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Building Gaming Into Science Education

By Katie Ash

Using recent advances in gaming technology, feedback from students and teachers, and the latest research on games and learning, educators and game designers alike are hoping to use that knowledge to draw more students into the field of science.

Experts say science is especially well suited for gaming because the subject stems from curiosity, inquiry, and investigation—fundamental qualities also shared by successful computer games.

"[Games are] kind of a model for what the scientific method is," says Ken Eklund, a freelance game designer in San Jose, Calif.

"The thing that's happening more and more is that teachers are looking at their students and realizing that games are just a great way to communicate with them," he adds. "It's really a part of student culture."

Eklund has created a series of online games that fuse scientific inquiry with a mystery storyline on his Web site **ScienceMystery.com**. He says his main goal in devising the series of educational games was to "bring in people who weren't necessarily in love with science—who might love science if they were interested in it in the right way."

So far, the results have been largely positive.

"I've had teachers tell me," says Eklund, "that after they introduced the game to their students, the classroom went completely silent because all of the kids were just reading."

"You just don't get that kind of engagement and involvement with the story" with a textbook, he says.

Eklund's observations are supported by education and gaming research.

At the Center for Technology in Teaching and Learning, based at Rice University in Houston, researchers have developed a number of online games, or missions, called **Medical Mysteries**. The games, designed for middle school science students, aim to present information about infectious diseases in an engaging way.

In addition to talks with panels of teachers and scientists before the games are created, researchers at the university also conduct tests on students, who play the games to find out how much of the information they retain.

"In fact, a week later, [students] still remember a majority of the content," says Leslie Miller, the principal investigator for Medical Mysteries and a senior research scholar for Rice University.

"I think teachers are realizing that our students are much different than we were, and they learn in different ways than we did," she says, "and games are certainly an example of that."

'Powerful Way of Learning'

Other researchers have had similar results.

A science-related time-travel game, called **The River City Project**, that blends 21st-century skills with history, sociology, and science is "a powerful way of teaching and learning," says Chris Dede, the principal investigator for the project and a professor in learning technologies at Harvard University. The game is funded by grants from the National Science Foundation.

A report written by researchers about The River City Project for a 2006 conference concluded "that students learned biology content, that students and teachers were highly engaged, that student attendance improved, that disruptive behavior dropped, that students were building 21st-century skills in virtual communication and expression, and importantly, that using this type of technology in the classroom can facilitate good inquiry learning."

But even with such findings, teachers who use computer games in science classes are still in the minority, says Russ Bird, an 8th grade science teacher at the 1,400-student Mesa Verde Middle School in the Poway Unified School District in San Diego.

"I don't see a lot of other teachers doing it," he says. Part of the reluctance is due to practical reasons, he suspects.

"I'm in a unique situation where there's a computer at every lab table," he says, pointing out that many teachers do not have that ratio of students to computers.

Andrea G. Pokrzywinski, a science education specialist for the 3,800-student Lower Kuskokwim school district in Bethel, Ala., cites other challenges that may prevent teachers from using computer games in the classroom.

"Just from a practical standpoint, I can't always get [the games] loaded onto the machine," she says. Pokrzywinski's background as a former director of technology services allows her to troubleshoot when the games don't work properly, but most teachers don’t have that level of technical skill, she points out.

"There are little things you need to know," she says, to keep the games running smoothly. "[Otherwise], it's not going to work in the classroom, and teachers aren't going to use it."

Benefits of Web-Based Games

Strong professional-development programs could help alleviate some of the technical problems teachers face when using games, Pokrzywinski says, and encourage them to incorporate new technologies into their lessons.

Another challenge science teachers face when using computer games is relevance to the established curriculum.

"If [the game] doesn't have a focus or clear reason for what they're doing, it really doesn't work," says Pokrzywinski. Adapting games to the curriculum is possible, she says, but it takes time—something many teachers don't have.

Leslie Miller, from the Center for Technology in Teaching and Learning, recognizes Pokrzywinski's concerns. Spurred by similar feedback from teachers, her team put together a package of teacher materials to go along with each Medical Mysteries game.

Each package includes learning objectives, a glossary of vocabulary words, a breakdown of how the game correlates with science curriculum standards, and mission logs—worksheets of questions for students to answer while playing the game.

"We've tried to base it on teacher input," says Miller, which is why she emphasizes the advantages of working with Web-based games as opposed to CD-ROMs.

"It makes [the games] changeable," she says. "And we have done that many times based on good suggestions from the audience."

That kind of flexibility and timeliness is simply impossible for CD-ROM games, she says. Pulling back hundreds of CD programs to add in new information after they've been distributed and sold is not an option for game designers working with CD-ROMs, she says.

Another advantage of Web-based games is that they can be accessed by multiple players at the same time from a variety of locations, Miller says. And online resources often are free.

Miller also points out that although her team works specifically in science, computer games are applicable to all subject areas.

Eklund, from ScienceMystery.com, agrees.

"I think that games can be much more widely applied than they are now," he says. "Certainly there are certain subjects which are kind of a challenge to think of a good game, but that doesn't mean it's not going to be done."