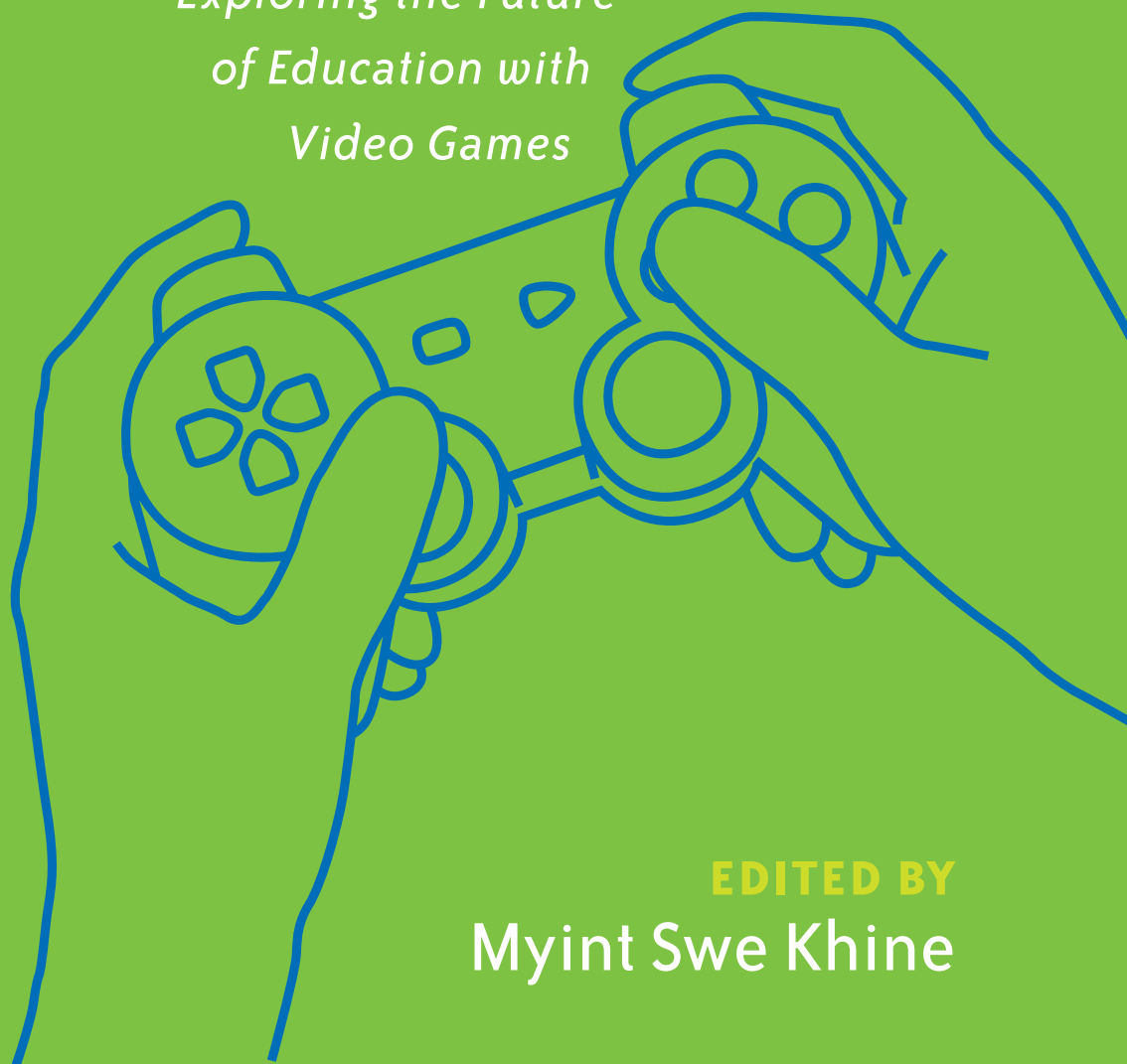
Learning to Play

Exploring the Future of Education with Video Games



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Myint Swe Khine

Over the past two decades, much attention has been given to the new media culture of video games, due to their unique features and pervasive nature among young people. This book critically examines the role of video games in education, arguing that they encourage strategic thinking, planning, communicating, negotiation skills, multi-tasking and group decision-making. It is also observed that video games promote higher levels of attention and concentration among players. The book contains multiple perspectives and presents thought-provoking ideas, innovative approaches, systemic exploration, exemplary and promising efforts, and future-oriented scenarios. The book draws together distinguished researchers, educational and curriculum planners, game creators, educational and social psychologists, and instructional designers to explore how video games can transform the future of education.

"This volume makes a substantial contribution to the growing field of games and learning. Both the range of topics and the depth of exploration make it well worth the read. A forward-leaning discussion that will certainly help shape this emerging field."

—Constance Steinkuehler, University of Wisconsin–Madison, USA

"To push the field forward we need more critical thinking, like this book, that will find innovative ways to get us from experiments to practical use in schools."

—Simon Egenfeldt-Nielsen, IT University of Copenhagen, Denmark

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Learning to Play

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• CHAPTER ONE •

Let the Game Begin

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Introduction

Educators around the world acknowledge the fact that we live in a knowledge-based society, and the ability to think systematically is one of the necessary skills in order to function effectively in the 21st century. Many have agreed that games are immersive and promote strategic thinking, planning, communicating, negotiation skills, multitasking, and group decision making. They also observe that games promote high levels of attention and concentration among players. There is a cogent belief that video games can be a powerful tool if we can exploit the affordances and harness the application in classroom settings. There is no shortage of articles in scholarly journals (both print and nonprint media) about the emergence of video games. Some articles address what players learn from the video game, and some focus on how video games can be designed to facilitate learning.

The interest in using games in education has been gaining momentum over the last decades, and it was reflected in articles and case studies published in the scholarly journals. For example, the journal *Learning, Media and Technology* published a special issue on "Digital Games and Learning" (Martin & Murray, 2006). The *British Journal of Educational Technology* also published a special issue that focused on the potential of game-based learning (Pivec, 2007). Similarly, a 2007 issue of the *Journal of Educational Multimedia and Hypermedia* covered learning and teaching with electronic games (Ferdig, 2007). A number of book authors have also added their knowledge and perspectives to the existing literature. Some notable tiles include *Re:Play: Game Design and Game Culture* (Scholder & Zimmerman, 2003), *The Game Design Reader:* A

Rules of Play Anthology (Salen & Zimmerman, 2005), *Worlds in Play: International Perspectives on Digital Games Research* (de Castell, 2007), *Good Video Games and Good Learning* (Gee, 2007), *Playing to Learn: Video Games in the Classroom* (Hutchison, 2007), *Understanding Video Games: The Essential Introduction* (Egenfeldt-Nielson, Smith, & Tosca, 2008), *Perceiving Play: The Art and Study of Computer Games* (Mortensen, 2009), *Gaming and Cognition: Theories and Practice from the Learning Sciences* (van Eck, 2010) and *Teaching Digital Natives: Partnering for Real Learning* (Prensky, 2010). From these evidences, it is clear that the study of games and their applications in education will be key research areas in the years to come.

This book critically examines the profound understanding of the role of video games in education from multiple perspectives and presents thought-provoking ideas, innovative approaches, systemic exploration, exemplary and promising efforts, and future-oriented scenarios. The book draws together distinguished researchers, educational and curriculum planners, game creators, educational and social psychologists, and instructional designers to explore how video games can contribute to transforming the future of education. The chapters in this book inform theoretical frameworks and best practices from in-depth investigations, discourse analyses, classroom-based experiments, incisive observations, and narrative studies. The book is divided into three parts, and the following paragraphs acquaint the reader with the substance of the chapters in each of those parts.

Game Design and Learning

In Chapter 2, Halverson, Blakesley, and Figueiredo-Brown from the University of Wisconsin–Madison discuss how video game design can be used as a model for professional learning. They note that professional preparation programs in education play an important role in the education system, and such programs provide a pathway for practitioners to enter their professions with the appropriate knowledge and skills. They developed a five-step Interactive Cases for School Leadership (ICSL) design process to structure the learning environment by incorporating Gordon's (2004) branching-narrative development model. These five steps involve story selection, story building, prototyping, production, and playtesting. The chapter presents findings from observations of two courses. The chapter authors present an example of how to implement game design as a scalable model for professional learning using common technologies. They also discuss how students used ICSL design to integrate theory and practice while producing playable and reusable learning games. The chap-

ter concludes with the remark that ICSL experience moves the students beyond the learning consequences of case study discussion.

Educational games are used to teach a variety of subject areas, including business, military training and policy analysis. Although we know about the motivational and engagement aspects of games, little is known about what elements of these games influence outcomes (Gredler, 2004; Wilson et al., 2009). In Chapter 3, "A Game-Based Learning Framework: Linking Game Design and Learning Outcomes," van Staalduinen and de Freitas present a framework that explores the relationship between individual game elements and expected learning effects. The authors believe such a framework could assist game designers in constructing effective serious games and repurpose the existing game contents. When analyzing game design, they define the relationship between "games" and "play." It is noted that "games are a subset of play" and "play is a subset of games." They present three educational game design models: Amory and Seagram's game object model, Kiili's experiential game model, and de Freitas and Oliver's four-dimensional framework. Based on these models, they propose a framework combining several aspects of games and learning. They present 25 game elements that can contribute to learning and propose a hybrid framework comprising four consolidated elements, described as learner, context, pedagogy, and representation.

In Chapter 4, Hirumi and Hall note that instructional game designers are facing the challenge of presenting information and facilitating learning that is both fun and engaging. It seems that when education and entertainment are combined, the power of both practices is often diluted. As such, "edutainment" fails to meet the standards of either high-quality education or high-quality entertainment. To minimize these effects, the authors suggest the use of certain techniques in educational game design. The chapter presents a dozen techniques for conveying content information and facilitating instruction that minimize the disruption of the game flow. Among them are the uses of personal and environmental devices, placing Easter eggs, cinematic cutscenes, and so on. For example, personal devices such as cell phones, PDAs, and e-mail can be used as mechanisms in gameplay to allow the players to remain connected to the game even though they are away from the computer or otherwise not playing the game. The program can be designed in such a way that the "agents" in the game program contact the player through these personal devices. The player is required to work in teams or groups to solve puzzle or overcome problems. Such continuous contact with the game world can immerse the players in the game, blurring the boundary between fictional game experience and real-world encounters.

Enhancing Teaching and Learning with Video Games

Using digital games and virtual environments to enhance learning is the topic discussed by Green and McNeese in Chapter 5. According to them, the reasons for using games in learning are (1) different genres of games accommodate a variety of learning environments, (2) games provide challenges to the player, and (3) games are multimedia in nature and well-suited for today's students. The authors analyze the various genres of instructional games and classify them according to their features and the discipline areas in which the games can be used for learning. For example, health and physical education games focus on medical problems and how to stay fit with physical exercise. World history and geography games allow students to explore the world without leaving the classroom. Mathematics and science games introduce mathematical and scientific concepts and stimulate students to practice in exciting learning environments. While some drill-and-practice game programs can enhance students' vocabulary, technology games allow integration with other technological devices such as handheld computers, PDAs, and GPS. Another genre of video games is multiuser games—games that are played by more than one person at a time. Multiuser dungeon games (MUDs) and massively multiplayer online role-playing games (MMORPGs) allow gamers to play from different geographic locations. Often these online game environments are partitioned into sections or rooms, and players can only interact with other players in the same room they are assigned. The authors explore other game genres such as multiuser virtual environments (MUVEs), augmented reality (AR), and alternate reality games (ARGs). In conclusion, they note that despite the advantages, the uses of digital games are still limited in the classroom for a variety of reasons.

In Chapter 6, Jackson states a belief that video games can be a powerful tool in the classroom and that their motivational and pedagogical techniques have the potential to transform education. She describes how educators can learn from the principles of video games and apply these principles in the classroom to create an immersive and mastery-based discovery zone. Although some of the pedagogical principles in game design are not new, educators can learn from the innovative ways video games use these techniques. For example, educators talk about "zones of proximal development" (ZPD) that link to an individual student's capacity to learn. Most video games are designed to enable the player to set the optimum level he or she can handle. Video games often require a certain level of mastery before moving up to another level. While it would be time consuming and labor intensive to design curriculum at individual levels, educators can provide students with new learning experiences based

on the previous learning and allow them to progress at their own pace. It is often said that today's students are the gamer generation and gaming is part of their social life. Game players are able to take on new identities and perspectives and see themselves as active problem solvers (Gee, 2003). Citing de Castell and Jenson (2003), Jackson presents guidelines for successful games.

Motivating science education through games is the topic of discussion by Egert and Phelps in Chapter 7. They look closely at the game-playing process and the cognitive and affective domain models of learning. They examine how the steps involved in game playing support the classification of the learning models. The cognitive domain model is divided into six stages: knowledge, comprehension, application, analysis, synthesis, and evaluation. At the lowest level (knowledge), players are able to recognize and recall game objects, players, and basic interaction. At the highest level (evaluation), players are able to formulate which situation will provide the maximum advantage in game play. In the affective model of learning, five levels have been identified: receiving and attending, responding, valuing, organization, and characterization. At the level of receiving and attending, the player is presented with stimuli and, through repeated exposure, is able to differentiate the game characteristics. Egert and Phelps also note that players need to discover the rules of the game and the behavior of the objects and characters and how they interact with each other. They urge that games can be considered as collaborative learning environments and tools for inquiry. The authors conclude that game playing has potential for exploration of the sciences. They stress that scientific inquiry through interaction, collaborative and cooperative activities with like-minded individuals, and the use of complex simulations and visualization methodologies are distinct methods of inquiry into new models of science.

Approaches to Research on Game-Based Learning

In Chapter 8, Travis and Young examine the development of games and how games were adapted to educational use in the early years. Some early games were based on behaviorist theory that results in stimulus-response reinforcement, but recent designs allow players to explore and discover new information. They note that game design and instructional design are not in sync. Following the list of nine principles for educational game design proposed by Warren et al. (2009), the authors analyze the game program *Operation KTHMA*. The game is set in ancient Greece and consists of alternate-reality and role-play components. The students are presented with important conflicts that need to be resolved. Throughout the chapter, the authors discuss

how the game design principles were implemented in *Operation KTHMA* and in teaching the works of Greek historians Herodotus and Thucydides.

Many educators voice that teachers, instructors, and trainers should learn the structure and language created by game designers to improve their teaching, learning, and training practices (Prensky, 2001; Shaffer et al., 2005; Gee, 2003). In Chapter 9, Squire analyzes *The Legend of Zelda*, a role-playing game (RPG), and discusses how such games can enhance learning. Most RPGs are immersive and provide complex scenarios for problem solving. Players need to align themselves with the fantasy world, and this requires orientation skills and the ability to memorize routes or pathways provided in the game. The players experience intensive involvement in the game-playing process and make connections with the imaginary characters in the fantasy world. Squire urges that the notion of taking on an alternative role has inherent learning benefits. At some stage, the player needs to discover, examine, and manipulate objects and resolve a puzzle that enables him or her to progress to the next level. For example, when puzzles are resolved, players are rewarded with access to hidden areas and gain powers or weapons they can use in confronting their enemies. This process allows the player to develop experiential and reflective cognition. The chapter concludes with remarks on a new simulated learning and gaming experience, situated in virtual settings but transferable to the real world.

Foster, Mishra, and Koehler (Chapter 10) analyze games with the use of the Technological Pedagogical Content Knowledge (TPACK) framework to determine the affordances of a game in learning. In particular, they closely examine *RollerCoaster Tycoon 3 (RCT3)*, a computer-based economic simulation strategy game for building amusement parks. The games present a different pedagogical stance from traditional direct or guided instructional practices (Foreman, 2004), and the attributes include the ability for contextualizing, individualizing, collaborating, and experiential learning. The TPACK framework provides a focused analysis of how technology integrates with content and pedagogy. The authors note that by knowing what content a game offers, the game analysis facilitates what to focus on for assessment of learning. The chapter presents detailed analysis of *RCT3*, which involves understanding of economic principles by using the TPACK framework and Playing Research Methodology (PRM). They conclude that *RCT3* combines knowledge of economics, social studies, and information and technology literacy skills. The players can also learn basic physics principles and mathematics while playing the game.

Conclusion

The study of video games in education and its implications for teaching and learning are at a critical point. Kafai (2006) notes that educators have paid no real attention during the past several years to the promise and challenges of games for learning. She believes that the special role of games in contemporary children's culture creates an opportunity to study playing and making games for learning. If we are to teach the next generation of students effectively, video games may provide progressive and complex learning environments that will prepare them to face the challenges in their real lives.

The contributors to this volume have considered challenges and potentials in this area. This book sums up the innovative use of video games as learning resources and assesses the prospects of education through edutainment. It considers creative educational game design; the psychology of gaming; cognitive, motivational, and affective processes in games; game-based learning; integrating games in learning; and how video games can be used in education. This book will be a valuable compendium for those teachers, educators, game designers, and researchers who believe in gaming as a potentially useful and effective educational tool.

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• CHAPTER TWO •

Video Game Design as a Model for Professional Learning

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Introduction

This chapter presents an example of how video game design can be structured to facilitate professional learning through our Interactive Cases for School Leadership (ICSL) project. We present a rationale for how the ICSL branching narrative–based game design activity can help address a central challenge for professional learning contexts, then describe our experiences with developing a game design learning environment in two graduate-level classes in Educational Leadership at the University of Wisconsin–Madison. We present an example of how to feasibly implement game design as a scalable model for professional learning while using common technologies. We provide templates for how we organized student design activities, elicited the requisite expertise to develop and test emergent game designs, and regularly assessed as students learned. We present a five-step plan that guided students through the ICSL game design process, involving topic selection, narrative development, scripting an interactive narrative, playtesting and post-production activities. We discuss how students used ICSL design to integrate theory and practice while producing playable, reusable learning games. In the conclusion, we explore how game design activities such as ICSL might be adapted to fit the needs of other professional learning environments.

Why Video Game Design for Professional Learning?

Professional preparation programs in education play a critical and controversial role in our education system. Education programs provide an important path for practitioners to enter their professions with the appropriate knowledge and skills. But graduate programs in education have come under fire for the quality of the preparation provided to students (Levine, 2005; Labaree, 2006). While many of these difficulties are outside the control of education schools, some problems are located in the struggle to develop viable programs to induct students into the problems of practice. Adult learners present interesting challenges for designers of learning environments. Adult learners bring robust knowledge structures reinforced by long experience to any learning opportunity. Good instructional design must lead learners to problematize what they already know in order to open up fresh possibilities for learning and growth. Preparation programs have well-established techniques for introducing novices to key concepts, theories, strategies, and practices; many preparation programs have also developed rich practicum experiences that introduce novices to the conditions of practice. Like other professional preparation fields, education classes have also long relied on tools such as problem-based learning (PBL) scenarios (e.g., Bridges & Hallinger, 1995), case study discussions and role-playing activities to help students apply theories and strategies to contexts. But preparation programs have difficulty providing legitimate feedback in activities that allow students to adapt their knowledge to professional circumstances. Students can, for example, discuss strategies for addressing the issues that arise in a PBL scenario, but seldom receive feedback from the actors represented in the scenario itself. Students can also try out theories and techniques in a practicum situation, but feedback about whether the theories were appropriately implemented typically comes from practicum situations, not from the education program. If professional programs could develop methods to provide direct feedback on student efforts to experiment with the ideas learned in education programs, then perhaps the quality of activities designed to induct novices into professional practices would improve.

At first glance, it may seem as though video game design is a curious choice for a possible strategy to design professional learning activities. Video game play itself has received considerable attention as a possible platform for professional learning. Gee (2004) argues, for example, that video games can introduce learners into sophisticated discourse practices and allow for vicarious experimentation in virtual environments. Reeves and Read (2009) suggest that experience with video gaming will become more relevant as professional environments begin to look more like virtual worlds. Instead of focusing on

play, we will argue that video game design provides an intriguing model for professional learning (see, for example, Mateas, 2005). Relatively few adult learners, however, have significant experience with digital media design, much less video game design. The world of game design is driven by a younger generation. The reaction of many adult learners to the claim that games and game designers can yield valuable learning outcomes typically ranges from skepticism to scorn. We argue that addressing the critical gap between theory-testing and feedback in professional practice programs may outweigh the challenges of establishing video game design as a legitimate adult learning activity. The successful implementation depends on how the instructor structures a learning environment that can problematize prior knowledge while scaffolding the skills and tools necessary to engage in game design activities.

ICSL locates the process of video game design in the wider context of design-based research (Barab & Squire, 2004; Edelson, 2002). A design-based research investigator builds hypotheses about practice into features of interventions, then studies how users interact with the intervention to determine the accuracy or feasibility of the hypotheses. For example, a design-based researcher may develop a curriculum that encourages students to test the quality of evidence given to substantiate historical claims. The researcher can then study how the curriculum influenced student behavior in an authentic classroom context while also studying the quality of the curriculum design. Design-based research thus yields both theoretical and practical insights about the practices that interventions are designed to influence. Researchers have already adopted a design-based perspective to engage in hypothesis testing through video game design and play (see, for example, Squire, 2005; Dede, et al., 2004). Of course, the relation between doing and learning as a model for pedagogy is as old as education research. Constructionist learning theory (Papert & Harel, 1991), for example, offers a compelling account of the power of learning through creating manipulable models of understanding. Building and testing a model of prior assumptions leads learners to perceive the shortcomings of their initial hypotheses and to model new assumptions that better fit the problem space. A key to constructionism is providing learning environments that allow students to build dynamic models of what they know. These types of learning environments that link actions to outcomes through direct feedback depend on constraining the range of possible learning activities. Constructionist learning environments, from NetLogo to Boxer to Squeak, typically depend on developing a "procedural literacy" (Mateas, 2005) in programming in order to develop dynamic models. These environments lead toward learners asking the kinds of questions that are afforded by programming-based environments, including a wide range of social science investigations

that involve system- and agent-based modeling (for an overview, see Gilbert & Troitzsch, 2005). Once students learn the rules of the environment, they can develop and test models of the kinds of phenomena that can be represented in these environments.

Our ICSL game design efforts focus on building branching-narrative games for professional learning. While system- and agent-based modeling provide insights about the operation of complex systems, they do not exhaust the range of theory-practice integration and testing activities that novice professional learners must participate in to gain expertise. Game design activities can follow the programming-based path established by traditional constructionist learning environments (see, for example, GamestarMechanic.com), but the variety of video game genres offers a range of approaches for how learners can model and test hypotheses about complex phenomena. The branching-narrative genre creates opportunities for designers to create interactive stories that give players feedback on choices. Branching narratives are useful for motivating learners to participate in complex environments. "Choose your own adventure" stories (e.g., Packard, 1979) provided early examples of branching-narrative environments in which readers could choose the pages that would allow the story to continue in different directions. Interactive fiction games create virtual branching narratives that allow players to choose from among multiple paths through a complex story (Shelton, 2009). Gordon (2004) uses the phrase outcome-driven simulation to suggest how branching-narrative models can be adapted for developing training applications. Gordon's account describes a branching narrative building strategy to capture relevant professional knowledge and to present learning challenges in terms of critical choices that distinguish novice from expert perspectives.

A key design step in Gordon's account is to structure narrative options that reflect several novice interpretations of the given problem, then to construct responses to each option that challenge novice conceptions to include more characteristics of expert problem-solving strategies. This two-step process—narrative options and consequential responses—gives the designer an opportunity to anticipate player perceptions of problems and to provide responses that will challenge players to rethink the initial problem-setting. Playtesting provides the critical step in providing feedback for the designers to understand the accuracy of anticipated options and responses through player reaction and comments (Winn & Heeter, 2007). In playtesting, players interact with early versions of the learning environment in order to provide feedback on design decisions. Playtesting typically occurs at multiple points during the design process in order to test different aspects of the environment (Zimmerman, 2003). In learning game design, playtesting provides feedback on the pedagogical assumptions as design-

ers assess how players learn from the options and responses coded into the environment. In Gordon's model, playtesting allows designers to learn whether the anticipated novice preconceptions reflect how novices actually think about presented problems, and whether the range of responses provided by the designers actually lead players to rethink their approaches.

ICSL pushes the design-based research framework into service as a pedagogical strategy for professional preparation courses. If design-based research allows researchers to test hypotheses in real contexts of practice, then structuring learning environments to allow learners to act as designers ought to allow students to gain similar insights as a result of their designs. This study adapts Gordon's outcomes-based education framework to help learners create their own branching-narrative games. Shifting the locus of control from designers to learners allows students to reap the insights designers of learning environments typically enjoy. Our cases illustrate how to structure a learning environment in which students select an example story for adaptation to a branching narrative; build a single narrative path through the storyline; develop decision points that allow players to test different hypotheses of action; construct a working branching-narrative prototype; then structure playtesting opportunities for designers to learn about the assumptions they felt players would make in their narratives. The ICSL narrative design process engages students in design activities that lead them to anticipate the ways players are likely to encounter complex environments. Playtesting serves as an assessment that pushes designers to revise their initial design decisions. Game design, however, requires significant technical and design expertise, and the pressures for content coverage can make it difficult to implement game design as a classroom learning activity. ICSL highlights a method for providing a structure sufficient to organize game design for a nontechnical audience in ways that supplement, rather than supplant, existing course learning goals.

The Context for Design

Our ICSL examples focus on two graduate-level courses in educational leadership offered at the University of Wisconsin–Madison in 2009. One class (702) was designed as an introduction to K–12 education leadership; the other (703) addressed how to evaluate teaching and learning. The first author (Halverson) was the instructor of record for both classes; Christopher Blakesley and Regina Figueiredo-Brown served as graduate assistants. The 702 ICSL project involved students adapting a problem-based learning case derived from the Journal of Cases in Educational Leadership (JCEL). Each of five groups (consisting of three 702 students) chose a JCEL case for adaptation into a branching-narrative game.

The 702 students were challenged to show the core ideas developed in the course through their game design project. In contrast, the 703 ICSL project was situated in a teacher evaluation cycle context. Each of two groups of five students chose a video case example of classroom teaching—one of an eighth-grade math teacher, the other of a seventh-grade language arts teacher. The purpose of the 703 ICSL project was to structure the anticipated post-observation evaluation conference between a principal and the teacher represented in the video case. The 703 project put the player in the role of a principal who was challenged to provide effective feedback without being either irrelevant or judgmental. Together, the ICSL projects resulted in seven interactive cases, through which students were able to test their assumptions about how theories of leadership and evaluation would play out in everyday contexts.

We faced several significant problems in asking our students to engage in ICSL game design. First, it did not appear clear to many of our students how game design was a relevant activity for introductory education leadership coursework. Several students were put off by the demands of engaging in design work and wondered how these projects would either link to the course content or help them develop leadership skills. We reminded students throughout the game-development activities about how class outcomes described connecting theory to practice, and explained how the playtesting experience would help students see the connections between game design and professional learning. Second, only a few students had any experience with technology design. Most of the students had experience with learning management systems, e-mail, office applications, and Internet tools, but little experience with web design, video production, storyboarding, or production tools. We felt that asking students to learn new production technologies would probably overwhelm our intention to have the learning be about school leadership. We therefore decided to confine game-development activities to a tool with which all students were familiar: PowerPoint. We treated PowerPoint as form of HyperCard stack by using hyperlink connections across slides to simulate a branching-narrative game environment.

Designing Branching Narratives for Professional Learning

We developed a five-step ICSL design process to structure the learning environment (Figure 2.1). We incorporated aspects of Gordon's (2004) branching-narrative development model to articulate the procedures involved in each step. After providing a brief description of each step in the process, we will use the steps to share reflections on the challenges and opportunities presented by the game-development process.

1. *Story selection.* This step involves introducing the student group to the design process by selecting an established problem-based narrative or video for adaptation into a branching-narrative game. Gordon's (2004) approach to design aims to create a narrative from expert and novice anecdotes; our process emphasizes the adaptation of an existing narrative to a game format. In the 702 course, problem-based learning scenarios included topics such as curriculum reform in a rural school, appropriate treatment of a special needs student, a community grievance about a faculty member's political views, and data-driven decision making. The 703 course allowed student teams to pick from among several videos of classroom teaching practice to structure a post-observation conference branching narrative.

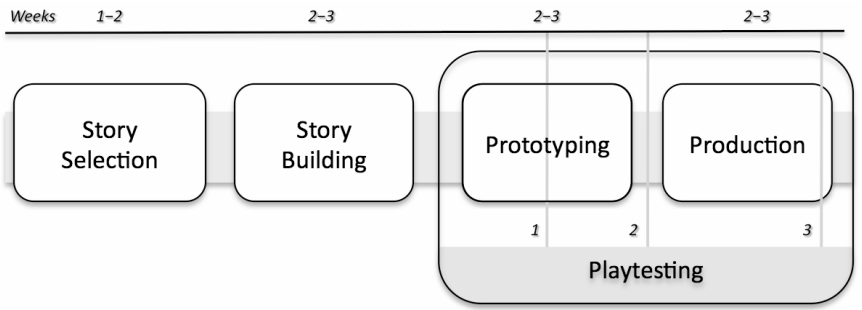

Figure 2.1. ICSL design model.

2. *Story building.* This step involves adapting or extending an existing account into a branching-narrative game. Story building addresses three points of Gordon's model: chapter sorting, point analysis, and decision formulation. Chapter sorting addresses a significant problem with branching-narrative design. Each decision point in the narrative yields at least two choices, which in turn yield at least two more, which lead to two more, and so on. Soon designers are faced with an exponential number of story directions to construct, making the narrative process unwieldy for both the designers and the players. A chapter structure allows designers to resolve decision-point multiplication by drawing story threads together into a new singular decision point. Next, the designers conduct a point analysis, which highlights the narrative events that might lead novices and experts to different reactions. The final part of story building involves decision formulation, in which designers script how the game system will respond to player choices. These activities allow students to build multiple narrative paths into their games.

3. *Prototyping.* This is the activity of translating narratives into a virtual environment. Prototyping begins with Gordon's graph assembly task. Designers may use note cards to detail each step of the narrative process, then fit the cards into a comprehensive narrative map and script that show how narrative elements fit together. Then designers engage in Gordon's narrative assembly by translating the note card text into a PowerPoint-ready blueprint. Prototyping results in a fully articulated version of the story that includes all designed narrative elements.

4. *Production.* At this point, the branching narrative must be translated into a stand-alone PowerPoint document. Gordon's production step involves the design and selection of graphic elements and formatting necessary to bring the story alive. The production task allows designers to revisit the story from the perspective of the player to assess the degree to which the intended narrative branches successfully convey the story lessons.

5. *Playtesting.* The three occasions for playtesting constitute the central ISCL learning and assessment tasks. Playtesting tasks are iteratively woven into the prototyping process. The first playtest occurs after designers have completed story building. This low-tech playtest helps designers recognize gaps in their narratives, and clearly shows where the responses and narrative elements are insufficient to carry the story along, The second low-tech playtest occurs after the script has been fully articulated. Here designers see how well the branching narrative makes sense, and can recognize the degree to which their point analysis and decision formulation decisions adequately capture how practitioners might respond in the situation. The final playtest occurs after the production process, and gives the designers feedback about the adequacy and persuasiveness of the media used to present the case.

As our ICSL model evolved, we encountered one key difference with Gordon's model. Gordon assumed that the goal of the designer is to identify and articulate a clear difference between novice and expert interpretations of a given event. Emphasizing a clear expert/novice distinction would lead to more accurate measurement of learning for players who worked through the case. However, we felt that clear distinctions between expert and novice learning might result in cases that led to mutually exclusive right and wrong paths. Instead, we pushed our game designers to elicit mutually plausible narrative paths that would challenge players to think through the implications of a given approach to the problem. This reflected our assumption that the in-class learning was to take place in the design process, not through playing the games. Building mutually plausible choices into the game model would force design-