ETEC 510-65A

Design Project Proposal

Lee Ackerman, Harmeet Grewal, William Redmond, and Tracey Stevens

February 11, 2018

Key Frameworks

This design project is focused on the creation of a wiki-based, video game building toolkit. High-school students and teachers are the toolkit's target audience. The toolkit will provide the guidance and scaffolding needed to develop a video game for elementary school students. The toolkit will promote and support game literacy - a "multidimensional combination of varied practices (e.g., reading, writing, and calculating; textual, visual, and spatial cognition; interactive design, programming, and engineering; multitasking and system understanding; meaning making, storytelling, role playing, perspective taking, and exercising judgment; etc.)" (Dormans, 2012, p.2).

Toolkit creation is influenced by the learning and learning environment ideas provided by Piaget, Vygotsky and Papert. Building on these ideas, the toolkit will also leverage more recent ideas about design and team collaboration including Lean Software Development, Agile, Play-Centric Design, Scalable Game Design and the Mechanics, Dynamics and Aesthetics (MDA) framework.

Some options for learning game development include reading books, watching videos, or following a tutorial. However, Vygotsky challenges us to do better as "...an essential feature of learning is that it creates a zone of proximal development, that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalised, they become part of the child's independent developmental achievement" (Shayer, 2003, p.471). The ideas of Piaget and Vygotsky play a key role in the decision to use a wiki-based, toolkit approach and to guide students to collaborate in teams. These ideas include

learning with peers, learning socially, the zone of proximal development and scaffolding (Blake & Pope, 2008).

Papert learned from Piaget, Vygotsky and others that “Knowledge is not transmitted, it is constructed” (Papert, 1998, p.13). Building on these works, this toolkit embraces the concept of constructionism. “Constructivism is the idea that knowledge is something you build in your head. Constructionism reminds us that the best way to do that is to build something tangible—something outside your head—that is also personally meaningful” (Papert, 1998, p.14).

The toolkit will incorporate ideas from multiple game design frameworks - Play-Centric Design, Scalable Game Design, and the MDA framework. The toolkit will highlight that games are designed by putting “...player experience at the heart of the design process to create deeper audience involvement, richer characters, more complex stories, and more meaningful interactions” (Fullerton, 2006, p. 38). In addition, the toolkit will embrace modern software development approaches such as Lean and Agile that are collaborative, team-based, iterative, incremental, feedback driven, flexible, and focused on delivering value, all while executing at a sustainable pace. “Students use paper prototypes, storyboards, and simple software mock-ups at the earliest stages of a project and continue to play-test and revise their system to ensure that play is engaging before expending time and money on secondary components. This iterative process enables students to efficiently evolve original concepts into sophisticated software products” (Fullerton, 2006, p.39).

The toolkit also embraces the idea that the “...activities of game design and programming, wiki-based teamwork and Web 2.0 communication, collaboration, and project management are particularly powerful in cultivating transferable contemporary learning abilities and encouraging

game-media digital literacies in participants" (Caperton, 2010, p.10). The toolkit will be published as a publicly accessible wiki that allows for contributions and collaboration - further supporting constructionism and literacy.

An additional toolkit goal is to support diversity and enthusiasm for software and game development. And, through these efforts, bring these literacy skills to as many students as possible.

Intentions and Positions

Game Creation

This design project will serve two purposes: 1) provide guidance for students in creating their own games and 2) provide a space for collaborative learning to take place (through the wiki). Scholarship in education generally agrees that teaching students how to create games leads to learning outcomes in a variety of important areas. These can vary depending on what types of games are created and how much time students spend creating games; however, results are largely positive for students and the overall gaming community (Kafai & Burke, 2015).

By creating games, students will learn how to program and understand the language and grammatical rules of different authoring software (Hsu & Wang, 2010, p. 406). They will learn basic programming tenets such as how to organize and comment their code and how to keep the proponents of usability concepts in the forefront while completing their code. Learning how to test, debug, remix, experiment, and revise their work will also improve their problem solving and decision-making skills (Kafai & Burke, 2015).

Game development will teach students design concepts and improve their artistic, language arts, and teamwork skills. It will encourage creativity and self-expression and teach

students how to make designs that are both appealing to the senses and straightforward. Students will learn how to create multi-modal systems by connecting elements such as audio and visuals (Kafai & Burke, 2015). Developing textual content for their games will also improve their grammar, punctuation, and spelling. Furthermore, creating games will encourage collaboration and build teamwork skills as students must work together during the testing phase. Students will provide each other feedback, which will engage them in social learning and the co-creation of knowledge.

Game creation will also expand perceptions about learning as students will learn through design and creation rather than evaluating static objects (creating a game rather than analyzing one already made), which is what they're typically accustomed to doing. Students will be taught to place value on the design process and the learning opportunities it can provide. They will also have the opportunity to more deeply engage with curriculum content if asked to create games that teach such content.

Researchers have associated the term "geek mythology" with programming culture since it often comes across like an "exclusive 'clubhouse' that is not accessible to girls and minorities" (Kafai, Peppler, Lemke, & Warschauer, 2011, p. 94). Stereotypes such as gaming being a "boy's thing" dissuade many girls from entering this field. Consequently, girls tend to show less interest in game development and have less experience and skill (Denner, Werner, Bean, & Campe, 2005). People of different ethnicities also feel dissuaded because they typically only hear of and see Caucasian and Asian developers (Kafai & Burke, 2015). Teaching students how to create games will help dissolve these barriers and generate interest in populations who typically do not have experience or interest in this field.

Wiki Creation

A wiki was chosen to host the toolkit as it not only provides opportunities for collaborative learning to take place, it also reinforces many of the same learning benefits as game creation. Having students use the wiki will improve their content creation and language arts skills as they will be required to learn the wiki's markup language and make changes and updates. Just as when they are creating games, they will "generate, mix, edit and synthesize subject-specific knowledge within a shared and openly accessible digital space" (S. Wheeler, Yeomans, & D. Wheeler, 2008). This will encourage students to take control of their learning and generate their own knowledge, which will in turn give them a greater sense of ownership and autonomy in the learning process.

Having students add to the wiki will encourage social learning as they will collaborate with one another to build upon and expand the wiki. In doing so, they will build stronger relationships with one another and form a community of learners (S. Wheeler et al., 2008). Students will engage with their peers by learning from their additions and contributing their own knowledge. Just as with game creation, using the wiki will alter perceptions about learning by teaching students through collaboration and content creation rather than passive knowledge review.

Larger Goals

Teaching diverse populations game design will not only expose them to the variety of learning outcomes that have been discussed; it will also give them the opportunity to contribute their voices to the field and potentially redefine the idea of a "good game" (Kafai & Burke, 2015). Students will benefit by having their voices heard and gaming culture will benefit from broader participation and a greater variety of ideas. This will result in a wider array of perspectives in game design and opportunities to explore under represented topics or themes (in relation to identity, social issue, etc.). It could also spark interest in careers in this field (Kafai & Burke, 2015). Broader participation would result in more diversity in games, which would appeal to larger audiences and consequently generate more interest in this field.

Teaching students game design will also teach them computer/technological literacy. As technology becomes an increasingly important part of society, the ability to effectively work with it becomes even more important. Teaching students how to create games and contribute to the wiki will put them in control of their learning and allows them to work with different technologies. This in turn will increase their confidence with technology in general and their ability to effectively use it.

Key Concepts and Contexts

This project focuses on the learning and acquiring of new digital and media literacy skills that can support student's technological capacities to function in an ever-changing digital world. "It is generally agreed that skills and competencies for digital literacy and media literacy are closely related to each other and to additional "21st-century" skills that are needed for living and working in media- and information-rich societies. (Hobbs, 2010)

Students will work to become technologically fluent and be better able to assess the various media they encounter. Armed with this type of knowledge, the student will refine his or her ability to access and use digital media, analyze the media and develop new ways of thinking and continually evaluate different types of media that is encountered.

Numerous recent studies have found that creating computer video games has been very motivating for the students (Molins-Ruano, Sevilla, Santini, Haya, Rodríguez, & Sacha, 2014) so the focus on designing a game will use this motivation in a learning context. They will employ the principles of Scalable Game Design and Play-Centric Design which when targeted to high school students is the most productive opportunity to arm the students with computational and digital skills and increase their desire to continue with further studies in the area (Repenning, 2015). The MDA framework will also be used to analyze and produce the game. The MDA framework helps the student understand the various components of the game and how it can impact the experience for the user. The context of the toolkit to game building is really to elevate a pragmatic example of the constructionist theory by Papert whereby knowledge is gained through construction, in this case, devising and building a game through the help of peers and available media.

The media and game evaluation portion of the exercise will extend to valuing diversity by engaging with various contributors in the design and production phase. Additionally, there is an opportunity for the players to evaluate it and potentially use the students' created media in another form. By working in groups, the students will consider feedback as a way to enhance and optimize their game. When focused on a broad audience of younger students, the game developers will need to understand how best to ensure the game reaches its goals for all the users (Deen, 2015).

A subset of the learnings for students while they learn programming and create the game for the younger grade will include learning about system-based thinking, game logic and rules, usability, and storytelling. Students will learn how to piece together components to create and maintain effective systems (systems thinking), which is a skill that has broad application outside of game design (Cabrera, Colosi, & Lobdell, 2008). The students will also acquire knowledge from other areas as they will need to incorporate the aspects of other subjects to execute effective storytelling and as well as various design principles.

An iterative process will be recommended to the students so that they produce the game with many cycles of design, produce, test, and feedback so that design flaws can be discovered early on in the process; feedback may even alert the students that the design is completely off the mark and needs to be entirely reworked.

Students will learn their new media literacy and technological capacities by following the toolkit as a guide but will employ their imagination to extend the possibilities further. The students will learn to incorporate various different components to create their specific game for the intended audience of the younger grade. They may also do extra research to find the appropriate media to include and explore other facets of appropriate storytelling.

InterActivities

In designing a video game building toolkit, the platform selected to host the interactivities must afford a number of critical characteristics. The platform needs to be flexible, progressive, modular (organized), and accessible (Colebourne, 2014). The development of a wiki site has been chosen to fulfill these characteristics. A wiki will allow for the development of a toolkit that is organized, user friendly, and resists stagnation by encouraging a community of contributors to

enhance the toolkit (Schwartz, Clark, Cossarin, & Rudolph, 2004; Wheeler, et. al., 2008). The open nature of a wiki allows the game developers to contribute new game frameworks, add videos and other media, post sample games, and add other content. Wiki technology permitting, contribution to the wiki will be gamified. Game developers will earn badges and unlock administrative features by contributing content to the wiki.

The wiki will be developed as a modular scaffolding toolkit to build an educational video game. By the time game developers move through each of the modules in the toolkit, they will have created a game by utilizing the content, tools, and resources. While it is a linear toolkit, game developers will have the flexibility to navigate freely between the modules. Modules will consist of a variety of educational media including editable text, videos, sample games, and podcasts. Topics in the toolkit will primarily be for the game developers, however there will be sidebar information for the educators to support the methods discussed in the toolkit. These topics may include:

Game Developers	**Educators**
● The purpose and aim of the toolkit ● How to focus the purpose of your game (learning outcomes) ● How to design a game for your audience ● Characteristics of fun and engaging games ● Good storytelling principles ● Visual and audio considerations ● The game development process ● Storyboarding, prototyping, mockups ● List of development tools and free resources ● Ethical considerations such as copyright issues ● Gathering feedback from players to evaluate the effectiveness of your game	● Theories of constructivism and constructivism ● Design thinking ● Play-Centric Design ● Scalable Game Design ● Agile software development ● MDA (mechanics, dynamics, aesthetics) framework ● Community of practice/social learning

Table 1. Wiki toolkit possible topics.

Verifications

A three-pronged approach will be used to ensure the design of the wiki allows for participants to accomplish the goals of the toolkit. First, game developers will be encouraged to fill out a survey at the end of the toolkit. The survey will ask questions based on the game developers experience with the module content and learning activities. The survey will evaluate if they learned something new, if there was enough content in the modules to guide them in completing a game and ask general questions on what worked well in the modules and what could be improved.

Second, game developers will be encouraged to post the games and source code they developed to the wiki. This allows for spot checking of the games and source code to see if the toolkit is effective. Are the games fun? Are they educational? Is the code well written? Does the game actually work? Do they properly reference source materials and observe copyright laws? Posting the games to the wiki allows for game developers to see the games others have developed and learn from one another. Wiki technology permitting, game developers will be able to rate (e.g. a star-rating) the games that others upload. This adds another layer of feedback to determine if the games being developed via the toolkit are of high quality.

Finally, game developers are encouraged to submit how their players rated their game. In the toolkit, game developers will be provided with a suggested method of gathering feedback after the game has been completed. An analysis of this feedback will assist in determining if the toolkit content is effective. Additionally, this will check if the players who provided input during the development phase (beta feedback) felt heard and that their input helped to shape the game.

References

Baytak, A., & Land, S. M. (2011). CASE STUDY: Advancing elementary-school girls' programming through game design. *International Journal of Gender, Science and Technology*, *3*(1).

Blake, B., & Pope, T. (2008). Blake, B., & Pope, T. Developmental psychology: Incorporating Piaget's and Vygotsky's theories in classrooms. *Journal of Cross-Disciplinary Perspectives in Education, 1*(1), 59-67.

Cabrera, D., Colosi, L., & Lobdell, C. (2008). Systems thinking. *Evaluation and Program Planning, 31*(3), 299-310. doi: 10.1016/j.evalprogplan.2007.12.001

Caperton, I. H. (2010). Toward a theory of game-media literacy: Playing and building as reading and writing. *International Journal of Gaming and Computer-Mediated Simulations*, *2*(1).

Colebourne, M. (2014). *10 characteristics of a good development toolkit*. Retrieved from https://www.linkedin.com/pulse/10-characteristics-good-toolkit-martin

Deen, M., Nack, F., & Haggis, M. (2015). Diversity through specificity. *Proceedings of the 12th International Conference on Advances in Computer Entertainment Technology - ACE '15*. doi: 10.1145/2832932.2832957

Denner, J. & Werner, L. & Bean, S. & Campe, S. (2005). The girls creating games program: Strategies for engaging middle-school girls in information technology. *Frontiers: A Journal of Women Studies 26*(1), 90-98. University of Nebraska Press. Retrieved February 10, 2018, from Project MUSE database.

Denner, J., Werner, L., & Ortiz, E. (2012). Computer games created by middle school girls: Can they be used to measure understanding of computer science concepts? *Computers & Education*, *58*(1), 240-249. doi: 10.1016/j.compedu.2011.08.006

Dormans, J. (2012). *Engineering emergence: applied theory for game design*. Universiteit van Amsterdam [Host].

Fullerton, T. (2006). Play-centric games education. *Computer*, *39*(6), 36-42.

Good, R., Mellon, E. K., & Kromhout, R. A. (1978). The work of Jean Piaget. *Journal of Chemical Education*, *55*(11), 688.

Grover, S., Pea, R., & Cooper, S. (2014). Remedying misperceptions of computer science among middle school students. *Proceedings of the 45th ACM technical symposium on Computer science education - SIGCSE '14*. doi: 10.1145/2538862.2538934

Hobbs, Renee, author. (2010). *Digital and media literacy: A plan of action: a white paper on the digital and media literacy recommendations of the Knight Commission on the information needs of communities in a democracy*. Washington, DC: Aspen Institute.

Hsu, H., & Wang, S. (2010). Using gaming literacies to cultivate new literacies. *Simulation & Gaming, 41*(3), 400-417. doi: 10.1177/1046878109355361

Kafai, Y. B., & Burke, Q. (2015). Constructionist gaming: Understanding the benefits of making games for learning. *Educational Psychologist*, *50*(4), 313–334. doi: http://doi.org/10.1080/00461520.2015.1124022

Kafai, Y. B., Peppler, K. A., Lemke, J., & Warschauer, M. (2011). Youth, technology, and DIY: Developing participatory competencies in creative media production. *Review of Research in Education, 35*(1), 89-119. doi: 10.3102/0091732X10383211

Manifesto for Agile Software Development. (2001). Retrieved February 10, 2018, from http://agilemanifesto.org/

Molins-Ruano, P., Sevilla, C., Santini, S., Haya, P., Rodríguez, P., & Sacha, G. (2014). Designing video games to improve students' motivation. *Computers in Human Behavior*, *31*, 571-579. doi: 10.1016/j.chb.2013.06.013

Papert, S. (1988). A critique of technocentrism in thinking about the school of the future. In *Children in the Information Age* (pp. 3-18).

Papert, S. (2005). Teaching children thinking. *Contemporary issues in technology and teacher education*, *5*(3), 353-365.

Poppendieck, M., & Poppendieck, T. (2003). *Lean software development: an agile toolkit*. Addison-Wesley.

Repenning, A., Grover, R., Gutierrez, K., Repenning, N., Webb, D. C., Koh, K. H., … Gluck, F. (2015). Scalable Game Design. *ACM Transactions on Computing Education*, *15*(2), 1-31. doi: 10.1145/2700517

Schwartz, L., Clark, S., Cossarin, M., & Rudolph, J. (2004). Educational wikis: Features and selection criteria. *The International Review of Research in Open and Distributed Learning, 5*(1).

Shayer, M. (2003). Not just Piaget; not just Vygotsky, and certainly not Vygotsky as alternative to Piaget. *Learning and instruction*, *13*(5), 465-485.

Wheeler, S., Yeomans, P., & Wheeler, D. (2008). The good, the bad and the wiki: Evaluating student-generated content for collaborative learning. *British Journal of Educational Technology, 39*(6), 987-995. doi: 10.1111/j.1467-8535.2007.00799.x