Implementing Game Design in School: A Worked Example

Mise en œuvre de la conception de jeu à l'école : un exemple pratique

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Abstract

This case uses a worked or 'working example' model (Gee, 2010), documenting the implementation of a novel game design curriculum in the United States. Created by an Instructional Technology Administrator (ITA) and two classroom teachers, it was subsequently offered to high school students. With an aim of providing in-depth understanding of conditions necessary to bring game design experiences to classrooms, the research describes the context while revealing processes and instructor perceptions of the experience. Data collection and analysis in this working example include observation, teacher interviews, student surveys, and artifacts intended to make thinking and practices overt while inviting scholarly conversation around the curriculum's successes and failures. Drawing on a previous case focused on initial course planning and early implementation (Herro, 2013), this paper advances insight regarding the process of moving game design into schooling and concludes with a discussion of educational implications.

Résumé

Cette étude se sert d'un modèle « d'exemple concret » (Gee, 2010) pour documenter la mise en œuvre d'un programme de conception de jeu aux États-Unis. Créé par un technopédagogue et deux titulaires de classe, le programme a ensuite été offert à des élèves du secondaire. Visant à fournir une compréhension approfondie des conditions requises pour l'intégration des expériences de conception de jeu en classe, l'étude décrit le contexte et révèle les processus et les perceptions qu'a tirés l'instructeur de l'expérience. La collecte de données et l'analyse dans cet exemple concret comprennent l'observation, des entrevues avec les enseignants, des sondages auprès des élèves et des artefacts ayant pour but de rendre manifestes la réflexion et les pratiques tout en stimulant la conversation savante à propos des réussites et des échecs du programme. S'appuyant sur une étude préalable qui mettait l'accent sur la planification initiale du cours et le début de sa mise en œuvre (Herro, 2013), cet article propose une perspective sur le processus d'intégration de la conception de jeu dans la formation et conclut avec une discussion portant sur les répercussions pédagogiques.

Introduction

Currently there is a great deal of hype regarding games for learning. This has translated to policy recommendations, predictive reports outlining trends for games in education, and research-based suggestions for transforming technology use in schools (Federation of American Scientists, 2006; Johnson, Adams, Becker, Estrada, Freeman, 2014; Squire, 2011; US Department of Education, 2010; Williamson, 2009). However, while awareness and efforts to use educational game play in classrooms is increasing (Fishman, Riconscente, Snider, Tsai, & Plass, 2014; Takeuchi & Vaala, 2014; Veraquest, 2013), effective integration of game design within the 'traditional' school day is far less prevalent. To broadly realize in-school game initiatives, successful models are needed - models that include teachers as "designers of experiences good for learning" (Gee, 2013, p. 23).

Research on games to promote learning is often conducted and studied in after-school or informal play contexts (Gee, 2007; Klopfer, Osterweil & Salen, 2009; Steinkuehler, Alagoz, King, & Martin, 2012; Steinkuehler & King, 2009). While these studies are valuable and rates of participation in after-school programs are increasing, ability to impact students remains proportionately low when considering regular attendance and overall K-12 student populations (Huang & Dietel, 2011). Admittedly, bridging research to practice with games in schools is difficult. Cost, limited time to integrate with curricula, and technology infrastructure issues continue to pose implementation challenges (Fishman et al., 2014). Squire (2015) notes that games are poised to enter mainstream education due to the proliferation of digital tools and devices, interest in games as new models of assessment and broad ecology to market and distribute games, but acknowledges the future of games in schools is still unclear. "The games and learning space is still in an exploratory, R&D phase" (Dieterle as cited in Bargseghian, 2013, para. 18).

Statement of the Problem

More than a decade of research supports gaming as a viable method of learning (Gee, 2003; Ketelhut, Dede, Clarke, & Nelson, 2006; McClarty et al., 2012; Williamson, Squire, Halverson, & Gee 2005) but this research has typically occurred in informal learning or after-school programs. Moreover, game design experiences in school are far less prevalent than game play. To significantly affect large populations of students, game-based learning – inclusive of game design, should be offered in formal classrooms. For this to occur, it is essential researchers consider the realities of schooling and practitioners feel compelled and equipped to make changes. Understanding conditions permitting successful in-school gaming allows for intentional decisions regarding appropriate curricula and project design. Methods and models connecting game-based research to in-school practice are not widely available (Federation of American Scientists, 2006; McClarty et al., 2012; Morelli et al., 2011).

Thus, the intent of this research was to explore: How might schools develop game design opportunities for students? What does the process entail? What is the instructor's approach and initial perceptions of the implementation? What are the challenges and successes realized?

Guided by the principles of 'worked (or working) examples' where an expert works through or explains the solution to a well-known problem making the thinking, practices, and values of a

discipline overt and public for newcomers (Gee, 2010), this paper proposes how game design in a traditional high school can be sustained. Initial portions of this paper correspond with a previous chapter detailing the early stages of curriculum inception and development (Herro, 2013). This paper more fully examines the process by describing the teacher's perspective of the experience, and offers representative curricular documents, student work and evaluations. A discussion of challenges, the District's next steps, and implications concludes the example.

Review of Relevant Literature Supporting Games for Learning

Socio-constructivist and situated learning are most commonly cited as theories supporting the social, embodied, and context-based experiences learners experience when thinking and problem-solving in gaming environments (Gee, 2003; Lave & Wenger, 1991; Schute & Kim, 2011). These theories suggest high-level learning is situated in socially mediated, authentic activities with culturally familiar, motivating tools (Brown, Collins & Duguid, 1989). Learning is thought to exist in contexts where thinking, reflection and problem solving is both social and relevant to the learner (Shute & Kim, p. 3). Drawing on these theories, and many other learning scientists provide powerful arguments to bring games or gaming principles into classrooms (Gee 2003, 2004, 2007; Klopfer, 2004; Squire 2005, 2006; Squire & Jenkins, 2004; Steinkuehler & King, 2009; Squire, 2011; Thomas & Seely-Brown, 2011) citing their ability to engage, teach, and aid in social and complex knowledge construction. Educational researchers suggest game-making offers a window into rich, meaning-making that affords systems thinking, problem solving, storytelling, creativity, and a host of digital and visual literacies (Gee, 2007; Klopfer, Osterweil & Salen, 2009; Salen 2007; Steinkuehler, 2010). The National Education Technology Plan (US Department of Education, 2010) describes embedded technologies in games, simulations, virtual worlds, and collaborative environments as promising learning and measurement tools due to their capacity to engage, provide immediate feedback, and offer sophisticated and complex assessments (p. 15). Students play, and recognize games as learning opportunities and suggest games fit into their vision for 21st Century learning which includes: social-based, un-tethered, and digitally-rich, engaging learning (Project Tomorrow, 2010).

Gee (2005) aptly sums up the potential in offering game design opportunities stating, "Good game designers are practical theoreticians of learning, since what makes games deep is that players are exercising their learning muscles, though often without knowing it and without having to pay overt attention to the matter" (p. 5) When referring to using game design principles for learning in school, he suggests the greatest cost may involve changing minds about how learning is done. Kafai (2006) proposes students making or designing games is an educationally effective, largely unstudied learning process. Squire (2011) furthers that educators using game-based learning pedagogies can offer design and interest-based learning for students supported by teachers as coaches or advisors.

Working Examples as a Method

Working examples, as explained by Barab, Dodge and Gee (2009), are intended as a "mode of inquiry, or a methodological tool" (p. 3), where "annotated examples and contextual framing establish a seed, or starting point in which readers are invited and engage theoretical claims to draw conclusions, scaffold discussions, and refute conclusions through distributed scholarship" (p. 3). As context and examples are foregrounded, the exemplar becomes the significant

methodological tool to illuminate conjectures. In a sense, the example provides the beginning of the thesis, and successive discussions, debate, and iterations of the example add to the plausibility of the claim or argument and body of knowledge. Again, reiterating the working example model, the purpose and value in recounting this case is to provide "a 'meta' take, narrating an instance of a phenomenon in terms of mechanism and process as well as providing contextual framing, to illuminate theoretical conjectures along with the body of work from which the conjecture evolved and takes on meaning" (Barab, Akran, & Ingram-Goble, 2012, para. 2). The description and interaction with the reader or audience creates deeper understanding through context and examples, and becomes a method of supporting or countering theoretical claims. Gee (2011) further maintains, in this new method of inquiry, "the working example does not have to be a big thing" (p. 53), or offer evidence, but instead "it is the presentation of argument, thinking, or approach" (p. 53), that serves the community inside and outside of a given discipline to inform theory. In this vein, this case serves as a 'contextual instance' to scaffold peer discussion eliciting 'verification or refutation' (Barab, Akran, & Ingram-Goble, 2012) to consider offering similar gaming curricula. The worked example emphasizes the process of working through the problem of 'how do we bring game design curriculum to schools?'

Describing the Context for the Curriculum

Support for innovative curricula within traditional schooling is built over many years and involves, at minimum, a true understanding of the ever-shifting notion of literacy (Baker, 2010; Kress, 2003; Leu, 2000). In this case, the transformation of research into practice developed over three years, after several supporting initiatives occurred including exposing teaching and administrative staff to presentations, research, and discussions about game-based learning in district meetings and on-site graduate courses. Podcasting, video-production, social media, virtual schooling, and Google Apps were already infused in curricula. The district didn't begin with game design offerings, the support for innovation existed. A supportive culture to participate with media and new media literacies (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006), and purposeful efforts to work through challenges when presented was instrumental in moving the gaming curricula forward.

      Planning and implementation. The process envisioning and writing the curriculum in this example entailed (1) consultation with UW-Madison's Games + Learning + Society (GLS), (2) surveying high school students to gauge interest, (3) reviewing research and proposing the course for Curriculum Coordinating Council approval, (4) writing and revising curriculum, (5) considering equipment and logistics and (6) revising curriculum based on staff and students perceptions (as further described in Herro, 2013). After a small team of district staff met with graduate students from GLS to review practices from a summer game design camp for adolescents, it was determined a mock syllabus and student survey would drive the decision to offer the course to high school students. The proposed syllabus outlined an 18-week course, to be offered as a technology education or visual arts elective credit, in which the history of games and their potential value would be examined along with opportunities to play and design board, physical, and video games. Alice (http://www.alice.org/index.php) and Scratch (http://scratch.mit.edu/) were mentioned as possibilities for game design spaces. Game design elements of aesthetics, dynamics, and mechanics (Hunicke, LeBlanc, & Zubick, 2004) were incorporated in proposed project requirements. The course was conceived as a response to the dwindling numbers of students electing to take computer science courses as well as the desire to

increase students' skill with digital media. It was seen as a potential first step to get students interested in honing problem-solving, new media literacies, and computer science related skills.

The Study

This descriptive case (Yin, 2003) documents the first year implementation of a game design curriculum offered to one hundred and seventy-four students, 41 girls and 133 boys, participated in 9 separate sections of Elements of Game Design (EOGD). The purpose of the case is to detail the nuances of in-school implementation and resulting outcomes regarding this novel curriculum. The research sought to capture the process through observation and instructor perceptions, and reveal logistical and instructional successes and challenges. Thus, whenever possible observations are presented and discussed in context. The intent is to offer educators a starting point to consider bringing game design into schools.

Participants

One instructor, 'Dave Keller', taught the course and was supported by the researcher who worked as the District Instructional Technology Administrator (ITA) and served as instructional support. All course participants were between the ages of 14 and 17 and elected to take the half-credit class to fulfill a technical education or visual arts requirement. Based on student surveys, observations, and teacher reflections the course drew from a range of ability levels and interests. The demographic make-up was representative of the mostly white, middle class attendance area of the public, Midwestern United States high school; however the proportionally high number of boys versus girls in the course did not reflect the school's equal gender distribution.

The Procedure

Multiple data collection methods (Yin, 1993) offered an in-depth look at the implementation. The researcher visited the classroom on more than a dozen occasions throughout the year writing field notes to narrate the process, observe students, and collect artifacts. Each observation was followed by discussions with the instructor. The teacher was formally interviewed before, during, and after the implementation and given transcribed interview data to check for accuracy. Students participating in the course during the first and third quarter completed electronic evaluations, created by their teacher, to provide sufficient data for program modifications (Rossi, Lipsey & Freeman, 2003). The evaluations served to (1) provide a snapshot of student interests outside of the course; (2) garner perceptions of learning within the course; and (3) suggest revisions for the instructor. Student responses were grouped into categories and member checked by the participating teacher and the district Director of Research. Artifact examination included instructional materials and student-produced work offering a broad portrait of the implementation.

One-third of the roughly 1,500 students attending the high school viewed the syllabus and answered survey questions; approximately 70% of students responded they 'might' or 'would definitely' enroll in a gaming course. This above-normal interest in a new elective course merited drafting a course proposal. The proposal included research supporting game design as a medium for engaged learning, and content linked to International Society for Technology in

Education Standards (ISTE, 2007), Technical Education, and New Media Literacy (Jenkins et al., 2006) standards. The Curriculum Coordinating Council unanimously approved the offering.

Writing the curriculum. The curriculum writing team included an Instructional Technology Administrator (ITA), Technical Education (TE) and Visual Arts (VA) teacher. The team was selected as the ITA had experience researching games for learning at a local university, and the teaching staff expressed interest in teaching the new course. Research articles and game design books provided an outline for the course, as did prior experience from the TE teacher, who was a gamer dabbling in game design during his middle school Technical Education courses. The VA teacher provided expertise in activities meant to explore the aesthetics of gaming, and was adept at appropriate pacing, as well as formative and summative assessment criteria. She actively participated in the curriculum writing process, however took a year leave-of-absence from the district during the implementation phase. Course documents were stored in Blackboard (see Figure 1). After a year of meetings, discussions, investigations of potential game design platforms, attending workshops on game design, document creation, building digital repositories of resources, and initial revisions, the first iteration of course was presented to students.
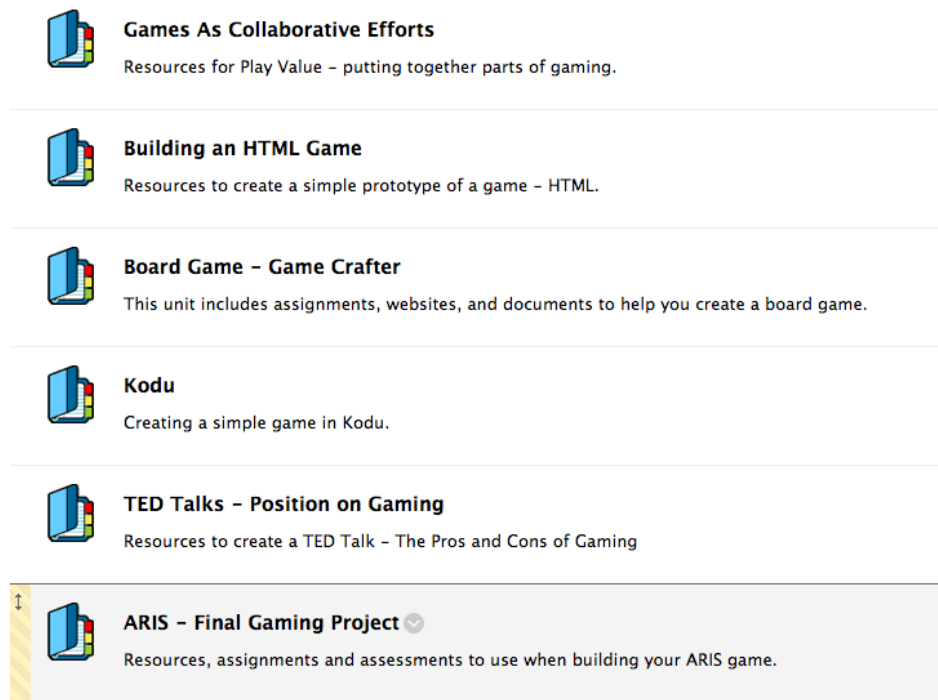
Games As Collaborative Efforts
Resources for Play Value – putting together parts of gaming.

Building an HTML Game
Resources to create a simple prototype of a game – HTML.

Board Game – Game Crafter
This unit includes assignments, websites, and documents to help you create a board game.

Kodu
Creating a simple game in Kodu.

TED Talks – Position on Gaming
Resources to create a TED Talk – The Pros and Cons of Gaming

ARIS – Final Gaming Project
Resources, assignments and assessments to use when building your ARIS game.

Figure 1: Screenshot of Blackboard.

Game play vs. game design. When considering in-school learning opportunities for gaming, an important distinction between game play and game design must be addressed. Presumably participants can play games without designing them, but game designers can't adequately envision, prototype, create, playtest, and refine games without playing them. In this instance, the goal was to offer students a game design curriculum, with many natural, embedded opportunities to play games. The initial outline for the course, expressed as an 18-week offering, (see Appendix A) demonstrates the extensive media and collaborative game design activities

purposely built into the curriculum. The final curriculum and accompanying criteria sheets, rubrics, assessment, and assignment documents contained images and electronic links to video and websites. It was modified as deemed necessary by the instructor throughout the year.

The teacher. Staffing allocations, as defined by the school district budget, determined one instructor would teach nine sections of the course in two scheduling formats: 90 minute taught over nine weeks known as 'block', or 45 minutes taught over eighteen weeks known as 'skinny'. The instructor, Dave, is in his early thirties and identifies himself as a gamer having tinkered with, played, and designed games since childhood. He clearly speaks the same 'gaming language' as the students and understands the value and complexity involved in playing and designing games. When scaffolding learning or creating exemplars, he draws on his gaming experiences. He seamlessly uses YouTube videos, Prezi (http://prezi.com/), Google Apps, and various gaming platforms, and is technically adept. While no specific data was collected to support the claim, it appeared his gaming background and technical proficiency assisted in relating to students. Student program evaluations repeatedly pointed to enjoying the atmosphere of the class alluding to the instructor as a key part of the satisfaction. A majority of students wrote about 'being surrounded by people who know what I am talking about,' or finding the teacher effective because he was a gamer, saying, 'the teacher understands gaming and provides criteria and helpful guidance.'

Teaching the Curriculum

Dave began the course by asking students to critically examining the history and value of gaming. He often gave mini-lectures and included examples of themes or elements in games he was personally interested in such as: the historical progress of societies in Civilization (1991), power and control in the Assassins Creed (2007) series of games, or the aesthetic environment and moral themes in BioShock (2007). Dave also had students watch short YouTube videos detailing gaming history, which he burned on compact discs after realizing they would not easily stream. Through these scaffolded activities, students begin exploring the history and narrative in games. They then deconstructed, and created a 'How to Play' or 'Game History' presentation of their choice. Google Apps facilitated students' collaborative work and communication. Two representative examples of slides shared with peers via a Google Presentation are below.

Figure 2: Example from student presentation detailing Yu-Gi-Oh!

The Begining...

- The Sims is a Life-Simulation Computer game
- The Sims was first created on February 4th 2000
- Sims was developed by Maxis (Will Wright) and Published by Electronic Arts
- By March of 2002 the Sims had sold over 6.3 billion copies

Sims (People)

by Mary and Jennifer

What is "The Sims"

- The Sims game does not have objectives
- Instead there are personal goals (Jobs, Relationship ect;)
- The player is encouraged to make there owns choices as they engage in a interactive environment
- There are life stages in the game. Babies, children, and adults
- Babies can grow up to be children, but children and adults dont change
- All though it is possibly to die in the game
- You can die from:
  - burning to death in a fire
  - drowning in a pool
  - starvation or dying from a disease

The Company who Started it All...

- The creator of the Sims is Will Wright, co-founder of the company Maxis, the company who had developed Sims
- Maxis was founded in 1987 as an independent video game developer
- Maxis software is located was located for many years at Walnut Creek, California
- But in 2004 the company was divided into Electronic Arts Headquarters
- Maxis has produced many games
- there most popluar games are:
  - The Sims Series
  - Skychase
  - Full Tilt Pinball 2
  - and Robo Sport

Unique about the sims

Whats unique about the sims would be its detail and story. the graphics are amazing and so realistic. You can do what ever you want and you have a life that is yours to do as you wish. Either you want to be a loner or not its your choice and if you don't want that choice then you can delete your character and start over.

Sims

There can only be one player at a time. You don't require a significant amount of thinking skills or strategy to play, but some is required.

They have a fan club called FanPop and people have created there own wiki page dedicated to The Sims Series.

Well the Sims clothing in the game is similar to the clothes we wear in reality.
But shirts with the games logo's and prints are available on T-shirt Print websites.

Figure 3: Example from student presentation detailing The Sims.

Board games. The design process began with all students constructing a non-digital board game, although some groups chose to use Photoshop and Daqri (http://site.daqri.com/), an augmented reality tool, for game cards. After a few days of playing and discussing card games and board games, students worked in groups of three to create board games with accompanying rules. They explored the narrative, logic, or design details together guided by a 2-page document prepared by their instructor. They also referenced an online website, The Game Crafter (https://www.thegamecrafter.com/), as their design framework.

Figure 4: Student-created board game.

Digital games. The second and third iteration of game design involved introductory programming, logic, and storytelling taught and practiced through various 2-D and 3-D platforms. Games were created and designed collaboratively with free or low-cost game spaces such Kodu (http://www.kodugamelab.com) and Augmented Reality Interactive Storytelling (ARIS) (http://arisgames.org). During the first semester ARIS was technically non-functional, thus units in Scratch were introduced in every class section and lengthened, abbreviated or eliminated depending on the amount of time necessary for Kodu or ARIS. Dave explained the allotted time depended on the overall skill of the students, their interest in extending projects in Kodu, and technical functionality of ARIS.

Gaming culture, experts, and organizations were threaded throughout the learning instances, and before completing the course students collaboratively produced a short TED Talk taking a stance on an issue in the gaming industry.

Formative and summative assessments were accompanied by criteria and rubrics aimed at assessing project work, including written or multimodal responses, design, and conceptual understanding of the elements of game design. At the end of each term, students researched gaming history, reflected on the value of gaming, and experienced prototyping, playtesting, and revising board, digital, and (once technically possible) mobile games.

Findings

Instructor Perceptions of Game Design in School

Observation, frequent conversations, and interviews with Dave revealed he was pleased with the course, sometimes frustrated with technical issues, and continually considering ways revise the curriculum or extend the learning. Throughout the semester, Dave tinkered with various gaming platforms not included in the initial curriculum such as Alice, Minecraft, Portal, and MIT App Inventor. He often downloaded beta or trial versions and tested them with students who had completed project work or needed extended opportunities. He began the second semester with an afterschool gaming club allowing students to more fully investigate playing and designing games they were interested in.

He believed you had to play games to adequately teach the course, and reflected on role of the teacher and support from administration on more than one occasion. Excerpts from interview questions at the end of the experience illuminate his beliefs:

> Researcher: What conditions do you think should or must exist to bring game design to the classroom?
> Dave: Administration must be on board. They need to understand the concept and value in teaching with games. They think it is just entertainment otherwise. They need to understand that games don't just 'happen', they are complex.
> Researcher: What do you think helped your administrator understand the value?
> Dave: His kids play video games. He has a son who has a Minecraft server. His kids play iPhone and iPad app games by themselves and he sees the complexities in their game play.
> Researcher: What sort of teacher might teach a course like this? What is the role of the teacher in a course like this? Can a non-gamer teach this course?
> Dave: The teacher's role is more of a facilitator. It isn't necessary to be a gamer, but you need to understand games. Why play? Why are there rules? Why are there goals in games? You need to draw on what makes games good to teach about them. I think it helps that I have the gaming lingo. When I talk about 'raging' in games my kids understand me and know that I know what I am taking about. As a teacher you have to understand that games have goals, or missions to complete – and I think you have to play games, not just read about them. If you don't play games you don't really get involved and you can't appreciate games.

Student Evaluations to Gauge Interest and Direct Revisions

Dave administered surveys to students completing the 90-minute block course during the first quarter to better understand students' personal interests, hobbies and career goals. He was also interested in students' general observations about their learning. A brief summary of survey results from thirty-five (n=35) responses to two questions described more fully in Herro (2013) follows:

When asked to describe themselves (hobbies, interests, or future goals), students responses (n=number of responses) demonstrated interest in: playing video games (n=17), physical

activities including snowboarding, sailing, dancing, football, track, cross-country, horse-back riding (n=21), and creative activities (n=13) such as building things, playing music, drawing, painting, photography and writing.

When asked, "What, if anything, do you think you learned?" responses (n=number of responses) were classified in the following categories: Game Process and Design (n=10), Technical Skills (n=9), Complexity of Games (n=9), Teamwork (n=6), History of Games (n=5), Time Management (n=2), Educational Value of Games (n=2), and Nothing (n=1).

Second semester course evaluations were revised to better understand students' perceptions of learning within the course. During the third quarter it was administered to all (52) students completing the current 'block' sections. Of the participants, 45 students, 39 male and 6 female, elected to answered questions aimed at determining their perspectives towards learning and value within the course. Questions posed included:

1. How would you describe the class to someone who hasn't taken it yet?
2. Describe any math, science or technology skills you have used in this class.
3. What do you like about the class?
4. What, if anything, do you think you've learned?
5. What tools do you think have helped you learn the content in this class?
6. What don't you like about the class, what would you change, or what could be improved?
7. What type of games, if any, do you play outside of school?
8. Explain in a few sentences if you think the learning and projects in this class will help you with future classes or preparing for a career.

Responses to two of the eight questions categorized by themes which emerged in student responses (SR), are represented on the tables below.

Table 1
Describe any math, science or technology skills you have used in this class.

Skill	Mentions	Representative responses
math/logic	19	SR: In this class I had to use math skills when we made our board game. Designing the board required this to make it proportionally correct. SR: We used a lot of math skills in the board game for measurements and programming in Kodu. SR: Learn more about logic which is used in all types of programming languages.
technical/ computer	18	SR: not much math, but you need to be computer literate. i.e. Photoshop, Google Chrome, vegas, Kodu, and you need to have a basic understanding of programming SR: we have used a lot of technology to learn how to program games and learn about the history of games.

Skill	Mentions	Representative responses
Science/ physics	5	SR: games created in the Kodu program require math and physics to control how different objects work. SR: "science in the realistic part of the program. for example if you throw a apple you want it to drop and not keep soaring through the air..."
None	5	SR; Well, I haven't used any math or science really, but understanding how the programming works definitely helps. SR: none. I used none.

Table 2
What, if anything, do you think you've learned?

Categorized response	Mentions	Representative responses
Process, how to design a game	15	SR: So far I've learned a lot about programming (Kodu) and the 'behind the scenes' of how a game is created. It helped me to start thinking in more of 'how' when I play a game. SR: I've learned the basic fundamentals to designing a game.
History of games, insight into gaming industry	13	SR: I actually learned a lot from this class, even stuff I already knew I am now excelled in and know more about certain thing. Some things I learned are programming, history of certain games, how to make my own board game and many more. SR: I've learned about the progress gaming has made through history.
Coding or programming	14	SR: how to program games and new aspects of games I never really thought about before SR: massive amounts of info on programming and the science behind making games and insight into the video-game industry
How to use Kodu (specific mentions of the platform)	9	SR: I've learned how to program a game, i.e. Kodu SR: Loads about Kodu and programming in general SR: the Kodu program, Google docs
How to use or apply technical skills	5	SR: I've learned how to apply the technology skills I have learned and use them when I work with Kodu or even creating your own board game. SR: I've learned how to use many different programs, not all for game designing, such as Kodu, Photoshop, Sony Vegas, Google Apps, and others.....

Admittedly, student perceptions of skills or learning are not a definitive indication that learning occurred. More in-depth measures and analysis is necessary to determine increases in achievement. Additionally, overlap of themes between students responses are not categorized on the table. For example, Kodu was mentioned as a valuable tool for building programming skills or learning content 31 separate times on the survey.

Students were overwhelmingly positive describing what they liked about the class, citing its: creativity, variety, constructive practices, design-work, game play, independent work, hands-on approach, learning involved, teacher, group work and fun. Many wrote statements such as "I like just about everything, especially working with computers", "I like that it is 95% hands on activities and you can use your creativity to create what you would like while still in the guidelines" or "everything about it makes this class likeable, I mostly enjoy it because I like programming and video games."

Additionally, a majority of the students surveyed believed the EOGD prepared them for future classes or careers. Students responded the course might assist in their future goals, which included: game design (n=13), programming (n=7), technology or the computer industry (n=7), graphic design (n=2), electronics (n=1), becoming a pro-gamer (n=1) and becoming an author (n=1). Others suggested future transferrable skills included: problem solving or logic (n=4), creativity (n=3), critical thinking (n=2), prototype testing (n=1), and staying on task (n=1). Two of the 45 respondents believed the class did not offer future skills or preparation for their intended careers, but added it might help others going into game design or programming careers.

Measuring Success

Project-based learning, ISTE Standards (http://www.iste.org/standards) performance indicators, new media literacies (Jenkins et al., 2006) and 21st century skills (http://www.p21.org/about-us/p21-framework) drive the course; therefore achievement is measured in formative and summative assessments geared towards principles within these frameworks. After sharing and discussing student produced work - often in the form of Google Docs, Sites, Presentations, as well as board and digital games, Dave deemed the course successful articulating its value in honing participants' creativity, collaboration, problem-solving, research, writing, presentation, programming and logic skills. Additionally, he often commented, "my friends [in technical education] can't believe I get to teach this course", implying they shared an understanding of the learning value in designing games. Dave's perception of success was somewhat broader than his students. In general, students recognized the class as valuable towards teaching programming and technical skills, but not necessarily as honing collaboration, creativity, communication and research skills (as suggested by *ISTE Standards 1-4 for Students*). These skills were apparent in students' completed coursework, but not recognized by them.

After the initial implementation, EOGD was considered successful enough to offer in subsequent years, and resulted in forming after school clubs throughout the district allowing for additional game play and design. A second gaming course is in progress (see Results section).

Challenges

Time, technical requirements, implementation costs, scheduling and variance in student abilities posed the greatest challenges in this case. While the visioning and approval process for EOGD was relatively seamless due to the districts' culture supporting innovation, the actual logistics of implementation and planning posed challenges to unblock and prepare the environment that often persisted when revisions were made. Curriculum writing was time consuming, involving months of weekly meetings and revision by an invested group of teachers. The curriculum writing team had a clear advantage with one member being both the ITA and an educational games researcher. In the same vein, it is difficult to completely eliminate researcher bias considering the dual-role of games researcher and instructional support within this working example.

Technical requirements and network limitations were challenging before and during the implementation. Significant time and work in the preceding summer months was necessary to order equipment, prepare the lab, work with technicians, and finalize documents and projects. During the initial student implementation, weekly visits by the ITA were required to ensure technical issues and curricular questions that surfaced could be promptly addressed. Available infrastructure within the high school limited both broadband speed and wireless connectivity, and ARIS wasn't fully functional on mobile devices until the fourth quarter of the school year. Game creation materials, commercially produced board games, and mobile devices for students without access totaled approximately $8,000 necessitating additional funding through an outside grant.

Instructor perceptions of challenges. Informal discussions and three formal interviews with Dave revealed perceived challenges and frustrations within EOGD. Three issues frequently surfacing were the academic variance in students, discrepancy in productive learning environments between the block versus skinny scheduling, and technical issues. Students, at times, struggled with the complexity of the curriculum and intensive project work. Dave frequently commented some students were highly motivated - completing projects early, asking for more difficult programming work, or creating multiplayer, multilevel games - while others wanted to play games but lacked enthusiasm to design complex games. He pointed to the different ability level and behavior issues in students across courses, believing the range in skill levels and behavior management created a chasm between students during collaborative work times. In fact, early student evaluations indirectly pointed to similar frustrations. "Let me choose my own group," was listed most frequently on initial student course evaluations when asking for improvement suggestions. After allowing students to choose collaborative groups "change nothing" was listed most frequently on mid-year evaluations.

Dave taught four blocks and five 'skinnies,' and believed the block schedule was conducive to greater learning and project development. He often remarked the 45-minute session didn't allow students to 'dig in deeply' before class time was over.

Technical support was an ongoing frustration, and in all likelihood exacerbated by his technical ability. Dave knew what was possible from his expertise providing technical support in a home improvement store, and became annoyed when hindered by blocked sites, inaccessible equipment, or slow response times. Over the course of the year, he developed a number of

'work-arounds' to assist in delivering content, including: substituting Scratch for ARIS when mobiles were inaccessible, burning and distributing online videos to CDs for student use, and bringing in his own equipment

While this research didn't measure standard achievement gains, a foreseeable challenge moving forward is matching current testing measures to capture and assess multimodal and project-based learning. More defined measures of achievement have yet to be explicitly integrated in the coursework.

Discussion of Results and Educational Implications

The above working example makes the thinking and practices of 'how' to move game-design into schools overt (Gee, 2010) by detailing the successes and challenges, and proposing how this sort of curriculum might be sustained. Drawing on the above illustration, a discussion of resultant outcomes and themes in this instance is tied to broad implications for school districts and researchers interested in integrating gaming in school.

Suggestions for Game Design Implementation in School: Themes

Involved and flexible teachers. Teacher involvement in visioning, writing, and piloting the curriculum was a key to successfully teach this course, and resulted in enough 'buy-in' to flexibly implement the curriculum. The instructor accepted the possibility of failure and inevitability of revision with unpredictable technologies, yet he appeared comfortable making changes throughout the year. He often substituted other gaming platforms or digital spaces when a tool was inaccessible or less effective, and considered student evaluations and suggestions. This was evidenced in his addition of instructional tools, removing portions of units or processes students believed ineffective, introducing a Minecraft server to interested students, exploring MIT App Inventor (http://appinventor.mit.edu/) in a gaming club, and increasing programming (time) in Kodu. This implies successful characteristics of a gaming instructor include flexibility, comfort with change, capacity to explore emerging technologies, and responsiveness to learner feedback.

Student engagement in the implementation process. From the inception of the course students were consulted in surveys and informal conversations to gauge interest or guide revisions. In all likelihood this increased engagement with the content as their perceptions and evaluations were used to refine the course. By the 3rd quarter a majority of students surveyed deemed the design, projects, learning, and tools within the course exciting and relevant to their learning style. Some described the course as significant in building skills for future preparation or as a gateway to careers requiring programming, prototype testing, game design, electronics, technology, engineering, and graphic design. Understanding and listening to students' views presents researchers and practitioners a window into designing meaningful game-based experiences; one which values student input and prospectively encourages academic or career opportunities. This implies educators and researchers may want to include students in curriculum planning, implementation and evaluation. Since the depth of understanding and application of skills such as creativity, communication, information fluency and problem solving is unclear in this case, gathering further evidence from students regarding learning in these areas would serve to support the value of game design curricula in schools.

Supportive communities of practice. The instructor had considerable technological and pedagogical support implementing the curriculum from the ITA and district administrators who understood the potential of games for learning. Although not detailed in this example, parents and school board members were supportive of the new course, sanctioning the curriculum. This suggests in-school practices with games may flourish in communities where understanding and valuing technological innovation is broadly distributed among administrators, technical support, teachers, students and the community.

Extending learning. Student interest in course projects led to the formation of after-school gaming club focused on further developing games and designing Apps. Students set up a Minecraft server, built location-based augmented reality mobile games at a local museum, and shared games they were interested in playing. This extended understanding the relevance of games to the broader community. Interest in the course from local newspaper stories, EOGD students' video-conferencing with middle school technical education classrooms, and administrative support led to forming additional afterschool gaming clubs at both intermediate schools in the district. The high school principal requested the curriculum-writing team propose a subsequent offering of game design with an emphasis on computer science and higher-level programming skills. The new course uses Portal 2 (http://www.thinkwithportals.com/), Unity (http://unity3d.com/) and MIT App Inventor to teach computational thinking practices. Compared to the introductory, broad scope of EOGD, the course will include more immersive 3-D gaming platforms and sophisticated editing software aimed at preparing students for post-high school computer science training or coursework. Extending game-based learning in after school clubs, creating an additional game design course with increased rigor, and connecting with a larger community implies scalability and acceptance for this type of learning.

Conclusion

The landscape of games in education is gradually changing with ample research evidencing games as potentially effective learning tools (Takeuchi & Vaala, 2014). However, even with increased teacher support for game-based learning adoption of integration models in schools is not yet mainstream (Squire, 2015). Beyond surveys reporting frequency of game play in classrooms to support instructional goals and formative assessment (Fishman et al., 2014) little data exists detailing instructional models of game-based learning. Continued studies in this area are important inclusive of models for educators to scrutinize in real contexts.

The example provided by revealing the first year process, challenges, and successes when implementing EOGD is not an argument for a specific game design curriculum in schools. Instead, it sets a foundation for interested scholars and teachers, across domains and areas of expertise, to consider approaching the problem of 'how to' move games into learning environments. In this case, a game design experience, in which game exploration and play was naturally embedded, led to a culture of support for games, and increased learning opportunities for students. Moreover, this working example demonstrates the difficulty of the task: providing meaningful game design experiences corresponding with student interest and engagement, while navigating the complexity of school. District-wide support for innovation, a basic understanding of the capacity of game-based learning, regular check-ins with the instructor, staff and student critique, and on-going revisions make the course successful enough to continue and expand.

EOGD offers a novel model for educators interested in considering ways to offer game design curriculum. In a similar vein, working examples offer a new approach to inquiry and scholarship. Sharing the process and curriculum in this case provides 'plausibility arguments' and "offers illuminative proof-of-concept instantiations… focusing on revealing mechanism and process to afford insight, promote dialogue, and inspire change" (Barab, Dodge, & Gee, 2009, p. 2). This paper serves as the beginning for discourse regarding effectiveness of this type of curricula. It is an invitation for researchers and practitioners seeking a way forward bringing game design to the classroom.

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Appendix A: Course Outline

Elements of Game Design – Course Outline (18 week)
Curriculum – Draft 3

Elements of Game Design is intended to be an introductory course for students to critically examine the history, usefulness, elements, and process of game design.

Technology tools or spaces embedded in course: Blackboard, Google Docs, Kodu, Scratch, ARIS, photo editing, Elluminate, YouTube, online videos, iPad games, Google Maps, Daqri

Awareness of Gaming culture/authentic expertise embedded in course: TED Talks, Games+Learning+Society, Games for Change, Globaloria, Games for Heath, Play Value, Gaming Experts: Jane McGonigal, Jim Gee, Katie Salen, etc...

Formative assessments are designed to provide analysis and critical feedback and allow for ongoing self-improvement. Assignments are geared to task and concept practice, reflection and refinement.

Summative assessments include 1) instructor and peer review student-produced games or media and 2) project work demonstrating conceptual understanding of the history, elements, and process of game design.

*bolded text indicates accompanying document

Week 1- What are games?
Introduction, background with games, building interest, history
Day 1: Intro – Examples of Games, Google Apps, Ask kids what games they play **(assignment – Why play? Review of individual, collaborative games, multiplayer games)**
Day 2: Review syllabus (posted on Google Apps) Value of Games – Frontline Video
Watch: The Most Wired Place on Earth (Reflection assignment Google Apps) Is World of Warcraft on your resume? – **(in class reflection)**
Day 3-4: History of Games (Lecture/Google Apps demonstrating the history); kids choose game developer to research **(assignment – research and share history of game they choose, create list of games.)**
Day 5: Work day to demonstrate understanding of gaming history, presentation (can partner)

Week 2 – History of gaming. Guest Speaker/Skype (GLS, ENGAGE, Raven Software)
Continue with history of gaming. Compare/contrast of types of games/usefulness
Day 1: Discussion/presentation and sharing of their game history
Day 2: Comparing and contrasting types of games **(dynamics, aesthetics, mechanics)** board, card games, tiled, arcade, video, serious games.
Day 3: Class discussion using ARG (dynamics, aesthetics, mechanics); kids play a game of their choice and analyze for the three **(in class assignment)**
PTSS – video from Frontline
Day 4: Playing a game and analyze (card) active formative assessment – work with partner – **(formative assessment)**
Day 5: Guest Speaker from GLS. Recruiting for the military using video games – digital or real,

right or wrong? Where are we headed?
http://www.pbs.org/wgbh/pages/frontline/video/flv/generic.html?s=frol02n39ffqdbb

Week 3 – Creating a board game
Game creation
Day 1: Play board games **(reflection in school/at home, use standards for unpacking games)**
Day 2: Dissect board games – discussion based on demographics/video/online text from board-game industry/elements of game design
Day 3-5: Create game using *The Game Crafter*
http://www.thegamecrafter.com/publish/templates
Preview crafts/available tools to design games/Game Elements/Student outline of basic game, material sheet Demo card making/Photoshop – **Google Doc
Day 4: Discuss with groups class; get feedback – modify over weekend

Week 4 – Continue designing, playtest, modify board games
Day 1-3: Work day
Day 3: Playtest with "outsider", work on modification (feedback tool)
Day 4: Final modifications/Game Due
Day 5: Presentation to class, include game **(summative assessment of board game)**

Week 5 – Games as collaborative efforts
Creating a video timeline
Putting together the pieces of gaming – watch videos from Play Value.
Arcade games * Simple video games *Complex video games (edutainment vs. education vs. entertainment)*Serious games
Day 1: Watch "Video Game Industry in North Carolina" Invite them to Google Docs, take them to http://www.onnetworks.com/videos/play-value
Day 2: In-class work analyzing video clips **(analysis assignment– summary, image, hypertext etc. shared through doc)**
Day 3: In-class work day – putting together Video/Timeline (Homework: Analyze game at home – **(assignment: MMOG, video, handheld, board etc., genre, mechanics, aesthetics)**
Day 4: Game day – play games – **(reflection on video-clip work - i.e. gender)**
Day 5: Game day – different game/compare and contrast

Week 6, 7 and 8 – Introduction - Online Digital Games
Introduce online games; Kodu
Day 1-9: Basics of Kodu, play games in Kodu
Day 10: Discussion of design elements, begin designing a game in Kodu
Day 11-13: Continued design in Kodu, playtest, modify
Day 14 – Play game **(progress/failure reflection sheet)**
Day 15 – Modify game

Week 9 - Games as Tools for Exploring Global Issues
Create a TED Talk – 3-5 minute video in defense or opposition of games
Day 1 – Build background, show clips/website related to global aspects of gaming to solve problems. Consider – Globaloria, Jane McGonigal, Evoke, Games for Change, Games for Health
Day 2 – The Cons of Gaming - PC Magazine, Addiction, Study on Addiction

Day 3: Research, begin TED Talk Script
Day 4: **Script writing**
Day 5: Finish Script – approved by teacher

Week 10 & 11– Utility of games/Games as Global Tools
Create video in topic area/TED Talk
Day 1-4: Practice script (criteria/rubric to assess script - formative)
Day 4-6: Video
Day 6-8: Video-editing
Day 8-9: Final video-editing
Day 10: Video share and evaluation **(criteria/rubric to assess video – summative)**

Week 12 – Scratch Video Game design
Learning to use Scratch
Day 1: Introduction to scratch program/Explore/Play
Day 2-5: Learning how to use the Scratch tools/create content for games. Creating simple Scratch games.

Week 13 – Scratch Video Game design
Create your own (simple) game in Scratch
Day 1: Outline of scratch game/audience/elements/gameplay
Day 2-5: Creating the actual scratch game
Day 4: Beta testing peers games

Week 14 - Rapid Prototyping a Mobile Game in ARIS
Creating a game in ARIS – Augmented Reality Games and Mobiles
Day 1: Play educational games and identify good game elements/bad elements
Day 2: Review basics of ARIS; demo website. Identify scenario or problem for game: interview teacher (pre-recorded in Elluminate); discuss final project **(criteria and timeline)**
Day 3: Play games in ARIS; QR codes vs. quick tours vs. location-based
Day 4: Form groups/dividing tasks – begin research of problem, identify elements of game design research, idea/concept – issue/characters/problem/mechanics
Day 5: Group work – design, prototype, playable **(formative assessment – checklist and response)**
Week 15 & 16 – The Production Phase of Game Design
Day 1: Review narrative with peers, continue to prototype game
Day 2-4: Groupwork – adding characters, images, locations,
Day 5: Playtest within group
Day 1-2: Playtest with other groups, modify game after peer review(s)
Day 3: **Reflection assignment**
Day 4-5: Final work to complete games

Week 17 – Playing Games with a Real Audience
Day 1: Playing the game with other students (modding sheet)
Day 2: Modifying game – with group
Day 3: Share modifications with class – final feedback
Day 4: Prepping for presentation

Day 5: Each group presents to teacher/class **(use criteria and rubric – summative assessment)**

<u>Week 18 – The Future of Games</u> (if time permits - otherwise eliminate)
Preview of popular gaming activities and trends in gaming
Day 1: MMOG/Exergaming/App Development, Location-based games Brightkite, Foursquare
Day 2: Konict or Wii or DDR
Day 3: iPad play games
Day 4: Quest to Learn (Katie Salen Video) http://vimeo.com/3979489 **(reflection final assignment)** iPad – Reflect on games (types, usefulness, thinking and learning.)
Day 5: Reflection – 2-3 pages – Definition of games. Develop plan/policy for high school; what should high school students know about games? How should games be used or not used in high school? What is the future of games?

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