ITEST Learning Resource Center

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## In This Issue

Increasingly, educators are leveraging games and computer simulations to create dynamic learning experiences. Among the numerous ITEST projects engaged in this work are **Girl Game Company**, in which girls design and program their own games, and **Global Challenge**, where teams of youth learn about systems and scientific concepts through games and simulations. This IdeaBrief draws on the ITEST LRC webcast on Using Gaming & Computer Simulations for Youth Engagement & Learning, available at http://admin.acrobat.com/_a34442951/p26048951/.

## About ITEST

The Information Technology Experiences for Students and Teachers (ITEST) program was established by the National Science Foundation in direct response to the concern about shortages of IT workers in the United States. The ITEST program funds projects that provide opportunities for both school-age children and teachers to build the skills and knowledge needed to advance their study and to enable them to function and contribute in a technologically rich society. The ITEST National Learning Resource Center at EDC supports, synthesizes, and disseminates the program's learnings to a wide audience.

# Using Gaming & Computer Simulations for Youth Engagement & Learning

In virtual worlds generated via computer simulations and games that they design or play, young people are building their scientific and technology literacy and exploring issues in their lives. What are their games like? In the Girls Creating Games project, the precursor to Girl Game Company, for example, the majority take place in real-world settings and have characters that defy authority. Almost all of the games address social issues. One third use humor, and only one quarter have violent feedback. "These are different than what you see on the shelf," observes **Jill Denner, principal investigator of Girl Game Company.**

## *The Basis for Using Gaming and Computer Simulations*

Gaming and simulations both motivate young people and offer unique learning opportunities. "Game design is fun, and tends to engage youth who don't necessarily see themselves as interested in computers," Jill Denner explains. This is in addition to other important qualities; specifically, it supports inquiry-based, hands-on learning, and teaches computer programming concepts.

> *"From the learner point of view the most important things are the individual learner's characteristics, their own strengths, interests, aspirations. These are not things that are normally tapped in school, but they are well-tapped in informal settings such as the ITEST Program."*
>
> *~David Gibson*

In the experience of Global Challenge, games appeal to all: boys, girls, people of color, white Americans, foreign nationals, etc. Beyond this broad appeal, there's a compelling theoretical basis for incorporating games and computer simulations into educational programs.

Notes **David Gibson, co-principal investigator of Global Challenge**, "Some useful background information for this work comes from learning theory and a recent report by the National Research Council called *How People Learn*, which helps to summarize cognitive science theories and constructivist educational theories. It's a great starting point for thinking about the kinds of elements that are needed in any complex learning environment."

He continues:

> "I think the central finding from cognitive sciences in the last few years has been in the area of the development of expertise. In traditional education, knowledge is treated as an inert thing. Kids spend most of their time doing different kinds of memorizing and recalling that knowledge 'out of context', such as for tests. But in a game setting or real-world setting, knowledge is acquired by accumulating it in context. Assessment informed by cognitive science findings focuses primarily on feedback to the learner about their performance so that they can improve it, not so much about summative, endpoint assessment."

In other words, he reflects, "I think there's a nice alignment between the way games and simulations support research-based ideas from cognitive science and the kind of STEM knowledge we want students to learn."

## How Projects Incorporate Games and Computer Simulations

### Girl Game Company

This project builds on Girls Creating Games, a program that was funded by the National Science Foundation Program on Research on Gender in Science & Engineering. The ITEST project Girl Game Company targets 80 middle school girls, of which 81 percent are Latina and 15 percent white. They'll receive 248 program hours over one and a half years, which is longer than the previous project, and more intensive.

The program is framed as a simulation of what it would be like to work in a digital game software development company. The instructors are called CEOs; the girls help run the program by joining "departments"—human resources, marketing, production, and public relations. And, their game-building projects come from the company's "clients." For example, their first games have astrobiology as the focus—as requested by their "client," the National Science Foundation. The girls are compensated with virtual money on Whyville (www.whyville.net), an online community for teens and pre-teens. Working with Stagecast Creator software (www.stagecast.com), they create and then share their games at their very own clubhouse on Whyville, a place where they can get feedback from peers, as well as chat about games, IT interests and careers, and other issues.

Girl Game Company aims to build participants' computer confidence and IT fluency, promote collaboration, build a network of support to pursue IT careers, and allow for identity exploration. The overall goal is to increase girls' interest in and capacity to pursue STEM courses and careers.

### Strategies and Lessons Learned

"Research tells us that, for girls, we can't just focus on the computer—you have to look more broadly," reports Jill Denner. "Especially now that we have the girls for a year and a half, we've had to strategize about how to keep them engaged."

The Girl Game Company game-building process follows these steps: play and analyze games for ideas and inspiration; do preliminary design on paper; learn software while making the game; revise design; make a plan to monitor progress; test and debug; publish a working version; receive feedback; and improve games based on feedback from clients and users. These and other details are documented in the Girls Creating Games Program Guide: http://programservices.etr.org/gcgweb/.

**Jacob Martinez, project coordinator**, discussed other strategies for success:

- Provide visuals for scaffolding and supporting learning (i.e., handouts, big posters for the walls). This is especially important given the number of English language learners participating.
- Limit the scope of their game in terms of technical complexity, size, and amount of content—to

ensure that girls have success.
- Limit adult "rescuing," so that they get involved in computer problem-solving.
- Ensure that girls engage in reflection about what they are learning (i.e., electronic journals to record their experiences, group discussion during class).
- Implement client-driven game design.
- Simulate a workplace environment.
- Hire undergraduates to act as near peer role models.

The project staff report that they have benefited enormously from the experience of their previous project, and are applying those lessons in this new grant. "In Girls Creating Games, at the middle school level, we had to do so much intervention to help youth work in teams," recalls Jill Denner. Subsequently, "we went to a pair-programming approach, working with a computer scientist who's done work on pair programming. We developed strategies to support middle school students as they worked closely with a partner."

She also notes that, "We used to have the girls do a very detailed paper prototype but now we just have them do a sketch, since they change it so much in the process."

In addition, they're trying different software with the new project. The girls are picking it up very quickly, enabling them to have more time for independent problem-solving during the production process, which is a key goal of the project.

## Global Challenge

This global game partners two youth from the U.S. with two youth from another country. They are challenged to develop a business plan for a product or process that helps mitigate global warming. Teams are formed in the fall, and they submit their business plans in late April for judging. In the last cycle, 2,600 kids from 50 countries signed up; of those about 400 formed into teams, and then about 50 submitted very extensive solutions after working for months in a global context. "In a sense it's a traditional contest," says David Gibson, "although it has some very deep paths of self-discovery for the kids. We're seeking to build a space, a 3-dimensional environment, where high school kids from around the world can explore the natural world, learn about the processes of STEM, engage with each other and with experts, and form their own individualized paths through this museum-like world that we're developing."

Games and simulations are integrated in the STEM exploration component, to which seven weeks of the contest calendar are devoted. All of these explorations relate in some way to global warming, and each introduces a new concept. "A unique feature of our STEM explorations," notes **Susan Grasso, director of STEM curriculum development**, "is the degree to which we incorporate games and simulations. We hunt the Internet for existing software that we can use to keep the explorations engaging and interesting," for example: earth systems - http://cs.clark.edu/~mac/physlets/DaisyWorld/Daisy.htm, complex systems - http://www.bitstorm.org/gameoflife, and natural selection - http://www.biologyinmotion.com/evol. By completing these mini-challenges, teams can accrue additional points for the final challenges. She concludes, "Ultimately, in our program, teams are judged by the high quality of their business plan, diversity of their team, evidence of their global communications, and the degree to which they complete the STEM exploration."

## Strategies

For **Sally O'Rourke, director of student advising and enrollment**, the key is that "the challenge is student-directed. They can choose how far they want to delve into the subject; they address an open-ended, real-world problem." She points out that "we encourage students to find their own path through the challenge, so each team has a very different take on it."

Global Challenge project staff provide mentoring support for the young people in a number of ways. Each team is required to have an adult mentor from both countries represented. In addition, they can contact specialists in various STEM areas as necessary. Finally, besides the project staff themselves, undergraduates at the University of Vermont also serve as mentors.

In this program, youth rely on the Internet as a resource for STEM information and research material for their business plan. Project staff help teams stay on track with the aid of an online calendar demarcated by checkpoints. Teams also use the Internet—specifically,

eFolio—to document the work that they complete. These experiences collaborating online support their development as "data-gatherers and problem-solvers," observes David Gibson, giving them opportunities to "build up a heuristic level of knowledge, and to experience things that are hard to experience in the classroom."

## What Games Teach; What Young People Learn

Among the valuable skills and abilities that young people develop through game design, Girl Game Company staff cites: IT fluency, increased confidence with computers, planning and self-monitoring skills, problem solving skills, and perspective-taking (i.e., when you're making a game you have to think about what the player is going to see).

> *"Games take on real issues in their lives: negotiating relationships, negotiating parent and peer expectations, negotiating school demands."*
>
> *~Jill Denner*

Likewise, Global Challenge staff emphasize the planning and problem solving skills that games and simulations teach, as well as systems knowledge—understanding big ideas; decision-making; concepts, strategies, and tactics; understanding processes beyond experience; and 'practice makes improvement.'

At the end of the program, Global Challenge staff conduct indepth interviews with participants, soliciting individual and team statements of what the experience meant to them. David Gibson reports, "Overall, the entire project is a different kind of education… they see potential to change how education works."

## Resources

ITEST LRC Webcast Archive: Using Gaming and Computer Simulations for Youth Engagement & Learning
http://admin.acrobat.com/_a34442951/p26048951/

Girl Game Company
http://programservices.etr.org/gcgweb/

Global Challenge
http://www.globalchallengeaward.org

Digital Games Research Association
http://www.digra.org

The Education Arcade
http://www.educationarcade.org

Gamasutra – The Art and Business of Making Games
http://www.gamasutra.com

The MacArthur Foundation Digital Media and Learning Initiative
http://digitallearning.macfound.org

Game Developers Conference
http://www.gdconf.com

Games for Change
http://www.gamesforchange.org

Games, Learning and Society
http://glsconference.org/2007

Serious Games
http://www.seriousgames.org

How People Learn
http://books.nap.edu/html/howpeople1/