order to Meet the Educational Demands," (Henriksen, 2004) Thomas Henriksen presents a theoretical framework for role-play in education as well as a section for applying this framework to education. Notably, Henriksen considers larp as an excellent method of supplementing traditional teachings techniques. He draws heavily from the works of Jean Lave, who, with Etienne Wenger, developed Situated Learning, where learning takes place in the same context to which that knowledge is applied. Henriksen uses Situated Learning as a key to implementing larp for learning. This essay, one of the earliest in the field, was inspired by the increase of educational larps in Denmark.
4. **Progressive Inquiry:** Developed at the University of Helsinki by Kai Hakkarainen, this framework sets up a cyclical investigative process by the students after the teacher has created a context using a fictional or real-world situation. The instructor provides collaborative multi-disciplinary opportunities for students to share information and challenge one another. This framework is similar to the work started in the 1990's by history professor Mark Carnes, called *Reacting to the Past* (RTTP). RTTP is a college level history edu-larp program that began at Barnard College and is now implemented at hundreds of colleges around the world. In an online article for *The Chronicle of Higher Education* entitled "Setting Students' Minds on Fire", Carnes writes "…research shows that the strongest gains come from pedagogies that feature teamwork and problem solving. Experience also suggests that teams work harder when they're competing against one another, and that students learn more when they're obliged to think in unfamiliar ways." (Carnes, 2011)
5. **Self-Directed Learning (SDL):** In 1975 Malcolm Knowles outlined the framework of SDL where students set, strive for, and assess their own educational goals. This is a framework for empowerment, which is one of the four ways that edu-larp works. Malik Hyltoft is one of the most recognized names in educational larps today. As co-founder, with Mads Lunau of Østerskov Efterskole (established in 2006), a Danish boarding school that uses an all-larp curriculum, he has one of the best perspectives on the efficacy of this method of instruction. In his 2008 essay "The Role-players' School: Østerskov Efterskole," he describes the pedagogy used and the school life experienced by the students of the first school in Denmark—possibly the world—to base its teaching primarily on role-playing. A second essay, "Four Reasons Why Edu-Larp Works," discusses four areas where educational larps differ from traditional learning methods, and the advantages to this alternative. The four qualities are:
    a. Distraction (from daily life). (Hyltoft, 2010, p. 45)
    b. Motivation (clear reasons for learning the material) (Hyltoft, 2010, p. 48).
    c. Activity (at an unusually high level, compared to traditional lecture style of teaching). (Hyltoft, 2010, p. 51)
    d. Empowerment (allowing the student to make their own character decisions and live with the results). (Hyltoft, 2010, p. 53)

Østerskov Efterskole is currently one of the very few places where educational larps can be observed on a broad, long-term scale. Unfortunately, there is no control group to compare them to, but they have realized some interesting findings. The school is open to visitors and tours as well.

6. **Experiential Education:** The most obvious and prevalent framework, of course, is experiential education, which has its roots in the words of Aristotle: "for the things we have to learn before we can do them, we learn by doing them," (Aristotle, 350 B.C.E., Ross translation, 1908). The Association for Experiential Education calls experiential education "a philosophy that informs many methodologies in which educators purposefully engage with learners in direct experience and focused reflection to increase knowledge, develop skills, clarify values, and develop people's capacity to contribute to their communities," (Association for Experiential Education, n.d., retrieved March 6, 2015). Almost all edu-larps can be seen as fitting the framework of Experiential Education. Mark Hoge, founder and director of Renaissance Adventures, a youth summer camp that features larp games, summarizes decades of experience in his article, "Experiential Learning for Youth through Larps and RPGs." He writes that participants learn when:
    a. They are wholly engaged (Hoge, 2013, p. 48)
    b. They are frequently empowered to make decisions with consequences (Hoge, 2013, p. 48)
    c. They face "diverse, tough challenges" (Hoge, 2013, p. 49)
    d. "When supported by a physically and emotionally safe environment" (Hoge, 2013, p. 49).

    He continues to explain the differences between larps and tabletop RPGs, the impact of their proprietary system of foam sword fighting, and the potential that "interactive storytelling and role-playing can truly transform traditional education" (Hoge 2013, p. 50).
7. **Hjalmarsson (2011):** In an honors thesis from Edith Cowan University in Australia, Sara Hjalmarsson presents "An Evaluation of Educational Live-Action Role-Play as a Learning Medium for Security Education and Training." She argues that larps can be an excellent methodology for educating potential security professionals in the critical, possibly life-saving skills and competencies of "emotional intelligence, communication skills, reflective learning, judgment, planning, decision making, and ethics." (p. 1) Her thesis goes on to create a framework, "because no formal Edu-LARP model exists today, a theoretical framework was built on related methodologies and learning theories" (Hjalmarsson 2011, p. 1). Hjalmarsson and others are developing more frameworks that use live action role playing. It is an emerging field.

Key Findings

Unfortunately, very little direct research is available for larps in general, and even less about educational larps, at least those with the moniker "larp." But there are a few.

1. Current research on educational larps focuses on student engagement with the material. In Simkins' dissertation, "Negotiation, Simulation, and Shared Fantasy: Learning Through Live Action Role-Play," he summarizes as follows: "Role-play, or role-playing game (RPG), is not often discussed as a tool for learning in classroom contexts…It may not be commonly used…Where it is found, it seems to serve two purposes: It increases interest and engagement in learning, and it creates a more authentic environment for learning," (Simkins 2011, p. 76).
2. Sanne Harder provides one of the few front-line reports on educational larping in "Confessions of a Schoolteacher: Experiences with Roleplaying in Education," (Harder, 2007) where she describes her decade of experience using larp in her classes for the Danish municipal school system called *Folkeskolen* or "people's school", a type of Danish school covering all required education from ages six to 16. Besides detailing a few case studies of her successes and failures, she also offers her opinion on "What types of teaching is role-playing ideal for?" (p. 233) She writes,
    a. "When I choose to use role-play as a means of teaching it is because it is an excellent way of organizing teaching, not because the hobby appeals to its fans. In the 21st century, being a teacher is not about teaching pupils facts, it is about helping them internalize knowledge, skills, and competencies" (Harder, 2007, p. 229).
3. In his essay "Educational Larp: Topics for Consideration" (2012), Yarolsav I. Kot presents a brief but insightful history of educational larps in the former Soviet Union and Belarus, starting in the early 20th century and continuing to this day. He looks to Inokentiy Nikolaevich Zhukov (1875-1948) and Daniil Elkonin (1904-1984) as leading figures in the educational larp movement. He categorizes educational larps into different types and functions, features a table listing "Three Objectives of Edu-larp" (Kot, 2012) and provides tips for developing educational live action role-playing games. In a related essay, "The Larp Legacy of Innocent Zhukov" (Kot, 2013), Kot presents a compelling biography for one of the leading yet overlooked pioneers of larp and the practice of using larp for education.
4. A qualitative and quantitative study conducted by Bowman & Standiford (2013) before and after a semester-long series of science educational larps designed by Seekers Unlimited in 2013, hints at remarkable data: "The qualitative interviews revealed strong excitement for larping, praise for larp's interactive capabilities, and an emphasis on the fun of learning through play. 100% of the 21 participants said they would like to learn through larp in the future" (Bowman & Standiford, 2013).

5. Barnard's Reacting to the Past college level history curriculum has undergone a number of formal double-blind assessment studies across different campuses using the program. The studies show that RTTP students, when compared with those enrolled in other general education courses, improved in certain salient categories associated with learning, including the development of an appreciation of multiple points of view on controversial topics and a belief in the malleability of human characteristics over time and across contexts. Speaking skills also improved substantially (Reacting to the Past, 2014). Their publications are available on their website, listed in References. Each lesson has extensive preparation—reading the primary and secondary sources from history—and a long debrief assessment of the material after experiencing it in a new format different from traditional methods of learning.
6. Despite being an eight-year-old all-larp school, the data from Østerskov Efterskole is limited—the obsession with standardized testing does not exist in Denmark at the same level as in the United States. Still, they have released some qualitative and quantitative information. School founder and former headmaster Malik Hyltoft wrote:

> Østerskov Efterskole prides itself that its students do just as well (and sometimes a bit better) as students from all other [Danish] schools. And this in spite of the fact that 15% of the students have a mental handicap (ADHD and Asperger's), about one quarter is dyslectic and one quarter comes from homes that are socially challenged. All shares are somewhat larger than in the average Danish school…When we started enrolling students for Østerskov, we soon realised that a disproportionally large group of them suffered from dyslexia. This made us look around at the larp environment, and we found that many dyslectics have found a way to prove their ability and smarts through larp, and this of course reflected on the school enrollment… We soon had groups of students suffering from both ADHD and Asperger's, and these students also found ways to thrive in the school.
> (Hyltoft, 2012, pp. 22-23)

All students of every differentiated level were involved in the edu-larps, even if they were not familiar or comfortable with role-playing. They need to participate, if not role-play.

After the completion of Østerskov Efterskole's first year, they discovered their class had a grade average of 7.9, compared to an intended national average of 8.0. Normalization for demographics was not performed for this figure, and in a personal interaction with this author the current Headmaster, Mads Lunau, said that their test scores average one grade level higher than the national level. In addition, Østerskov Efterskole's fluctuation score, which represents the ratio between the number of students enrolled through the year regardless of how may weeks they stayed in school and the number of full tuition years taught by the school, is significant. The higher the number, the greater

the disruption in a student's school year as they withdraw, transfer, etc. Østerskov Efterskole's fluctuation was 1.38 for 2006-2007, and they expected a fluctuation of 1.25 for the 2007-2008 year. The national average is 1.65. "The low fluctuation is a very positive indication of the school's ability to engage the pupils in school life and make them feel like they belong" (Hyltoft, 2008, p. 22).

According to Mads Lunau, within a year the majority of students acquire roughly a 10% grade lift in all subjects from their previous transcripts. The boost for special needs students (e.g., those with ADHD, Asperger's, dyslexia) is even higher. An average of 70% of their students pass the general education qualifier for higher education, compared with 60% at other boarding schools (M. Lunau, personal interview, April 8, 2012).

7. Finally, one anecdotal datum: after running a week-long educational larp at the New Roads school in Santa Monica, California, one of the instructors, Tedd Wakeman, revealed in an interview an interesting observation,

> Too often the teacher is maybe disengaged with the experience that the students are having. If you are standing in front of a group of kids and lecturing to them, you are not really taking in what those kids are experiencing throughout that process. I think for us to be able to take on roles and really play characters not only encourages the students to be more creative in their process but also breaks down that barrier of "is this cool, is this silly" when they see their teachers participating on a grand scale. (Wakeman, 2013, personal interview)

With the teachers taking the material seriously (and fun), the students, too, took it seriously.

Case Study Two: The Great Phlogiston Debate

Inspired by a Royal Society educational larp created by Østerskov Efterskole, Seekers Unlimited produced a larp, *The Great Phlogiston Debate*, for an 8th grade science class. It ran at a charter school in South Los Angeles with a 53% African-American, 46% Hispanic, and 1% Pacific Islander student population (Movoto Real Estate website, school demographics for 2012). One-quarter of their students live below the poverty level. There is one computer lab shared by each class, and although each classroom has two or three computers, they do not all work and the Internet connection is spotty.

Seekers Unlimited produced eight educational larps that were aligned to California Science Standards. Following the Østerskov Efterskole model, each lasted for one week, roughly 60-90 minutes, or the duration of their science class. The teacher was running the scenario, but the designers were often present to observe and, if needed, adjust the larp.

The Great Phlogiston Debate asks students to play real world scientists who were active at the end of the Age of the Enlightenment, during the late 18th century. One of the biggest scientific principles under scrutiny at that time was the theory of phlogiston, a substance that supposedly existed in elements that burned and was released when set afire. The concept was disproved and the correct understanding of combustion was discovered in this time period. The goals of this scenario are to:

1. Introduce science as a developing, changing field to students.
2. Emphasize the importance of research, study, observation, and experimentation.
3. Place the study and presentation of science into a historical context.
4. Impart comprehension of some of California 8th grade science standards.

Students were given characters on Monday after the larp's rules, purpose, and setting were explained. On Tuesday and Wednesday, they researched their characters and theories in the school's computer lab. On Thursday they role-played and on Friday a focused group discussion wrapped up the concepts.

Each student was given a character sheet that contained a short biography and picture of the historical figure, plus a list of theories the character believed. The theories were based on grade-appropriate California Science Standards and related to the historical period. Understanding and explaining these theories were the goals for the character to accomplish during role-play, and goals for the student to complete as a project after role-play. A structured goal system allows both students and teachers to know where they are in terms of understanding the material.

Some of the theories the characters believed were spurious, such as phlogiston and mesmerism. The setting was a garden party hosted by Antoine and Marie-Anne Lavoisier, a.k.a. the Father of Modern Chemistry and his wife, who was invaluable in her husband's research and work. Other historical people in the sciences from around the world populated the party. Due diligence was paid to ensure the person was alive in 1785, and, if possible, in France or at least Europe. To include enough female scientist characters for the girls in class, geographic boundaries had to be stretched. The teacher also had a character to role-play: Queen Marie Antoinette. For male instructors, their role would be Nicolas Caritat, marquis de Condorcet, the Secretary of the French Academy of Sciences.

The students were to mingle and talk to one another about the theories they espoused. Some had specific goals such as listen to all the theories of female characters or all characters from Italy. Most had to present and defend their theory to Marie Antoinette—thus making a scientific argument to the class instructor. Some were out to disprove one another's theories, e.g., one of Benjamin Franklin's goals was to debunk Franz Mesmer's theory of animal magnetism. Historical fact: Franklin and Antoine Lavoisier were commissioned by King Louis XVI of France to do exactly that. All of the talking between students raised the volume of the classroom far above normal. However, this chaos, observed and managed by the teacher in character, was expected. It also indicated peer-to-peer learning. The teacher was not a bottleneck to the knowledge, students could disseminate it among themselves.

Students were allowed to experiment to generate data and improve their arguments. They had to use the scientific method and think of an experiment to test their theory, but no actual experiment was conducted due to limited lab resources. Seekers Unlimited staff improvised the results for the students on paper.

Although enjoyed by all, flaws from this first run were exposed:

1. Students had two theories they had to learn, which was one too many.
2. The vocabulary on the character sheets was prohibitive to some students, particularly ESL individuals.
3. The number of theories discussed meant few were seriously considered or debated, and often students would simply read their theory to one another.
4. Students who held the same theories did not really collaborate as a team for a group presentation of the same theory. Some students did not find their fellow phlogiston believers until late in the larp.
5. Only a few students performed experiments, and they occurred late in the event.

These setbacks can be corrected for subsequent runs, and a number of interesting benefits were observed from this first experience:

1. Female students were exposed to famous, historical real world female scientists, with science presented as a viable career field for women. A few expressed interest in these occupations. Again, these girls were ethnic minorities in a poverty-stricken urban environment.
2. All students learned to appreciate the logic of the scientific method, especially the importance of replicating an experiment to get the same result.
3. Students realized that scientists are not always right, and new evidence can disprove their long-cherished idea.
4. Students would debate ideas and theories together, without teacher involvement (peer-to-peer learning).
5. The teacher could maintain discipline both in character (the Queen), and out of character (teacher).

A rough version of *The Great Phlogiston Debate* is freely available on DriveThruRPG.com. A completed commercial version will be released in 2016.

Assessment Considerations

Although more research on the power of educational larps to engage students (and teachers) is welcome, what is sorely lacking in this field is a comparative study between learning by larp and learning via traditional pedagogy. A school with two classes of the same grade level and standards would be ideal for this kind of experiment. However, factoring out teacher ability and student ability would be required.

One of the most difficult aspects of assessing educational larps is the difficulty of judging someone's role-playing—if a student's character succeeds or fails at a task, does that indicate the student herself knows or does not know the material? One benefit of role-playing a character in a larp is that the real person, under an alibi of "my character does not know" can experiment and fail at their objective without penalty. But another method for assessing that student's real understanding of the concept must be created separately from the points or badges they may gain in the game or larp. This is already a problem for assessing the efficacy of digital games, as evidenced in this study. Subrahmanyam explains that,

> A recent year-long study conducted by the Department of Education (DOE) found no gains on reading and math scores following the use of reading and mathematics software in the classroom. For virtual worlds to live up to their hypothesized learning potential, we not only have to show that they lead to learning but, more importantly, the learning in question must transfer to academic contexts.
> (Subrahmanyam 2009, p. 1079)

Although almost every educational larp demands some kind of presentation by students to the teacher about the material, either written or orally, it is unknown if talking for ten minutes to the teacher about a complicated subject can guarantee the student will fill in the correct bubble on a standardized test.

There is a promising approach to assessment by using evidence-centered design, as explained in the paper "A Brief Introduction to Evidence-centered Design" by Russell G. Almond, et. al.,

> The evidence-centered design (ECD) project at Educational Testing Service (ETS) provides a conceptual design framework for the elements of a coherent assessment, at a level of generality that supports a broad range of assessment types, from familiar standardized tests and classroom quizzes, to coached practice systems and simulation-based assessments, to portfolios and student-tutor interaction…Designing assessment products in such a framework ensures that the way in which evidence is gathered and interpreted is consistent with the underlying knowledge and purposes the assessment is intended to address.
> (Mislevy, Almond, Lukas, 2003, p. 1)

The following steps are recommended for improving educational larp assessment:

1. Recognize that educational larps are not always labeled as such, but they occur frequently in classrooms around the world under other names such as experiential learning, role-playing, etc. Proper identification of this technique will highlight many more programs available for study.
2. Design an experiment of at least one semester to one school year between two similar classes, with one receiving traditional education and the other using educational larps comparing attendance, engagement, test scores, enjoyment, and further interest in the topics.
3. Accept other aspects of evidence of student comprehension in addition to raw test scores such as presentations, essays, peer-to-peer tutoring, and the ability to hold a conversation about the topic with the teacher.
4. Survey educational larp teachers about their personal satisfaction with a larp-based curriculum compared to traditional curriculums.

Future Needs

Larp is barely recognized as a word (see what your spell checker or auto-correct thinks about it), and hardly, at least in America, seen as anything beyond an escapist hobby, even among dedicated veteran larpers. However, with more study and use of larp in classrooms, hard data will be difficult to ignore by critics, academics, academia, mainstream media, and even the most finicky group of all: live action role-players. An interesting study would be to measure the level of engagement and enthusiasm teachers have for using live action role-playing in their classrooms, and how much of that excitement transfers to students, if at all. A longitudinal study of the effects edu-larp has on standardized testing not only in the grade of the student but in their future educational career is long overdue. Hopefully this chapter will spark others to look at, consider, implement, and test whether or not larp is indeed an amazing tool for learning or merely another fad. The field, and future, is wide open.

Case Study Three: Reacting to the Past

Neil Patten and Donna Smith, two communication faculty members at Ferris State University, were searching for ways to further engage their students in their public speech course. Both faculty were exposed to the *Reacting to the Past* (RTTP) pedagogy at the annual conference at Barnard College. RTTP uses role-playing to engage students in historical settings. Each student is given a role to play with a series of victory objectives. These objectives are unique to the character, while some of them overlap into others. These common goals create factions that debate issues at hand. A typical breakdown of a class would have 1/3 for an issue, 1/3 against, and 1/3 indeterminant. Indeterminants are historically correct individuals who had little directly related to the argument, but whose lives could be influenced by the decision. These students play the swing votes in the class.

While there are many published RTTP scenarios to choose from, both faculty agreed on a scenario based on the Chicago 1968 Democrat National Convention. This setting allowed the students to take on large personalities and debate issues such as civil liberties and the Vietnam War. The factions here were very muddy as a mix of Senators, protesters, and media might agree on one issue, but act as fierce rivals in the next. Students played all the various roles. Some students led protest marches and sit-ins, but chose not to escalate to full riots (as was a goal of some of the roles). Media roles were able to report on all the happenings during class and interview a few personalities, uncovering their hidden objectives. Senators made public statements for or against a vote, but the real decisions and opinions only came out in the quiet corners of (fake) smoke-filled rooms.

Students transformed from note-card reading, grade-driven, submissive individuals with small voices into emotionally charged, heatedly debating, fact spewing, engaged participants. This became their game while the faculty sat back and watched history unfold in new ways.

Students were surveyed about their experience with *Reacting to the Past* at the conclusion of the course. Of the 38 students who completed the survey, 97% either agreed or strongly agreed that RTTP was a unique learning experience. 79% either agreed or strongly agreed that their public speaking skills were enhanced while playing RTTP. 87% of the students reported they enjoyed the RTTP experience. Using RTTP in the classroom will continue. The next semester will feature an equal number of sections running RTTP and a traditional classroom curriculum. This will allow the case study to include comparative data.

Best Practices

Following are a list of principles to help in the design and running of educational larps for developers and instructors that have been harvested from a variety of sources.

1. **Create structured goals**. In his essay "The Use of Structured Goal Setting in Simulation" Stephen R. Balzac writes about the "need to keep the participants actively involved and interested in the scenario. A failure to maintain interest means that the simulation or game fails in its purpose" (Balzac, 2013).
2. **Manage the chaos.** A typical educational larp can appear to be complete bedlam. However, this indicates high energy, enthusiasm, and, strangely enough, deep engagement with the material. It is the student who is sitting quietly alone, the preferred state of traditional learning, who may need some extra help.
3. **Encourage freedom and allow for failure.** Educational larps are, at heart, improvisational. So, too, is teaching. Expect the unexpected and allow students to experiment, attempt, and fail. Let them see and experience the consequences of their actions, but be sure their mistakes are reviewed and explained, not criticized or judged. Too often tests and teachers limit the life options of students. If a student tests poorly on one math test, they are pressured toward the humanities. Danish all-larp school Østerskov Efterskole's philosophy is to open all (career) doors for the students and let them close the ones they do not want to pursue. In larping, it does not matter if you lack complete comprehension of general relativity; you can still role-play Albert Einstein. If the student makes a mistake, it will not go on their permanent record. According to Lunau, "[Students] can safely learn failures by wearing the mask of role-playing without getting hurt" (M. Lunau, personal interview, April 8, 2012).
4. **Take it seriously.** Serious games require respect. When dealing with emotions, as role-playing naturally will, the potential for hurt feelings exists. Avoid thinking that because "it is just a game" that the activity is frivolous. Additionally, when students see the teacher makes an effort in costuming, personality affectations, accents, etc., they, too, will follow. If the teacher is dismissive, the students will react in kind and learning could be stunted.
5. **Include time for preparation and, critically, debriefing.** Avoid launching directly into an educational larp, even with students who have participated in the pedagogy before. Prior to starting, be sure to state what the learning goals are, besides salient points about the larp. A post-larp session that reviews the material, answers questions, checks on understanding, and achievement of learning goals is mandatory. The debrief session should be broken into two parts: presentations and summation of the learning objectives, opinions, and critiques of the larp. Students may be very eager to talk about what happened in the larp, or what they would like to do differently. It helps to have that time, but it is far more important that the instructor provides a thoughtful denouement that recaps the knowledge generated in the event, as well as leave questions for students to ponder.

6. **Participation is required, role-playing is not.** Some students will be unwilling or unable to role-play at the same level as the others. Rather than dismiss them to a completely different task, bring them into the teacher's realm as an assistant. Perhaps they can keep track of time in a debate, record the votes of a mock election, hand out materials, or remind other students of rules. Always ask all students to participate, but allow some to have a different role than improvisational character acting. Like everything else, it is up to the teacher's discretion. No one knows a class better than the instructor. If a student lacks proficiency in the primary subject, they may enjoy or possess competency with a secondary topic in the larp. It is easier to integrate multiple subjects than focus solely on one. Educational larps work well in a holistic sense across multiple subjects. It will be easier to learn about astronomy and math while role-playing the trial of Galileo (one of the Reacting to the Past scenarios) in a history larp.
7. **Facilitate cooperation and peer-to-peer learning**. In a traditional classroom situation, learning is a bottleneck contained by a teacher or a textbook written by experts years ago in a city far away. Educational larps should encourage student characters to assist learning merely by allowing one student to talk to another, instead of listening quietly to a teacher. At best, a classroom of 20 students and one teacher becomes 21 teachers in an educational larp.

How to Tell if an Educational Larp is Working

Through 18 educational larps produced over the last four years, one author has discovered eight aspects of edu-larps that may indicate student learning. This is purely anecdotal evidence, and has not been scientifically determined nor peer-reviewed.

1. **Intrinsic motivation:** Students often become intrinsically motivated to learn—not to get a grade or because the teacher assigned them work, but because they want to improve their character or complete the narrative adventure.
2. **Emergent gameplay:** When an issue arises in the adventure and is solved within that same adventure, in what is called emergent gameplay, student attention and personal investment is very high.
3. **Student empowerment:** When students are empowered to alter the rules of the educational larp, their involvement increases. In one educational larp about Ancient Mesopotamia, a student on his own time and volition researched his role as a priest and presented a case to the teachers as to why priests should have a higher income. The teachers agreed and the priests' income rose—this decision and implementation took less than five minutes. How long would it take an educational video game to change its program based on the unexpected research of a student?
4. **Cognitive and affective learning:** Student learning can often be on a deep conceptual level, not just cognitive, but affective (the emotional aspect), and even, to some degree, the psychomotor realm. One part of the Ancient Mesopotamia scenario asked students to design cuneiform symbols for different trade goods. They were given real clay and

styluses (pencils) with which to work. When confronted with the arduous task of drawing a fish, one girl said “We don’t have to make it look like a fish, we just have to all agree that what we draw means fish.” (Anonymous 6th grader playing Seekers Unlimited’s “Ancient Mesopotamia” edu-larp). This realization about symbols and written language arose because students were having trouble making legible fish symbols in the clay.

5. **Emotional attachment to intellectual facts:** Knowledge attached to emotional baggage has a greater chance of retention; it is easier to recall the quadratic formula when it is used to save the ship from plunging into a black hole than filling a Scantron bubble.

Additional practice tips for educational larps are available in Michał Mochocki’s article “Edu-Larp as Revision of Subject-Matter Knowledge” (2012) and, with some caveats, the January 2009 publication from the Software & Information Industry Association (SIIA), “Best Practices for Using Games & Simulations in the Classroom: Guidelines for K-12 Educators.”

Resources

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Education-Larpers' International Network (ELIN) (http://www.edu-larp.org)
EduCade (http://www.educade.org)
EdWeb (http://home.edweb.net)
Games for Change (http://www.gamesforchange.org)
Learning Lab Denmark (http://valhalla.norden.org/links/learning-lab-denmark-en?set_language=en)

Educational Larp Schools, Companies, and Programs

GameDesk (http://gamedesk.org)
KidZania (http://www.kidzania.com)
LajvVerkstaden (http://www.lajvverkstaden.se/in-english/)
National Model United Nations (http://www.nmun.org)
Østerskov Efterskole (http://osterskov.dk/om-os/osterskov-in-english/)
The Pericles Group (http://www.practomime.com)
Pretend City Children's Museum (http://pretendcity.org)
Reacting to the Past (http://reacting.barnard.edu)
Renaissance Adventures (http://www.renaissanceadventures.com)

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Mads Lunau
Michał Mochocki
Markus Montola
Erin Reilly
Amanda Siepiola
David Simkins
Jaakko Stenros
Kaveri Subrahmanyam

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CHAPTER 11

Development Platforms, an Overview of Major Programming Languages, Engines, and Frameworks

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Key Summary Points

1. This chapter introduces the concept of programming languages, along with code, game engines and platforms, and how they are connected.
2. Also discussed are current programming languages and game engines and which might make the most sense to use depending on a project's goals.
3. Real world examples are provided to help connect all the information together

Key Terms

Programming languages
Code
Game engine
Development platform
Game platform
Unity
Android
iOS
C++
HTML5

Introduction

Digital games have evolved greatly since their creation half a century ago and so have the tools to make them. Originally there were no tools to aid game creators because the video-game field was entirely new. Today, one can easily find a wide assortment of programming languages, game engines and frameworks

to assist game developers in their trade. These languages, game engines and frameworks each have their own pros and cons to consider when deciding which ones to include in development. This chapter provides an introduction to these topics, information on currently popular game development tools, as well as a protocol for deciding which tools to use for your upcoming project.

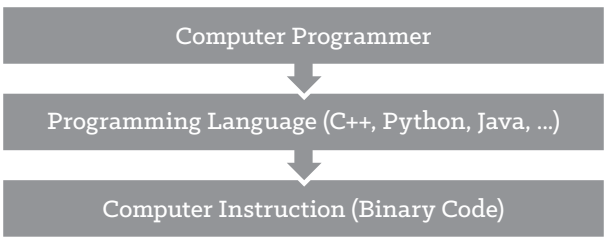

Figure 1. Code development process

Key Frameworks

Code: The Magic Behind Software

Ever wondered how videogames respond to your interactions? Code, a set of instructions for a computer, is what makes computers do something. Code makes computers react when you touch the screen, draw and animate images at a whim, it tells Siri how to respond to your request and so much more. Code is written in programming languages, such as Java and Objective C, which are used as a means to tell computers what to do. Programming languages are used because they are languages that computers are able to break down and understand. Tasks are relayed from the computer programmer, through the code that's written in a particular programming language, to the computer, which interprets the task into machine code that the computer understands.

There are many different programming languages, and much like spoken or written languages, each has evolved or been designed with different goals or usage in mind. Some, such as Python, are "high level," which means they abstract away many of the details of the underlying computations that are handled with each command or sentence. Programs written in these types of languages tend to be more readable and concise. Others, such as C and assembly language, which work "closer" to the underlying machine code, tend to produce more verbose and specific code, but can potentially run more efficiently and faster (Abelson, Sussman & Sussman, 1996; Carro et al., 2006).

Table 1. Overview of popular programming languages

Game Engines: What Makes a Game Tick

Game engines gather together a number of systems in one place to provide common functionality, such as certain types of animation, physics properties, sound effects, artificial intelligence, and more. The purpose of using a game engine is so that you do not need to create the entire game from scratch—some of the properties and functionality have already been provided. This greatly reduces development time, costs and the knowledge required to develop a game.

For high budget AAA games (a term used for games with the highest development and marketing budgets) such as *Call of Duty*, an engine is likely to have been specifically crafted with the target genre in mind. In some cases the game engine may even be developed only for that game. This is often expensive and time-consuming, but can allow developers to flexibly design their game as they are not limited by the constraints of any particular game engine. In some cases, game engines are available to be purchased or licensed from their creators. Because game engines are often designed for a particular purpose it is vital to choose an engine that aligns with your project goals, audience and design needs.

Table 2. Overview of popular game engines

Game Engine	Overview
Unity	Likely the most popular game engine at the moment, Unity (previously known as Unity3D) is a game engine combined with a very visual Integrated Development Environment (IDE) (Polsinelli, 2013). It allows developers to create games that run on most platforms from Apple and Android phones to the Xbox and PlayStation platforms.
GameSalad	Billing itself as "Amazingly easy to use" and aimed at creating games for iOS, Android and HTML5, GameSalad is a common choice amongst educators and students a-like (Defee, 2015). Although it does not have any flagship titles such as Angry Birds it does boast having had over 65,000+ games developed and 3 games that have been #1 in the US App Store ("Want to make games? GameSalad Makes It Easy", n.d.).
Source Engine	Developed by Valve Software, the Source Engine has been utilized to make a number of high profile PC games such as Half-Life 2, Counter-Strike: Source, The Stanley Parable and Garry's Mod. The updated Source 2 engine is aimed at increasing developer productivity (Kollar, 2015).
Unreal	The Unreal Engine is developed by Epic Games and is aimed for developers of all sorts, from student to indie to professional. It supports development of a variety of game types such as 2D, 3D and VR games on mobile devices, PCs and consoles ("What is Unreal Engine 4", n.d.).
In-house Engine	Some game development studios develop their own engines to suit their own needs, which are proprietary and not available for public use. Some examples of this are Electronic Art's Frostbite Engine, Konami's Fox Engine, id's id Tech 5, & Ubisoft's UbiArt Framework.
Construct 2	Targetted at indies, hobbyists, teachers and students as well as professional developers, Construct 2 allows rapid development of 2D style games and prototypes. No code is necessary; it allows anyone to build games ("What is Construct 2?" n.d.).
GamePress App	Create simple games without coding on the iPad with the ability to share them with friends. Aimed at introducing parents, teachers, artists and gamers to game development and allowing them to unleash their creativity ("Create the Games of Your Imagination." n.d.)

Game Engine	Overview
Scratch	A visual programming language and engine, Scratch works to make it easy for users to create interactive stories, animations, games, music and art and share them on the web. It was designed to facilitate the development of 21st century learning skill such as critical thinking, problem solving, communication, collaboration, creativity and innovation (Screawn, n.d.)
ARIS	Short for Augmeneted Reality and Interactive Storytelling, ARIS is an engine as well as an iPhone application that work together to create mobile, location-aware, narrative-centric interactive experiences (Gagnon, 2010). ARIS creates games where players experience a hybrid of virtual interactive characters, items and media placed in physical spaces ("ARIS" n.d.).
Cocos2d	A suite of frameworks that allow development of crossplatform games and apps. There are several forks that allow developers to create games in their favored language of C++, JavaScript, C#, Objective-C, or Python ("Cocos2d", n.d.).

Game engines may not include everything needed for a particular project, but are often extensible; middleware, frameworks, libraries, scripts, or other modules may be available to supplement or extend the available functionality. Middleware, frameworks, libraries and scripts are code that has already been written by a developer for a specific task or set of tasks. Using these common sets of code allows for more efficient development and for communities to arise around the use of them. For example, let's take cloth simulation. The physics and mathematics involved in making realistic clothing that interacts properly with the character and environment is highly complex, and middleware can hide most of that complexity from the game designer or programmer with carefully designed tools or interfaces. Cloth does not seem like it is so complex to design, but in a game environment, you need to describe exactly how something should move, or otherwise the game will not know to do anything with it. In this case, making clothing on a character respond to the characters' movements, such as a skirt reacting accordingly as the character moves their legs forward to walk, is a problem many games encounter and thus why middleware exists to solve this problem.

Platform: Almost Anything Can Run Games Now

There are a myriad of platforms available to develop games for: desktop computers, mobile phones and tablets, game consoles, and even children's toys. The decision of what platform to create games for can be a key factor in which programming languages and game engines should be used in development. To choose a platform or platforms to develop a game for, a number of questions need to be answered related to project goals, budget, team and so on. Is it the goal of the project to reach a population that's inside schools in the United States? If so, computer labs are currently ubiquitous across many schools, however the rate of technology progression over the last couple of decades has rendered much hardware in schools incapable of running any recently developed games. SMART Boards (interactive whiteboards) as well as smartphones and tablets are increasingly available in schools, although they have other complications that affect development, such as wireless availability and operating system differences. Understanding that these choices affect which engines, languages and even the team of programmers that can be used on a project is crucial.

According to the Joan Ganz Cooney Center's Teacher Attitudes about Digital Games in the Classroom (2012) report 85% of students can access digital games on PCs or Macs, while two-fifths can use interactive whiteboards and a quarter can access games via tablets. These numbers are moving quickly; tablets were introduced less than 5 years ago! Educators are learning about these games and platforms through a mix of their peers, self-interest and conferences. A new development to ease the burden on school districts to keep up with the ever-changing market is a trend referred to as "Bring Your Own Device" (BYOD). With seventy-seven percent of students owning cell phones and one third of those being smart phones BYOD seeks to utilize these devices in addition to the traditional computer labs (Richards et al., 2013).

It is easy to see how anyone can be overwhelmed with the amount of information required to have an informed discussion about game development in general, or especially educational games in particular. This chapter helps provide a baseline of knowledge to better assist.

Understanding Code

As mentioned above, code is what is written by programmers to help computers understand what they need to do. Each programming language is unique and thus code that is written in that language even if it is designed to do the same thing as code that is written in another language will likely be different. For example, the simplest task for a program to do is often just displaying text on the computer screen. When learning a new language, the first thing programmers will often do is take a "Hello World" tutorial. Figure 2 shows an example of such a tutorial in a few common programming languages.

```
<script type="text/javascript">
document.write("Hello World")
</script>
```

```
#include <iostream>
int main()
{
std::cout << "Hello World!\n";
return 0;
}
```

```
print "Hello World!"
```

Figure 2. Code blocks to display "Hello World!" on-screen in JavaScript (left), C++ (middle), and Python (right).

The first on the left is JavaScript, and running it in your web browser would cause Hello World! to appear on-screen. The middle one is C++ and is a bit more complex because the programmer needs to include existing code written elsewhere to allow them to handle output to the display. Then inside of the "main" function, which is called when the code is run, it will print out "Hello World!" to the screen before completion. This is "lower level code" than JavaScript and is a bit more complex. Finally on the right we have another fairly straightforward example that is done in Python, which is the easiest to discern for any layperson.

Each of these code blocks require differing levels of complexity in the code itself in addition to being able to compile and test how they run. With JavaScript all one needs to do is create an .html file on their computer and open it in a browser such as Firefox to see if what they did worked as they wanted. C++ or Python requires other more complex setup on the computer ahead of time to be able to run the code the programmer has written.

Variables

Variables are containers of information for programming langauges that can be easily referenced. There are different kinds of variables and any specific programming language may have some but not others. Some simple examples are:

Boolean

A Boolean has a value of true or false. An example of a Boolean variable might be "gameIsOver." If a player had just finished the game then one could set the variable to be true with the following code (this example is from C++):

```
gameIsOver = true;
```

In this case, the "gameIsOver" Boolean would have to be initialized before it was used in this context. That would look like this:

```
bool gameIsOver = false;
```

Integer

An Integer holds a number value, which max size can change depending on the language and its usage. In C++ it is also important whether the Integer is signed or unsigned. Signed Integers support negative values where-as unsigned Integers do not. An example of the use of an Integer could be as follows:

```
int player1Score, player2Score, sum;
player1Score = 500;
player2Score = 1000;
sum = player1Score + player2Score;
```

For this example, 3 variables are created "player1Score," "player2Score" and "sum." "player1Score" is set to a value of 500 and "player2Score" is set to a value of 1000. The "sum" variable is then set to equal the amount of "player1Score" + "player2Score." In actual games "player1Score" and "player2Score" would be set to equal the amount they had scored during the actual game but for this example the values have been set directly.

String

Strings are variables that contain text. Depending on the language and the type of String that is utilized once a String is initialized and set it may not be able to be altered. An example of a String being used is:

```
std::string name = "Christopher";
std::string sentence = name + std::string(" is ") + std::to_string( name.length() ) + std::string("
characters long.");
```

In this case, we're creating a string with the name of a person "name" which is given the value "Christopher." Then we combine the name variable along with several other pieces to create this sentence "Christopher is 11 characters long." This is done by concatenating the initial name variable along with creating two short strings temporarily for the "is" component and the "characters long"

component. Then the "11" is created by using a function available called length() which returns the character length or size of the string it is run on. This is all put together as part of the variable "sentence" which can be used in the future to display this text all at once.

Logic

For code to react differently based on data from the game, programming langauges have conditional statements such as If-then-else statements and Switch statements. These popular conditional statements are a foundation of coding and are used widely. They allow for software to have appropriate actions based on what is occurring at any given time (as long as the programmer thought to plan for it and create a conditional statement for it). An example of this might be:

```
if lives < 1:
        gameOver()
```

In this example if there are no more lives left for the player to continue (measured by if the lives variable has a value of 0 or less) then the code will compute the gameOver() function. Another example showing a switch statement instead with JavaScript:

```
switch (event.keyCode) {
  case 37:
        leftArrowKeyPressed();
        break;
  case 38:
        upArrowKeyPressed();
        break;
  case 39:
        rightArrowKeyPressed();
        break;
  case 40:
        downArrowKeyPressed();
        break;
  default:
        notArrowKeyPressed();
        break;
}
```

In this case the JavaScript code will run the code in the appropriate function based on what specific keyboard button is pressed. This code could be used to move a character in a direction based on the keyboard input to the game.

Functions

Many programming languages utilize a feature called functions. Functions are a segment of code that can be called by name. In addition, certain pieces of information can be passed to the function so that the code can utilize that information. An example of a function might be one that updates a line of dialogue to use what the player has put in as their name. In python this might look like the following:

```
def displayWelcomeText(name):
  print("Welcome to our game " + name + ".")
```

This function could then get called in other areas of code and potentially even other functions. Functions are used to make it simpler to run pieces of code many times, rather than having to copy and paste the same code over and over again. Functions are also used to help keep code organized. If a lot is happening at once, functions can be used to logically split up separate parts of the code to make it so that you can still get a high level overview of what is happening without reading through all of the code. An example of this might look like this:

```
if hasBallCrossedGoal( ballLocation ):
        updateScore()
        playAudio("Goaaaaaal.mp3")
```

In this case a simple soccer game is checking if the ball has crossed the goal line via a function "hasBallCrossedGoal(ballLocation)". This function takes in the location of the ball (where it is in the game / on-screen) and then inside the function if we can guess by the name that it returns yes or no based on whether the ball is across the goalline. If it returns yes, then the game will run the function to "updateScore" and another function "playAudio("Goaaaaaal.mp3"). Based on the function names again we can make an educated guess that the game will then go on to play the "Goaaaaaal.mp3" audio file to the player(s). If someone wanted to make sure of what the functions are actually doing they would have to go to the source for the functions and see where they are defined. This is part of the reason why it can be important to have functions that are appropriately named.

Case Study One: C++

Letter Factory is an educational game targeted at early learners developed by 1st Playable Productions and published by LeapFrog. It is based on the popular DVD, also called Letter Factory. Because the game was published by LeapFrog, the game needed to run on both the Leapster Explorer and LeapPad mobile game platforms. Both systems require development to be done through LeapFrog's SDK (Software Development Kit). This also means that the game needed to be created in one of two supported languages: C++ or ActionScript. With an internal engine that was already widely used around the studio created in C++ The decision was made to adapt the engine to work with LeapFrog's SDK.

The decision to support C++ as the development environment provided a number of positive benefits. This allowed the vast array of knowledge that existed in the internal game studio engine to be brought over to this new platform with a low layer of code to work directly with LeapFrog's SDK. Any individual at 1st Playable Productions who had experience with most areas of the internal engine would see no difference in developing on this new platform, which would allow them to jump right in and be able to create at a similar level to other platforms. As the internal engine used by 1st Playable was already optimized for portable hardware such as the Nintendo DS, there were many areas that the engine performed very well and the team did not need to spend a large amount of additional time addressing performance issues.

Although many areas of the game were coded in C++ with the internal engine that existed, some areas needed to be extended to work within LeapFrog's SDK. This included areas dealing with the curricular, audio, and hint systems. New and unknown issues did come up when supporting the new SDK, as is the norm when learning new areas, however the use of the internal C++ game engine in this case helped reduce the number of new items for this project, which helped make the project successful.

Key Findings, Languages and Engines

This section details the programming languages and game engines in more detail.

Programming Languages

There are a fairly large number of programming languages out there in computer programming so we will focus on most popular ones at the moment. Languages often intersect within a specific game project, as teams and programmers play to the strengths and requirements of each platform and language. The following languages are used for a wide variety of games today: C++, Objective C, C#, Java, JavaScript and HTML5, Python and ActionScript.

C++ (Created in 1979): C++ is the language of choice for many games on consoles and handheld/mobile devices due to its flexibility, performance and ability to interact with the machine directly. C++ is a relatively complex language with a higher barrier to entrance than many other languages.

Objective C (Created in 1983): Objective C is the main language for interfacing with Apple's products, and has seen a tremendous growth in use out of necessity as the iPhone and iPad popularity have reached epic proportions. Objective C is required to interface with native iOS features such as using the camera within an application or being able to tell your game what to do when players tap the home button and exit the game (for example, you will probably want the game to save).

C# (Created in 2000): C#, which is pronounced as "C sharp," is a bit higher level than C++ and provides some additional conveniences, which can result in a lower learning curve and provide shorter development times. It is important to note that these conveniences can be problematic if programmers are attempting to implement very high performance applications and are unaware of how the language is handling things under the hood.

Java (Created in 1995): Java is often used as an entry-level programming language for students in college as it's more accessible than C languages but lower level than Python and web-based languages such as JavaScript. Java is one of the most popular programing languages and was popular for developing games on phones in the pre-smartphone era, but due to the need for high performance it has not made many inroads in being used widely in the game development community. Java is the core language for Android development, similar to Objective C's use in Apple's products.

JavaScript and HTML5 (JS Created in 1995, HTML5 is still in development): JavaScript has continued to get more powerful and faster as the Internet and its browsers have been updated throughout the last 10 years. It's now a powerful tool to create web-based games with. Due to the increases in performance of computers, browsers and the language itself in addition to the ability to use HTML5 for new multimedia features JavaScript and HTML5 are becoming widely used tools to create games with. HTML5 is very much still in development and not all of the same features are supported across all browsers which can make development challenging. Although they are newcomers into the space and their ability to run on any platforms (phones, computers, tablets) is promising, the performance level that is needed to run intricate games is still fairly unproven.

Python (Created in 1991): Used throughout game development and other areas of programming, Python is a more accessible language than most. It emphasizes ease of use and readability that make it very useful for a wide array of applications. In game development it can be used to create simple games with tools such as PyGame and is often utilized for scripting game events such as the AI responses and creating tools to assist more complicated game development projects.

ActionScript (Created in 1998): Although not the top choice for some developers at this point in its lifespan, ActionScript is still wildly popular due to the ease of creating games in Flash that can be readily available to anyone with a browser. Creating games with ActionScript and Flash still has a comparatively quick iteration time relative to other means but they are primarily limited to a PC audience.

Game Engines

Similar to programming languages, there are a number of game engines in use across game development today. These game engines are designed to allow developers to create games that fit their needs while working with a preexisting system that often times many engineers are familiar with. Many of the engines discussed below support games that can run on multiple platforms. To be able to use one engine to create games on all the major platforms saves a lot of development time and resources. This is wonderful for teams because members will not need to learn new tools as trends change and they can also be used across different teams within a game development studio without changing tools.

However, using a game engine, especially one that is new, can be a challenge if the game requires functionality outside of the engine. Working with an external game engine means your team may not be able to solve some problems that arise because of the engine itself. It is a fundamental problem that when you work with an externally developed game engine, the team must rely on it to keep the game running smooth and refraining from crashing. If there is a bug in the engine, or a feature that you are using in a unique way, it may require an engine upgrade or for the team to change its plans for development and use a different engine.

Unity: Currently at the top of the game development popularity list is Unity. The Unity Engine has been growing in its feature set and popularity due to the ease of working with it, along with its price point (it is free to publish on PC and mobile as long as you do not earn over a certain amount). As such, it is currently in use by students, indie game developers, and professional developers. Although relatively inviting when compared to most game engines, anyone unfamiliar with game engines will definitely need some time to learn the ropes. Happily, because of the popularity of Unity at the moment, there are many developers across the globe to lean on for tutorials and information to help in learning the Unity engine. Unity works with a wide range of current platforms such as Xbox 360, PlayStation 3, Xbox One, PlayStation 4, Wii U, iOS, Android, Windows Phone, PC, VR.

GameSalad: As far as ease of use, GameSalad is one of the most accessible engines to be able to get in and start creating things right away for just about anyone. The key feature about GameSalad is that everything is made through drag and drop behaviors and changing properties of objects to create games. There is no "code" that's visible to the game creators, all of that is handled behind the scenes by GameSalad for the game creator. Although not viable for high end games it is a great tool to create simpler games and allow experimentation with the game design process. It also provides an opportunity for students (or anyone) to very easily create something and share it.

GameMaker: On the spectrum of accessible game engines, GameMaker is similar to GameSalad and is also relatively easy to grasp. Similar to GameSalad, it allows creators to drag and drop items and edit properties to create games, but the ability to edit the code directly furthers the ability to create unique games, as well as allow programmers or technical designers to create prototypes without relying solely on the drag and drop features.

Source Engine: Source is a fairly old engine at this point (originally developed by Valve Software for Half Life 2 in 2004), however it has been updated continuously and is available to be tweaked with every purchased copy of the game. Source is a robust engine with many tools within it to aid in development. It is a more complex engine but can create sophisticated games because of that complexity. Many mods have been developed based on the Source SDK and commercial games continue to be released for it such as commercial games continue to be released for it such as Titanfall (released in 2014). A much higher learning curve and expertise level is required for this type of game engine, but options like this do exist for anyone to be able to create their own game at a very professional level.

In-house Engine: Often times a game development studio may utilize an internally developed game engine or toolset to work on its games. This has a few benefits: team members within the company can be utilized on any project the company is working on, because they share the same engine and team members can get to the root of problems, since all of the code is available to work with. Some downsides are that this is that the engine is limited to whatever the company has worked on and without the sole purpose of the company being dedicated to the engine portions of it can become stale or out of date. It can also be costly as new additions to the engine and upkeep cost engineers who could otherwise be working primarily within existing engines to help create the game itself.

Case Study Two: Python

Through the development of a number of titles at 1st Playable Productions, we have amassed a large number of voiceover, special effects, and music files. We have a system to deal with this audio data, to more easily update, remove and change them within a game. The audio files are uploaded onto the web for us to download as they are created and updated by the audio team that we are working with. Unfortunately the tool does not notify users that audio files have been uploaded; rather, we have to rely on others to tell us that the files were uploaded or updated.

This is less than ideal in a few ways. First of all, many times the entire team does not have access to retrieve these files, which can sometimes create a bottleneck when the game audio needs to be updated and only one person has access to do so. In addition, it relies on individuals to make sure they download all the necessary files and place them in the appropriate location within the game.

This may seem like a small problem, but over time, small problems add up, and there are many places for human error. These types of issues are also always the ones that seem to be left off checklists, forgotten, or where time simply did not exist to do the process necessary. People on the team want to be focused on the game development, rather than worrying about where the audio files are located. This is the type of task that should be automated.

Since changing the overall system was not an immediate solution, 1st Playable developed a new tool using Python that provided information about when and where the audio files were uploaded or updated. In this case it was important to create a log that would show what specific files were downloaded, and when there was an error, so individuals could see that the file was supposed to have been created, but did not exist on the server yet. This tool is just one example of how Python could be utilized within a project's game development to help make the project and future projects more successful.

Future Needs

The trends of the future are leaning toward programming games to be played on more and more devices of all sizes and types. Whether it is the Microsoft Surface (imagine a coffee table touch screen computer that displays your photos when you place your phone on it), iPads, SMARTBoards, or the Oculus Rift (virtual reality headset), games are going to be developed for a wide range of experiences. These platforms all have unique design constraints, which require special approaches in how to develop games for them. However, we know that new tools will help assist with game development, engines and programming languages will be updated, and new ones will take shape. If one thing has become clear over the last decade, it is that game development is being democratized and that anyone can be a game maker now.

Case Study Three: HTML5

Released in 2009 on iOS by Rovio Entertainment, the game Angry Birds is one of the most popular of this generation. It has over 2 billion downloads across all of the available platforms through its regular and special editions. Rovio Entertainment has been expanding its brand by releasing the game on platforms outside of the original mobile market. One of these efforts was to release the game for web browsers with the idea that anyone with a recent Internet browser would be able to play the game. Rovio worked with Google to develop the game in HTML5 to make this happen.

They developed the game through the library PlayN with the Google Web Toolkit framework. Through this library they were able to program the game in Java and had the ability to use the cross-compiler to make the game available via Javascript (HTML5), ActionScript and Android. Although only the HTML5 output was used for this project. With the benefits of HTML5 the game could be played in the browser without players having to download anything to play it. Rovio did run into performance problems for later levels in which there are a large number of objects that collide and cause complex calculations, which they needed to work around. In addition, there is also an expectation that games load very quickly on the web, which they needed to overcome. Limited bandwidth was a part of this issue, even though it is behind the scenes to the player, the browser does need to download all the resourc(d t)4.2 (o d)4.6 (ow)-26.

3. **Choose something widely used:** A tool that is widely used is much more likely to have the community support that you will eventually need to help solve issues as they come up. A community of people who use the tool means it is also much more likely that people will come across similar problems and even share their solutions! If this is not an option for you, make sure you will have sufficient access to be able to get the support you will need to resolve any issues as they come up.
4. **Choose something that fits your cost needs:** This is obviously an important consideration. Different tools have different costs and licensing structures associated with them. For instance Unreal is free, but takes a percentage of revenue after you make a certain amount. Unity has an upfront cost for professional use but also has a free version. Certain tools may or may not be options for you because of this.
5. **Choose something that fits your team and project's experience, culture and needs:** Some tools are better at some things than others, so try to choose tools that excel at what your project aims to do and who is working on it. This seems simple, but it is important. In some cases things will align, and you'll have people on your team who are experienced with a particular tool and that tool happens to be perfect for what you want to build. Other times this may not be the case, you may have a team that's really experienced with a tool but you want to make a game for a platform that tool is just starting to support. In this case you'll have to weigh the development team's ability to adapt to a new tool and perhaps build a better experience, or decide whether sticking with the current tool would be a better option for you because you may actually be able to create something in the time that you have.

Resources

http://stackoverflow.com/
http://gamedev.stackexchange.com/
http://html5gameengine.com/
http://jquery.com/
http://www.python.org/
http://www.pygame.org/news.html
http://www.adobe.com/devnet/actionscript.html
http://unity3d.com/
http://gamesalad.com/
http://www.yoyogames.com/gamemaker/studio
http://source.valvesoftware.com/
http://box2d.org/
http://gamedev.net/
https://scratch.mit.edu/
http://arisgames.org/
http://cocos2d.org/
http://haxe.org/
https://code.org/
www.scirra.com/construct2

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Appendix: Game Development Tools, Platforms, and Resources

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The following chart is culled from a collective spreadsheet found online at https://goo.gl/PpyPCC.

The chart is always being updated and its level of detail and scope improves with more users, so please feel free to add to it.

Name	**Stencyl**
URL	http://www.stencyl.com/
Dev Platforms	Windows, Mac, Linux
Target Platforms	Flash, Windows, Mac, Linux, iOS, Android
Genres / types of games	top-down, side-scrollers, platformers, flexible for almost anything
Issues and Notes	Stencyl, GameMaker Studio, Construct 2, and GameSalad are all relatively similar tools to create mostly 2D platformers or topdown sprite-based games. Stencyl uses the same drag-n-drop building-block interface for programming as Lego Mindstorms and Scratch. Graphite.org review at https://www.graphite.org/game/stencyl
Name	**GameMaker Studio**
URL	http://www.yoyogames.com/studio
Dev Platforms	Windows
Target Platforms	mobiles, desktops, and consoles
Genres / types of games	top-down, side-scrollers, platformers, flexible for almost anything
Issues and Notes	Very popular and massive community, in part due to it being available on Steam. GameMaker Studio has built-in source control through the use of usernames/passwords checking in and out process. Steps in this are 30/second, btw. Graphite.org review at https://www.graphite.org/game/gamemaker-studio
Name	**Construct 2**
URL	https://www.scirra.com/construct2
Dev Platforms	Windows
Target Platforms	HTML5
Genres / types of games	top-down, side-scrollers, platformers, flexible for almost anything
Issues and Notes	Very popular and massive community, in part due to it being available on Steam. Vibrant sharing community. Steps in this are 60/second. Graphite.org review at https://www.graphite.org/game/construct-2

Name	GameSalad
URL	http://gamesalad.com/
Dev Platforms	Windows, Mac
Target Platforms	Mac, Windows, iOS, Android
Genres / types of games	top-down, side-scrollers, platformers
Issues and Notes	Looks like no programming is necessary (just drag and drop). Could probably be used in more introductory courses before moving onto one of the other three (or to Unity), but there's a paid subscription model that might not work for some classrooms.

Name	Twine
URL	http://twinery.org
Dev Platforms	Windows, Mac, Linux
Target Platforms	browser
Genres / types of games	web-based interactive stories, though technically, it could be completely image driven
Issues and Notes	Twine, InkleWriter, Ren'Py, and Quest are similar in that they make text-based games with Ren'Py making "visual novels." Twine is massively popular as a low-barrier entry for designers from diverse backgrounds to share their voices and experiences. Very easy to use; the main barrier/bottleneck is having written content ready. Creates a URL for your interactive story. Hugely extensible through HTML, Javascript, and stylesheets, but doing all that means knowing how to do all that... Depression Quest is an excellent Twine game.

Name	InkleWriter
URL	http://www.inklestudios.com/inklewriter
Dev Platforms	browser
Target Platforms	browser
Genres / types of games	choose your own adventure game books
Issues and Notes	Even easier to use than Twine, but also less extensible. What's nice is students can just jump right in through a broswer. A good example of what students could create is the Inkle version of Frankenstein on iOS. Not a huge online forum, but team seems relatively responsive. Also, lots of good press recently and some notable games (like Sorcery! and 80 Days).

Name	Ren'py
URL	http://www.renpy.org/
Dev Platforms	Windows, Mac, Linux
Target Platforms	Windows, Mac, Linux, iOS, Android
Genres / types of games	visual novel
Issues and Notes	This makes Japanese-style "visual novels," which are often dating sims--text heavy with little player choices, but that's more a genre thing than a limitation of the game platform. Examples of really good, innovative games using Ren'py include Christine Love's Digital: A Love Story and Analogue: A Hate Story.
Name	**Quest**
URL	http://textadventures.co.uk/quest/desktop
Dev Platforms	Windows
Target Platforms	browser
Genres / types of games	text adventures
Issues and Notes	Relatively popular alternative to Twine and Inkle as it makes games with a parser (a la Zork and other Interactive Fiction). This site also hosts completed games, encouraging creators to share their stories
Name	**Adventure Game Studio**
URL	http://www.adventuregamestudio.co.uk/
Dev Platforms	Windows
Target Platforms	Windows, Mac, Linux, iOS, Android
Genres / types of games	point-n-click adventure games like old school Sierra or LucasArts games
Issues and Notes	For fans of old-school point-n-click adventure games (King's Quest, Monkey Island, etc.). Kind of a pain to actually use, though, compared to newer apps such as Stencyl, Construct 2, or GameSalad.
Name	**Scratch**
URL	http://scratch.mit.edu/
Dev Platforms	browser
Target Platforms	browser
Genres / types of games	stories, games, and animations
Issues and Notes	Massively popular with schools and lots of academic research. Could easily create an interactive narrative in one day. Designed for ages 8 and up and classroom use. It's easy to take and modify someone else's game on their website. Graphite.org's review https://www.graphite.org/website/scratch

Name	Snap!
URL	http://snap.berkeley.edu/
Dev Platforms	browser
Target Platforms	browser
Genres / types of games	2D games, stories, and animations
Issues and Notes	A derivative of Scratch that's targetted to slightly older stuents (high school instead of pre-high school) and is meant to serve as a great intro to computer science.

Name	ARIS
URL	http://arisgames.org/
Dev Platforms	browser
Target Platforms	iOS with GPS, Android support soon!
Genres / types of games	location-based mobile games, tours, and interactive stories
Issues and Notes	The devs claim that the tool mechanics can be learned in an hour or two. Lots of great academic research backing up ARIS projects. Their training page has docs for teachers.

Name	Kodu
URL	http://www.kodugamelab.com/
Dev Platforms	Windows
Target Platforms	Windows, XBox
Genres / types of games	2D and 3D adventure, side scroller, racing, storytelling
Issues and Notes	Kodu and Gamestar Mechanic are more like game makers that come with lessons to teach kids how to make games rather than straight up programs that a game developer would use. Designed for ages 8 and up and classroom use. Classroom kit with lesson plans available. Graphite.org review: https://www.graphite.org/game/kodu-game-lab

Name	Gamestar Mechanic
URL	http://gamestarmechanic.com/
Dev Platforms	Windows, Mac, Linux
Target Platforms	browser
Genres / types of games	2D platformer
Issues and Notes	Learn the tool mechanics as you play quests. User-paced. Graphite.org review: https://www.graphite.org/game/gamestar-mechanic

Name	Unity
URL	http://unity3d.com/
Dev Platforms	Windows, Mac
Target Platforms	Windows, Mac, Linux, iOS, Android, Steam, browser, and consoles
Genres / types of games	2D and 3D, all genres
Issues and Notes	This and Unreal Engine 4 are serious game creation tools that many studios use. As such, they are the most robust of the bunch and allows for full versioning control, etc. It can take years to become expert in it, however. Would be good for advanced students, hs-level self-directed courses, or full year-long game design courses.
Name	**Unreal Engine 4**
URL	https://www.unrealengine.com/
Dev Platforms	Windows, Mac
Target Platforms	Windows, Mac, Linux, iOS, Android, Steam, browser, and consoles
Genres / types of games	2D and 3D, all genres
Issues and Notes	This and Unity above are serious game creation tools that many studios use. As such, they are the most robust of the bunch and allows for full versioning control, etc. It can take years to become expert in it, however. Would be good for advanced students, hs-level self-directed courses, or full year-long game design courses.
Name	**RPG Maker**
URL	http://www.rpgmakerweb.com/
Dev Platforms	Windows
Target Platforms	Windows
Genres / types of games	2D RPGs with sprites and character overlays similar to a visual novel
Issues and Notes	Mostly makes old-school Japanese-style Role-Playing Games (JRPGs) with character classes, advancement schemes, and monster events are almost drag-n-drop. Adding dialog, etc. is a little trickier, or at least doesn't seem to have it's own heading in the tutorials that I skimmed.
Name	**RPG Maker**
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Name	Gamefroot
URL	http://gamefroot.com/
Dev Platforms	browser
Target Platforms	browser, iOS for Pro
Genres / types of games	2D platformers
Issues and Notes	Gamefroot, Flowlab, and Sploder are browser based apps. They are pretty limited but are included here in case someone needs a browser based app (e.g. teachers who have no administration rights to their computers). Sort of similar to GameSalad, but so far I've seen only the most basic of games come out of using Gamefroot... Maybe in the right hands, this could be a contender, but, if you can manage it, I'd suggest just going with one of the first few tools on this list instead.

Name	Flowlab
URL	http://flowlab.io/
Dev Platforms	browser
Target Platforms	browser
Genres / types of games	2D platformers
Issues and Notes	This tool is notable for the way it uses flowcharts to diagram programming logic. The user interface has many, many issues and is likely to frustrate greatly, though. Graphite.org review: https://www.graphite.org/game/flowlab

Name	Sploder
URL	http://www.sploder.com/
Dev Platforms	browser
Target Platforms	browser
Genres / types of games	varied: platformers, puzzlers, top-down shooters
Issues and Notes	Actually, Sploder offers a suite of tools to make different types of games, but they are all pretty rigid with no consistency in user-interface between them. Graphite.org review: https://www.graphite.org/website/sploder

Name	CraftStudio
URL	http://craftstud.io/
Dev Platforms	Windows, Mac, Linux
Target Platforms	Windows, Mac, Linux, HTML5
Genres / types of games	3D games
Issues and Notes	Both visual and Lua text scripting options. Building blocks. CraftStudio is relatively unique in that it allows for multiple users to manipulate the same project at the same time (like Google Docs). The fact that designers can work on the same project live, without having to worry about versioning, checking assets in and out, etc. makes this definitely one to watch, especially for group-based classroom use.

Resources

Other Game Creation and Programming Tools

StoryNexus (http://storynexus.com/s)
ADRIFT (http://www.adrift.co/cgi/adrift.cgi)
Wintermute (http://dead-code.org/home/)
ZGameEditor (http://www.zgameeditor.org/)
The Game-Make-inator (http://lunduke.com/?page_id=3152)
Impact (http://impactjs.com/)
MIT App Inventor (http://appinventor.mit.edu/)
StarLogo TNG (and now Nova coming soon) (http://education.mit.edu/projects/starlogo-tng (Nova is www.slnova.org)
Agent Sheets (http://www.agentsheets.com/)
edugames4all (www.edugams(/)-4728.3C(g)-4.2 (a)4.58.3 (46 (r)-15.9 (g)-15.3 (/)-47.5 ()8.4/Span <</MH)48 (/)60.()2p(w)-46.5 (o)-5.a