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What Can K-12 School Leaders Learn from Video Games and Gaming?

by Richard Halverson

Schools have much to learn from video games and the gaming community. By providing compelling activities for motivating otherwise indifferent learners, video games can potentially help teachers improve the design of learning environments. However, there are considerable rhetorical and practical barriers between the schooling and gaming communities grounded in fundamentally different approaches to learning. Whereas schools are moving toward increasingly standardized learning experiences, games offer the prospect of user-defined worlds in which players try out (and get feedback on) their own assumptions, strategies, and identities. It is difficult, at first glance, to see how gaming can help teachers meet the demands of an increasingly standards-driven public schooling system.

The adversarial relation between the two cultures heightens the contrast between the underlying theories of gaming and schooling. Many school leaders and teachers react negatively to video games and gaming culture, bashing video games as diversionary threats to the integrity of schooling or as destructive activities that corrupt moral capacity and create a sedentary, motivation-destroying lifestyle. Apart from embracing a few games such as [Oregon Trail](#) or [SimCity](#), schools have typically acted to eliminate or marginalize gaming. The strong content and the addictive play of games such as [Doom 3](#), [Grand Theft Auto: San Andreas](#) and [Everquest](#) have led non-players to overlook the learning principles incorporated into the game design. Thus games have come to typify the essentially subversive side of computing in schools (Squires 1999).

Gee (2003) argues that the compelling nature of video game participation is in part due to the underlying social, cognitive, and developmental learning principles around which game designers build successful games. Games succeed because they encapsulate powerful design principles for learning environments. When school leaders and teachers begin to appreciate the compelling nature of gameplay and the powerful learning principles embedded in games as positives, they then can consider how games might inspire alternative approaches to learning, both within the existing contexts of schooling and in the development of new learning environments. However, facing the different assumptions made by game designers about learning will force leaders and teachers to reexamine the core principles of learning in schools. If leaders and teachers can come to recognize the learning principles of game design, the gaming and schooling communities together can begin to see how to learn from each other and build the next generation of learning environments.

Endogenous Gaming as a Medium of Learning

To highlight the differences between current education games and video games, I draw on the distinction between *exogenous* and *endogenous* games (Malone and Lepper 1987). Exogenous games provide simple networks of generic, interactive strategies useful for organizing access to a wide variety of content. Teachers and curriculum designers have long used exogenous games, such as *Jeopardy*-style or *Wheel of Fortune*-style quizzes, in order to provide a review of or a break from ordinary learning activities. The learning environment of an exogenous game bears no necessary relation to the content—*Wheel of Fortune* activities, for example, can be quickly constructed for a wide variety of topics. Simple designs and adaptable content make exogenous games popular in schools, relatively easy to create, and usually peripheral to central learning activities.

Endogenous video games connect game design and domain content by integrating relevant practices of the learning environment into the structure of the game. Mastering the learning environment is itself the learning

outcome; it is not merely a means to an ulterior goal. Learning to navigate the game architecture provides an introduction to how knowledge is organized in the modeled domain. Advocates of learning through playing endogenous games such as [Rise of Nations](#) and [Civilization III](#) describe how interactive environments allow players to explore counterfactual historical claims and manipulate complex historical models. Squire and Barab (2004) show how students who traditionally struggle in school can use *Civilization III* to examine, for example, what would happen if Africa (instead of Europe) had colonized North America. The ability to play out alternative histories, a difficult task for typical classrooms, requires players to manipulate and master the game environment in order to learn the complex lessons of the game. Other endogenous games provide constructionist learning opportunities for students to represent their understanding by building models and simulations (Kafai 2001). [Railroad Tycoon II](#), for example, allows players to engage in design activities that draw on the same issues of resource allocation and terrain navigation faced by the original rail designers.

While exogenous games provide valuable tools in the teaching repertoire, formal schooling has shied away from the adoption of endogenous games. This preference for exogenous over endogenous games follows from the widespread acceptance of educational content standards in K-12 education. Standards specify what to teach; school leaders and teachers construct efficient pedagogies and learning environments to teach it. Exogenous games have long played a supplemental role in helping schools reinforce lessons and provide remedial activities for students. Endogenous games, on the other hand, provide inefficient and unpredictable environments for learning school-based material and have learning outcomes that are difficult to map onto curriculum standards. Learning in endogenous video games can be a protracted and indirect affair with a steep learning curve when compared with standard curriculum units on mathematical fractions, Egyptian history, or European expansion.

Though it may be difficult to map the outcomes of endogenous games onto traditional school curricula, advocates of gaming in schools continue to extol the learning possibilities of, for example, real-time strategy (RTS) games. RTS games such as *Rise of Nations* and *Civilization III* are designed around complex models of variable interaction intended to approximate the evolution of social-political systems. Learning in these RTSs, advocates argue, would help players interact with, and ultimately understand, the underlying principles of such systems. Let us consider *Rise of Nations*, one of the best-selling endogenous video games of 2003. *Rise of Nations*, a turbo-charged version of the popular board game *Risk*, allows players to develop civilizations from antiquity to the information age. Like *Risk*, *Rise of Nations* requires players to strategically outnumber opponents in order to conquer the world. Instead of using a dice-roll to decide conflicts as in *Risk*, *Rise of Nations* uses real-time strategy episodes to decide conflicts in which players must build sufficient economic, agricultural, financial, political, technological, and military resources to withstand assaults and conquer territories. The game-play is based on a sophisticated model about the interaction of variables in complex socio-economic systems. *Rise of Nations* requires players to build cities and generate citizens in order to construct buildings and to secure adequate resource bases of wood, metal, food, money, and later oil. These resources can be spent for a variety of purposes such as the development of industry, sea power, religion, commerce, espionage, and diplomacy. Players soon realize, either through internal caps on development or through invasion by opponents, that expansion in any given direction has limits, and balanced development of national capacities is both the best defense against aggression and the most effective path to conquest.

Learning to play the game is a challenge in itself. In single player mode, setting the difficulty level from "easy" to "moderate" can overwhelm new players with the number of strategic and tactical decisions required to cope with newly aggressive adversaries. Simply manipulating the game model to simultaneously develop resources, trade, and defense involves impressive dexterity and cognitive complexity. However, from a schooling perspective, learning to play the game successfully is a different question than what can be learned from the game. Here the question arises about the "real-world" conclusions players can draw from gameplay. Can recognizing the modeled relationships among game variables transfer to insights about theories of socio-cultural interaction? Building temples, for example, allows players to build wealth through taxation: subsequent investment in "temple research" allows players access to more sophisticated (and onerous) taxation resources. The connection between religion and taxation, however, is an interesting and

counter-intuitive historical association. Strictly within the context of the game, players can overlook the legitimacy of this association to consider the relation of religion and taxation as a mere functional dependence necessary to win the game. In other words, within the game players may not "learn" anything more than clicking on one kind of button to receive a desired outcome. Even though players must invest considerable time in the game to uncover these functional dependencies (Squire and Barab 2004), successful gameplay itself does not necessarily generate insight into the underlying conceptual model.

The key to learning school-related content from endogenous RTS games depends on structured opportunities for students to research the historical connections implicit in the game model, to collaboratively reflect upon their play, and to relate their experience to conventional standards-based content (Squire 2005). Recognizing the analogies between the "rise of nations" and *Rise of Nations* requires opportunities to understand *why*, for example, taxation depends on religion, rather than simply recognizing *that* these functions are related. In themselves, RTS games do not necessarily establish viable analogies with real-world phenomena, but they can complement high-quality classroom learning experiences. As RTS games help players acquire complex models of variable interaction, quality school lesson design can in turn help students relate this systems-learning to the history and features of social systems. Constructing learning environments for endogenous game-based instructional designs requires scaffolding lessons for students to recognize the analogies between observable variable interactions in games and the relations between social systems in the world. Thus a key to integrating endogenous video-gaming into schooling requires instructional designers to reflect carefully on what players do, and do not, learn from gaming and to design learning environments to help students bridge the gap between game-insights and school content knowledge. In the case of RTS games, connecting gaming to schooling will require instructional designers to establish and maintain robust connections between game-based systems interaction and school-based content.

Gaming for Leadership; Leadership for Gaming

The frontier for systematically incorporating either existing endogenous games or game-based learning environments in schools is largely unexplored. However, inspired teachers across the country are developing lessons and learning environments to help students learn from endogenous gaming. The loosely coupled structure of the American school system has long granted individual teachers space for instructional innovation while at the same time preventing these innovations from reshaping teaching practices across schools (Weick, 1976; Meyer and Rowan 1978; Cuban 2001). Thus, although the inspiration for instructional innovation often comes from teachers, the responsibility for realizing the power of game-based learning environments across schools lies mainly with school leaders. Formal school leaders such as principals, technology and curriculum coordinators, superintendents and department chairs, and informal leaders such as lead teachers and curriculum designers share responsibility for shaping the conditions of teaching and learning in schools. To realize the potential of such a radically new learning technology, leaders must coordinate their efforts with teachers in order for gaming to get a foothold in schools. In the following sections I first consider *leadership for gaming* to outline the conditions necessary for the implementation of gaming in education and illustrate some practical ways in which such implementation might take place. I then consider *gaming for leadership* to argue that the best way for leaders to understand the potential for gaming may be to experience first-hand the power of participating in game-based learning environments.

Leadership for Gaming

Leadership for gaming addresses how leaders can integrate existing games into schools. Although games certainly push schools to expand what counts as learning (see, for example, Gee 2003), the discussion here focuses on how school leaders, teachers, and instructional designers can use existing gaming to help students learn existing content standards. (The discussion here also assumes that although the principles of game-based design can be integrated into school lessons, the actual development of endogenous video games is beyond the scope of most school leaders and teachers). Commercial endogenous games require an integrated lesson design that incorporates the depth of gaming insights into standards-based school environments.

Schools can rely on technology-based simulation research to guide how games might be integrated into learning environments. Simulations are structured opportunities for learners to engage with artificial worlds for the purpose of making predictions and/or engaging in consequence-free interaction (Prensky 2000). Simulations have provided efficient and safe learning opportunities for medical, architectural, business, and scientific students; activity-based simulations such as mock trials, Model United Nations, or lab experiments have been staples of school instructional programs. Simulations are not, however, by definition engaging—rather, the learning activities that help learners make sense of interaction with the simulation create engagement. Integrating game features such as compelling goals, user-defined paths, and action-linked consequences make simulations more compelling (Prensky 2000). Goal-based scenario design likewise suggests that the integration of player-level goals and opportunities to learn from failure help create authentic, engaging learning environments (Schank 1992; Gee 2005). For example, games such as *Supercharged!* point toward how to integrate player experimentation and strategizing with the study of electricity and historical causation and change (Holland, Jenkins and Squire 2003). When viewed from this perspective, integrating simulation-based endogenous games into existing instructional programs seems less of a stretch.

Integrating endogenous games into typical school settings highlights the role of teachers and leaders in designing learning environments. As mentioned above, school leaders, teachers, and instructional designers all play a role in shaping school learning environments. While traditional standards-based school learning environments are focused on sequenced content coverage, endogenous game-based pedagogies require curriculum designers to rethink the relation of learning content and the learning environment. The role of the learning environment in a traditional school setting is to provide a context to make structured content accessible to students; the role of the learning environment in an endogenous game-based setting is to scaffold prompts for helping students construct legitimate analogies between what can be learned in the game and what schools need to teach. Learning from endogenous games, as the *Rise of Nations* example illustrates, requires teachers to help students make sense of their game-based insights about complex systems in terms of school content. Building learning environments around endogenous games can thus provide a pathway for genuine constructivist learning in schools (Fosnot 1996; Kafai 2001).

Learning sciences research on the dimensions of successful learning environments illustrates how leaders and teachers might integrate gaming into schools (Bransford, Brown, and Cocking 2000):

Learner-centered environments draw on the interests and motivation of learners to direct learning. Endogenous games are powerful learner-centered environments that scaffold learning content in terms of what students need to know and when they need to know it. Here learning designers must be able to mediate the learner-based features of game design with the content-based features of traditional curriculum design. A first step may be to identify content areas that can be best learned in games. Curriculum alignment initiatives can identify aspects of the instructional program that will allow the kinds of in-depth, learner-centered occasions conducive to gaming. Researchers have found that standard learning objectives such as systems thinking, geology, immigration, or global warming may be taught effectively with technology-based simulations (see for example Radinsky, Ryan, and Buelow, under review; Edelson, Gordin, and Pea 1999; Kafai 1995; Krajcik 2002). In these domains, learners benefit from interacting with dynamic, virtual representations of content. Games such as *Rise of Nations*, *Civilization III* and *Black and White II*, for example, help players to participate in complex environments that lend themselves to systems thinking and ecological analysis. Learning environment designers would need to construct domain-appropriate questions within the game that promote understanding of content outside the game.

Assessment-centered environments integrate authentic learning measures into the environment. Endogenous games provide opportunities for risk-taking and controlled failure that link player actions directly to consequences. Failing at a particular mission or task provides a direct, authentic assessment of gameplay; the short jump from cause to consequence provides players with the formative information necessary to reassess initial assumptions and act in new ways. Designing environments to integrate games into schooling can thus draw on the assessment devices already built into games. The technology of multi-player gaming,

for example, generates tangible records of prior game moves in the form of discussion threads that can be used to spark reflection on the assumptions behind earlier game moves (see, for example, the [Rise of Nations Universe](#) site). Learning environment designers can use these public representations of game-based information to discuss school-based learning outcomes. The arguments players develop online to defend in-game moves open valuable windows into the players' thinking processes. The outcomes of game-play also provide authentic artifacts of student learning that can be used as summative evaluations of learning. The final products of more open-ended, "world-building" games (e.g. *SimCity* and *Railroad Tycoon*) provide detailed artifacts that can be used to measure the comprehension and application of knowledge. Developing rubrics that relate gameplay to learning outcomes is a central task for assessment-centered instructional design.

Knowledge-centered environments organize content for appropriate use by learners. School knowledge, organized in terms of disciplines, often neglects to help students integrate what they know across disciplines. *Rise of Nations* provides a prime example of how different domains such as economics, politics, history, and warfare interact in a dynamic system. Using *Rise of Nations* to spark conversations about religion and taxation, for example, could help students make connections across disciplines. Analyses of curriculum alignment may point to areas of program overlap ripe for multidisciplinary investigation to show where integrated lesson design could make the most sense. For example, a game-based approach to immigration policy might require a student to learn the history and consequences of past immigration policies, develop statistical tools to detect patterns and analyze trends, and apply ethnographic perspectives to the question of what life is like for new immigrants or why immigration happens when it does.

Community-centered environments situate learning in meaningful social contexts. Although video games have been criticized for isolating players, the emergence of online gaming calls into question the stereotype of the socially isolated game-player (Steinkuehler 2004). The social dimension of the [Sims II](#), [Lineage II](#), and [fantasy sports](#) allows players to participate in a wide variety of social worlds and to try on alternate identities. These venues for social experimentation provide interesting occasions for students to engage in the developmental identity tasks of adolescence (Gee 2003; Kroger 1996). Online video gaming affords synchronous interaction within gameplay and asynchronous interaction through gaming forums in which players explore gaming interests through conversation and exchange of game-related materials. The social context of gaming thus expands the spatial limitations of the classroom environment by allowing students to learn through participating in affinity groups (Gee 2003) as well as institutionally selected peer groups. The community focus of gaming environments can also help players participate in simulated virtual communities. For example, the [Education Arcade](#) game *Revolution* places players in the American Revolutionary era, and *Eyewitness* uses the first person perspective of a photographer to guide players through the Nanking Massacre of 1937. These games aim to bring the complex world of historical events to life by allowing players to interact within a recreated virtual world.

Although these suggestions do not yet form a comprehensive plan for remaking classrooms according to the principles of endogenous game design, I believe they help extend these research-based principles of successful learning environments to situate game-based pedagogies in traditional school contexts. However, recognizing the potential of gaming for learning is only the first step. Integrating endogenous games into existing learning environments presents considerable challenges. Many games are difficult to master given the technical limitations and time constraints faced in classrooms. Research on how teachers can respond to these challenges in the classroom, much less how school leaders can respond at the school level, is just beginning to take shape (see, for example, Squire 2005 and Egenfeldt-Nielsen 2003). These researchers suggest that integrating endogenous games into existing classrooms pushes teachers to become expert game players in order to act as helpful facilitators for students—and as a result, to abandon the certain results of traditional instruction for the serendipitous possibility of deep learning. Teachers already pressed with meeting the requirements of standardized testing may balk at the suggestion to develop these new forms of expertise.

Yet the push towards standardized testing may also work toward establishing legitimate spaces for

experimenting with game-based learning environments. For many school leaders and teachers, improving student achievement on standardized tests pushes for increasingly prescriptive, content-coverage approaches to instruction. In turn, the recent attention paid to standardized testing in math and language arts has diverted policy makers and public attention from subjects such as social studies, fine arts, and civics. This comparative lack of accountability has the hidden benefit of opening these non-tested subjects up for curricular innovation. Developing game-based, learner-centered environments for these subjects could focus and reinvigorate attention to these subjects now marginalized through omission on standardized assessments.

Gaming for Leadership

The experience of playing games provides many players with a persuasive argument for the learning potential of endogenous games. But nowhere is the current generational gap in technology greater than in game literacy, and while asking school leaders and teachers to play commercial video games may be a stretch, integrating game-based learning experiences in their professional development may help them see the merits of gaming from the inside. What would it mean to build game-based learning environments for school leaders? Simulations have long been familiar components of training programs, but recent advances in both technology-based gaming and accessing professional knowledge could open up new areas for development. Web sites such as [Social Impact Games](#) include links to a variety of "serious" games in the fields of public policy, health, business, and the military. Clark Aldrich's [Virtual Leader](#) indicates how leadership skills might be taught online. In the world of education, games such as [School Tycoon](#) and [Virtual U](#) allow players to practice generic management skills in experimenting with the infrastructural, financial, and personnel systems in K-12 and post-secondary schools.

Learning the specific skills of school leadership might require an approach that goes beyond a generic representation of leadership skills. David Shaffer's (2004) research on professional *praxis* demonstrates how to use the epistemic structures that professions such as architecture and urban planning develop to organize knowledge. Documenting and representing these structures in complex simulations allows learners to access and use the *epistemic frames* that guide professional practice (Shaffer 2005). Once uncovered, these epistemic frames can serve as design principles for *praxis*-based learning environments. My work on school leadership practice (Halverson 2002; 2003) suggests an approach to game design that builds on Shaffer's insights into pedagogical *praxis*. I argue that the practical wisdom of school leaders is largely composed of the ability to "set" problems as solvable in authentic, complex situations. Developing this grounded ability to successfully frame problems in complex systems is difficult to cultivate in traditional leadership preparation programs. Communicating practical wisdom requires building accessible learning environments based on careful reconstructions of the authentic tasks and contexts for professional practice. Halverson and Rah ([in press](#)) contributed to the initial stage of this work by developing a multimedia representation of a principal's effort to restructure learning opportunities for students who traditionally struggle. The next step in this research will be to integrate game-like principles in such simulations in order bring the processes of school leadership alive for learners. For example, Gordon's (2004) outcome-driven simulation models point toward how analyzing novices' and experts' responses to the typical problems of practice can be used to structure game-like interaction through branching narratives. Game-based representations of professional knowledge may allow novices to vicariously experiment with the kinds of complex systems they will soon encounter as school leaders and thus show them, first hand, the power of games to teach.

Conclusion

Gaming and schooling have, until now, followed separate developmental paths. The gaming generation, our students, is at the forefront of a wave of computerized innovation that the leaders of the educational establishment resist, even as leaders are pressured to use technology for improving classroom instruction.

Young people must clearly want something that the formal institutions of which they are a part cannot, or at least do not, provide. What is that something? Could mainstream institutions do a better job of providing it?

Perhaps they could, but only if those in charge are able and willing to examine the alternatives closely and to consider the possibilities of new forms of organization that are better suited to an era in which ideas and information flow without apparent control and in which the boundaries between youth and adulthood are far less clear than formerly (Resnick and Perret-Clermont 2004).

Schools have typically responded to adolescents' identity exploration and wandering attention by increasing behavioral controls and decreasing the complexity of cognitive tasks assigned, creating a mismatch between adolescents' developmental stage and the school learning environment (Eccles, et al. 1993). Games address this mismatch by providing increasingly complex, customizable learning-by-doing environments. The success of video games at motivating students suggests that schools may bring gaming in from the periphery to reconsider the institutional barriers to change.

In their efforts to improve learning for all students, educational leaders and teachers need to continuously explore new paths for learning. Video games and gaming provide paths for integrating new technologies. Simply recognizing games as potent learning environments would be a start for counteracting the current anti-gaming rhetoric. Schools can then take steps to incorporate gaming principles in the design of school learning environments. Participating in game-based learning environments themselves may help leaders to appreciate and promote gaming as a legitimate form of learning. When the worlds of gaming and schooling can be described on a common learning map, we may see the start of learning environments in which schooling and gaming work together to define the future of education.

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