Learning with Portals: STEM Education Through Gaming

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Abstract: Two teachers, Steve Isaacs and Cameron Pittman, discuss how they successfully engaged and motivated students with *Portal 2*, an award winning commercial video game by Valve Software. Steve, a middle school video game design teacher in Basking Ridge, NJ, uses the Puzzle Maker, the *Portal 2* world-building tool, to teach computational thinking and the iterative design process in his courses. Cameron, formerly a high school physics teacher in Nashville, TN, turned the Puzzle Maker into a virtual physics laboratory. Leslie Redd, the former Director of Educational Programs at Valve, joins them to discuss how she created a community of educators through the Steam for Schools "Teach with Portals" project, which provided free copies of *Portal 2* to educators and an infrastructure for teachers to collaborate. The session will focus on successes and challenges of using *Portal 2* in the classroom from the perspective of educators and the companies supporting them.

Session Overview

Portal 2, an award winning commercial video game by Valve Software, has entered the classroom as a popular teaching tool for mathematics, science and game design curricula. Two teachers, Steve Isaacs and Cameron Pittman, have successfully engaged and motivated students with *Portal 2* and its accompanying Puzzle Maker world-building tool. Leslie Redd, former Director of Educational Programs at Valve, joins them to discuss how classroom teachers are using *Portal 2*.

Steve Isaac's Classroom

Steve teaches a unit called "Portal 2.5," which uses the Puzzle Maker to teach computational thinking and the iterative design. The Puzzle Maker's ease of use allows students to focus on design, iteration, and computational thinking. Steve's students begin playing *Portal 2* to better understand how puzzle elements are incorporated into the game. Students are then presented with broken rooms, with which students have to create functional puzzles following a predetermined set of parameters. Students then create broken levels for others to fix. In the process, Steve's students create a functional room then consciously break it to present a challenge to their classmates.

Using their experience as a guide, students then create an original puzzle using the Puzzle Maker. Iterative design is a key component of this exercise as students recruit their peers to provide constructive feedback. The playtesting and feedback loop recurs several times with an emphasis on achieving an acceptable difficulty level. Students collaborate to create levels with increasing difficulty and coherent storyline.

Cameron Pittman's Classroom

At its core, *Portal 2* is a physics simulator. The laws of physics, like gravity and collisions, are built into *Portal 2*'s game world. Cameron turns the Puzzle Maker into a virtual physics laboratory this past fall as his students learn physics by developing, running and analyzing experiments they built within the Puzzle Maker (http://physicswithportals.com).

As Steve's students use the Puzzle Maker's ease of iteration to teach game design, Cameron's students use the Puzzle Maker to create, analyze, adjust and analyze custom physics experiments. Through a series of ten labs, Cameron's students build experiments that test everything from gravity and Newton's Laws through conservation of momentum and conservation of energy. In the process, Cameron's students collect and analyze virtual data through the same processes and procedures physics students use with real world data.

As part of their end of semester final project, Cameron's students create and describe custom levels that showcase three concepts they learned during the semester. Students write a physics word problem that is brought to life by one of the experiments from their final project.

Leslie Redd's Classroom Support

Leslie created a community of educators through the Steam for Schools "Teach with Portals" (http://www.teachwithportals.com) project, which provided *Portal 2* for free to educators and supports teacher collaboration. Leslie is currently the Governance Chair of the Games and Learning Publishing Council of the Joan Ganz Cooney Center at Sesame Workshop. She will also speak to the efforts of the Council and its members (experts from educational media publishing, children's media organizations, developers, researchers, policy & investment sector) to catalyze the consumer and educational marketplaces for learning games.