What Schools Can Learn from Games and New Media as Information Technologies

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Technologies for educators have flourished in schools by focusing on data-driven accountability practices. Technologies for learning, such as video games and digital media, have transformed our experience of learning outside of schools. In both cases, the classroom has been left behind. Here I argue that we can bring the lessons of video game design to bear on transforming teaching and learning in schools by orchestrating network convergence, designing participatory learning spaces, customizing assessment and harnessing the power of big data.

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I wanted to share a several insights about how the Games for Impact initiative might help us think about improving teaching and learning in schools. I will consider games and gaming as part of a larger digital media and literacy movement that has reshaped learning outside schools, but has had little impact inside schools. Over the past months, I have had a number of conversations that suggest several points where research in education reform, technology, assessment and data analysis might converge. My comments are organized around a fundamental disjunct between *technologies for education* and *technologies for learners*.

Technologies for education. Schools are organized to guide students to master disciplinary content as a condition for participation in interest-based learning. Technologies for education, such as school information systems, benchmark assessment systems, and value-added analytic models, are used to record the progress of students toward disciplinary mastery. These technologies use student test scores to judge instructional system performance. Technologies for education both cause and result from a culture of accountability that dominates current discussions teaching and learning in schools. The resulting data from technologies for education are valued by system designers (e.g. policy-makers, administrators and teachers), but are of little use to learners themselves.

Technologies for learners, such as video games, Google, Facebook, and Wikipedia, thrive in public and commercial spaces but have had limited impact in schools. This is because technologies for learners are do not become widely used unless they effectively serve the interests of users. It might seem strange to label these consumer and entertainment technologies "for learners." However, technologies for learners are all organized around systems that enable users to use information to achieve goals. The main differences are the centrality of the user, and the role of the disciplines, in technologies for learning. Rather than focusing on disciplinary mastery as a condition wider participation, technologies for learners rely on user interest and engagement in the participatory cultures[1] as the catalyst toward disciplinary learning.

The gap between technologies for education and for learners prevents schools from taking advantage of the ways in which new tools engage students in different ways. Education policy makers and school leaders have made a bet that optimizing teaching, curriculum and assessment practices is the key to improving learning for students. Students, however, play little active role in these traditional models of education. Technologies for learning can provide existence-proofs of how we might think about education from the perspective of learners, thus shifting education as a process done to students to student-based learning environment.

Here I discuss four areas of possible investigation/design that may create bridges over which schools can begin to work the full range of information technologies: (a) orchestrating convergence of administrative and play networks; (b) designing

participatory media production spaces; (c) bridging assessment of learning with assessment for learners; and (d) exploring how the big data worlds of digital media can serve as a model for thinking about learning data in schools.

Orchestrating network convergence. The underlying technologies that support student information systems, learning management systems, gaming networks and social network systems are quite related. Each involves coordinating access to distributed databases; each involves customizable user profiles, querying tools, and context organization. To be sure, the proprietary nature of each database design creates linkage problems for local technology designers that often limit ideal information exchange. Further, issues of who controls which kinds of data, and which data are appropriate for which context, can thwart efforts to link information across systems. However, each kind of technology system is situated in a culture of practice that admits a certain range of uses, but prohibits others. Student information systems, for example, are organized largely around security concerns designed to protect information about minors. Database access, then, is organized around who gets to see which information, and who gets to draw on which databases for which information. While some of these systems include portals for student access, the information is more frequently *about* students, instead of *for* students. SIS user profiles encode permissions about which *information about others* users are allowed to see.

Social networking technologies represent the other extreme of organizing access. Social network systems (SNS) allow the user to create a local information cluster in order to customize who gets to see what kinds of information in the user profile. The persistent agent profile allows users to customize how they appear to others on the network (creating a medium through which users can design the interface for what William James called the "social me"). Users can join affinity groups[2], participate in collective action (multiuser gaming communities; photo-sharing), or simply keep up with friend information feeds. Friending, an elective procedure, creates the information pathways through which information circulates. The illusion of the user-created network confidentiality is a source of on-going struggle for information control (a large-scale version of the battle for preserving SIS confidentiality). Still, social network user profiles encode permissions about which *information about themselves* others are allowed to see.

Taking another look at learning management system (LMS) design may provide a bridge between institution-controlled (SIS) and user-controlled (SNS) data-exchange. LMS tools (e.g. *Blackboard*, *Moodle*, Canvas *Infrastructure* and, increasingly, Google Apps for Education) connect persistent user profiles with institutional learning resources through technologically mediated opportunities for interaction. As described above, LMS technologies in schools, especially in higher-education environments, have been almost completed co-opted as technologies to coordinate learning. Still, the capacities of the LMS technologies allow for meaningful linkage between SNS and SIS. Social network profiles could serve as links into an LMS in which content and certain information about learners (course enrollment, instructor, and learning goals, etc.) are provided by the SIS.

SNS motivation structures, such as customizing presentation of self, point and merit based participation rewards, and scaffolded task structures, could inform the learning process and provide multi-leveled opportunities to coordinate social interaction around learning. As with identity management in *World of Warcraft*, *xBox Live* or *iTunes*, students could retain a self-created, persistent self-image (avatar) across learning environments that would feed information about success and failure back into the (properly secured) SIS. Maintaining a context for persistent interaction among digital selves would provide students with another "channel" for participation in learning and might well inject a measure of institutional influence (and civility!) into the currently self-policing adolescent social network communities. Research into the next generation of learning management systems might well create the kinds of technologically facilitated interaction that would produce better information on learning *and* information for learners.

Designing participatory learning spaces. Homework presents a chronic problem in schools. Homework is the central product of most learning activities, and typical homework assignments can be directly linked to expected school learning outcomes. Homework typically involves the rehearsal, or repetition, of known content as a demonstration that learners have met the learning goals (of others). Even if it is collaboratively produced, the design constraints in which homework assignments are developed prohibit much meaningful learning production. Meaningful production, however, is a central feature of digital gaming and media design spaces. If we are to utilize technologies for learners in school contexts effectively, we must revisit the challenge of homework as an opportunity for students to engage in authentic production. How can meaningful production opportunities be designed, in the context of schools, which produce both information on learning and information for learners?

The current focus on basic literacy and math skill development in K-12 schools provides a window for school teachers and leaders to explore the development of participatory cultures in non-tested subjects, such as technology, the arts, social studies and physical education. Youth media arts organizations, for example, provide models of how students can develop new literacy skills through making sophisticated media products to share with authentic audiences. Organizations such as *ReelWorks*, *Street Level*, *Appalshop* and *In Progress* have already established programs that guide youth through the challenging course of creating, critiquing and sharing authentic new media products.[3] Reframing media arts or technology development courses in terms of these vibrant participatory cultures presents a viable option for high school program design.

Similarly, technologies for learners are transforming civic participation around the world. The majority of youth already get their political information, hear and voice perspectives, and learn norms of public interaction and participation in online spaces.[4] On-line participation in non-political participatory cultures provides youth with models for public interaction that can be leveraged to support engagement in traditional political and social arenas. Situating civic education in participatory communities, such as Wikipedia editing, can help teach students norms for appropriate public interaction with authentic audiences that can carry outside the school experience. Exploring the (relatively)

unmonitored subject areas in the typical school program provides a unique opportunity to experiment with technologies for learners in schools.

Assessment plays a defining role in the ways technologies are used in schools. Assessment for accountability focuses on summative assessment of the quality of system outputs; assessment for participation focuses on formative assessment to guide the learner process. The similarities in underlying assessment technologies, however, suggest ways in which new practices can emerge if we can change the cultures in which practices are embedded. Video games provide the most compelling examples of how information technologies organize data for learners. The typical game interface is a dashboard of essential system information organized to produce direct feedback on game play. The connection between action and outcome is so tight in games that the ability to proceed to the next challenge *is* the evidence of successful learning. The tight connection between action and outcome is also the problem with assessment in video games. When we want the learning process to lead to distal outcomes (e.g. standards), it is difficult to generate the information necessary to provide evidence for learning gains.

A central problem in using in-game/in-environment data as evidence for learning is the self-referential nature of technology for learning performance data. The data generated in conquering an army or reaching a character development goal in a participatory culture is only of use only to the player or the player's group within the culture. It has proven difficult to marshal these data of evidence for anything other than in-game performance. A key design challenge is the exploration of "data-channels" that convert in-game play processes and outcomes to out-of-game learning goals. The goal of this work is to create data structures that translate evidence of player/user mastery of learning goals within the game/environment structure into representations that are convincing to non-participants.

Badges have played in important role in thinking through this "evidence translation" process.[5] Traditional badges, such as diplomas, certificates and degrees, serve as legitimacy markers that communicate the value of achievement across domains. New media badges seek to serve a similar function in communicating the quality of in-environment achievements to out-of-environment audiences. "Badging" serves the function of communicating the legitimacy of accomplishment across domains. For example, a reliable badge system would allow out-of-game observers to use badged in-game accomplishments as evidence of successful learning or skill development. The Digital Youth Network platform *YouMedia* (http://iremix.org/) creates a multi-faceted badging system to certify student efforts to make, critique and share new media products. It relies on underlying data-channel technologies that allow both players and system managers to trace the development of user skills and achievements over time. Players customize their in-game avatar with badges to publicly demonstrate skill and knowledge accomplishments.

The next goal for learning design would be to validate whether (and how) badges can support inferences about the mastery of learning goals outside the system. Research on building badge-based assessment "bridges" that translate the value of in-community achievement to out-of-community audiences point to new areas for how educators can

integrate participatory cultures in to everyday schooling activities. One way to think about this bridging challenge is the idea of *evidence transformation*. This can occur when indicators of successful participation in one domain are rendered as legitimate markers of performance in another domain. In the gaming world, for example, in-game performance is typically judged according to player success in the domain. This typically means that game-level data aids game performance, but is not considered relevant outside the game world. Evidence transformation research draws on theories of performance assessment (e.g. the work of researchers such as Robert Mislevy, Valerie Shute, and Constance Steinkuehler) to translate and certify in-game performance as evidence of out-of-game competence. A successful model, or set of protocols, for evidence transformation would allow schools to construct arguments that successful engagement in game- and digital media-based worlds could be used as evidence of standards-based learning.

An evidence transformation research agenda would have far greater scope than mere assessment design. Digital media developers would need to build environments with standards-friendly outcomes in mind; school information systems would need to be open to receiving new forms of data as evidence of achievement; and trusted partners would need to legitimate the transformation processes/badges/results to guarantee institutional acceptance. However daunting this agenda might appear, the scope of this work has become much more attainable in recent years.

Big Data. The ubiquity of school information systems, and the increasing complexity and depth of the data they contain, offers an unprecedented opportunity for education to transform our understanding of teaching and learning. When complemented by formative assessment data systems (such as NWEA Measures of Academic Performance and CTB/McGraw Hill's *Acuity* platform) and by learning management systems data existing school information systems can offer analytic opportunities similar to those currently being explored by marketing, credit rating and medical researchers. Outside of schools, large scale research initiatives, such as the Carnegie Mellon DataShop and the Inter-University Consortium for Political and Social Research, store and organize the data-sets of many education research initiatives.

We are rapidly approaching the point where we will be able to trace multiple trajectories of learners through math and literacy domains; anticipate the challenges types of learners will face as they progress through education systems; and provide customized opportunities for learners based on records of past success of learners with similar profiles. Research in these areas will help educators and students inform the heuristics that guide everyday practices of teaching and learning with powerful new tools and knowledge that take some of the uncertainty out of education.

There are, however, significant obstacles and challenges to the liberation of big data in education.

- First, the existing data systems are *fragmented* and do not have ready capacity to facilitate information exchange. Education is notorious for maintaining siloed information capacity. Often information systems in the same district, such as student scheduling, finance, and special education, are stored in separate, non-compatible

environments. In these systems, data exchange exists in powerful, but inefficient social networks among education professionals, and there is limited capacity to marshal multiple sources of evidence at scale to describe or define systemic learning challenges.

- Second, fragmentation is reinforced because existing data systems are *proprietary*. Schools purchase data and assessment systems from private vendors who have little incentive to create data sharing protocols. The need to negotiate with each vendor within a district, much less across districts and to state levels, creates considerable political and practical challenges.
- Third, there are considerable *security* issues involved with sharing data across systems. Current federal regulations create practically insurmountable obstacles to data sharing that individual actors (i.e. schools, districts or states) have limited will or ability to influence. Better safe than sorry, goes the argument, even if public schools and researchers renounce the capacity for the potential of big data (opportunities which, of course, non-public concerns will gladly explore).
- Finally, there are significant ethical issues involved with big data analysis. The potential will exist to estimate the probabilities that a certain student or group with likely benefit from a program, and may lead funding challenged districts to make strategic investments in the students most likely to succeed. Students with poor performance records would have a more difficult time getting a fresh start in a new system if haunted by bureaucratic shadow of prior disappointments. Marketers, rather than educators, could use data sets for recruitment into colleges and career opportunities. Granted, all of these practices currently occur in public schools, but large-scale data analysis would give a scientific justification for bias and discrimination.

To avoid the exploitation of students and families that may come with unregulated privatization of big data, the federal government ought to work with key actors to develop guidelines for system integration, data sharing and research. These guidelines would need to balance protecting the opportunity of students to start anew, the interests of educators to better understand learning and the effects of teaching, and the public cry for better accountability measures of school performance. It is time to assemble a group of researchers and developers in education to extend the insights of the early big data initiatives in marketing and medicine into education.

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