By Peter Tromba

Build Engagement and Knowledge

One Block at a Time with Minecraft

How do you get through to those students who would rather be playing video games? Bring immersive worlds into the classroom and watch their creativity and learning take off.

How can educators use computer games effectively to increase student learning? The core of instruction is the interaction between the student, the content, and the teacher. Good instructional design accounts for the students' needs and interests by personalizing the core to each student. Video games and simulations are one way to meet student needs and leverage their interests for increased student learning.

In the 2011–12 school year, eighth grade students at Monroe Middle School in Eugene, Oregon, USA, participated in a pilot class that featured the popular online game Minecraft (minecraft.net). The project clarified for me the question of how video games can be a tool for learning. It also brought into stark relief the misconceptions many career educators have regarding gaming in education.

As principal, I sat on many student- and data-centered planning teams that met frequently to discuss referrals regarding academic and behavioral issues at middle and high schools. Over a period of years, I began to notice common needs among certain groups of students. I discovered that a particular group of students who generally saw schooling as irrelevant, poorly paced, and out of touch cleaved to the world of video games. Often these students were talented and gifted but not necessarily identified as such. Our school counselor, Shirley Madathil, clued me in to the fact that these students at Monroe were also Minecraft players.

Meeting Students Where They Are
I am an avid video game player, as is my son, Sequoya. Years ago, when Minecraft emerged, he asked me to buy

him an account. After listening to stories about his adventures, I bought one for myself too. At that time, Minecraft was in an early beta stage, but the basics of the game world were already set:

- The entire game is a first-person perspective 3D world, and the game allows multiple players.
- The world is huge, with a playable area larger than the surface of eight earths.
- The world is made of blocks, almost all of which are cubes of different colors and simple patterns, representing different types of organic and hand-crafted materials. The world also contains objects such as pick axes, seeds, and wood.
- Players can chop down trees for wood and mine rocks and minerals, such as diamonds, emeralds, and stone, to craft objects such as tools by combining materials according to a specific formula.
- Players can use foraged and created blocks to build persistent structures.
- One mode of the game includes monsters that come out at night. Players protect themselves from the monsters. If a player dies, he returns to his home point, and everything he is carrying is left where he dies.

Although many of our staff regarded video games as one cause of reduced student achievement, Madathil and I decided to create a small Minecraft class, which I would teach. Initially we enrolled five students, although that number rose and fell as the year went on. Ultimately seven students finished the class.

In the first months, I attended most of the class sessions. As the year went on, however, I was often unable to attend because of something going on in the office. One of my chief realizations from this pilot is that a video game–based class can be supervised by a support staff member because the content, student engagement, and on-task performance are completely mediated by the electronic content generated by the teacher asynchonously.

Students Set the Goals

During our first class meetings, we worked to establish the goals of the class. I provided the students with links to the Oregon content standards and national curriculum resources, including Common Core State Standards. I also gave them what little research I had found about using Minecraft in the classroom. They were tasked with answering the question of whether Minecraft could be a valuable tool to enhance education and why it should be a regular class at Monroe. They all researched the question and were

excited to have the chance to justify and elevate the importance of this game—and gaming in general.

One student, Sam Reposa, was charged with writing up their findings (see "In Defense of Minecraft" on page 22). After students finished their research, we discussed what their first project should be. Their sixth grade social studies teacher suggested they build pyramids. The 3D view in Minecraft would allow students to "walk" around the pyramids and see them from all angles. They worked in teams, each using different approaches.

Meanwhile, I was working on getting the class a server so they could cooperate in one Minecraft world. Unfortunately, despite Sam's persuasive arguments, my request for district server space to host our server was denied. I never did find out exactly why, but I assume it had to do with scarce computing resources combined with the fact that gaming is not considered to have enough educational potential. That's one reason I left my position that summer to take on the job as director of technology for our school district. My interest in pursuing the position was in part a result of my unsuccessful attempts to argue for district support for this innovative class. Video games are commonly understood in only a pejorative sense among many career educators, especially those furthest from the student population.

As word of the class spread, gamers and nongamers alike started asking to enroll. We added a few more students, but I put most petitioners off because the students in my class wanted to have a say in the direction the course would take as it went up in scale and scope.

After finishing our pyramid competitions, the class established criteria to include more students and created rules concerning the class agenda. Their schema for this work grew directly from how written and unwritten rules are established in online gaming. Our work bringing the social order and skills from online to inform real life demonstrates how educators can leverage this student interest and skill set in classrooms in novel ways.

Our next set of projects involved students interviewing their seventh grade social studies teachers to find out what historical buildings the teachers would like created in the 3D world. This led to the students researching and constructing medieval castles. In both the pyramid and castle work, students not only engaged with the content that fueled their model building, they also experienced the physical layouts from a first-person perspective and were much more fluent in the architectural topics as they constructed and explored. It was clear that the physics of a game engine or other artificial reality can inform students' understanding of the real world.

In Defense of Minecraft

Monroe Middle School student Sam Reposa wrote the following letter with the help of classmates.

Minecraft is a survival/sandbox computer game that has more educational value than most people think. Minecraft has many elements within the game that can be very appealing to teachers. Some of these include: science, architecture, spatial mathematics, geography, art, and circuitry. This essay will be covering how Minecraft can be used in the classroom, and why parents do not need to be worried about Minecraft being inappropriate for their child.

Minecraft is a great way to build teamwork and to build community. For example, if you have your students all start on a new world and they all have to survive for a certain amount of days, they would have to decide who would gather the materials, who would find shelter or build a shelter, and who would gather food. This will teach them how to work together. Maybe once students have survived for a while, they can start creating their own civilization.

There are many places in the game that show examples of physical science. For example, when you are throwing an object, such as a snowball or an egg, through water, it eventually slows down. Teachers can use this to demonstrate fluid friction. You can do the same thing with air friction by throwing an object through air. The object would still slow down eventually but the object goes farther because the object has less friction in the air than the water. Newton's laws of gravity apply in many places in Minecraft.

A popular thing that many Minecrafters enjoy doing is making scale models. A scale model can be of anything: a statue, a building, or even a city! When building scale models in the classroom, students will have to count the blocks that they place to make sure what they are building is to scale. They will also need to use spatial mathematics to find out how to fit everything into what they are building. If you are a history or social studies teacher, you can have your students build some national monuments, such as the Statue of Liberty, the Empire State Building, or even the great pyramids of Egypt (I know that isn't a national monument but you get the idea) as class projects.

Parents Report Better Engagement

A couple months into the class, a parent of one of my Minecraft students asked for a conference, and I worried that she would question the value of the class. Instead, she was ecstatic. She said her son loved the class, and the experience was improving his attendance and interest in school.

In fact, every student in the class recorded better attendance, Madathil said, adding:

> One very unexpected positive outcome of offering a Minecraft class was the increase in consistent attendance for the students involved. Their attendance history was sporadic, and while their capabilities were great, their motivation to attend school regularly lacked—until they began participating in the Minecraft class. This class allowed students' minds to expand, create, and collaborate. Socially, students who were less likely to participate in class discussions and/or even advocate for themselves gained more confidence that spilled out into their other classes and interactions with peers and adults.

Parents also commented on the knowledge and skills their children were learning. Ali Groberg, a parent of an eighth grade student, was particularly thrilled:

> When I first heard that a computer game class was being offered and my son was going to be a part of it, I thought, 'Oh, great, now I am going to have to buy lots of game systems!' Then as I learned more about the class, I thought, 'Interesting application, to reach children through this one game for various levels of academia: math, history, language arts, strategy, logistics, graphic design, agriculture, chemistry, alchemy are just a few areas that can be enhanced by this one game. My son thought ancient history was more interesting after he was creating buildings and landscapes in Minecraft.

Not All Video Games Are Created Equal

The Minecraft class was successful for two reasons that I believe can be applied to other video game content for instruction. First, the basic game was something that students already knew well, and it generated a high level of on-task behavior with little real-world supervision. Second, the game could be adapted to align to core academic standards and assessments.

It is now common for publishers to design video games to teach content. At Monroe, teachers have used game software to teach prevention education, physical science, social studies, and math. After all the hours of work put into these attempts, none has generated the interest among students as Minecraft has. I don't think educational publishers will ever produce games with the cachet

of popular games, and the lack of interest students show these games will not catalyze student learning the way a successful commercial game will. It is comparable to the interest students would show in a documentary about the Holocaust versus watching *Schindler's List* or reading *The Diary of Anne Frank.*

On the other hand, right out of the box most of the popular commercial games teach some of the soft skills that predict career and college readiness, such as perseverance. In addition, they are designed to be modified by users in ways that can immediately bring academic content to the existing game world. The ability to "mod" these games allows educators to create puzzles, challenges, and awards and to assess progress in a multitude of ways with constant feedback to students. Therefore, a relevant skill for teacher preparation is the ability to evaluate video games and do the simple programming necessary to add to or modify popular games to teach or reinforce academic content.

Students Create According to Interests

As the year went on, the students in the Minecraft class finished reconstructing castles and moved on to building city structures, such as hotels. They even re-created the floor plan of our middle school. When their eighth grade language arts class read *The Outsiders,* the students replicated in Minecraft the layout of the town where the action takes place.

During the year, the students branched out and followed their interests. Some students also modified other game engines that required more advanced programming skills.

An after-school Minecraft club drew a diverse group of 25 or more students every Wednesday afternoon, and the class members helped set up and supervise the club activities.

And in the two years since I first discovered Minecraft, I've noticed a promising trend: Minecraft in the classroom is exploding. Last fall, a Google search for the phrase *minecraft in the classroom* produced about a dozen results, most linking to the same teacher. I did the same search recently, and it produced more than 64,000 hits.

Computer gaming presents a challenge and opportunity for educators. Our experiment with Minecraft suggests that gaming is easily leveraged to improve learning. If you don't believe me, listen to former student Seth Lanz:

What I liked about Minecraft the most was the building. You could look up pictures of historical places and re-create that architecture and let your mind run wild, really. I feel like that was a nice part about the class because I could take places I was learning about in social studies and build them in my own little virtual world.

Minecraft Meets the NETS for Students

Minecraft meets several aspects of the NETS•S, including:

1. Creativity and Innovation

a. Create original works as a means of personal or group expression

Minecraft is a 3D blank palate that allows for hundreds of students to collaborate.

c. Use models or simulations to explore complex systems and issues.

Minecraft allows students to design, construct, and virtually investigate complex 3D structures that have static and dynamic elements.

These structures can include a wide variety of programmable elements built from simple circuits and switches.

2. Communication and Collaboration

d. Contribute to project teams...

Minecraft is fundamentally a multiplayer collaborative environment that requires teamwork to build persistent and meaningful structures.

3. Critical Thinking, Problem Solving, and Decision Making

b. Plan and manage activities to develop a solution...

In the Monroe Middle School course, students were asked:

"How can we use Minecraft to help our educators teach ancient and medieval architecture in a more immersive way?"

As a group, they came up with a solution.

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