

Chapter 12

Citizen Science: Designing a Game for the 21st Century

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ABSTRACT

In order to adapt to the educational demands of an increasingly digitized and globalized society, reformers have pointed toward games and their communities as potential models for what 21st-century educational systems might look like. As educational game research develops as a field, the need for design frameworks that leverage contemporary perspectives on education, learning, and established commercial game design techniques grows. In this chapter, the authors briefly describe current educational demands that highlight a shift away from content-focused curriculum and outline the design process used to make the game Citizen Science, a game to teach civic science literacy. By providing insight into the process of design, the authors hope to illuminate the relationship between theory and its enactment.

INTRODUCTION

Just a few short years ago, the idea of combining games and education was met with skepticism, if not scorn. This attitude has changed as educators have noted that video games are worlds capable of communicating sophisticated ideas (Jenkins, 2004; Squire, 2006), instantiate in their designs the principles of situated learning theory (Gee, 2003, 2005), are leading activities for academic or lifelong pursuits (Squire & Steinkuehler, 2005)

and can, in some cases, be used for the pursuit of traditional academic goals, such as learning history, physics, or ecology (see Ferdig, 2009; Shelton & Wiley, 2007).

While investigations that design and investigate games in the pursuit of education have progressed, more specific, even pragmatic issues have started to take shape. How can these games be implemented in classrooms? Can a more precise vocabulary be developed to analyze games? *How does one actually design a game that is both educational and fun to play?* This chapter investigates the latter question by investigating one such design theory that seeks

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to extend earlier notions of games as designed experiences. Before we can address this complex question, however, we need to say a little more about the current state of the educational system and the role that games may play.

Games, Education, and Civic Science Literacy

A study released by the Pew Internet & American Life project in September 2008, which showed that 99% of boys and 94% of girls play games, exposes the degree to which games have come to saturate and impact youth culture. Around the same time as the Pew study, Barack Obama called specifically for education reform that would help children “compete in a 21st-century knowledge economy.” While the two events may seem disparate, we argue that these two foci—one on the impact of digital gaming (and participatory culture) on youth and the other on the importance of civic engagement—are indeed two sides of the same coin. Today’s youth are raised in a media-saturated environment in which they expect to participate meaningfully in communities as media producers—perhaps even in the creation of entire virtual worlds. Yet in schools, they are trained not even for the world of today, but for that of yesterday as it was imagined to have existed.

One core theme behind the Games, Learning, and Society (Squire, 2007) initiative has been how to take seriously the mechanisms by which games (as opposed to other forms of media) engage players. The differences between the design features of video games and those of school are marked. Where games are frequently customizable, nonlinear, responsive to different play styles, transgressive, participatory and empowering to players, features of school include emphasizing standardization of curricula, uniform and linear paths through the curriculum, fixed learning objectives, uniform learning outcomes, a lack of attention to aesthetics, student passivity, and subjugation to authority (Gee, 2004; Squire, 2003). A

challenge for designers then, is how to reconcile the discrepancies between video games—artifacts that are designed for consumption in player’s leisure time—and the constraints of formal schooling. If there is hope for designing and developing games that honor the underlying mechanisms by which games work—and the values of gaming culture—while leading toward socially desirable learning goals like a scientifically literate citizenry, what would a design theory of such a game development process look like?

As games mature as a medium for learning, a number of educational subgenres (or models or paradigms) have emerged, including *targeted games*, *open-ended sandbox games*, *epistemic games*, and *multiuser virtual environments*, each with its own unique approaches to design. For example, one relevant design from the second author’s earlier work was that of a *targeted game*, focusing on specific conceptual change with schoollike settings. The game, *Supercharged!*, was designed by a team of researchers and MIT physicists to provide players with the opportunity to adopt the perspective of a charged particle within a “world of electromagnetism,” a perspective that expert physicists frequently adopt while thinking through problems. By strategically placing charged particles around themselves, players moved through space to accomplish in-game goals. Research found that not only did students develop a more robust conceptual understanding of electromagnetic physics, but they also gained insight as to why visualizing forces was helpful. These learning gains, however, did not necessarily generalize to more advanced thinking about electromagnetism writ large, nor the development of identities among students as physicists, nor a better ability to participate in contemporary popular discourse around issues in which such understandings might be brought to bear (such as alternative energy). The shortcomings of this model drove us to look toward role-playing games, as they put players in real-world kinds of situations where they must use scientific understandings to

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