Gaming the Schoolyard: Promoting High School Students' Collaborative Learning through Geolocative Mobile Game Design

Judy Perry, Massachusetts Institute of Technology, jperry@mit.edu

Abstract: Geolocative augmented reality game design offers students a potentially rich collaborative learning experience connected to their local school's physical and cultural environment. This qualitative study describes a pilot implementation of a collaborative geolocative mobile game design curriculum within a high school computer science classroom setting, considered through the lens of embodied and enactive learning, and suggests ways in which teacher facilitation strategies can support utilizing this approach in a classroom setting.

Background

Geolocative mobile augmented reality (AR) games situate gameplay within a real-world context. As the player moves around the physical environment, their location-aware mobile device senses their position, triggering in-game content (e.g., interactions with virtual characters). Students can learn from and engage with a physical setting via location-based AR games in scenarios ranging from investigating a fictionalized toxic spill (Klopfer & Squire, 2008) to exploring the illegal wildlife trade in a zoo-based whodunit (Perry & Nellis, 2012).

Constructionism suggests deep learning can stem from making and sharing personally meaningful digital artifacts (Jonassen, Howland, Moore & Marra, 2003), including location-based AR games (Klopfer & Sheldon, 2010; Perry, Coulter, Rubio, & Holden, 2015; Vogel & Perry, 2018). When working collaboratively (Resnick, 1996), students can externalize and refine their ideas with one another, and divide tasks enabling more complex designs. Making an AR game involves a range of skills, including manipulating maps, thinking in geospatial terms, creating visual designs, coding, writing, playtesting and iteration (Vogel & Perry, 2018). This pilot study examines one high school class that utilized an AR game design curriculum, examining how embodied and enacted learning intersected with the unique affordances of geolocative game design.

Implementation of collaborative AR game design curriculum

Methods, sample and data collection

In Spring 2018, researchers collaborated with a high school computer science teacher who assigned a three-week class project in which students used TaleBlazer, a free AR creation platform, to make a geolocative game on their school's campus. The 10 students in grades 9-12 were divided into three working groups. Participation in the research study was voluntary and uncompensated. Each group was tasked with designing and implementing a location-based AR game for school's lower school students. The teacher challenged his students to create an AR game artifact that, "takes place outside [anywhere on the school's large campus], uses the physical environment, tells a powerful story, [and] uses game mechanics in some way." Researchers gathered qualitative data, including interviews with the instructor and participating students, three sessions of class observation field notes, digital game artifacts, and draft game design notes. Researchers analyzed data looking for ways in which embodied and enacted learning appeared to impact students' experience, ways in which the teacher scaffolded student work, and opportunities to improve future iterations of the tools and curriculum.

AR game design through the lens of embodied and enacted learning

Embodied learning considers the role of the learner's physical body as integral to the learning experience. Location-based AR games require players to move through the real world as the game unfolds. *AR game designers* therefore consider ways in which their game design decisions (e.g., where they position their virtual characters) impact their players (how far players walk, how quickly they move, etc.). Youth game designers were sometimes surprised to see how the physicality of the experiences played out. During a playtest, one group of game designers observed young game players joyfully counting the number of stairs (a clue in the game) by running up and down the stairs while counting, rather than just standing and pointing. For the game designers, this observation reinforced the ways in which the potential for physicality in the game could be engaging for the learners. The *teacher* also reminded student game designers of the ways in which players (in this case younger students at the middle school) would be physically affected by the choices they made (e.g., they might get tired). He also noted that due to the affordance of the AR editor's primarily a top-down view of the Google map, designers did not anticipate the time and effort to move through the game space and sometimes "put down the dots" without fully considering implications of distance between game hot spots, backtracking, etc.

Enacted learning refers to interactions between the individual and their environment that promote learning. For location-based AR games, the game space integrates with the larger social, physical, and cultural context. Moreover, AR games frequently ask players to examine, observe or infer something about the real world to progress in the game. *AR game designers* are tasked with considering where, when, and how to ask players to interact with the real world in their game designs. Even though most students were very familiar with their school environment, nevertheless the *teacher* provided time for students to walk the grounds, pick their game's specific locations and artifacts, and determine ways in which they would ask the player to engage with the environment. Midday through the process, the teacher raised concerns that students were not yet able to develop a robust game concept beyond a superficial "tour" as a way to create a location-based game.

> [The students] needed to do some research to come up with some ideas around their theme…Their original idea was to do a tour of campus, but unless they could find something specific to say about their theme regarding each of the buildings, I think it'll be hard to be comprehensive enough. It might be kinda of a pain to force [building name] to match [famous alumnus of the school] in some way, you know... (interview, April 8, 2018)

Later, the teacher noted that by considering the role of a narrative, students began to think holistically about their game, and more thoughtfully integrate locations, commenting, "I think when we first started talking about it was just a series of locations, and now they're starting to put the pieces together… so I'm happy about that."

Discussion and conclusions

Two key challenges emerged with the AR game design curriculum. First, students unfamiliar with this genre of enacted learning – in which the physical context of the game plays a significant role – were put into the role of designer. Sample games did not demonstrate enough complexity and variety, leaving students ill equipped to envision more creative, complex game mechanics and defaulting to closely mimic the models and/or initial suggestions of the teacher, which was problematic. Student designers would likely benefit from additional varied sample games (including previous year's student projects) helping students to envision a wider possibility space of projects. Second, the top-down map view tools themselves had unintended consequences by not providing students, who typically do not consider embodied learning constraints and impacts, with a sense of spatial scale, leaving them unable to anticipate player fatigue or feasibility of completing the game within the allotted time. Early prototyping, and potential changes to the tool (e.g., distance calculators) might potentially help designers quickly uncover such flaws. As educators consider implementing AR game design curricula, the novelty of students' considerations of enacted and embodied learning ought to be scaffolded both technologically and pedagogically for student designers to successfully work within this genre.

References

Jonassen, D.H., Howland, J.L., Moore, J.L., & Marra, R.M. (2003). Learning to solve problems with technology: A constructivist perspective. Merrill Prentice Hall, Upper Saddle River, New Jersey.

Klopfer, E., & Sheldon, J. (2010). Augmenting your own reality: Student authoring of science-based augmented reality games. *New directions for youth development*, 2010(128), 85-94.

Klopfer, E., & Squire, K. (2008). Environmental Detectives—the development of an augmented reality platform for environmental simulations. Educational Technology Research and Development, 56(2), 203-228.

Perry, J., Coulter, B., Rubio, J. & Holden, C. (2015). How I Learned to Stop Worrying and Love Youth Game Creation. Games+Learning+Society, Madison, WI.

Perry, J., & Nellis, R. (2012). Augmented Learning: Evaluating Mobile Location-Based Games at the Zoo. ISTE, San Diego, CA.

Resnick, M. (1996, July). Distributed constructionism. In *Proceedings of the 1996 international conference on learning sciences* (pp. 280-284). International Society of the Learning Sciences.

Vogel, S., & Perry, J. (2018). We got this: Toward a facilitator-youth "apprenticeship" approach to supporting collaboration and design challenges in youth-designed mobile location-based games. In D. Herro, S. Arafeh, R. Ling & C. Holden (Eds.), *Mobile learning: Perspectives on practice and policy* (Digital Media and Learning), (pp. 143-168). Charlotte, North Carolina: Information Age Publishing, Inc.

Acknowledgments

Thank you to Lisa Stump, Eric Klopfer, and Emma Anderson for contributing to this work.