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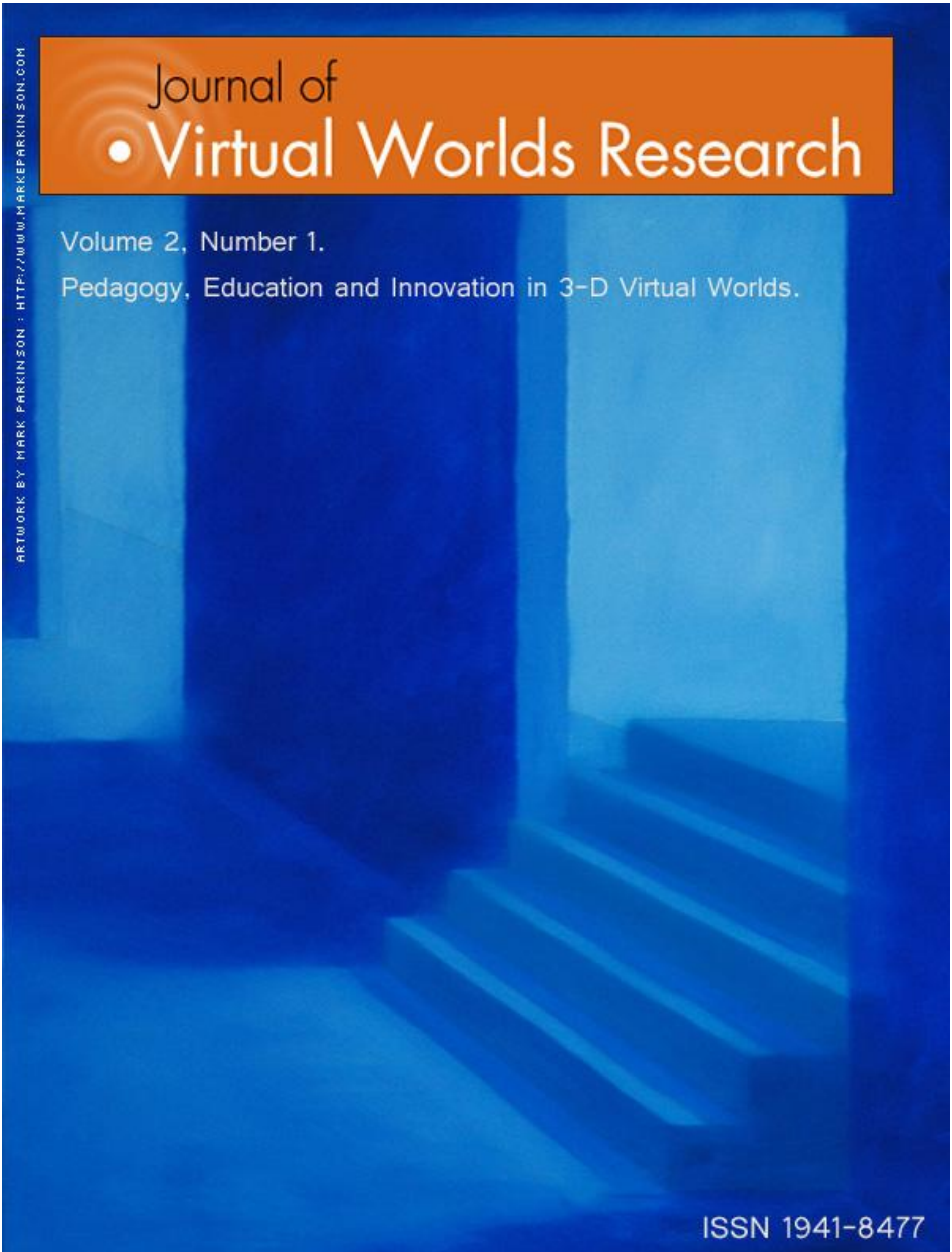

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Games, learning, and 21st century survival skills

By James Paul Gee, Arizona State University

Abstract

Digital games hold out great potential for human development. There is no reason to think about games simply as "fun." At the same time, there is no reason to equate learning with being "serious." Games and learning, at their best, engage humans at a deep level of pleasure (Gee 2005). Play and learning are primordial human urges. Unfortunately, we have come to take it for granted that adulthood will kill play and schools will kill learning as a human pleasure. These assumptions are particularly dangerous in the twenty-first century.

Keywords: digital games; research; learning.

Games, learning, and 21st century survival skills

By James Paul Gee, Arizona State University

We live in a high risk world of interacting complex systems. A world subject to dangerous global warming, a now melting high-risk global economy, and massive destruction due to unchecked poverty and population growth. Natural systems are no longer independent of human beings. Urban environments and human energy seeking now affect temperature and storms. Things that were once “acts of God” and are now also “acts of man.”

In my view, in the twenty-first century we need the following—and we need them fast and all at once together: embodied empathy for complex systems; “grit” (passion + persistence); playfulness that leads to innovation; design thinking; collaborations in which groups are smarter than the smartest person in the group; and real understanding that leads to problem solving and not just test passing. These are, to my mind, the true twenty-first century skills. We will not get them in schools alone and we will never get them in the schools we currently have.

To start my discussion of these twenty-first century skills, let us first think about what gaming and science have in common. Games and science share with each other that they are both games, although only games seem so at first view. They share, as well, the fact that they are both centered on “model-based thinking,” although only science seems so at first view. To see this let me juxtapose a quote from the physicist and physics educator David Hestenes and from the game designer Will Wright, designer of such games as Sim City, The Sims, and Spore:

> The basic principles of Newtonian mechanics can be interpreted as a system of rules defining a medley of modeling games. The common objective of these games is to develop validated models of physical phenomena. This is the starting point for a promising new approach to physics instruction in which students are taught from the beginning that in science “modeling is the name of the game” (Hestenes, 1992).
>
> If you look at any kid playing a game, what they do is they go up and they grab the controller and they start pushing buttons randomly. They observe the results. They start building a model in their head for how the buttons are mapped. Then they start trying to set high-level goals. They start building a more and more elaborate model in their head of the underlying simulation in our game. And they're doing it purely through the scientific method. They observe data. They craft and experiment and do interactions to test their experiment. They observe their results then they increase the resolution of their model. And that's pretty much exactly what the scientific method is. So I think any kid, almost inherently, knows that and recognizes it as such (Wright, as cited in Mastrapa, 2008).

What Hestenes is saying is that Newtonian mechanics is a “tool kit” or an “engine” or a “design theory” that tells us how to build models of things like force and motion, models which are “toy versions” of reality (things like computer simulations, balls and ramps, or diagrams). We can then play with the toy (manipulate it according to certain rules) and, thanks to its resemblance to the real world, we can make some educated guesses about how the world works and why it does so. If we are wrong, we have still learned something and we can change the model accordingly and try again.

This is, by the way, just the way military video games (like for example, Full Spectrum Warrior) or police games (like SWAT4) work. A military game is a toy version (model) of warfare based on a theory of how war should work (e.g., Full Spectrum Warrior has the U.S. soldiers in the game operate by the U.S. military rules of engagement). A player can play the game and make guesses about how things might work in the real world. Of course, these guesses can only be checked by looking at actual wars and that is why such games are used for training. But part of their entertainment value as video games is the way in which they make the player think about how and why things work in the world. SWAT4 is particularly good at letting players feel what it is like to be a (toy) SWAT team member and certainly gave me a much greater appreciation of what SWAT teams do, how they do it, and why they do it that way. The game also taught me just why I personally would not want to be a real SWAT team member (too much stress).

We build models—toy versions of reality—because the real world is often too complex to take on in full all at once. Models are simplified representations of reality, good for some purposes and not for others. Model airplanes are models, so is a diagram of an electromagnetic field, a blueprint of a house, a map of an environment, and a simulation of warfare.

In science, then, one way to look at theories is to see them as tool kits, engines, or design theories for building and playing with models. Aerodynamics can be seen not just as a bunch of theoretical statements, but as a set of tools or an "engine" for how to make models, for example, a model airplane, and how to use the models to play a game of making guesses (hypotheses) about reality—say, by using the model airplane in a wind tunnel to study airflow around planes designed in certain ways. Theories are recipes for making things, just as game engines and game design theories are recipes for making games (and video games are models, keeping in mind that simulations are types of models).

Now let us turn to Wright's quote above. What Wright is saying is that players are actually building a model of a model. This is thinking at a "meta" level. Gamers are engaged in building a model of a model in order to play games.

Let me give one simple example. In the anime game Valkyria Chronicles, players engage in what looks like warfare with tanks and all. When I played the game I first assumed that the game was, like many other games (e.g., Call of Duty), a model of real world warfare. I carefully protected my soldiers behind cover and moved them up slowly and carefully, attempting to remove all opposing forces before moving to the final goal. None of this works well in the game (though it works well in Call of Duty). The fighting in Valkyria Chronicles is, in fact, a model of "capture the flag" in multiplayer games, not real world warfare. You need to move fast past the opposition to get one soldier up to the goal. Playing this game requires players to see that the game is a simulation (model) of capture the flag and then work out (model) how that the simulation works so they can be successful in the game.

The fact that playing games involves modeling models is the tip of the iceberg as far as modeling goes in gaming. "Modding" is part of the culture of gaming. In modding players modify games or make whole new ones (as in, for example, building skate parks in Tony Hawk games or building new scenarios in Civilization). Modding requires one to think about what sort of modeling tool Tony Hawk is, for example, and how one can build models of real world skate parks in it.

Think about World of Warcraft (WOW) players building “mods” like damage meters. What are they doing? They are asking how damage is modeled in WOW and then building a tool that models that model in a certain way to enforce certain ways of thinking about and acting in regard to damage in WOW. The damage meter is their theory of how damage works and what role it ought to play in WOW. There are different damage meters and thus, too, different and contesting theories.

When players slap damage meters up on the screen (for example to demonstrate who is and who is not doing his or her job in a dungeon) or other mods—and mods sometimes cover most of the screen, actually “eating” up the images of actual game play—they are placing their theories (really visual representations of their theories) on top of the actual game play. Theory is now on top of practice. They are creating tools (like the damage meter) to allow players to theorize their game play as they actually engage in that play. This is “theory” not just of practice, but in practice.

So gamers regularly engage in model-based thinking at a dizzying variety of different levels. The games they play are models (or simulations). They model those models in their heads as Wright said. They build “mods” that encapsulate their theories of things like damage in WOW and, in the act, place representations of theory right into their practice (on top of images of actual game play) to enable collaborations where players theorize and reflect even as they play. This would be “expert practice” for any profession and, indeed, for science, as well.

All this modeling and modeling of modeling and modding and building mods requires gamers to become designers and to engage in design-based thinking. What I mean by design-based thinking here is thinking about how various parts of a system (e.g., different sub-systems within a system) or different systems interact with each other. For example, how does the core mechanic of a game interact with the content of its virtual world and how do both of these interact with human interactions with the game? This type of thinking is crucial in today’s world of high risk interacting complex systems. For example, it is crucial that we learn how the structure of our built environments interacts both with “natural” systems like the weather and with human social and cultural interactions in those built environments.

So I have argued that model-based thinking (at various levels) and design-based thinking are key aspects of gaming and good cognitive modes for our twenty-first century global world. But thinking in games and gaming is not purely cognitive—a matter of the mind alone. Games give players what I have called an “embodied empathy for complex systems” (Gee, 2004). Gamers have a surrogate body in a game (as in first- and third-person games like Halo or Metal Gear Solid) or act in a god-like fashion building and manipulating things at a given time and place in a game, much like God molding clay into humans in the Garden of Eden (as in Civilization or Rise of Nations). Gamers are inside their games (their virtual worlds) and they move, act, and sometimes build things in the game world from a particular place or perspective. Games are systems of interacting rules or variables and players are embodied at given place within the system and see it from that place.

Scientists when they are studying complex systems (like the solar system, weather, gasses, cells, turbulence, and the rise and fall of civilizations) often build and use simulations to study them. But, unlike gamers, they are not inside their simulations acting from moment to moment at a give place from the perspective of that place. However, research has shown that, though they are not in their diagrams and simulations, scientists often talk and act as if they were, for example, an electron in an the representation of an electromagnetic field or a wolf in the wolf pack.

At the same time as games offer gamers an embodied and perspectival empathy for a system, they also offer gamers a dual perspective. Gamers are used to switching between the "inside" embodied perspective where they see things and act from a given place and time in the game and an "outside" more global top-down perspective where they think about the big picture, the whole scene of which their inside perspective from one place and time is but a small part. Many games let gamers easily switch between the two perspectives, either seeing and acting from one place or looking down on the whole world. This is typical, for example, in real-time strategy games like Rise of Nations and such games go even further and give players diagrams and graphs after a play session that map out their game play in a quite abstract and "big picture" way. Sometimes games use maps, diagrams, and other tools (as in SWAT4) to let gamers get the big picture perspective. Or think even of flying across the world of World of Warcraft as against being in an actual battle.

This dual perspective, the ability and encouragement to flip between an inside (situated) and an outside (global) perspective, is potentially an extremely fruitful way to think about complex systems. People can learn to see what things in a system look like from a given place in the system and, at the same time, how that place looks from the perspective of the system as a whole. Such a dual perspective seems to me ideal for cases where we want people not just to understand systems, but also to intervene in them and act within them, with do regard for unintended consequences as individual acts ramify out through the whole system.

Of course, such a dual perspective—the trade off, juxtaposition, and comparison/contrast between an embodied, situated, insider perspective and a more abstract, global, outside perspective—both facilitates the model-based and design-based thinking characteristic of gaming and, in turn, these two forms of think facilitate the ability to appreciate and use the dual perspective in fruitful ways. In fact all these forms of thinking—which in gaming are also always, too, forms of acting—are closely integrated.

My discussion thus far is misleading in one important respect. Because I have wanted to stress the sorts of thinking and acting that gaming recruits, I have left out the social side of gaming. However, when we discuss digital games, we really need to see the "game" as not just the software in the box, so to speak, but as that software plus all the social interactions built around the game. These social interactions take place at all levels, from people watching others play (and commenting) through multiplayer gaming and gamer gatherings to intense boards, forums, and gaming websites of all sorts. Some people call the game + social interactions the "meta-game" or the "Game"—"big" G game (Shaffer, 2006). In Gee (2003/2007) I referred to these two aspects of gaming as the internal and external grammars of gaming.

Among many other aspects, there are two important contributions this social side of gaming makes to thinking and acting in games. First, in games—as in science at its best—

knowledge is “distributed.” That is, the important knowledge in gaming (or science) is not stored inside just the player’s head. Good players have to learn to pool their knowledge with the knowledge built into the “smart tools” in the game. By “smart tools” I mean artificially intelligent characters (e.g., the other police you control in SWAT4) and the guidance (a form of knowledge) built into the objects and environments of good games. By “smart tools” I also mean all the “mods” and other tools that shape, enhance, and guide play, especially at expert levels (e.g., the damage meters in WOW). And, finally, by “smart tools” I mean, too, other real players whose knowledge we must use to supplement our own knowledge for good multiplayer gaming.

It may seem odd to call other real players “smart tools,” but in much modern knowledge work today, in high-tech workplaces, the “team” is made up of people and their technological tools and devices that must all work together to pool knowledge that goes beyond what is in any one person’s head. In such teams, one of the leading criteria for the humans in them is that the team function in such a way that it is smarter than the smartest person in it and not dumber than the dumbest (which is the hallmark of committees in universities, for example).

Such teams are sometimes called “cross functional teams” because in them each person must have a specific function—a deep specialty—but all members must understand each other’s function well enough to integrate successfully with them. Such teams have long become a *sine qua non* in modern high tech workplaces (Gee, Hull, & Lankshear, 1996). But, as anyone who has played World of Warcraft knows, they are the heart and soul of that game, recruited for pleasure and mastery.

Finally, consider that today we live in the age of “Pro-Ams”; that is, these are amateurs who have become experts at whatever they have developed a passion for (Anderson, 2006 and Leadbeater & Miller, 2004). Many of these are young people who use the internet, communication media, digital tools, and membership in often virtual, sometimes real, communities of practice to develop technical expertise in a plethora of different areas. These include video games, digital storytelling, machinima, fan fiction, history and civilization simulations, music, graphic art, political commentary, robotics, anime, fashion design (e.g., for Sims in The Sims), and nearly every other endeavor of which the human mind can think.

Pro-Am communities allow anyone to become an expert. They offer lots of guidance, but they hold anyone who wants to be a central participant to high standards. To achieve mastery and high respect on in these communities requires “grit” (Duckworth, Peterson, Matthews, & Kelly, 2007). “Grit” means a passion shared with others around which the Pro-Am community is, in fact, organized and perseverance or persistence to put in the many hours of practice (with failure and feedback) required for mastery in any worthwhile endeavor. In schools we have pretended for years that deep learning can occur without “grit”—either with no passion or without intense persistence over the long haul. But today’s popular culture—as well as research in the learning sciences—shows that is not true. So we need to switch to a new mode for schools: everyone must find a passion and learn to persist in it to mastery—and then they need to learn to teach and share their passion with others and work with people who have other passions to solve problems that cannot be solved by one passion alone.

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