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The Shaffer–Gee perspective: Can epistemic games serve education?

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ABSTRACT

This paper addresses the issue of how games can reshape education by describing current educational practices. It argues that there are conservative camps that emphasize structure and development of basic literacy and numeracy skills in education as well as liberal camps that emphasize immersion, and notices that both camps fail to train students able to address the crisis of innovation. A post-progressive pedagogy that integrates both structure and immersion to address this innovation crisis is described in the paper. It is also emphasized that epistemic games can serve as excellent tools at the hand of this post-progressive pedagogy.

1. Introduction

The question of whether games can serve education has been addressed by several researchers over the past five decades or so. In one instance, Shaffer and Gee (2005) noticed that educational games could serve education by facilitating student development towards the requirements of the workplace in society. This paper will provide an overview of how games can serve the crisis in education.

In 2005, Friedman argued that US society was facing an educational crisis. He noted that young children, both in schools and at home, were prepared for what he called commodity jobs whereas society would very soon reward only those who could do innovative work. Commodity jobs are defined as jobs that have to do with manufacturing commodities (i.e., goods that are sold to households at a reasonable price) (Greider, 1997; Thurow, 1999). Although the United States was in the past superpower in the production of commodities, this is not the case nowadays since places like China, where production costs (e.g. labor force, raw materials, etc.) are lower, have taken the lead in manufacturing commodities. The result is that countries like the US can no longer compete; they can only survive if they can develop new technologies to manufacture innovative products that cannot be easily copied and reproduced in other places. This ability does not lie in either the labor or the materials that are used for the production of innovative products; rather, it lies in knowledge about new forms of social relationships and interactions (Drucker, 1993; Gee, Hull, & Lankshear, 1996; Kelly, 1998; Rifkin, 2000).

A new definition of commodity jobs was proposed by Shaffer and Gee (2005): a commodity job within a country is any job that can be done more cheaply and just as efficiently outside that country (cf., Mehta, 2005). A job is a commodity job if it can be easily outsourced, and it is easily outsourced if it requires only standard and standardized skills (Friedman, 2005). As such, a patient who refers to a doctor overseas is, in effect, outsourcing a job by making the job of doctors inside the country into a commodity job. Therefore, commodity jobs are no longer bound within the realm of manufacturing household goods, but have come to include technical and scientific jobs as well. This is the real crisis. To survive this crisis, countries have to move towards producing people who can do work that is centered on creativity and innovation rather than the simple reproduction of standard and standardized skills (Hagel & Brown, 2005; Kanter, 2001; Shaffer & Gee, 2005). This is where the real threat lies. It is sheer naiveté to think that countries like China or even Iran will remain 'commodity servants'. They, too, are ambitious enough to think of moving the value chain to produce innovative people in their universities and entrepreneurial centers (Shaffer & Gee, 2005). This, in and of itself, is not a bad thing; it means that the world will definitely be a better place. It becomes problematic only when the educational system within a country does the opposite (i.e., produces commodity servants instead of training innovators).

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2. De-innovative educational system

When a curriculum relies heavily on standards of teaching and testing practice (i.e., standards-driven curriculum), it becomes de-innovative. Such a curriculum will only educate students who are prepared for commodity jobs. In most, if not all countries, children are provided with standard literacy and language skills (i.e., reading, speaking, listening, and writing). They also receive general mathematics knowledge, general science knowledge, and so on. They are then given standard or standardized tests to see if they pass or fail. Such an approach to the curriculum will most probably make all children similar. This kills innovation, and is de-innovative. We should not forget that the most outstanding scientific figures of the world were people who did not think in the way others did. Growth and development owes much to innovative people.

According to Shaffer and Gee (2005), the foundation for innovation has to be laid from the start. It should not start in college; it should begin in kindergarten and before. It includes a wide range of skills and abilities like mastery of complex technical languages, complex symbol systems, and complex practices. Examples include the language of chemistry, non-linear mathematics, engineering of workplaces, and so on (Gee, 2004; Neuman & Dickinson, 2001). Each of these abilities is an 'island of expertise' (Crowley & Jacobs, 2002). The real importance of these islands of expertise is the preparation they give young children for lifelong learning. Crowley and Jacobs (2002) noticed that parents can introduce their children to these islands of expertise even before school age. In their study, they noticed that a mother talked to her child about a computer game that had to do with the 'replica of a dinosaur egg', and that she used "school-based" technical language to talk to the child, not just the vernacular. For example, she used words like 'oviraptor' and 'cretaceous period' to engage her child in early preparation for later acquisition of academic and specialized language (Crowley & Jacobs, 2002).

The school curriculum is expected to build on this 'home work' and sustain it. It should engage the child with complex and deep learning from the start. It should prepare the child for future learning that gets ever more technical and complex. Very often, however, public schools move in the opposite direction (Chall, Jacobs, & Baldwin, 1990). This is a looming crisis.

3. Types of school curricula

Some school curricula advocate pedagogies that immerse children in rich learning activities by focusing on children's own goals and backgrounds. Although it may seem empowering, it hides the 'rules of the game' for many children. These rules include the skills, values, assessments, and willingness to work hard, that learners must recognize and master. If children have not picked up these rules through parent mentoring at home, they may fail to do so at school. On the other hand, some other school curricula too often advocate pedagogies that stress telling children what they need to know and then skilling-and-drilling them on factual knowledge (Shaffer & Gee, 2005). This is the kind of knowledge standardized tests usually measure. All too often, children trained within the milieu of such curricula will not be able to apply what they know to real-world problems. Such curricula do not allow much room for building expertise and innovation.

According to Shaffer and Gee (2005), the way out of this maze lies in the implementation of epistemic games (i.e., knowledge games). By immersing them in rigorous professional practices of innovation, epistemic games engage students in doing things that matter in the world (Shaffer, 2004). In epistemic games, students are asked to do things that have meaning to them and to society in a structured way. Structuring will lead to expertise, professional-like skills, and an ability to innovate. As such, epistemic games include eclectic features from both sets of curricula. From the latter set, they borrow structure; from the former, they borrow immersion.

4. Small-c culture or epistemic frame

The population of every society lives in a matrix that is often referred to as Culture. This can be called the capital-c Culture of that society. Yet, educationalists have recently come to distinguish many sub-cultures within this Culture. Each one of these sub-cultures can be called a small-c culture or an epistemic frame.

> When people become members of a community, they start to think and act in particular ways. They develop the skills of the community. They start to care about things that matter to the community. They start to see themselves as members of the community, and to think about things in ways that other members of the community do. All of this is only to say that a community has a local culture…, and becoming a member of the community means developing that culture's distinctive ways of doing things, of valuing things, and of knowing things (Shaffer & Gee, 2005, p. 10).

People who are completely familiar with these small-c cultures are called professionals—in a modern sense of the word. In its traditional sense, the term professional meant an individual who worked in such traditional occupations as medicine, law, and engineering. Used in the context of small-c cultures, however, it identifies people who do work that cannot be easily standardized and who continuously welcome challenges at the cutting edge of their expertise (Shaffer & Gee, 2005). Such people are, in fact, innovative or reflective practitioners who work in non-commodity and highly-uncertain domains which require continuous reflection, judgment, and direction. Such innovative works cannot be standardized or routinized.

This, however, does not mean that these professionals work haphazardly and in a pseudo-realistic manner. Rather, they all use the knowledge, skills, and ways of thinking of their own professional communities; they all share a repertoire of knowledge about and appropriate ways in which problems in the world can be addressed (Shaffer, 2004; Shaffer & Gee, 2005). A given community's distinctive ways of doing, valuing, and knowing is called its epistemic frame or its small-c culture.

> For example, 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. Acting and valuing and talking and reading and writing like a lawyer are made possible by thinking like a lawyer. The same is true for doctors, but for a different way of thinking—and for master carpenters, graphic designers, and so on, each with a different epistemic frame (Shaffer & Gee, 2005, p. 10).

Earlier in 1983 and 1987, Schon had argued that the "key step in developing the epistemic frame of most communities of innovation is some form of professional practicum" (cited in Shaffer & Gee, 2005, p. 10). Shaffer and Gee define professional practica as environments where learners act in supervised settings and then reflect on the results of their action with peers and mentors. To illustrate what this means, Shaffer and Gee (2005) give the example of "internship and residency for doctors, moot court for lawyers, or the design studio for architects" (p. 10).

As students learn, in professional practica, to see the world using the epistemic frame of professional communities, skills and

knowledge become more and more closely tied together. The problem, however, is that professionalization in this modern sense is to be delayed until students enter college. Therefore, there should be a way of bringing professionalization into earlier levels of education. This is where epistemic games enter the scene. It was noted earlier that a mother can introduce her child to professional terminology of geology in the 'replica of a dinosaur egg' game.

5. Epistemic games

An epistemic game is one that lets players learn to work and think as innovative professionals would do. They help students to develop in themselves the c-cultures and epistemic frames of innovative professionals. Because they are concerned with innovation and mastery of complex domains, epistemic games keep the gamer focused for hours at a time (Shaffer & Gee, 2005). They are modeled upon practices of innovation and are, therefore, rigorous, motivating, and complex. As such, it is very important that educationalists notice that, by simulating professional practica, epistemic games can let students learn to innovate and to think outside the box the way the professionals do (Shaffer & Gee, 2005). They are both fun and learning work. They are tools for sustained deep learning (SDL) since they require lots of time and lots of engagement and motivation (Gee, 2003). Epistemic games motivate players to ask creative "what if" questions and provide them with feedback to inform their work.

The computer game Sim City 4 is an example of an epistemic game. It requires players to work as urban planners to design cities with residential areas, trade neighborhoods, and industry section; the player should also plan all the necessary infrastructures a city may need (e.g. metro, railways, airports, power plants, etc.). It is a great example of simulating innovative work. The game requires deep understanding of both social and scientific issues. Learning to think and work like an urban planners, players of Sim City 4 learn to solve complex real-world problems in which science, society, economics, and technology intersect.

A game like Sim City 4 it is not just a game in which kids play around; rather, it is a rich, immersive experience where gamers learn to think and act as urban planners. Educationalists can also develop games where children can learn to think like doctors, lawyers, architects, engineers, journalists, and other innovative practitioners. In other words,

> with epistemic games students don't have to wait to begin their education for innovation until college, or graduate school, or their entry into the workforce. In these games, learning to think like innovative professionals prepares students for innovative work. These games are based in the ways in which professional practica create the epistemic frame of innovative practices. That means doing particular things in particular ways, and being assessed relative to a particular set of external norms. It means coming to think about problems and care about issues in particular ways (Shaffer & Gee, 2005, p. 13).

Perhaps the first major appearance of educational games can be traced back to the 1990s. Wheatley (1999), for example, discussed the significance of play in culture, quoting the old proverb *a lesson taught with an entertaining facet is a lesson retained*. Wheatley (1999) presented 13 children's games that were being used at that time in management-training and development programs, and described the purpose, activity, preparation and debriefing involved for each game. In another study of educational games, Jayakanthan (2002) discussed computer games that were used for education and training. The study described educational computer games, simulation games in military training, and adventure games in business and corporate environments.

Along the same lines, Vandergriff (2006) identified 'reform military education' as the bandwagon in the arena of military transformation on which everyone was jumping, and argued how *Tactical Decision Game (TDG)* could help US army to train better army leaders and officers. Army leaders and officers had been trained to deal with second-generation or industrial war, yet what was going on in Afghanistan and Iraq was far from this; US army faced complex problems in Afghanistan and Iraq. Nevertheless, the army leader development system had to do better to adapt to the unexpected demands of the ongoing wars in Afghanistan and Iraq. As a result, think tanks and military task forces proposed all kinds of changes to military education, at the levels of joint education, midlevel officer career courses, and senior-level war colleges. Vandergriff (2006) saw *Tactical Decision Game (TDG)* as a tool which provided an efficient and effective way to teach intuitive decision making–or, as the Army calls it, rapid decision making–in aspiring leaders. Vandergriff (2006) discussed how to use the *TDG* as a decision-making teaching tool and provided a set of general guidelines when using *TDG*s. Vandergriff (2006) also discussed the implications of *TDG* for performance improvement and its applications in the nonmilitary world.

US army is not the sole user of educational games. In connection to physical education, Trout and Christie (2007) noticed that interactive video games can help children to overcome their sedentary lifestyles. As the obesity epidemic in the United States spreads among children and teenagers, they noticed, some physical education programs are using interactive video games to keep students engaged in physical activity by making physical activity fun and challenging for both high- and low-skilled students. In addition to being entertaining, these games measure heart rate, power, and reaction time; moreover, they estimate caloric expenditure, search for movement deficits, and require students to aim, strike, and move in ways they never have before. In their study, Trout and Christie (2007) examined five products (i.e., Dance Dance Revolution, Cybex Trazer, Eyetoy, Cateye Gamebike, and Sportwall) and gave practical strategies for implementing them in a physical education setting.

In their own study, Shaffer and Gee (2005) describe *Madison 2200*, which is a computer-based game in which high school students work as urban planners to redesign a downtown pedestrian mall popular with young people in their city. The game had been designed as part of a summer enrichment program for "at-risk" students. The players had no prior experience with urban planning but received the required information (e.g. city budget plan; letters from concerned citizens about such issues as crime, revenue, jobs, waste, traffic, and affordable housing; etc.). The players would then begin to work in teams to develop land use plans, using an interactive GIS model of the downtown area that let them assess the ramifications of proposed land use changes. For example, if a player was interested in raising the number of jobs, she might choose to place a new retail business in the downtown area. The GIS model would show whether that proposal would raise or lower the number of jobs predicted for the neighborhood; it would also show how other issues would be affected by the same land use choice, thus leaving players to make a decision about the overall impact (and therefore the utility) of alternative land use proposals. As a result of playing by the rules of urban planning in *Madison 2200*, students learned to think like urban planners. When Shaffer and Gee (2005) interviewed players before and after the game, those conversations showed that players had begun to understand the complex issues and systems involved in urban planning in new ways, and perhaps more important, that they were able to apply their understanding to solve new kinds of problems. For example, after playing the game all of the students saw how the game had changed the way they think about cities.

Shaffer and Gee (2005) also noticed that, in the game *Digital Zoo*, players worked as mechanical and biomechanical engineers to design virtual structures and creatures (i.e., the kinds of things you might see in a computer-animated movie from a major studio). In *Digital Zoo*, players learn the engineering design process, keep design notebooks, and make presentations to clients, just the way real engineers and engineering students do. Shaffer and Gee (2005) reported that gamers also learned about things like physics and biology, the center of mass, the period of waves, and how muscle pairs function in multi-legged locomotion. In one instance of testing *Digital Zoo*, players' use of scientific justification to answer textbook science problems went up 600% on average after playing the game. Shaffer and Gee (2005) also mentioned that these virtual biomechanical engineers creating innovative virtual creatures and learning biology and physics (i.e., the gamers who played *Digital Zoo*) were mostly in sixth and seventh grades. This means that, with epistemic games, students do not have to wait to begin their education for innovation until college, or graduate school, or their entry into the workforce. In these games, learning to think like innovative professionals prepares students for innovative work.

Many other epistemic games are on the market now. They fall into different categories (e.g. simulations, strategic games, etc.). Each one of these games has the potential to train children in some area of expertise. Even professionals can keep their knowledge and skills up-to-date by playing epistemic games. *Age of Empires*, for example, tacitly teaches its players knowledge of history; it shows gamers how human beings civilized from an early nomad or pre-historical life style. *Microsoft Flight Simulator X*, as another example, tells gamers a lot about aircrafts, airports, climatic conditions, etc. It is even claimed that the pilots who hijacked the airplanes that hit World Trade Towers in New York in the September 11 tragedy had been educated by *Microsoft Flight Simulator 2000*, an earlier version of *Microsoft Flight Simulator X*. Table 1 describes the major advantages and disadvantages of educational games:

Table 1 does not exhaust all the potentials of epistemic educational games; it only lists the most important advantages and disadvantages of such games. It shows that there are more advantages in epistemic games than disadvantages. Moreover, the few disadvantages can be prevented through certain educational policies. As such, their inclusion in educational programs will definitely result in important positive outcomes.

By playing epistemic games, young children will begin their apprenticeship in innovative thinking; they will learn to think using a variety of epistemic frames. In other words, they learn to see the world and solve its problems in multiple ways.

Epistemic games are not necessarily played only for pleasure; they are also about facts of life. They are knowledge in action and knowledge in context. To develop and test epistemic games, educationalists should look outside schools, to places where children have time to think and work in depth with and about complex problems; they should focus on children's innovative thinking rather than on their performance on basic and routine skills.

Table 1
Major advantages and disadvantages of educational games.

Advantages	Disadvantages
• Familiarize children with technical language; • Are knowledge in action and context; • Bring knowledge and practice together; • Alleviate the commodity job crisis; • Allow and promote innovation; • Familiarize gamers with the c-cultures of different professions.	• May be abused by terrorist groups; • May hinder socialization; • May result in a detachment from reality.

Current educational systems in many countries overload students with factual knowledge that is detached from practice. When asked to apply what they have learnt in school to a life problem, many students fail. This problem will persist as long as schools are fixated on teaching every child literacy and numeracy skills and ignore innovation. Epistemic games are excellent tools to alleviate this problem since this disconnection between stored and applied knowledge simply does not happen in them. They allow students to learn basic skills and content in the context of innovative ways of thinking and working.

This, however, will not happen unless schools and educators appreciate the need for a huge change in their cultures and ethos. They need to realize that schools play a vital role in preparing children and young people for responsible citizenship, and for effective participation in society. They need to realize their responsibility to provide that kind of education which affords all children the opportunity to achieve their full potentials. They need to appreciate that schooling is completely intertwined with social station. They need to understand that, without education, the civilized society would not be possible. Moreover, schools and educators need to realize that, for many children, school is very much the defining experience for a life. It concentrates all of the values and yardsticks children use to define the worth of their society and culture. For many of them, school is the only outlet for their intellect and creativity. For many of them, school is the only path to a civilized society where all are equal, and where individual rights are balanced by individual responsibilities (i.e., responsibilities to oneself, to ones neighbours, and to society as a whole). This emphasizes the need for schools and educators to realize that education is critical. Schools and educators should understand that, without a real commitment to education, the civilized nature of the whole society may be under threat. Schools and educators need to understand that education should offer children the ability to step outside what is usual, and to expand their personal horizons beyond the norm.

Schooling is expected to have profoundly important benefits that are all too often overlooked in the current narrow concept of what it means to receive an education. Education should not simply be the act of gathering facts or theories; it should be viewed as a process through which individuals evolve to their full potentials. This process-oriented view of education requires the realization by schools and educators that life necessitates change, and that change in school curriculum is inevitable; resistance to change is, therefore, counter-productive and counter-educational. New technologies, new ways of problem solving and news ways of managing society affairs all require change on the part of schools and educators.

One such change can be the inclusion of epistemic games in school curricula. If epistemic games are a path to success in the face of a crisis of innovation, what is currently being done in many schools "is nothing short of taking the road to disaster" (Shaffer & Gee, 2005, p. 15). The alternative, according to Shaffer and Gee (2005), is to mobilize the power of new technologies to change the way schools think about education. "Epistemic games thus give educators an opportunity to move beyond disciplines derived from medieval scholarship constituted within schools developed in the industrial revolution—to a new model of learning for a digital culture and a global economy" (Shaffer & Gee, 2005, p. 16).

6. Conclusion

Overall, this paper argued that schools should move beyond traditional modes of education that emphasize factual knowledge and basic literacy and numeracy skills. They should move towards post-progressive pedagogies of practice that include features from

both conservative education camps that emphasize structure and liberal education camps that emphasize immersion. The key point in reshaping schools to address the question of innovation is to understand how new technologies make it possible to develop innovators.

It was argued that computer and video games have the potential to prepare students to learn to use the techniques of communities of innovation. Epistemic games emphasize ways of learning that stress immersion in a practice, supported by structures in knowledge. As such, they lead to expertise, professional-like skills, and innovative thinking. Epistemic games are thus one way to solve the innovation crisis.

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