The Radix Endeavor: Designing A Massively Multiplayer Online Game around Collaborative Problem Solving in STEM

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Abstract: Massively multiplayer online games provide rich contexts for fostering scientific and mathematical thinking and reasoning. We are leveraging these affordances by developing an MMOG, The Radix Endeavor, which integrates STEM practices as core game mechanics. In this poster, we will describe how we are designing the game-play experiences around activities in biology and math content linked to the common core and next generation standards. We hope to generate discussion around (1) designing collaborative problem solving activities (2) using log data to assess players at the individual and group level.

Massively multiplayer online games (MMOGs) provide rich contexts for fostering scientific and mathematical thinking and reasoning. Due to being massive and persistent, the open-ended game play encourages a sustained investment in "systems-based reasoning, model-based reasoning, [and] evaluative epistemology in which knowledge is treated as an open-ended process of evaluation and argument" (Steinkuehler & Duncan, 2008). This reasoning is often done collaboratively (both synchronously and asynchronously) with peers. We are leveraging these affordances by developing an MMOG, The Radix Endeavor, which integrates science, technology, engineering and math (STEM) practices as core game mechanics. In this poster, we will describe how we are designing the game-play experiences around activities in biology and math content linked to the common core and next generation standards. We hope to generate discussion around the types of strategies for (1) designing collaborative problem solving activities (2) using log data to assess players at the individual and group level.

Theoretical Framework

Our work is guided by theories of situated and collaborative learning. From the situative perspective, learning is seen as enculturation supported by social interaction (Brown, Collins, Duguid, 1989; Lave & Wenger, 1991). Engagement and participation in activities are dependent on interaction with other people (Greeno, 1998).

Many terms have been used to describe collaborative learning, such as cooperative learning (Slavin, 1996, Johnson & Johnson 1999), group processes (Webb and Palinscar, 1996), collective cognitive responsibility (Scardamalia 2002), groupwork (Cohen, 1994), and collaboration (Roschelle, 1992). We define collaborative learning as a group of students with distributed expertise sharing cognitive responsibility for a specific task or goal. The emphasis in collaborative learning is on the learning and cognitive advancement of the group. MMOGs, more than any other type of game, rely on collaboration. Not only is this a necessary so-called, "21st century skill;" it is one that is particularly relevant to science as it is practiced by working scientists.

The MMOG: The Radix Endeavor

The Radix Endeavor is a Massively Multiplayer Online Game (MMOG) being developed by The Education Arcade at the Massachusetts Institute of Technology, designed to improve learning and interest in STEM in high school students. The content specifically focuses on statistics, algebra, probability, geometry, ecology, evolution, genetics, and human body systems. Players take on the role of mathematicians and scientists and embark on quests that encourage them to explore and interact with the virtual world through math and science. Players become embedded in a narrative in the world where they encounter a villain who does not believe in the practices of science. Players have to reason about science issues applicable to game characters' everyday lives, refute the unscientific claims of the villain, and make choices based on what they consider to be valid evidence.

Collaboration

A number of tools built into the game will enable players to connect across time and space, communicating about concepts and challenges in the game. For example, "guilds" and "parties" let players easily find where their classmates and friends are in the world, and in-game chat and trading encourage them to discuss their progress and share what they have discovered.

Despite working on quest tasks together, even players on the same quest will see different versions of that task. For example, players may be asked to breed reptiles for different desired traits, or create a scale map of different areas of the city. In this way, players can gift the reptiles they have bred and share their in-progress maps, but doing so in no way "gives away" the answer. Instead they need to use those artifacts as examples and explain the concepts involved in the problem, in order to help their teammates complete the challenge.

Certain quest mechanics will be designed in a way that require two or more players to work together, either to make a large goal more attainable, or by taking on different roles to solve a problem. For example, imagine an ecosystem that has been thrown out of balance: players have noticed that snakes are difficult to find, but they don't know if the problem is related to pollution from the newly built factory, last year's mouse epidemic, or something else entirely. They want to collect population data from this area as well as another similar ecosystem across the island, but it's a daunting task for one player to tag and track every species. So a number of players team up, decide what information they will need to find about each species, and sync up their notebooks. Then as they observe the animals, their data are saved and can be shared with each other. After running some simulations to model the ecosystem, the players come up with a plan to increase the snake population but it requires them to introduce snakes with a certain level of disease resistance, while simultaneously monitoring the changing state of the ecosystem. While this is difficult for an individual, with multiple players one is in charge of breeding more disease-resistant snakes, and one takes on the role of the field ecologist distributing the snakes, while the other uses the simulation tool to keep track of the real-time effects created by their actions. In this way, players are motivated to communicate in order to form a plan as well as to continually provide the team with feedback specific to their own perspective and expertise.

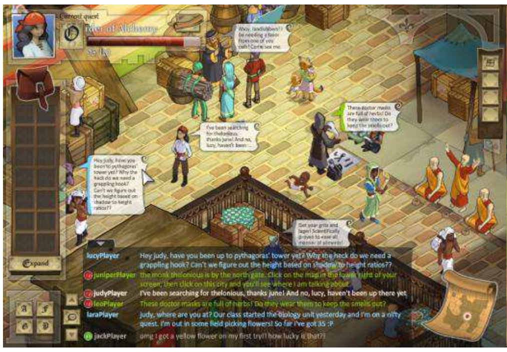

Figure 1. Interface prototype.

Figure 2. Geometric map-making prototype.

Data Tracking System

As players interact with the quests, we capture their actions (how they are solving the quest) and whether or not they complete it. We flag actions within quests that may indicate a "misconception" or where to give feedback. For example, if a student breeds the wrong flowers more than three times, feedback is triggered and students receive in-game feedback. This data will allow us to assess individual and group contributions in quests.

Discussion

Early results of prototype testing have been promising. We will continue pilot testing in the winter and spring of 2013 in math and science classrooms in the Northeast. We will present results from our pilots and hope to generate rich discussion around the collaborative tasks and how we are assessing them.

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