Gaming used to challenge students through real-world, problem-solving situations

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Sasha Barab talks about games and learning. Credit: Learning Sciences Institute

About 65 percent of American households play video games. Some are dedicated PC gamers, while others find thrills in online competition through consoles like Xbox and PlayStation. Even more people play games to pass the time on their smartphones or tablets, considerably extending the reach of games into our everyday lives.

But can games benefit us beyond simple entertainment? Researchers at Arizona State University are exploring different ways that games can enhance and facilitate learning.

"To me, games are an invitation with a contract," says Sasha Barab, a professor in the Mary Lou Fulton Teacher's College. "There's an invitation to engage in your own becoming, but there's a contract because you have to do something."

One of Barab's projects, titled "Using a game-based curriculum to achieve academic success," places users in a virtual environment that challenges them to find solutions to in-game problems that reflect those in the real world.

For example, one game positions players as an environmental scientist in a national park, tasked with finding out why fish are dying. The game makes the student an active participant in a reactive, fully formed world. Barab wants to engage players in a storyline in which they need to fully understand academic content in order to make decisions that can positively affect the world.

Barab strives to make his virtual worlds as real and responsive as possible to the player. If a player says something negative to a character, word will spread and other characters' perception of the player will change based on that statement.

Choices actually matter to how people will respond, says Barab, also a director of the newly founded Center for Games and Impact and a senior learning scientist at the Learning Sciences Institute (LSI), both at ASU.

Say the student determines that a logging company is causing the fish to die. The head park ranger puts more restrictions on the loggers, which sends the park into bankruptcy. The responsive world drives the player to realize science isn't just about facts, but understanding the system.

A major point of Barab's work is to make content from a teacher seem driven by the interest of the user. That mentality was a big part of one of

Barab's previous projects, a multiuser online learning environment called Atlantis Remixed.

The game offered various lessons that could be unlocked by the teacher, from academically centered topics like persuasive writing or genetics, to social issues like bullying or defining a civilization. But these topics weren't assigned like homework; they were designed to be something like a quest in a roleplaying game.

This way, students would build a relationship with a broader narrative and want to grow their identities in that narrative, says Barab.

Students could level their characters within the game while connecting to the academic content, all inside a virtual world. By building social structures and guided lessons in games, Barab's programs can monitor a student's progress within a contained environment.

But Barab isn't satisfied with limiting that progress to a virtual world. He doesn't want learning constrained to the scope of the game.

"I want the 'box,' but if it stays in the box, it's not going to ever have the effect on you I want," says Barab. "I want you to have a playful experience, I want you to try things on without too much risk. On the other hand, I also want to work with a teacher, work with you and your relationship to the big ideas to help give you resources outside the game."

There are several schools of thought concerning the design of games for learning. Danielle McNamara, another senior learning scientist at the LSI, takes a slightly different approach to educational games.

McNamara has integrated games into her intelligent tutoring systems, iSTART and Writing Pal. Her work focuses on the different features of

games and how they can be combined to improve learning.

"Learning is intrinsically tied to emotions and whether or not we want to be there," says McNamara, also a professor of psychology in the College of Liberal Arts and Sciences. "So we're looking at how games improve motivation and how motivation potentially mediates learning."

With this approach, McNamara has infused her tutoring systems with mini games to motivate students to stick with the programs. She's interested in finding the mechanics of games that perpetuate learning.

One of her systems, Interactive Strategy Training for Active Reading and Thinking, or iSTART, is designed to help students learn strategies for understanding science text. Students practice self-explaining and using reading strategies while playing games. The students enter explanations of the content and the system rates the quality of the response using natural language processing. Students' performance during practice games unlocks options within the system.

The system is centered on a point economy, where users earn "iBucks" from academic achievement. Students can customize their avatars using iBucks, or use the points to pay for games. Writing Pal, McNamara's intelligent writing tutor, also makes use of points in the form of leaderboards.

"One of the things we've found is that simply adding points to a task and 'gamifying it' does not work," says Tanner Jackson, an assistant research professor who helped design the learning systems and games. "There's not enough context; there's no impetus or motivation. So what we do is provide a point-based economy where all these points have a purpose, they have context. There has to be some overall meaning for this, how they fit together in order for them to have enough impact."

The games in the tutoring systems are aligned with academic tasks, but include different combinations of game features. iSTART's "Map Conquest," which mirrors the board game RISK or the Flash game "Dice Wars," has emerged as one of the more popular games in the system. In the game, a player starts out with a set number of flags to place on territories on a map. The more flags, the better off a player is – but the number of flags is dependent on how the student performs on the academic task.

"Many people who build games predict that if the game is not well married to the task that they're learning, it won't be successful and the students won't enjoy it," says McNamara. "We've found some contrary results to that, where games that are not well married are highly enjoyed and successful."

By tying success in the game to success in the academic task, the system avoids making the learning portion a punishment or a means to an end. One is dependent on the other – if you goof off in practice, you fail in the game automatically, says Jackson.

Whether games are implemented as a motivator for learning or a learning experience themselves, they may become a staple in education, as some major companies have made their products available to classrooms.

Minecraft, a popular sandbox building game, has been modified by Finnish and American programmers and teachers in partnership with the game's developer Mojang. Minecraft places players in an open-ended world comprised of blocks to be manipulated into structures. Minecraft has no objectives, allowing it to be customized for lessons about anything an instructor can imagine, from architecture to graphing.

Valve Software launched an educational version of their game

distribution service dubbed Steam for Schools in June 2012, which allows teachers to use the game Portal 2 to guide lessons on math and physics.

Barab envisions further possibilities to marry gaming and learning.

"I think that the goal is to transform what courses look like," says Barab. "We might even move away from the Carnegie credit and instead use achievements to complete that course."

"Most importantly, we have to think deeply about what can a teacher do well, what can a game do well, and what can they do well together," adds Barab.

Provided by Arizona State University