

Epidemic: Learning Games Go Viral

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This case study reports on the design, development and initial implementation of an online educational resource entitled *Epidemic: Self-Care for Crisis*, available at <http://contagion.edu.yorku.ca/epidemic-dev/login.php>. *Epidemic* represents the continuation and extension of an educational game design experiment, one that involves building and testing different environments for imparting to players critical health-related knowledge: the transmission vectors and symptoms of particular contagious diseases, and the methods, practices and habits for avoidance and treatment. The impetus was the recognition that few public school curricula, even those that embrace 'health promotion', explicitly address disease prevention and self-care in the face of new contagious disease strains, some of which have, in recent years, threatened to become global pandemics (SARS, Avian Flu, and H1N1, for example). We identified a set of understandings and abilities vital to protecting oneself, and one another, in the face of contagious outbreaks: practical information for

self-care (identifying and treating symptoms, managing contagion and prevention), but also scientific facts (epidemiology and virus structure) and social science-related understandings (i.e., relating to historical or ongoing misconceptions).

Our experiment began in 2003 with the creation of *Contagion*, a Flash-based, narrative-driven adventure game. An interactive narrative with embedded and related mini-games, *Contagion* asks players how they will save a futuristic city-state from a mysterious outbreak, perform rudimentary epidemiology, treat the sick and comfort the dying, and navigate the city's restrictive social and political hierarchies as they do so. As we report elsewhere (de Castell, Jenson & Taylor, 2007), *Contagion* represents an attempt to build an environment where educational 'content' is not recognizable as such (that is to say, in a textual and propositionally-organized form), but is distributed across multiple modalities – narrative, as well as character and environment design and game mechanics. In contrast, *Epidemic: Self-Care for Crisis* is, paradoxically enough, a social networking site delivering content, in a decidedly old-fashioned manner, with a series of text-based Fact Sheets that offer information on 30 individual contagious diseases. Where *Contagion* appropriated single-player, narrative-driven gaming conventions to create an environment in which educational content is both everywhere and nowhere, *Epidemic* purposely invokes the interface, architecture and functionality of social networking tools: its didactic Fact Sheets constitute just one interlocking module among several with which users can *voluntarily* engage, alongside a poster-creation game, comic book/stop-motion animation maker, and fictitious disease creation tool. Moreover, where the Fact Sheets employ a dry and straightforward tone to 'serious' content, *Epidemic's* authoring tools feature palettes of disease-themed characters, objects and backgrounds presented in a deliberately irreverent style. The goal here is to capitalize on the kinds of informal distributed and collaborative learning opportunities made possible by

Web 2.0 technologies (Lankshear & Knobel, 2007), while still encouraging a significant amount of “serious play” (de Castell & Jenson, 2003; Rieber, 1996).

In this paper, we report on the theoretical innovations we think that our design and development of this small-scale educational resource might represent. Specifically, we discuss the Flash and XML-based architecture of *Epidemic* in terms of the pedagogical affordances this modular configuration of content makes possible. We then highlight when and where we draw from social networking tools as well as commercial game design in building a series of interactive components to be included in the resource, where users can either individually or collaboratively explore information and build narratives around contagious diseases, their symptoms and transmission vectors, and public (mis)conceptions of them. Finally, we describe our user-testing process, documenting how we looked to user engagement and *affect* for evidence of how, where and when users learned from playing *Epidemic*, rather than asking them to answer “what they learned” (Sedgwick, 2003). We think this approach embodies an understanding of education as more concerned with outcomes – with *Epidemic*, the cultivation of awareness and understanding with regards to contagious diseases – rather than assessment. In other words, we are shifting the focus here from ‘figuring out what people know’ (e.g. assessment) and asking something more like, ‘what did you experience’ (e.g. did a player laugh? Did they lose track of time as an outcome of playing the game). While *Epidemic* certainly does not meet the requirements for a ‘game’ according to most ostensive definitions (Salen & Zimmerman, 2004), we believe it more successfully enacts a *play*-based mode of learning – a “ludic epistemology” – than many conventional approaches to educational gaming. That is, unlike many educational resources that call themselves ‘games’, *Epidemic* does not check whether players get their facts right, but

rather invites them to engage with *serious* issues in a *playful* way, through trying out new roles, understandings, and behaviors.

We begin with an overview of what we mean by curriculum in the context of educational game design, then move on to connect this to scholarship related to educational game design, noting some of the more persistent conceptual pitfalls that arise from trying to reconcile digital games with conventional curricular content and delivery.

Background: Designing a ‘Content Free’ Game

One of the most often contested, and yet, thoroughly taken for granted aspects of education is that it is concerned, firstly, with knowledge and, secondly, with teaching and learning. ‘Knowledge’ in educational terms is, in the blink of an eye, routinely translated into curriculum and curriculum no less promptly converted into teachable and testable learning outcomes. What it is we want someone to know — in education, a curriculum and its specific learning outcomes — is then fed to those who might or might *not* want to know it, in readily decomposed bits and pieces, operationalized in a purportedly developmental stage and sequence framework that somehow believes that 8- year-olds should not read Proust or do calculus. (We pause here to recall that Piaget’s first scientific paper was accepted for publication when he was 8 years of age. Ironically, he is later the very reason cited for developmental learning; imagine considering — no, requiring — 8-year-olds in schools today to be capable of scientific publication.) The assemblage that is schooling withholds facts and knowledge, often without adequate evidence to support that withholding, in order to show developmental progress. Students are moved through the assembly line of K-12 schooling, and knowledge is divvied up much in the same way that auto parts are added to a car. Those ‘parts’ are fit into a ‘whole system’ that is evaluated (and tested) and judged to know more and less. Central to this

system, then, is curriculum, and imagining it differently, in a format that does not rely on print or speech acts as the primary media for delivery, is the particular tact we have taken in imagining this project.

In the context of designing an educational game, what is most often crucially considered is this mechanized, information-driven curriculum or, even more broadly and noxiously, “content”. For educational games, content is usually the most formally and central educational component that signals a game is delivering some kind of curriculum, whether that be in math or social studies or health. In this work, we have flattened out content, making it one of *many* crucial considerations when designing a game. This flattening automatically de-emphasizes ‘what is to be taught’ in the interest of many other considerations: where the game will be played, with whom, what the interests of the players are, on what device/s they will play, what the game affords its players in terms of choices, and so on. In more typical educational game design, content, or the curriculum the game will address, is the primary priority and its ‘learning’ considered the primary outcome for the game, instead of fun, high affect, ongoing engagement with the game, or even pleasure in playing. By deprioritizing content, indeed, in evacuating it as a design problem in lieu of attempting to create a particular kind of experience and/or environment within which we imagined players might dwell, we were able to create a *very* different kind of ‘educational game’.

The State of Play in Educational Game Design

Most approaches to educational game design are keen to appropriate those elements of commercial games that are most amenable to ‘good’ learning. Here, we briefly recap dominant conceptions of what and how educational game designers can learn from commercially successful game design, in order to identify how our own approach in designing

Epidemic differs from this more canonical approach to educational game design.

Until quite recently, the dominant approach to discussions of games and play has been an extrinsic one: games and play are (by definition!) 'fun'. Thus teachers can use games as motivational tools, whether directly as a reward for doing one's work well ("and now you get to play for 20 minutes"), or as a form (actually more accurately as a disguise) for making learning more palatable, in other words, "the spoonful of sugar that helps the educational medicine go down"). In this view, learning is structurally posited as unpleasant and the challenge is to determine what forms of 'sugar' are both most effective for learning and most rewarding for learners. A good deal of effort in this approach is devoted to carving out typological distinctions among entities, and fitting different kind of educational content into them. There is a preoccupation with ontology in this view, asking questions such as: "What is a game? What is a simulation? What is a puzzle? What is a simulation game?" Then evaluation is pursued: "Which of these is best suited to this (or that) kind of learning/content, and how can we meaningfully measure and report relative effectiveness?" From this standpoint we are most likely to learn that games are good for teaching low-level content and skills; while puzzles are good for teaching mathematical reasoning; and, simulations are good for teaching social and communication skills and strategic reasoning, and so on. Here disciplinary knowledge is again more or less held constant. Proponents of this view pay little attention to volition: that we would and should require players to play games found to be educationally effective is not something over which much sleep is lost (Kafai, 1995).

This approach, we believe, rests on a critical misunderstanding of the relationship between attention and education. For both the education and digital entertainment industries, the attention of the learner/player is central and is the primary currency – though arguably, digital games

have a far better handle on this “attention economy” (de Castell & Jenson, 2006). In contrast to formal schooling, as well as conventional educational game design, commercial games rely upon their ability to elicit attention voluntarily (de Castell & Jenson, 2005; Gee, 2003, 2007) and for prolonged periods. In games, player attention is central: the player must first choose to play, and then the game encourages her to continue through both sophisticated and simplistic reward structures that help her learn quickly. The player has agency and, in more than a trivial sense, significant meanings have ‘play.’ What we see represented in video games, therefore, is the fundamental principle at work in theoretical research on attention and learning (Lanham, 1997; Lankshear & Knobel, 2002): that intelligence is always adverbial to attentive action.

In keeping with classic definitions of what counts as play (Huizinga, 1955), the challenge we set out within *Epidemic* was to create a ludic environment that *invites*, rather than *demands* that users pay attention. In going ‘viral’ we wanted to design a pedagogically distinctive environment that does not rely on the formal framework of the interactive narrative, but which similarly rewards continued engagement rather than penalizing users’ lack of interest with tests and grades.

Modular Design

As we have previously remarked in relation to earlier educational technology projects (Jenson, Taylor & de Castell, 2007), Flash is a cost-effective and accessible means for developing digital learning tools, despite its technical limitations. Not only is it inexpensive compared to other commercial game development engines and educational content delivery systems, but developing content for *free, online* delivery means that educators can make use of applications without installing new software on computers –often a significant barrier to entry for digital learning tools in formal schooling.

Here, we identify two technical decisions related to the Flash architecture we deployed in *Epidemic*. We see these decisions as noteworthy not because they mark any particular innovation with regards to educational game design, Flash-based or otherwise, but because they represent particular *pedagogical* choices. Specifically, we describe how two particular rhetorical decisions enact very distinct environments in which educational content can be differently modified and reconfigured by users, and, in neither case, simply delivered.

First, the extensive employment of XML in the architecture of *Epidemic's* components supports the Hall of Infamy where historical and current contagious diseases are profiled on various Fact Sheets; FluTube, where users create animated comic strips about contagion and self-care; Propaganda Maker, an activity for making public service announcement-style posters; and, the avatar creation tool, where users create their own viruses which they then use to represent themselves to other users. While the interfaces for these components are built in Flash, the content is coded and accessed dynamically via XML files so that new content (for instance, new background images for the Propaganda Maker, or new Fact Sheets for the Hall of Infamy) can be added quickly and without much technical know-how. This means that content for the central, interactive parts of the *Epidemic* resource can be updated and edited independently of a trained programmer.

The second significant decision in terms of architecture concerns the deployment of Flash to embrace Web 2.0 capabilities, including functions that allow users to actively produce or modify web-based content, rather than just reading, watching, and pointing and clicking. This is used effectively in *Epidemic's* FluTube application, where players select from an array of backgrounds, characters and props to build animated comic strips frame-by-frame, as well as view and edit other users' FluTube creations.

The significance of these programming decisions, we argue, is that they enable non-programmers (e.g., educators and researchers) to contribute to the already sizable pool of textual and visual disease-related content the tool offers. This inclusionary design represents a significant pedagogical affordance, giving educators access to a shared ‘design grammar’ that they can contribute to and draw from (Hedberg, 2003; Kress & van Leeuwen, 1996). This sort of adaptability has for some time now been identified as among the most important goals of learning object design (Bradford, et al, 2006; Dougimas, 1999; Hedberg, 2003). While XML-based approaches of the kind described in these studies—where primarily textual content is coded in easily-editable XML documents rather than hard-wired into the resource itself—work towards this goal, they generally do so at the expense of divorcing *educative* concerns from questions of design. As we have described elsewhere (de Castell, Bryson & Jenson, 2002), template-driven instructional resources, though efficient in their capacity to deliver different content within different contexts, deny instructors and students agency in determining *how* they engage with educational material. Looking at design itself as a pedagogical exercise in the development of on-line learning capabilities means asking what kinds of pedagogical choices we forgo when opting for resources which deliver content efficiently but which offer no control in terms of how that content is enacted and delivered.

Learning from Commercial Games & Social Networking Sites

While *Epidemic: Self-care for Crisis* is not, in any traditional sense, a ‘game’, we have appropriated ludic features within a social networking frame to support the overall goal of keeping learners engaged and involved. This was the reasoning behind three key design decisions, which, as was also demonstrated in our user-testing and evaluation,

represent the tool's preliminary success as a learning resource. The first involves our choice to implement a scoring system diametrically opposed to what is, otherwise, largely a tool for the delivery of propositionally organized content related to educational disease. Users are scored more 'contagion points' and their fictitious disease avatars grow from outbreaks to pandemics the more information they access, stories they publish, posters they create, and friends they make. As they interact on the site in these ways – literally, as they become more 'viral'- they are able to unlock more content in the form of characters, backgrounds, and object palettes in 'FluTube' and 'Propaganda Maker'. In this way, the goal was to create an environment where the reasons to progress through activities are intrinsic and virally organic.

The second significant game-informed design choice involved the development of a user interface and, in particular, a character creation tool. The overall interface and functionality of the *Epidemic* user home page invokes a Facebook-style networking resource where users befriend each other and view each other's disease-related stories and posters. Unlike Facebook, however, we encourage users to create alternate identities – specifically, 'fake' viruses that become their avatars for the site. Research on other games and virtual environments (Ducheneaut, et al., 2009) report users spending considerable time and attention selecting and customizing avatars, so we elected to mobilize this affordance *educationally*. *Epidemic's* character creation tool allows users to select their 'body', each representing a different family of viruses; what kind of virus the player chooses informs what kinds of symptoms, transmission vectors, and weaknesses users can attribute to their virus – all of which is based on actual epidemiology. Thus, in developing their own fictitious avatar for use throughout the *Epidemic* tool, users are engaging the acquisition and consideration of legitimate epidemiological knowledge (see Figure 1 for a screenshot of avatar creation in *Epidemic*).

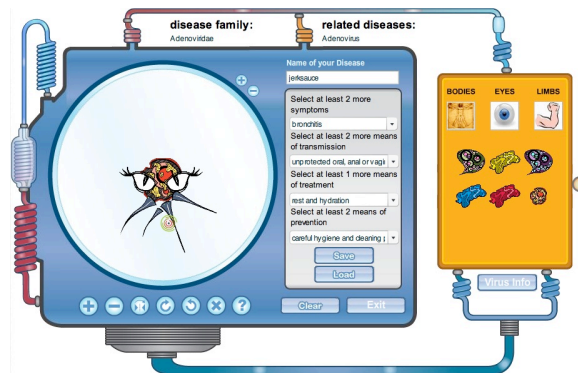


Figure 1. Epidemic's virus creation screen

Play-Testing

The play-testing we report on here took place over four weeks with approximately 50 students enrolled in a summer camp at York University. Students were divided into four groups of 10-16 and we saw each group, each week, for 45 minutes to an hour. Our lesson plans during these sessions involved having students work in pairs from a particular and randomized Fact Sheet from *Epidemic's* Hall of Infamy (our database of over thirty various contagious diseases, from Hantavirus to Chicken Pox) and develop posters or animated comic strips that demonstrated their understandings of their assigned disease (we used Ebola, Influenza, West Nile, and HIV / AIDS).

For these sessions, we purposely avoided asking students to answer (either through interviews or questionnaires) questions around what they learned from playing *Epidemic*. As has been pointed out in other educational research, such questions invariably ask students to ventriloquate responses (de Castell & Bryson, 1998) – that is, to provide answers that they think we, as researchers and educators, want to hear. Moreover, this line of questioning demands that we reduce the complex affordances of multi-modal, interactive learning (Alvermann, 2002; Kress, 2003; Lankshear & Knobel, 2003; Lotherington, 2005; New London Group, 1996) to singular, propositionally organized statements. The

'evidence' we draw from here in illustrating *Epidemic's* educational possibilities, by contrast, includes indicators of high student attention and affect (drawn from our qualitative observations), as well as students' actual FluTube and Propaganda Maker productions.

Diagnosing Engagement

Despite the time constraints of these sessions, and the persistence of certain glitches in the FluTube tool at the time of testing (particularly around saving projects), our analysis of students' activities in these sessions suggest that FluTube and Propaganda Maker enabled students to deploy, experiment with and work through real life considerations around the transfer and prevention of contagious diseases, but in a way that was irreverent and playful (Gutiérrez, et al., 1999). Our findings, based on qualitative observations by the three graduate research assistants present at each session, show evidence of a high level of engagement and attention - including laughter, significant periods of uninterrupted screen looking, and a willingness to stay on task without supervisor intervention.

Students' FluTube stories demonstrated that not only had they appropriated the language in the disease Fact Sheets they were given, but that they were able to mobilize the underlying understandings of disease transmission and prevention, showing how and under what conditions different viruses can be spread from one person to the next. These sessions demonstrated that for a group of students who had *little* preliminary understanding of considerations around self-care in relation to different diseases - that is, anything beyond an ability to rehearse ubiquitous public health care messages ("wash your hands frequently", for instance) - these lesson plans involving content and resources developed for the *Epidemic* project proved to be a highly effective and

engaging means of communicating deeper understandings of various contagious diseases.

“I didn’t know you could show that in schools”

The following stories from our user-testing sessions demonstrate the potentials of *Epidemic* to enact enjoyable and educationally rich forms of collaborative learning. In our second session with Propaganda Maker, we organized students into a friendly competition over who could most effectively persuade others that the imaginary disease represented in their poster was indeed real. In pairs, students volunteered to stand in front of their peers and presented their poster creations using a digital projector, describing in detail the kinds of side effects, transmission vectors, and methods of treatment their imaginary diseases entailed. We see this as a highly significant learning outcome for several reasons. Firstly, even though the content they presented was made-up (i.e., they were discussing wholly imaginary diseases), the terminology they used to describe their diseases (“vectors”, “self-care”, etc.) was accurately modeled on and paralleled real diseases. Through this play and the appropriation of disease-related concepts it involved, students demonstrated a working knowledge of how many real life diseases are spread, classified, and represented. Secondly, their eagerness to show their posters to other students and to voluntarily articulate how their fake disease works illustrates how this kind of resource, which invites students to both produce and *share* their creations, can enable collaborative learning opportunities where students can (and with very little educator/researcher intervention) engage with, support and critique one another’s work. Third, and perhaps most importantly, the discursive critiques which formed the basis for students’ accepting or rejecting a presented disease as ‘true’ involved their demonstration of substantive knowledge and authentic understanding of the particulars of

a disease. This meant that they mobilized a kind of imitative discourse about disease (“vectors,” “virus”, “contamination”, “prevention”) in order to demonstrate what and how they know (Gee, 1992).

In another session with Propaganda Maker, students were asked to create one real and one fake poster, which would then be shown to the rest of the group (see Figure 2 for an example of a fake poster). The goal here was not only to assess students’ knowledge of particular diseases but, as importantly, to enable them to meaningfully distinguish legitimate from illegitimate health-related knowledge through both creation and critique, and by re-mediating textual facts (from the Fact Sheet) into a visual and textual format. As with the Propaganda Maker exercise described above, we noted a high degree of affect and engagement among students as they collectively separated real from fake posters, even as they critically engaged with a domain of knowledge that is “deadly serious” (Kafai, 2006).

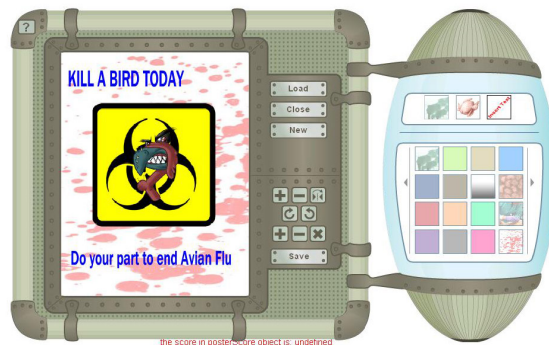


Figure 2. An (intentionally) fake poster design from a play-testing session

A third, predictably troubling, anecdote illustrates the important pedagogical affordances of a resource that, while it offers a fair amount of didactic content, does not dictate how or whether users deploy this content in their use of FluTube and Propaganda Maker. In our early user-testing of FluTube in which we gave pairs of students a virus Fact Sheet and asked them to build a story about contracting that particular

disease, we observed one pair of students disregarding their Fact Sheet and instead creating a narrative about zombie characters that drew heavily from the scatological imagery FluTube offers (images of feces and vomit: see Figure 3).

It might be easy to dismiss this as a frivolous and 'un'educational use of the application. However, what matters here is how the narrative this pair created exemplifies the way the imagery made available to FluTube users constrains and directs what the narrative is about: people getting sick from other people's bodily fluids. While it is certainly possible to make a FluTube narrative that is *not* about any disease in *particular*, it is far less easy, because of the thematically-constrained range of characters, props and backgrounds, to make a narrative that does not in some way address or engage with concepts related to contagion, disease, and self-care. This is a far more engaging mode of prescribing 'content' than to *demand* from players that they commit to accurately portraying certain facts about particular diseases. What's needed of course is more and further testing and analysis of student learning and engagement. Suggestive in this instance of stealth learning (Prensky, 2001) the pair of students that created the zombie narrative clearly and explicitly portrayed the consequences of an unhygienic and unhealthy action, but in a way that does not look particularly serious or 'educational': as one student in the pair remarked, "I didn't know you could show that in schools." Allowing students to give their attention in schools to what they are attending to in their own lives is surely the first large step towards making urgent knowledge, like self-care in conditions of crisis, transferable to and able to be mobilized within their own lives.

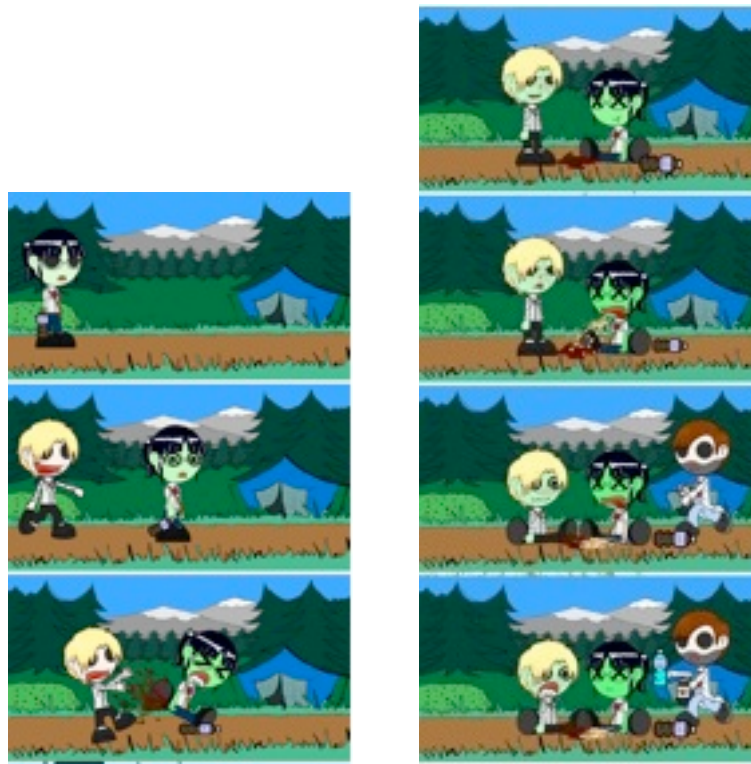


Figure 3. A 'zombie' narrative in FluTube

Conclusion: Assessment vs. Outcomes

Through this project, what we wanted to do is strip away the usual focus on content delivery in a game, and work explicitly from a standpoint that prioritized the ludic, or play. This meant that we view the 'content' for the game, not as curriculum (which designers of other educational games are quick to do), but as something that the player herself would fill in: she would construct her own story, her own way through. In so doing, we were able to refocus our attention on content to be one that is concerned with epistemology, a theory of knowing. The term "ludic epistemology" references the need to explicitly remediate traditional linguistically mediated epistemologies like reading and writing. By remediation here, we follow the work of Jay Bolter and Richard Grusin (1999) who define the process of remediation as one by which new media

forms change or 'refashion' older media. In this case, we ask questions of what and who the new media form of digital games changes what and how we know. So our guiding questions are about what it means to encode knowledge in the form of a game and to 'come to know' as a process of playing that game. A theory of ludic epistemology is concerned with the distinctive demands of—and the particular constraints upon—knowledge representation in the development of digital game-based learning environments. For people who work in education, as we do, the primary theoretical questions are about the re-mediation of educational knowledge and the representation of knowledge under conditions of massive cultural adoption of and engagement with these playful forms.

How is knowledge re-mediated in the form of the game? With explicit reference to *Epidemic*, it is encoded in the game through play-based activities that wouldn't otherwise be available in an educational setting: you can construct your own virus and become friends other viruses, and the more friends you have, the stronger your virus (i.e. the more deadly you are). With *Epidemic*, we have resisted a conventional notion of 'content' but we have taken a step in its implementation that we think neither formal education nor most educational games have done: we have made using & engaging with propositional, didactic content a *voluntary exercise*, housed as it is in an environment in which there is much else to do.

In previous works, we discussed the importance for educational game design of moving away from the notion that learning consists of the transmission of propositionally-ordered content (de Castell & Jenson, 2005; de Castell, Jenson & Taylor, 2007). Here, in this discussion of our user-testing with *Epidemic*, we address a similar and no less limiting convention related to e-Learning, and to education more generally: the notion that the best evidence that learning has taken place consists in

assessment-driven textual production. Even in this new world of “Learning 2.0” (Downes, 2005; Lankshear & Knobel, 2002; Seely-Brown & Adler, 2008) where educators and instructors celebrate the capacity of tools like blogs and wikis to transform learners from passive receivers of educational content to active producers, an understanding persists that learning is legitimated when students produce evidence of their learning in accordance with a prescribed and predetermined template. In formal education, we have *always* demanded that students *produce* – whether test scores, essays, etc. – and these forms of assessment are taken as proof that learning has taken place. The challenge for educators is to not simply demand differently-mediated (but still primarily textual) forms of production-based assessment (e.g. putting your essay on-line, with some pictures), but to return to a notion of education as the cultivation of dispositions and abilities for living meaningful and, in the case of *Epidemic*, slightly more health-conscious lives. When viewed in this way, the evidence for learning – digitally-mediated or otherwise – is less about whether and how students answer ‘what they learned’ from play, and more about their sustained and voluntary attention-giving, the cultivation of affect and excitement, and a desire to keep playing. All of this occurs within an environment designed to engage students with culturally significant knowledge and to understand how this can and should come in many and different forms.

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References

- Alvermann, D.E. (Ed.). (2002). *Adolescents and literacies in a digital world*. New York, NY: Peter Lang.
- Bradford, P., Porciello, M., Balkon, N. & Backus, D. (2006). The Blackboard Learning System: the be all and end all in educational instruction? *Journal of Educational Technology Systems*, 35(3), 301-314. <http://dx.doi.org/10.2190/X137-X73L-5261-5656>.
- Bolter, J. D. & Grusin, R. (1999). *Remediation: Understanding new media*. Cambridge, Mass.: MIT Press.
- de Castell, S. and Bryson, M. (1998). Re-tooling play: dystopia, dysphoria, and difference. In J. Cassell and H. Jenkins (Eds.), *From Barbie to Mortal Kombat: Gender and computer games*. MIT Press, 232-261.
- de Castell, S., Bryson, M. and Jenson, J. (2002). Object lessons: towards an educational theory of technology. *First Monday*, 7 (1). http://www.firstmonday.org/issues/issue7_1/castell/
- de Castell, S. and Jenson, J. (2005). Serious play. *Journal of Curriculum Studies*, 35 (6), 649-665.
- de Castell, S. and Jenson, J. (2006). Education, gaming and serious play: new attentional economies for learning. In J. Weiss, J. Nolan and P. Trifonas (Eds.) *International Handbook of Virtual Learning Environments*. Dordrecht: Kluwer Academic Press, 999-1018.
- de Castell, S. and Jenson, J., and Taylor, N. (2007). Digital games for education: when meanings play. *Intermedialities*, 9, 45-54.
- Dougiamas, M. 1999. Moodle – a web application for building quality online courses. Available from <http://moodle.com/>.

- Downes, S. (2005). E-learning 2.0. *e-Learn Magazine* (Oct. 2005).
http://www.cmb.ac.lk/newsletter/ext_pages/Vlc/E-learning%202.pdf.
- Ducheneaut, N., Wen, M., Yee, N., and Wadley, G. (2009). Body and mind: a study of avatar personalization in three virtual worlds. Proceedings of CHI 2009: The 27th International Conference on Human Factors in Computing Systems.
- Gee, J. P. (1992). *The social mind: Language, ideology, and social practice*. New York, NY: Bergin & Garvey.
- Gee, J.P. (2003). *What videogames have to teach us about learning and literacy*. New York, NY: Palgrave Macmillan.
- Gee, J.P. (2007). Pleasure, learning, video games and life: the projective stance. In M. Knobel and C. Lankshear (Eds.), *A new literacies sampler*. New York, NY: Peter Lang.
- Gutiérrez, K., Baquedano-Lopez, P., and Tejeda, C. (1999). Rethinking diversity: hybridity and hybrid language practices in the third space. *Mind, Culture, an Activity: An International Journal*, 6 (4), 286-303.
- Hedberg, J. (2003). Ensuring quality e-learning: creating engaging tasks. *Educational Media International*, 40 (3), 175-186.
<http://dx.doi.org/10.1080/0952398032000113095>.
- Huizinga, J. (1955). *Homo Ludens: A study of the play-element in culture*. Boston, MA: Beacon Press.
- Jenson, J., Taylor, N., and de Castell, S. (2007). Shifting design values: a playful approach to serious content. *E-Learning* 4 (4), 497-507.
- Kafai, Y. B. (2006). Playing and making games for learning: instructionist and constructionist perspectives for game studies. *Games and Culture*, 1(1), 36-40.

- Kafai, Y.B. (1995). *Minds in play: Computer game design as a context for children's learning*. Hillsdale, NJ: Erlbaum.
- Kress, G. (2003). *Literacy in the New Media Age*. London, UK: Routledge.
- Kress, G., and van Leeuwen, T. (1996). *Reading images: The grammar of visual design*. London, UK: Routledge.
- Lanham, R. (1997). The economics of attention. *Michigan Quarterly Review* 36, 270–284.
- Lankshear, C. and Knobel, M. (2002). Do we have your attention? New literacies, digital technologies and the education of adolescents. In D. Alvermann, (Ed.) *Adolescents and literacies in a digital world*. New York, NY: Peter Lang, 19-38.
- Lankshear, C., and Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Buckingham and Philadelphia, PA: Open University Press.
- Lankshear, C. and Knobel, M. (2007). Researching new literacies: Web 2.0 practices and insider perspectives. *E-Learning*, 4 (3), 224-240.
- Lotherington, H. (2005). Writing postmodern fairy tales at Main Street School: digital narratives and evolving transliteracies. *McGill Journal of Education*, 40 (1), 109-119.
- Murray, J. H. (1998). *Hamlet on the holodeck: the future of narrative in cyberspace*. Cambridge, MA: MIT Press.
- New London Group. (1996). A pedagogy of multiliteracies: designing social futures. *Harvard Educational Review*, 66 (1), 60-92.
- Prensky, M. (2001). *Digital game-based learning*. New York, NY: McGraw-Hill.
- Rieber, L. P. (1996). Seriously considering play: designing interactive learning environments based on the blending of microworlds,

simulations, and games. *Educational Technology Research & Development*, 44 (2), 43-58.

Salen, K. and Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. Cambridge, MA: MIT Press.

Sedgwick, E. (2003). *Touching feeling: Affect, pedagogy, performativity*. Durham, NC: Duke University Press.

Seely-Brown, J. and Adler, R.P. (2008). Minds on fire: open education, the long tail, and Learning 2.0. *Educause* (Jan.-Feb.2008), 17-32.