A New Model for Producing and Deploying Learning Games

Justin Leites, Amplify

Abstract: Amplify, a new publisher of digital educational products, uses an innovative model to produce and deploy a large number of ambitious learning games for grades 4-9. The model produces games suitable for outside-the-classroom use, with a focus on how best to achieve high levels of voluntary engagement. Key features of the model include a studio system inspired by practices from art galleries and Montessori pedagogy; agile/iterative development; students participating as active participants in the design process; extensive use of "explore, build and share" game mechanics; virtual worlds tying together dozens of games from different designers; and extensive integration of a large virtual library as part of one of those worlds. Early feedback is promising, including higher than expected levels of teacher and parent engagement. Many schools are initially anxious about students sharing user-generated content with each other, and seek best practices for deploying games that enable such sharing.

Three Problems the Model Seeks to Address

Learning Outside the Classroom

Educators and school systems across the United States are being held accountable for student performance. But, as has been shown by decades of research, differences in academic growth and achievement are mostly the result of how students spend their time when they are not in the classroom.

Reading skills are an obvious and well-documented example of the consequences of what happens outside the classroom. By middle school, summer reading losses, plus a relatively small achievement lag that carries over from pre-school, produce a cumulative lag of two years of reading achievement, despite the fact that lower- and higher-socioeconomic-status children learn at essentially the same rate while in school (Kim, 1994; Alexander et al., 2007; McCombs et al., 2011).

The outside-the-classroom learning gap is increasingly a problem for middle class as well as disadvantaged students. (The rich now outperform the middle class by as much as the middle class outperform the poor.) Family investments in outside-the-classroom learning account for much of the growing educational gap between the rich and the middle class. Since 1972, wealthy parents have been piling on cognitive enrichment activities outside of school from preschool on up, at a rate that is leaving everyone else in the dust (Reardon, 2013).

Simply assigning more homework won't solve the problem, because (as we have been told by teacher after teacher) the current generation of American students typically won't do the extra work. There is more resistance now to additional required homework is more than in the past, because students (and parents) increasingly see schools (and teachers) as service providers rather than sources of authority. This is part of a larger cultural shift in American society. As one researcher put it: "where once organizations could dictate, today they must entice" (Rigby, 2014, p. 114). Moreover, research shows that "extrinsic" enticements intended to increase completion of school work - such as badges, bribes or verbal praise - are not sustainable and often counter-productive (Kohn,1993, 1999; McQuillan, 1997; Deci et al., 1999; Fryer, 2011).

Traditionally, schools tried, with some success, to address the outside-the-classroom learning gap through school libraries and by sponsoring various extra-curricular activities such as math teams, science clubs and student theatre productions. These solutions, while potent, typically only reached a minority of students, were rarely active over the summer or during other long vacations, and in many places have now been severely curtailed due to budget pressures. Games, by contrast, can motivate a very high percentage of students; and digital games can be deployed at a low per-student cost (especially when schools use BYOD as one of their deployment strategies).

Game Quality

Many stakeholders see the potential value of games for learning, but are dismayed by the quality of the typical educational game and the typical portfolio of educational games. As more and more educators and parents play commercial games themselves, it is increasingly obvious to them how lame most educational games are, especially from the standpoint of engagement:

- Most educational games do not offer players the kinds of meaningful within-game choices that they would have in a leading commercial game such as *Legend of Zelda*. (Miyamoto et al., 1986), *Grand Theft Auto III* (DMA Design, 2001), *World of Warcraft* (Blizzard Entertainment, 2004) or *Minecraft* (Mojang, 2009). And, of course, schools do not offer the variety of games that can be easily found today on Steam, Google Play or the Apple Store.

- Most educational games do not make failure engaging. In a great commercial game, when you fail, something interesting or amusing happens; but in most educational games, when you fail, all you get is not-playful feedback indicating your error and perhaps how you might do better.

- With many of the games that are currently used by schools there is a huge disconnect between the game play and the learning: the "fun" part and the "learning" part are grafted onto each other in ways that seem arbitrary and manipulative.

- The games currently used by schools tend to provide mostly solitary activities. They provide few opportunities for peer-to-peer learning or to allow teachers to participate as players. In particular, they don't take advantage of what for forty years has been the most engaging game mechanic for ages 10-14: the "explore, build and share" process at the heart of games from *Dungeons & Dragons* (Gygax & Arneson, 1974) to *Little Big Planet* (Media Molecule, 2008) to *Minecraft*. These sorts of open-ended peer-to-peer interactions are often to the key to games-enabled learning (Gee & Morgridge, 2005).

Improving Production Processes

Institutional vs. Individual. Related to the above deficiencies in game quality, and perhaps most daunting, is the 'authenticity' problem. A great commercial game, like a great work art and great design more generally, is typically the result of a single person's highly idiosyncratic (weird) and highly coherent vision and sensibility (e.g. *Dungeon & Dragons*'s Gary Gygax, Nintendo's Shigeru Miyamoto, *Minecraft*'s Notch). For adolescents especially, their experience of games and other media tends to be linked very closely with their experience of the creators of those experiences (and so game designers such as Notch are increasingly treated as rock stars). Educational games, by contrast, tend to emerge from institutional production processes similar to the ones involved in the production of a secondary school textbook (weird is not the path to government grants or funding from foundations) and as a result tend to lack both coherence and personality.

Agile vs. Waterfall. Put in terms of software development methodologies, educational games tend to be developed in an exceptionally rigid version of "waterfall", as compared to (most successful) commercial games which use methodologies closer to "agile." For instance, educational games tend to be built according to the initial specifications of the original grant proposal or other funding document; whereas commercial games often undergo fundamental changes during an iterative development process. *Dungeons & Dragons* began as a variant of the rules of a medieval miniature wargame. *Grand Theft Auto* (DMA Design, 1997) started as a racing game. *Minecraft* began as a team-based competitive game, where the goal was to locate and excavate precious metals, and bring your findings to the surface to earn points for your team (Zachtronics, 2009).

$7,600 Coffee Pots. Government procurement processes sometimes leads to legendarily bad design decisions as a result of having too many initial design constraints and requirements (see notoriously Baker, 1984). This is also true with educational games (many of which depend on financial support from government or foundations whose behavior can be similar). For instance, it is currently fashionable to insist that educational games must include rigorous in-game assessments of student learning progress; most major funders would not consider a proposal for a new game unless those assessment methods were already specified. This is surely putting the cart before the horse: what matters most is the fundamental quality of the underlying activities with respect to learning and engagement – if you don't get those qualities right, the rest may not matter. (So, for instance, it might be better to prioritize collaborative and other forms of peer-to-peer learning, even in those cases where including such features might make in-game assessment far more difficult.)

Seven Things We've Done Differently

Portfolio/Studio Approach

Drawing on a production model more common in the art world, we work with more than a dozen "indy" commercial game studios around the world, sometimes on a game-by-game basis, sometimes on time-and-materials contracts

that cover work across a series of games. Some of these studios include:

- Schell Games, creators of *ToonTown Online* (Schell & Disney, 2003), the first MMO for kids;
- Finji, led by the creator of *Canabalt* (Saltsman, 2009), the first "endless runner" game;
- Zachtronics Industries, creators of *Infiniminer* (Zachtronics, 2009), the forerunner to *Minecraft*; and *SpaceChem* (Zachtronics 2011), which has been used to teach teaching concepts related to both chemistry and programming;
- Asymmetric, creators of the browser-based, multiplayer role-playing game *Kingdom of Loathing* (Asymmetric, 2003).
- Brit Meyers, creator of the hit iOS word game *W.E.L.D.E.R.* (Highline, 2011).

We initially approached these (and other similar) studios based on the quality of their published work. In a "pre-contract" phase (before any commitment to provide funding), we provided them with a long and varied list of educational objectives and pedagogical insights - e.g. the math learning progressions from NC State University (Confrey, 2011). We then asked these studios to submit one or more ideas for games related to one or more of these objectives. Initial ideas were submitted informally – typically just a few paragraphs and perhaps a few sketches for each one. We provided quick feedback on all of these ideas (usually over the phone or in person) – both the ones we liked and the ones we didn't. The ideation process then continued with elaborations of some of the initial game concepts, as well as new ones that emerged in response to our original feedback. Even in these early stages, students were involved as active participants in the design process (see below). The elaborated write-ups for the most promising ideas then became the basis of statements of work for an initial round (paid) software development.

A key aspect of this review process was that the initial feedback was rarely dispositive. One noteworthy example of this was an idea for an algebra game from Bossa, an up-and-coming British studio. We were initially somewhat skeptical of the idea, in part because we felt that such a game might only cover very basic math concepts, and in part because we felt the game would be engaging only if the level designs and environments were extraordinarily well done. We initially encouraged the designer to focus on other ideas that he had submitted, which we thought were more promising. The designer overcame our initial skepticism about the math game by flying over and spending a week working out of our office, elaborating and further explaining his proposal. Despite continuing reservations, we decided to fund an initial round of development, largely because the designer was (so talented and) so passionate about the particular project. Several rounds of development later, the game, *Twelve a Dozen* (Bossa, 2014) is now one of the crown jewels of our portfolio, winning accolades as an outstanding landmark in the history of educational games.

One of the American designers who participated in this process, and was accustomed to more rigid expectations from funders, was initially perplexed by the extent to which we were letting the game designers lead the creative process. But within a few weeks he enthusiastically embraced what he came to call "the Montessori method of game design".

Iterate, Iterate, Iterate (and Allow for Failure)

As in the ideation phase, we take an Agile approach to the prototyping and subsequent stages of game development that require building software. The goal is rapid iteration. Typically, we arrive at a playable version of a game, with a build that includes the key game mechanics, within 4-6 months. Within that 4-6 months, most sprint is punctuated by feedback from play-testing. Subsequent phases of work on a game can be considerably shorter.

Across the whole process, we have been willing to cancel game projects at any point, in cases where it became clear that a game has no promising path forward. Crucially, we understand (drawing on Dweck, 2006) that risk-taking is essential and failure is part of the learning process, for ourselves and also the game designers with whom we work. We explain to our design partners that we'd rather have one spectacular success and one complete failure, than two mediocre games.

One memorable indication that we had establish a "growth mindset" culture in working with our game designers came when one of them, Zach Barth, went out of his way to share an unintentionally hilarious initial prototype of the game he was working on for us. As he had hoped, we all laughed about it together, agreed to halt work on the game immediately, and had him set to work on another of his ideas, which has worked out quite well and published as *HabiTactics* (Zachtronics, 2015).

Game World as the Unifying Element

With the studio model, we have had some 40 games, from more than a dozen developers, in the pipeline at once. Nearly 30 of them have already gone out to students. We did not want to present students with all these games as a series of experiences each disconnected from the next. The easiest way to make connections across all the games would have been a light layer of gamification, similar to Apple's Game Center. But we were concerned that this would ultimately backfire, as do many attempts to use "gamification' to manipulate behavior (Deci et al., 1999; Rigby, 2014). In particular, we worried that such a gamification layer, even if successful in the short term, would eventually cause players to "optimize for boredom" (Woodward, 2012) with dreadful long-term consequences in terms of their attitudes towards the underlying skills and subject matters. So instead, we commissioned two ambitious game worlds - *Lexica* (Schell, 2015a) for ELA and *Planet Planners* (Schell, 2015b) for STEM - that provide across-game connections which players (or at least, our play-testers) find to be more intrinsic.

As Schell (2008, 2012) has observed, successful trans-media worlds tend to be rooted in a single medium - Sherlock Holmes in print (Doyle, 1887), *Dr. Who* as a television show (BBC TV, 1963), *Pokemon* as a game (Game Freak, 1996) - and have a single creative individual at the core. But they also facilitate the telling of many stories:

> "Successful trans-media worlds are never based around a single plot line. They have a solidity and interconnectedness that goes far beyond that. They leave room for future stories and for guests to imagine their own stories" (Schell, 2012. p. 342)

In our two games worlds, the various and diverse creations of game designers around the world (and of the players who participate in that world) are so embedded.

Integration With a Virtual Library

The most important feature in *Lexica*, our ELA game world, is its extensive real-time integration with a virtual library (Amplify, 2015) that provides access to more than 600 books. Characters from the books appear in the games, and characters from the games provide comprehension supports as students read books in the library's the e-reader. Characters in the game world also play roles similar to those of an attentive school librarian, helping students find books they love to read, and providing opportunities to discuss books (or parts of books) that they've already read.

The library offers students a wide range of books, both classics and modern works that have established appeal with today's upper elementary and middle school kids. In keeping with the idea of a trans-media world, game mechanics also encourage students to think about and discuss what they have read elsewhere (e.g., using non-digital books). At every stage of game play, students have choices as to what they want to read – and whatever they chose to read can be relevant and useful in some way in the game world.

The data so far about the amount of additional voluntary student reading in the context is preliminary but highly promising. We have been especially surprised by the popularity of some authors now in the public domain, including Charles Dickens. We suspect that the particular popularity of *A Christmas Carol* (Dickens, 1843) has something to so with the story's similarities to tales from another trans-media world, that of Harry Potter (Rowling J.K., 1999).

Social Features to Support Engagement and Learning

Social features are more difficult to implement in a school context given the need to protect student information and privacy, and given the potential for bullying and other misbehavior. But given the importance of social features for both engagement and learning, we have invested in platform tools which enable those features within, across and around games.

For instance, we provide secure threaded message boards where students can connect with one another or with game designers on topics such as tech support, games feedback, and book discussion. The idea is to enable safe and supportive communities where it's cool and encouraged to be smart, thoughtful, and creative in ways that are not necessarily valued by peers at school. The community provides a platform for kids to showcase their smarts and talents by generating and sharing content (fan fiction, art, video, etc.) — boosting their confidence and helping them hone their creative skills. We work with the schools to model and support of appropriate social behavior, but ultimately the students themselves are encouraged to take ownership over the social experience.

Within *Lexica*, students can create their own custom interactive stories. They can do this by writing character dialogue and clicking and dragging different furniture and building architecture options to create 3D settings for their stories. Students can play each other's stories as they would play other levels in the game world. Students can leave comments with feedback on one another's stories.

Similarly, within *C0D3BR34K3RS* (*Codebreakers*), a math game from Strange Loop Games that Amplify will publish later this summer, students are given the tools to build their own custom game levels. They can do this by writing character dialogue and clicking and dragging different furniture and building architecture options to create aerial views of a room, as well as designing 3D trophies for peers to win. Students can play each other's levels.

Many of our games have multiplayer options, so that students will be able to play real-time matches against other students.

Treat Play-Testers as Active Contributors to Game Development

One of the most exciting things about working with the current generation of middle school students is their high level of enthusiasm to participate in game design and development. Rather than always treat these students as lab rats, we have also worked to nurture a cadre of play-testers who work with us in a more active and collaborative way, and mostly on an ongoing basis.

Efficacy testing is of course essential, and rigorous data collection, with data from sufficiently large numbers of "normal" users, is essential to efficacy testing. But we feel that traditional user testing, especially with kids, is too often reduced to nothing more than checking on what works and what doesn't. Defining the roles and relationships in this way – like a clinical trial for a new pharmaceutical - tends to limit the range of feedback. But with our alternative approach, students are often thrilled to be part of an ongoing product development process, where we make them feel like co-creators; and they often give us a much wider range of really terrific (and often very specific) feedback. In particular, they are more likely to be honest in telling us what they don't like and why.

Implementing this approach required us to think differently about how recruit play-testers, about the design of the physical spaces where we work with them, use of our own staff time, etc. Many of our play-testing methods are based on those developed at the New Mexico State University Learning Games Lab (Chamberlin, 2015). On an almost daily basis, we have small groups of students (in our office or in after-school programs) who provide us with quick face-to-face qualitative feedback. We generally do not quantify this feedback, except in the cases where it is nearly unanimous (there are a surprisingly large number of cases where we can use the words "all" or "none"). We ask the students participating in these groups to commit to come for a reasonably large number of sessions (e.g. once a week for a semester), so that they truly feel like "emerging game developers."

"Games Are Never Finished; They're Only Published"

In the 1970's, when tabletop wargame designer and publisher James F. Dunnigan made the point that "games are never finished; they're only published," it was taken by his peers as a reality check: "there comes a time in every game's life where it is ripped from the bosom that's nurtured it and shoved out the door" (Emrich, 2001).

With today's digital games, Dunnigan's observation can be interpreted in the opposite sense, as a reminder that games can continue to be revised and improved even after they are published. We continue to work on all of the games in our portfolio. As is standard practice these days, we use aggregated (and anonymized) player data from the production ("live") version of the game to inform ongoing improvements.

But recently Russell King added a follow-on to Dunnigan's quip (King 2015) that is especially relevant in the context of today's educational games: "Absolutely correct. It's the players that finish them!" Now that our games are live, we are using a combination of social media tools and face-to-face sessions in schools so that students who are playing our games will also have the opportunity to contribute, individually and collectively, to the ongoing development of those games. We regard such ongoing feedback loops as an important part of the design of the product itself, not just because it helps improve game development, but also because we see that it leads students to have a different relationship with the game: they become "our games", not just "the games we got in school." Along with that different relationship comes a higher level of engagement.

Two things we we've learned so far

If You Make The Games Good Enough, Teachers (and Parents) Will Play Them Too

One of the most important results we got from the initial pilots of our games was the extent to which both teachers and parents wanted to play them. Their initial interest was often curiosity about what their kids were doing, but in many cases these adults kept playing because they found the games engaging in their own right. Many parents reported how much they enjoyed having educational games that they and their kids could enjoy playing together.

It seems to us that this insight has important implications for how schools should distribute educational games. For instance, providing access to parents (and perhaps siblings) could expand the community of learners in key domains including math and science.

Many Schools Want Help Implementing Social Features

Schools using our games do always have the option of turning off social features. Inasmuch as any set of social interactions create additional opportunities for misbehavior, this is, at least initially, an attractive option especially for schools wary about educational gaming more generally. But given the importance of social aspects of gaming to the learning experiences (e.g. Gee & Morgridge, 2005), we hope very few schools will actually do this, and so have begun offering coaching and other forms of support for implementing such features.

For instance, students may consider community moderators more abstract because they interact with these authority figures only virtually. Therefore, we advise schools that a known authority school figure should distribute a Student Code of Conduct prior to rolling out the games and related student forums. That way, students know what is expected of them; know that there are real-world consequences for their behavior in the community; and understand that what they do in the online game community may be communicated back to the school.

References

Alexander, K., Entwisle, D,, & Olson, L. (2007). Lasting consequences of the summer learning gap, *American Sociological Review, 72* (April), 167–180.

Amplify (2015). *Amplify Library* [iOS Application]. New York: Amplify.

Asymmetric Publications. (2003). *Kingdom of Loathing*. [Browser video game]. Mesa: Asymmetric Publications.

Baker, R. (1984, October 10). Observer; Aerial Brew HaHa. *New York Times.*

BBC. (1963). *Dr. Who*. [Television show]. London: British Broadcasting Corporation.

Blizzard Entertainment. (2004). *World of Warcraft.* [PC video game]. Irvine, CA: Blizzard Entertainment.

Bossa (2014). *Twelve a Dozen* [video game].London: Bossa Studios.

Chamberlin, B. (2015). *Trying very hard to make games that don`t stink: user testing at the nmsu learning games lab*. [Youtube video]. Retrieved from https://www.youtube.com/watch?v=psj3_Y5aGAc

Confrey, J. (2011). *Turn On CC Math*. [Online mapping resource]. Raleigh, NC: North Carolina State University. Retrieved from https://turnonccmath.net

Deci, E., L,.Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, 125(6), 627-668.

Dickens, C. (1843). *A Christmas Carol in prose: Being a ghost story of christmas.* London: Chapman & Hall.

DMA Design. (1997). *Grand Theft Auto* [Sony Playstation video game]. New York: BMG Interactive.

DMA Design. (2001). *Grand Theft Auto III.* [Sony Playstation 2 video game]. New York: Rockstar Games.

Doyle, A.C., (1887). A Study in scarlet. In *Beeton's Christmas Annual 1887.* London: Ward Lock & Co.

Dweck, C. (2006). *Mindsets: the new psychology of success*. New York: Random House.

Emrich, A. (2001). Official Comments. *Master of Orion III* board. Retrieved from http://moo3.quicksilver.com/official/devposts1.html.

Fryer, R. (2011). Financial incentives and student achievement: Evidence from randomized trials, .*Quarterly Journal of Economics*, 126 (4) 1755-1798.

Game Freak. (1996). *Pocket Monsters: Red & Green*. [Nintendo Game Boy video game] Kyoto: Nintendo.

Gee, J. P. & Morgridge, T. (2005).Semiotic social spaces and affinity spaces: from the Age of Mythology to today's schools (214-232). In David Barton & Karin Tusting, Eds. *Beyond Communities of Practice: Language,*

Power, and Social Context. Cambridge: Cambridge University Press.

Gygax, G. & Arneson, D. (1974). *Dungeons & Dragons* [Role playing game]. Lake Geneva, Wisconsin: TSR.

Highline. (2011). *W.E.L.D.E.R.* [iOS video game]. New York: Ayopa Games.

Kim, J. (1994). Summer reading and the ethnic achievement gap, *Journal of Education for Students Placed at Risk 9* (2), 169-188.

King, R. (2015, March 11). Comment posted to Facebook thread started on March 11, 2015 by Justin Leites at https://www.facebook.com/groups/spigames/ .

Kohn, A. (1993, 1999). *Punished by Rewards: The trouble with gold stars, incentive plans, A's, praise and other bribes*. Boston: Houghton Mifflin.

McCombs, J.S., Augustine C.H., & Schwartz H.L.(2011). Making summer count: How summer programs can boost children's learning, Santa Monica: RAND Corporation; 2011: Monograph Report 1120. Accessed on September 20, 2014.

McQuillan, J. (1997). The effects of incentives on reading, *Reading Research and Instruction,* 36, 111-25.

Media Molecule. (2008). *Little Big Planet*. [Sony Playstation 3 game]. London: Sony Computer Entertainment Europe.

Miyamoto, S., Tezuka. T, & Aonuma, E. (1986). *The Legend of Zelda*. [Nintendo Entertainment System video game]. Kyoto: Nintendo.

Mojang. (2009). *Minecraft*. [Multiplatform video game]. Stockholm: Mojang.

Preloaded. (2012). *Level Up!.* [Interactive website]. London: British Broadcasting Corporation.

Reardon, Sean F. (2011), The widening academic achievement gap between the rich and the poor: New evidence and possible explanations. In R. Murnane & G. Duncan (Eds.), *Whither opportunity? Rising inequality and the uncertain life chances of low-income children*, New York: Russell Sage Foundation Press.

Reardon, Sean F. (2013, April 27) . No rich child left behind, *New York Times*.

Rigby, C.S. (2014). Gamification and Motivation. In S. Walz & S. Deterdin (Eds.) *The Gameful World: Approaches, Issues, Applications*

Rowling, J.K. (1999). *Harry Potter and the Sorcerer's Stone.* New York: Scholastic.

Saltsman, A. (2009). *Canabalt*. [Multiplatform video game]. Austin, TX: Semi-Secret.

Schell, J. (2008). *The art of game design: A book of lenses*. Boca Raton: CRC Press.

Schell Games & Disney Interactive (2003). *ToonTown Online*. [PC video game]. Los Angeles: Walt Disney Company.

Schell Games (2015a). *The World of Lexica*. [Tablet video game]. New York: Amplify Games.

Schell Games (2015b). *Planet Planners*. [Tablet video game]. New York: Amplify Games.

Woodward, M. (2012). The other white meat: Design architecture for sandbox games. [Slide presentation]. *Game Developers Conference Online 2012*. Retrieved from http://twvideo01.ubm-us.net/o1/vault/gdconline12/Presentations/Woodward_Matthew_The%20Other%20White.pdf,

Zachtronics Industries. (2009). *Infiniminer*. [PC video game]. Seattle: Zachtronics Industries.

Zachtronics Industries. (2011). *SpaceChem*. [PC video game]. Seattle: Zachtronics Industries.

Zachtronics Industries. (2015). *HabiTactics*. [PC video game]. New York: Amplify Games.