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Science

River City, the MUVE

Several research projects have explored the merits of using game-like environments to advance learning. Multi-user virtual environments (MUVEs) promise increased student motivation and science learning in an immersive simulation.

In the real world, we learn by being immersed in various situations that require acquisition of new learning and skill sets. River City is an educational application of MUVEs. It uses simulation to immerse students in a participatory virtual reality with interactive museum exhibits in a historical setting. To date, more than 3,000 grade 5–12 students have experienced River City. Preliminary findings indicate that students engaged in scientific inquiry and developed 21st-century skills in virtual communication and expression. Both students and teachers were highly engaged, student attendance improved, and disruptive behavior dropped.

Implementations of River City evolve and vary from site to site. This article discusses use of River City in 2004 by sixth graders at Seeds University Elementary School, the laboratory school for the UCLA Graduate School of Education and Information Studies. These students participated in a distance intervention using the MUVE River City with a team from Harvard University's Graduate School of Education. The Harvard team included Chris Dede, co-author Diane Jass Ketelhut, Brian Nelson, Jody Clarke, and Catherine Bowman.

Playing the Game

In the River City simulation, students travel back in time to an unidentified late 19th-century American city where there are health problems. Students collaboratively investigate the virtual city, encountering health and environmental issues. River City has a river, a complex terrain that influences water runoff and insect propagation, houses, industries, a hospital, and a university. Students explore the world by questioning residents, searching hospital records, exploring the terrain, checking health meter levels, investigating Smithsonian artifacts, and conducting water-quality experiments. They ask such questions as, Why are people in River City getting sick? Why are poor people getting sick in much greater proportion than rich people? Through their investigation, they develop process skills in scientific inquiry and experimental design, learn biology and ecology content, and behave as scientists searching for solutions to problems. Responsibility for their own learning appears to highly motivate students.

The curricular context of the game is that students are enrolled at River City University. The six levels of the game correspond to university orientation, the four years of undergraduate study, and graduation. At each level, students must meet certain criteria that matches a step in the scientific method. They may pass to the next level only when these criteria have been met, as measured by the teacher. In the orientation period, students learn to make observations and inferences about River City in order to collect useful data. When students are freshman, they explore the city and define the problem they would like to investigate. As sophomores, students learn about the scientific method and then design an experiment that will provide useful information about River City's health problems. Once their experimental design is accepted, they become juniors. Their junior year is full of experimentation and data collection. They gather data in the control world and then repeat the process in a world in which the one variable they have hypothesized as the cause of health problems has been removed or altered. They then analyze the data to see what effects that change has had on the health of the residents, and they present their data in charts and tables. Their senior thesis involves writing a letter to the mayor of River City summarizing the problem they researched, a description of their experimental design, and a summary of results. The final part of the report to the mayor includes their conclusions and recommendations based on their experimental results. On graduation day, students share their work publicly with the other student teams and compare results, thus coming to understand the multivariate nature of the problem in River City.

Reaping the Benefits

River City integrates technology into science using the immersive simulation in a powerful way. Students learn and are motivated by being in various situations requiring acquisition of different learning and skill sets. The epidemic scenario, complete with real Smithsonian artifacts, in a familiar game-type environment, allows students to explore the world, the epidemics, people, and information, follow their interests within this world, experiment with different possible solutions, and challenge them to understand the world and communicate their ideas. In this way, the MUVE harnesses the power of technology to simulate real-world learning in ways not otherwise possible. Students seem

By Cathleen Galas
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to learn more deeply about science and problem solving in the simulation or manipulation setting than in traditional book education, as evidenced by their class discussions. Students are at home in the familiar gaming environment, learning scientific inquiry skills, biology, and ecology, instead of how many points an ogre is worth. The "messy" real-world setting of River City allows students to view complex problems holistically and not as having one correct answer. After the puzzle exercise, students discussed the multiple causes in the complex environment. They disentangle various problems and explain and expand their unique hypothesis. Their final investigations and comparisons of team hypotheses, experimental designs, and results brought about enthusiastic dialogue about problems in River City. UES students went on to generalize their River City experience to other real-world problems such as the SARS epidemic and West Nile virus. Students saw their contributions as valuable pieces of a total solution. The virtual reality of River City allowed them to experience complex real-world problems, struggle to find adequate solutions, challenge themselves to experiment and analyze their results, and to communicate and share their unique informed perspective with others.

River City has funding for 2½ more years. If you are interested in using River City with your students contact Ketelhut (diane_ketelhut@gse.harvard.edu) until June 2006 and Jody Clarke (clarkejo@gse.harvard.edu) thereafter.

Resources

Dede, C., Nelson, B., Ketelhut, D., Clarke, J., & Bowman, C. (2004). Design-based research strategies for studying situated learning in a multi-user virtual environment. *Proceedings of the 2004 International Conference on Learning Science*, pp. 158–165. Mahweh, NJ: Lawrence Erlbaum.

Morisette, K. (2003, March 1). Exploring new learning technologies: An interview with Wirth Professor Chris Dede. *HGSE News.* Available: http://www.gse.harvard.edu/news/features/dede03012003.html

River City Videos: http://www.gse.harvard.edu/~dedech/muvees/animations.htm

Standards: *NETS•S 3, 4, 5; NETS•T* II, III (http://www.iste.org/nets/). *NSES* Grades 5–8 A, C, F (http://www.nap.edu/readingroom/books/nses/html/).

Cathleen Galas was for many years a demonstration teacher/researcher at the University Elementary School in the Graduate School of Education and Information Studies at the University of California, Los Angeles. She is now consulting in the San Francisco Bay Area.

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Multidisciplinary

Instructional Planning for Differentiated Learning

Inspired by Tom Romano's idea of a multigenre paper, sixth grade teacher Barbara Poole and I, the technology resource teacher, planned a language arts and social studies integrated unit that differentiated instruction for her students. We wanted the unit to allow students to express what they have learned through a research project in many different genre formats and to incorporate a variety of technologies. Romano's multi-genre paper, which he wrote about in his book *Blending Genre, Altering Style,* is a multilayered, multivoiced blend of genres, such as dialogues, songs, plays, biographies, and poems, that tells what a writer knows, feels, and thinks about a topic.

By Diane Painter

First, we decided on the essential questions that would guide the unit:

- How are things, people, and events connected to one another?
- How can one express one's ideas in a variety of genres?
- How do effective writers hook and hold their readers?

Next, we identified the skills students would develop and demonstrate and how they might demonstrate them. We developed a curriculum map that identified the standards, content, skills, and products that would become the foundations of the unit. This process enabled us to see that the structure of our curriculum unit allows for differentiation because students make choices in how they research information and the different kinds of technologies they can use to create their genres.

We chose a flexible grouping plan—cooperative pairs—to allow for differing levels of skills and content mastery. We formed pairs who would work together to research a topic of interest to both students, but both students would create two genres that would be uniquely different from their partners' choices.

Finally, to help students take ownership of their learning and keep them organized and on task, we developed a guideline sheet outlining the steps the students should take and a rubric that both guided and evaluated the students' work.

Our multigenre project was a huge success. Students told us they really liked taking control of their own learning. In particular, they liked choosing a topic of interest to them, deciding the types of genres they would produce, and using a variety of