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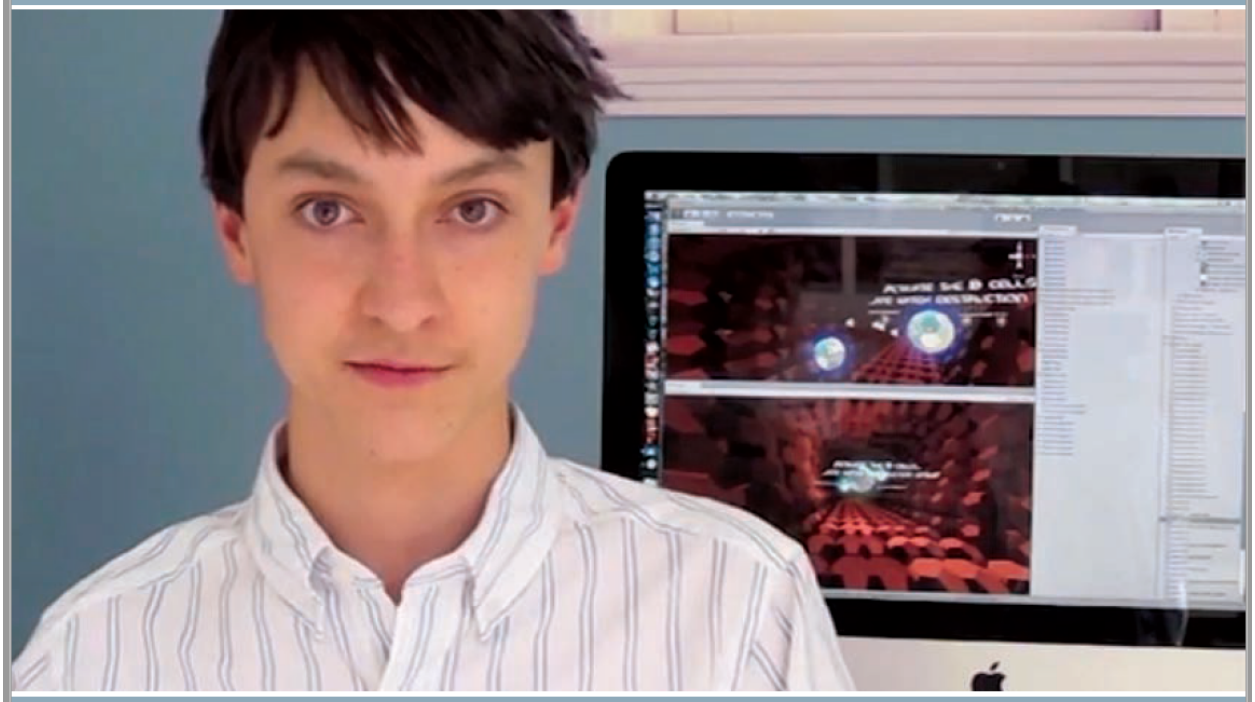
EPIC WIN



Inspire Engagement through Online Competitions and Collaborations

Owen Leddy of Santa Monica, California, entered his educational video game, Pathogen Wars, into the 2012 National STEM Video Game Challenge. See www.stemchallenge.org/press to watch clips from Owen's game and other participants' entries.

Students who are avid online consumers often need an extra push to become producers. Tap into their competitive and collaborative instincts to get them excited about creating and sharing their own digital content.

Getting students online has never been a problem. They are connected all the time—watching videos, reading their friends' social media posts, and playing games. And they are very comfortable using the internet for all manner of knowledge gathering, from Googling facts to finding answers to their questions in online forums.

But the web offers so much more than mere consumption. Students can use the internet to collaborate with others and showcase their own creations, including videos, blog posts, fan fiction, video games, and more. Of course, producing requires more higher-order thinking and computing skills than consuming, so students often need extra motivation to get involved.

One way to inspire even the most reluctant creators is by tapping into their competitive and collaborative instincts. Providing virtual spaces where youth can not only socialize, but also develop and share their own digital content, adds a new dimension to online participation. In fact, online competitions represent a new type of participatory culture in schools. Educators can leverage their ever-growing popularity to motivate their students to new levels of student-centered learning, "competitive collaboration," and technology use.

Inspired by this potential, we implemented two elective courses for middle and high school students at the Penn Alexander School and the Science Leadership Academy in Philadelphia based on two online competition models: the National STEM Video Game Challenge (stemchallenge.org) and the Scratch Collab Camp-Music Mashup (info.scratch.mit.edu/collabcamp2012), each of which offers a unique venue for children to develop their own digital production skills in a communal environment.

Student-Centered Skill Building

Two of the biggest and longest-standing hurdles facing educators are integrating technology into the classroom effectively and developing authentic collaboration within the classroom. Online competitions and camps can help meet both of these challenges.

Some teachers are reluctant to incorporate programming into their classes because they believe it requires extensive computing skills. However, participating in online competitions can ease the transition because students can start simply by remixing others' projects, which leverages collaboration to produce more complex work. Competitions also give students intrinsic motivation to learn and practice new tools and skills to create better products.

In our courses, middle school students at Penn Alexander created STEM video games with Scratch, an easy-to-use, graphical programming language developed at the MIT Media Lab, to enter in the National STEM Video Game Challenge. This yearly competition, which students enter online in groups or as individuals, builds on kids' natural passion for video games. They create a video game around STEM concepts and upload it to the site, and gaming and programming experts judge their final projects. (Watch our students' project video at www.youtube.com/watch?v=RcLZ_41nGiU.)

In the Scratch Collab Camp-Music Mashup, high school students from the Science Leadership Academy also used Scratch to design animated music videos in an interactive mashup project. But this is more of a collaborative competition, where students create animated or interactive music videos or music visualization projects using Scratch. They upload their creations to the Scratch website, which is home to more than 3 million projects and provides a non-threatening online space for beginners to start and more advanced "Scratchers" to thrive. The site even allows students to remix others' projects and make them their own, so beginners can start slowly.

Because many of our students were new to Scratch, they needed to develop the basic skills necessary to navigate the website and to program. Rather than teaching these

Shashank Mahesh (right) of Gibsonton, Florida, got support from his little brother, who was the main tester of his entry into the 2012 National STEM Video Game Challenge.

skills to students before they started their games, we taught them as they designed their projects. Instead of asking the students to complete exercises after each lecture, we encouraged them to start with their own ideas before we introduced key concepts they needed to make their games interactive and animated.

In this approach to project-based learning, young people use programming for personal expression to showcase their ideas. They interact with them. They think with them.

And as students perused the projects that their virtual peers had created, a remarkable thing happened: They began to share what they found and to comment online in the wider Scratch community. They didn't need experts to teach them programming skills. They became intrinsically motivated to learn more about Scratch and collaborate with others. This confirmed for us that teachers can work as facilitators to support student learning simply by introducing them to a constructive learning culture rather than a series of prescriptions.

Teachers have known for years that students can learn very well from each other. When students participate in an online community with shared interests and goals, they are even more engaged and motivated to learn. Add a competitive element, and they can barely suppress their excitement!

One of our students explained it well:

> So many people helped me with the smallest things. As soon as people started playing my game, that made me realize there were still things to fix. I realized if I'd fix all these things, my game would be overall strengthened. I go on Scratch when I'm at home with free time. I don't play video games. I make video games!

The Teacher's Role

While this type of instruction is student centered, the teacher plays a major role. To make the experience meaningful, teachers must first have a firm understanding of the curriculum standards. Then they can begin to incorporate online competitions into their classroom as tools to teach and assess those standards.

A seventh grader, Arne, created a game where the player can change the phenotype of an avatar by rearranging sections of DNA to manipulate her eye color, hair color, and facial features. Another student, eighth grader Michael, remixed the age-old Space Invaders game to destroy pathogens by firing lysosomes across cellular cytoplasm. Both of these students acquired understanding of their subject matter through the gameplay itself. Rather than functioning as "skill-and-drill" vehicles for memorizing science

Create Your Own Online Competition

Signing your students up for outside online competitions is an easy way to get them involved and inspired. But you can also take it a step further by starting your own competition. All you need are a collaborative online community, leadership support, time, and transparency to make it happen. Here are seven steps to creating your own competition:

1. Get the support of your building-level leadership. Let them know what you are planning. Emphasize that this is new and exciting for everyone involved.

2. Outline the parameters of your competition. What ages are eligible to compete? Will you award any prizes? How will you assess the project? Will you have judges? A rubric? What is the topic or theme? What standards would you like to address? Make sure that the rules are easy for potential participants to access and understand. If you use a backward design process, your expectations will become clearer to both you and your students.

3. Come up with a time frame. We suggest that you allot at least a quarter, but preferably a semester or more, for students to complete their projects. Give them class time, but a goal is for them to get so invested in their projects that they want to work on them at home or in an after-school club as well.

4. Decide on an online community or space to showcase the projects to each other and the world. Depending on your firewall limits and the type of competition, you might use Wikispaces, Facebook, or Google+. The Scratch website is perfect for programming projects. Visit the Scratch Help page (scratch.mit.edu/help). See what other educators are doing and get support on ScratchEd (scratched.media.mit.edu).

5. If you decide to use Scratch, create a Studio (gallery) and begin advertising on the website. Market your competition. You don't want it to be limited to just your students. Advertise to Scratchers, teachers, and other students in your school and district. Get ideas and learn how to promote on the Scratch Discuss page (scratch.mit.edu/discuss). Post on the "New Scratchers" forum and encourage your students to do the same to become enculturated into the community.

6. Reach out to the online community for feedback. Using the audience is key to producing high-quality projects. As your students begin working on their projects, require them to test other projects, post comments, and be open to feedback from others. You are teaching them how to interact appropriately as well as how to be part of the wisdom of the crowd. If you are using the Scratch website, refer to the FAQs (scratch.mit.edu/help/faq) and the community guidelines (scratch.mit.edu/community_guidelines).

7. Have fun! Your students will, so why shouldn't you?

Enter a Competition

The web is full of online competitions for students. Here are just a few we found:

Computer Science Network Competitions | goo.gl/48yL8f
Computer Science Student Network (CS2N), a collaborative research project to increase the number of students pursuing advanced STEM degrees, hosts a variety of themed competitions with prizes as well as competitions for third parties.

eCybermission | www.ecybermission.com
This web-based STEM competition for sixth through ninth graders invites teams to propose solutions to real problems in their communities for state, regional, and national awards.

ICS Scratch Competition | www.ics.ie/scratch
The Society for Chartered IT Professionals in Ireland's annual Scratch competition aims to raise students' interest in software development and related career opportunities by giving them a better understanding of how software is built and works.

Imagine Cup | www.imagincup.com
Students age 16 or older are eligible to enter Microsoft's global competition by creating an original technology project from start to finish in one of three categories: Games, Innovation, and World Citizenship. Finalists win a trip to Seattle, and winning teams in all three categories win $50,000.

Google Science Fair | www.googlesciencefair.com
The Google Science Fair is an online science competition that invites middle and high school students from around the globe to come up with ideas that will change the world.

West Point Bridge Design Contest | bridgecontest.usma.edu/schedule.htm
The United States Military Academy's annual contest introduces middle and high school students to engineering through computer bridge design.

Zero Robotics Tournaments | www.zerorobotics.org
After several phases of virtual competition, middle and high school finalists compete in a live championship aboard the International Space Station. An astronaut will conduct the championship in microgravity with a live broadcast!

facts, each game enacts the scientific processes and makes them integral to gameplay. The students needed to learn and understand at a deeper level to successfully create them.

In both of these examples, a science teacher could formatively assess student understanding of organelles and genetics over the course of the competition through rubrics or by posing questions that capture deep content knowledge: How does the expression of a genotype (DNA) express itself in phenotype (hair color)? How do lysosomes work to protect the cell from foreign invaders? What better way to assess understanding of how a cell functions than by having students show you by programming these functions in a video game!

By reaching out to the online community, teachers can also bring in the expertise they might lack to help students produce high-quality products. We sought constructive feedback from the online Scratch community by creating a gallery specifically for our students to post their work. One Scratcher, "Cooler-Than-Ice," who had won third place in the challenge the previous year, commented on all of our students' video games, and our students modified their projects based on her and other online feedback.

One student explained, "The [teachers] were there in case I needed help, but the students were helpful too, especially those who had more experience."

When they finished their projects, we hosted a Virtual Arcade where other young people could beta-test their classmates' STEM games and give feedback before the final upload to the competition website.

Top-Down Support

Because video game design and music video production are relatively new in schools, teaching with these tools might be an uncomfortable and even daunting feat for teachers. That's why technology leaders and school administration must support them as they take risks to incorporate innovative, constructionist activities in their classroom.

In our case, Peter Endriss, a technology leader at Penn Alexander, visited periodically and brought his class to participate in our Virtual Arcade. He supported our initial efforts by subsequently entering students' video games in statewide competitions, including the Science and Engineering Fair. These additional competitions ensured that students continued to work on their games even after our course had ended.

At our second site, the Science Leadership Academy, the principal and ISTE's 2013 Outstanding Leader, Chris Lehmann, supported the Collab Camps by giving us extended sessions throughout the year and allowing us to recruit participants during their student advisement periods. He also posted these projects on the school website, signaling a schoolwide commitment to constructionist learning.

But encouraging teachers to use more authentic learning activities and assessments rather than multiple-choice tests is not enough. Administrators and technology leaders must also provide opportunities for teachers to gain the skills to become even more successful through individualized professional development and common planning time.

At the Rockdale College and Career Academy, the leadership is working with teachers to redefine the use of technology in their classrooms and has already committed to funding a new project. Physics, electronics engineering, manufacturing, and Cisco networking teachers are collaborating with industry experts and each other to break down content silos and create meaningful constructing activities for students related to the workplace and their career

concentrations. Their students are using the Arduino and Raspberry Pi platforms to create code and software to control sensors and peripheral devices in do-it-yourself projects, and they will leverage online competitions, such as the EMC Club Website Challenge and the Robotics Education and Competition Foundation Educational Video Challenge (forum.robotevents.com/design), for extra motivation.

Lessons Learned

The sponsors of the National STEM Video Game Challenge offer a laptop as well as $2,000 to the winner's school. Yet in our own experience, fiscal and tangible awards alone do little to spur children's interest and certainly do not help them persist once they hit glitches. We found that ongoing feedback mechanisms worked best for that.

A crucial strength of the Collab Camps was that they provided multiple opportunities for students and the organizers to provide feedback online via the Scratch website. We tapped into this strength by making the Scratch website our classroom platform for the National STEM Video Game Challenge as well. The Collab Camps also made the competition transparent. Students posted their projects online, so everyone could see who their competitors were and, in the process, better understand—and even learn from—the competition.

Online competitions and camps are a great way to motivate students and promote student-centered learning environments where "competitive collaboration" is the norm. As students work toward a shared goal and reach out to the greater community, they begin to create more meaningful projects.

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