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# Epistemic games

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## Abstract

This paper discusses a theory and method for using professional practices as models for state-of-the-art educational games and simulations. I describe the theories of *epistemic frames* and *pedagogical praxis* (Shaffer, 2004a, 2004b), which link games, simulations, and professional practices, and then explain how these theories provide a set of tools and techniques for developing *epistemic games*: simulations that preserve the linkages between knowing and doing that are central to a reflective practice. The result, I argue, could be a set of educational games in which people learn to work as doctors, lawyers, architects, engineers, journalists, and other valued professionals, and thus learn to think in ways that are grounded in meaningful activity and well aligned with the skills, habits, and understandings of a postindustrial society. I illustrate these ideas with an example of one epistemic game that, while still a prototype, demonstrates how a deliberately constructed *thick simulation* of professional practice can be both an engaging activity and a compelling learning environment.

Jim Gee (this volume) asks the question "What would a state of the art instructional video game look like?" Based on the game *Full Spectrum Warrior*, he concludes that one model is "to pick [a] domain of authentic professionalism well, intelligently select the skills and knowledge to be distributed, build in a related value system as integral to game play, and give explicit instruction only 'just in time' or 'on demand.'" That is, he describes a good instructional game as an adaptation of "authentic professionalism" in video game format.

Here I'd like to give a more detailed account of the vision that Jim describes so evocatively by looking more closely at the terms "authenticity" and "professionalism." First, I connect these concepts more explicitly to some of the theories of learning on which they are based: ideas about *communities of practice* (Lave & Wenger, 1991; Wenger, 1998), *reflective practice* (Schon, 1987), *epistemic frames* (Shaffer, 2004a) and *pedagogical praxis* (Shaffer, 2004b). These theories link games, simulations, and professional practices more explicitly, and provides tools and techniques to guide the development of games. To show how this works, I'll give an example of one such game that, while still a prototype, demonstrates how a deliberately constructed simulation of professional practice can be both an engaging activity and a compelling learning environment.

## *Epistemic frames and reproductive practices*

Jim rightly explains that what we usually think of as the content of a knowledgedomain comes "free of charge" when learners pursue meaningful ends within a coherent practice. More than that, though, when learners engage in socially-valued practices toward ends *they* value—that is when learners can use real tools and methods to

address issues they care about—motivation tends to follow. Resnick and I have described learning contexts in which this kind of connection takes place as *thickly authentic*, meaning that activities are simultaneously aligned with the interests of the learners, the structure of a domain of knowledge, valued practices in the world, and the modes of assessment used (Shaffer & Resnick, 1999). In thickly authentic settings, content is free, and motivation is easy. Creating thickly authentic environments, though, is hard.

The problem of developing thickly authentic learning environments becomes more tractable if we recognize that such rich contexts for learning always involve becoming a participant in some community of practice—whether local or virtual. Lave and Wenger (1991) describe a community of practice as a group of individuals with a common repertoire of knowledge about and ways of addressing similar (often shared) problems and purposes. This collection of practices is made accessible to newcomers through the *reproductive practices* of the community: the activities through which individuals develop ways of thinking and reframe their identities and interests in relation to the community. The training and apprenticeship of doctors, lawyers, midwives, and tailors are the reproductive practices through which the next generation of doctors, lawyers, midwives, and tailors is developed.

Elsewhere (Shaffer, 2004a, 2004b) I have argued that participation in a community of practice involves developing that community's ways of doing, being, caring, and knowing, and that this way of doingbeingcaringknowing is organized by and around a way of thinking. That is, practice, identity, interest, understanding, and epistemology are bound together into an *epistemic frame*. Different communities of practice (for example, different professions) have different epistemic frames. Lawyers act

like lawyers, identify themselves as lawyers, are interested in legal issues, and know about the law. These skills, affiliations, habits, and understandings, are made possible by looking at the world in a particular way—by thinking like a lawyer.[1] The same is true for doctors, but for a different way of thinking. If a community of practice is a group with a local culture (what Jim describes as an ideology or way of "seeing, valuing, being in the world"), then the epistemic frame is the grammar of the culture: the conventions of participation that individuals internalize when they become acculturated. The reproductive practices of the community are the means by which new members develop that epistemic frame.[2]

The linkages between epistemology and practice that make up an epistemic frame are potentially quite powerful in the design of instructional games because one way to create thickly authentic learning contexts using new technology is to adapt the reproductive practices of valued communities of practice—an idea I have described elsewhere in some detail as the theory and method of *pedagogical praxis* (Shaffer, 2004b).

## *Pedagogical praxis*

Dewey argued that knowing and doing are tightly coupled (Dewey, 1915, 1958; Menand, 2001). Learning happens in the context of activity when a person is trying to accomplish some meaningful goal and has to overcome obstacles along the way. Schon (1985) describes professionals as people who make this link between knowing and doing through *reflective practice*. They think in action. Schon further suggests that professionals develop this ability to reflect-in-action in the *professional practicum*. Professional practica are environments in which a learner acts as a professional in a

supervised setting and then reflects on the results of his or her action with peers and mentors. Ways of knowing and ways of doing become more and more closely coupled as the novice progressively adopts the epistemic frame of the community. Think of internship and residency for doctors, moot court for lawyers, or the design studio for architects. Reflective practice is developed in the progressive internalization of an epistemic frame through action in a practicum scaffolded by the knowledge, skill, and values of peers and mentors.

The good news, then, is that extant communities of practice have already done a lot of work for us. Doctors know how to create more doctors; lawyers know how to create more lawyers; the same is true for a host of other socially-valued reflective practices.[3] Thus the ways in which reflective practitioners develop their epistemic frames may provide an alternative educational model. Rather than constructing a curriculum based on the ways of knowing of mathematics, science, history, and language arts, we can imagine a system in which students learn to work (and thus to think) as doctors, lawyers, architects, engineers, journalists, and other valued reflective practitioners—not in order to train for these pursuits in the traditional sense of vocational education, but rather because developing those epistemic frames provides students with an opportunity to see the world in a variety of ways that are fundamentally grounded in meaningful activity and well aligned with the core skills, habits, and understandings of a postindustrial society.

To accomplish this end, one has to uncover the structure of a reproductive practice, which means understanding how activities bind epistemology, practice, identity, interest, and understanding to form the epistemic frame of the practice. Because some

parts of the reproductive practices are more central to the creation of an epistemic frame than others, analyzing how the epistemic frame is created tells you, in effect, what it might be safe to leave out. That analysis thus guides the development of tools to adapt those activities to the skills, habits, understandings, and abilities of young people.

The result of such a process is a simulation that preserves the linkages between knowing and doing central to an epistemic frame—a form of simulation that I refer to as an *epistemic game*.[4] An epistemic game is not necessarily a game in the traditional sense of a video or computer game. As Vygotsky (1978) suggests, "pleasure can not be regarded as the defining characteristic of play" (p. 92). Rather, he argues, play is the world a child enters when he or she learns to resolve in imaginary form desires that can not be immediately gratified. In play, we participate in a simulation of a world we want to inhabit, and epistemic play is participation in a thickly authentic simulation that gives learners access to the epistemic frame of a community of practice. When it succeeds, it is fun, not because fun is the immediate goal, but because interest—linked to identity, understanding, and practice—is an essential part of an epistemic frame, and thus of an epistemic game.

## *Madison 2200: an epistemic game*

To illustrate the idea of an epistemic game, I'll describe *Madison 2200*, a learning environment developed here at the University of Wisconsin by a student of mine, Kelly Beckett, using the theory of pedagogical praxis. In Madison 2200, high school students learned about urban ecology by working as urban planners to redesign State Street, a downtown pedestrian mall popular with young people in Madison.

Urban planners take a central role in keeping urban ecological systems in balance. They develop land use plans that meet the social, economic, and physical needs of communities. As in many professions, urban planners use technology to develop solutions to these problems, including geographic information systems (GIS) that make it possible for planners to ask "what if" questions and get feedback to informs their decision making process. Urban planning is thus a valued reflective practice though which ideas in ecology impact the environments in which students live, and urban planning practica involve learning to use GIS models and other tools to solve real-world problems.

In the Madison 2200 project, eleven high school seniors from a summer enrichment program worked with a graduate student for ten hours over two weekend days in an urban planning workshop. The students had no prior experience with urban planning before the workshop. At the start of the workshop, students received a project directive from the mayor, addressed to them as city planners, to create a detailed re-design of State Street. An informational packet included a city budget plan and letters from concerned citizens about issues such as crime, revenue, jobs, waste, traffic, and affordable housing. Students watched a video about State Street, featuring interviews with people about the street's redevelopment, then walked to State Street to conduct a site assessment. Next, students began to work in teams to develop a land use plan using MadMod, a custom-designed interactive GIS model of State Street that let them assess the ramifications of proposed land use changes. For example, if a student was interested in raising the number of jobs available on State Street, she might make the decision to place a new retail business on State Street (see Figure 1). The model would show whether that proposal would raise or lower the number of jobs predicted for the neighborhood.

However, the model would also show how other issues were affected by the same land use choice, thus leaving students with a decision to make regarding the overall impact (and therefore the utility) of alternative land use proposals. After completing a land use plan in MadMod, students entered their decisions into an interactive map of the State Street area. In the final phase of the workshop students presented their plans to a representative from the city planning office.

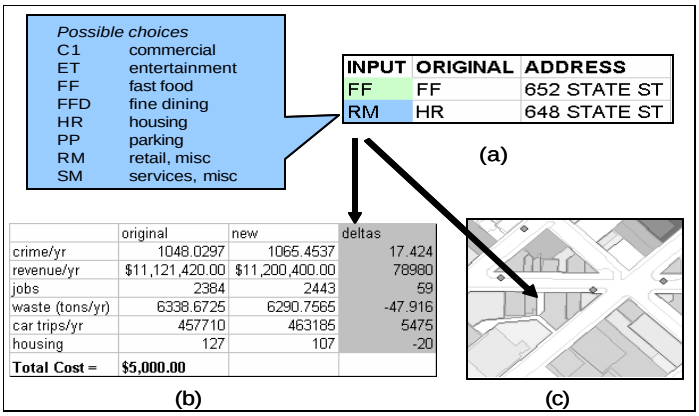


Figure 1. A student makes a land use change in the shaded cell in the decision space on MadMod (a). The change is numerically reflected in the deltas column (b), and spatially on a map of State Street (c).

Data collected in pre and post interviews show that in playing this game students formed—or started to form—an epistemic frame of urban planning. They developed their understanding of ecology and were able to apply it to urban issues. More important, the urban planning practices and GIS model that the game was built on played an important role in shaping the development of that understanding. During post-interviews, all of the students said the workshop changed the way they think about cities. One student commented: "I really noticed how [urban planners] have to... think about building things... like urban planners also have to think about how the crime rate might go up, or

the pollution or waste depending on choices." Another said about walking on the same streets she had traversed before the workshop: "You notice things, like, that's why they build a house there, or that's why they build a park there." Students consistently referred to the MadMod simulation model ($r = 0.628$, $p<0.05$) and urban planning practices ($r = 0.723$, $p<0.05$) when explaining their understanding of the interconnectedness of urban ecological issues.

Perhaps this epistemic game doesn't seem very game-like—not as game-like, say, as *SimCity,* or *Full Spectrum Warrior*. The students in Madison 2200 did enjoy their work. But more important is that the experience let them inhabit an imaginary world in which they were urban planners. They first entered that world because they had volunteered to participate in an experimental workshop. But the world of Madison 2200 recruited these students to new practices, identities, interests, and understandings, as part of a new way of seeing the world. Urban planners have a particular way of identifying, evaluating, and addressing urban issues. By participating in an epistemic game based on these practices, students began to appropriate the epistemic frame of urban planning. This was play. Most serious play. Epistemic play. And as a result, it was fun, too.

### *Epistemic games as a new paradigm for learning*

My point in describing Madison 2200, even though it is only in its pilot stage, is to show how designing an epistemic game based explicitly on professional learning practices has particular advantages. A more intensive study of the reproductive practices of urban planners will support the development of a more authentic simulation of those practices. Even the current version, though, could be easily adapted for important streets

in other cities, and could be used in classrooms to help students start thinking about ecological and civic complexity.

Madison 2200 is just one example of a collection of projects that my students and I have undertaken to explore how the reproductive practices of reflective practitioners such as architects, journalists, mediators, and engineers can form the basis for compelling, computer-supported learning environments for middle and high school students (Shaffer, 1997, 2000, 2002, 2003, 2004a, 2004b, in press).These projects show that (a) one transformative power of new technologies is that they support the creation of epistemic games; (b) such games are developed by analyzing how the epistemic frames of professionals are created, and (c) creating epistemic games depends *both* on developing appropriate simulation technologies—what I have referred to elsewhere as the game engine or *simulation engine* (Shaffer et al., 2000)—*and* on developing an appropriate activity system. That is, what matters is the things learners do, the people with whom they work, the tools they use, and the context in which all of this takes place.

The implications of epistemic frames and their role in developing epistemic games are thus quite profound. They suggest that the ways in which professionals acquire their practices may provide an alternative model for organizing our educational system. Epistemic games make it possible for students to learn through participation in authentic recreations of valued reflective practices, and thus gives educators an opportunity to move beyond disciplines derived from medieval scholarship constituted within schools developed in the industrial revolution—a new model of learning for an era of dramatic social and economic transformation brought about by new technology.

References

Collins, A., & Ferguson, W. (1993). Epistemic Forms and Games. *Educational Psychologist, 28*(1), 25-42.

Dewey, J. (1915). *The school and society*. Chicago: University of Chicago Press.

Dewey, J. (1958). *Art as experience*. New York: Capricorn Books.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, England: Cambridge University Press.

Menand, L. (2001). *The metaphysical club* (1st ed.). New York: Farrar Straus & Giroux.

Schon, D. A. (1985). *The design studio: An exploration of its traditions and potentials*. London: RIBA Publications.

Schon, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco: Jossey-Bass.

Shaffer, D. W. (1997). Learning mathematics through design: The anatomy of Escher's World. *Journal of Mathematical Behavior, 16*(2), 95-112.

Shaffer, D. W. (2000). This is Dewey's vision revisited. In D. T. Gordon (Ed.), *The digital classroom: How technology is changing the way we teach and learn* (pp. 176-178). Cambridge, MA: Harvard Education Letter.

Shaffer, D. W. (2002). Design, collaboration, and computation: The design studio as a model for computer-supported collaboration in mathematics. In T. Koschmann, R. Hall & N. Miyake (Eds.), *Computer support for collaborative learning 2* (pp. 197-222). Mahwah, NJ: Lawrence Erlbaum Associates.

Shaffer, D. W. (2003). *Portrait of the Oxford design studio: An ethnography of design pedagogy* (WCER Working Paper No. 2003-11). Madison: University of Wisconsin-Madison, Wisconsin Center for Education Research.

Shaffer, D. W. (2004a). *Epistemic frames and islands of expertise: Learning from infusion experiences.* Paper presented at the International Conference of the Learning Sciences (ICLS), Santa Monica, CA.

Shaffer, D. W. (2004b). Pedagogical praxis: The professions as models for post-industrial education. *Teachers College Record, 106*(7).

Shaffer, D. W. (in press). When computer-supported collaboration means computer-supported competition: Professional mediation as a model for collaborative learning. *Journal of Interactive Learning Research*.

Shaffer, D. W., Dawson, S., Meglan, D., Cotin, S., Ferrell, M., Norbash, A., et al. (2000). Design principles for the use of simulation as an aid in interventional cardiology training. *Minimally Invasive Therapy and Applied Technologies, 10*(2).

Shaffer, D. W., & Resnick, M. (1999). Thick authenticity: New media and authentic learning. *Journal of Interactive Learning Research, 10*(2), 195-215.

Vygotsky, L. S. (1978). *Mind in society.* Cambridge, MA: Harvard University Press.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge, England: Cambridge University Press.

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# Footnotes

[1] Of course, this is a two-way street: thinking like a lawyer is made possible by these skills, affiliations, habits, and understandings.

[2] It is important to note that epistemic frames are not hegemonic any more than identities are. Lawyers don't *only* think like lawyers. They may also be parents, and videogamers, and sports fans, and amateur carpenters. They are able to take on these other epistemic frames and to think and act in these ways as well.

[3] There may be debates about whether such reproductive practices are optimal, or about how to adapt such practices for new social and technological conditions. But no one seems worried that we are going to run out of lawyers any time soon!

[4] Collins and Ferguson (1993) use the term *epistemic games*, as well, but in a more limited sense than I am describing here, to refer to the ways in which certain forms of knowledge (*epistemic forms*) can be manipulated in the context of a particular domain of inquiry.