ROOT & STEM

WHY GAMES MATTER

COYOTE & CROW
Decolonizing the RPG

EMPOWER PLAY
Seven experts on
games and learning

MINE GAMES
Teaching sustainability
with Minecraft

✛ Plus comics, games and over 10 pages of teaching resources!

EDUCATION

ADVOCACY

RESOURCES

PRODUCTION

MENTORSHIP

EMPLOYMENT

PINNGUAQ
LIFE CYCLE

Pinnguaq follows a life cycle model to support the core phases of a person's learning journey in STEAM education. We strive to provide educators and students with opportunities and resources each step of the way.

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To learn more about what we do, visit our website at

pinnguaq.com

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ROOT & STEM

ABOUT PINNGUAQ

The Pinnguaq Association, a not-for-profit organization, incorporates STEAM into unique learning applications that promote storytelling, health, wellness and growth in rural and remote communities. At its core, Pinnguaq embraces diversity and creates opportunities in order to empower all people.

DIGITAL TAXONOMY

Computer Science Education is more than just coding. A comprehensive approach to it includes learning skills and competencies from each of the areas listed below. Look for the following icons at the end of each article for suggested curriculum connections. *Reference: Learning for the Digital World: A Pan-Canadian K-12 Computer Science Education Framework. 2020. k12csframework.ca*

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DESIGN

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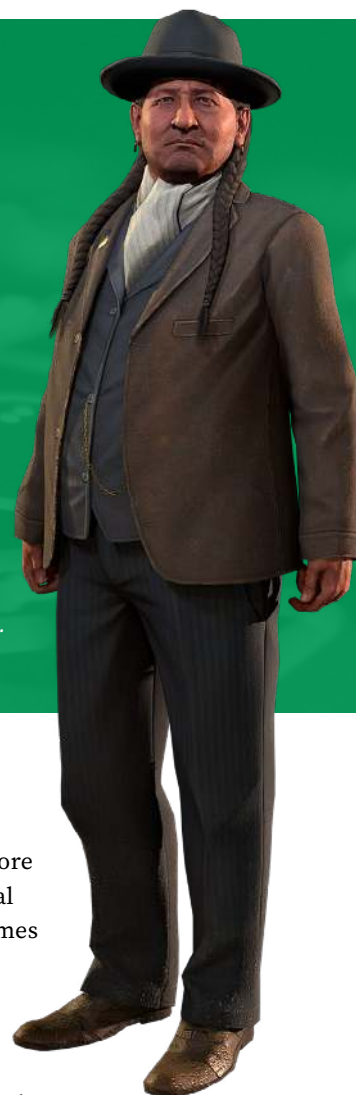
Kawartha Lakes CFDC

GAME FACES

Playing games is essential to everyone and has been for millennia. For 99.9 per cent of the time we've been playing games as a species, they have been unplugged. That changed in the 1900s with early mechanical games that eventually added electricity, and then again when games went digital in the 1970s. The electronic game industry took flight when the 1977 "Holy Trinity" was introduced to the world: the TRS-80, Commodore PET, and Apple II. Soon after, the computer game industry was born.

The earliest video games had no deep thoughts about what kind of character you played—the resolution was so low you couldn't tell. Game design in the 1980s was more focused on screen layouts, action and setting. If you look at all the biggest hits of the '80s, you'll see a lot of abstract characterizations: Pac-Man, Defender, Lode Runner, Choplifter, and lots of tanks, planes and spaceships. There were few humans on the screen, and those that did appear were made up of so few pixels that you filled in the gaps yourself. The little pixel-person on the screen could be anyone you wanted them to be.

As computer technology matured in the '90s, games became predominantly three-dimensional, and more realistic characters began to emerge. But 99 per cent of those characters were male. In 1996's *Tomb Raider*, players could finally control a 3D female avatar, Lara Croft. Note that she was a white female, not an Indigenous person, Mexican, Asian, or other minority. It would take more time before diversity became a focus for game designers.

For kids, playing games is a way to learn about the world. Games allow players to explore cultural and social identities. But when you have a world full of white avatars, you have games that unintentionally perpetuate racial stereotypes.

Over the last 10 years, programmers have been striving to make games and their characters more diverse. Nowadays, there are cultural funds that back development for games that feature Indigenous stories and characters. These games are essential to the Indigenous community and show the rest of the world what its culture is about and allow non-Indigenous players to immerse themselves in that other culture and learn about it. In our latest game, *Empire of Sin*, there are 14 boss characters for players to choose from. Two are Hispanic, a man and a 70-year-old woman. From the roster of 60 gangsters available for hire, two are Indigenous—one is Navajo, and the other is Cree (pictured above), and they speak their native languages.

Since conversations about diversity have been spreading like a social tsunami, we have seen more in-depth characterizations of different races and cultures. Thankfully, now a diverse approach is expected, and game designers begin with that aspect in mind at the beginning of a game's design. Today, the first question is "Who are you?" rather than "What do you do?" and games are better for it.

This makes for a more diverse, more inclusive world, and it benefits everyone. It's excellent timing, now that games are the dominant media of the 21st century. I'm excited about the future of gaming, and this issue will shine more light on all the ways games are affecting our world.

— JOHN ROMERO

John Romero
Guest Editorial • Page 5

John Romero's work with id Software, which included titles such as *Doom*, *Quake* and *Wolfenstein 3D,* helped invent and popularize the first-person shooter game. A completely self-taught programmer, designer and artist, he has worked on 130 games and counting, and is considered to be among the world's top game designers. He lives in Galway, Ireland, where he runs Romero Games with his partner, Brenda Romero.

Cole Pauls
"Just Like Us" • Page 30

Cole Pauls is a Tahltan comic artist, illustrator and printmaker hailing from Haines Junction, Yukon Territory, with a BFA in illustration from Emily Carr University. Based in Vancouver, Pauls focuses on his two comic series, *Pizza Punks* and *Dakwäkãda Warriors,* for which he won Best Work in an Indigenous Language from the Indigenous Voices Awards in 2020, among other honours.

Allison Pomenta
Up Your Game • Page 22

Allison Pomenta is a journalist and educational media specialist with a background in educational publishing and museum education. She created the Golden Lamp Award-winning children's storybook app *Axel's Chain Reaction*, and has designed a continuing education program in educational software creation for a South American university.

Sharon Aschaiek
Sustainability Cubed • Page 34

Sharon Aschaiek of Higher Ed Communications is a writer, editor, content consultant and project manager who lives just north of Toronto. She writes about education in Canada and globally for media publications and academic institutions. Trained in communications, marketing and journalism, Aschaiek is a former *Toronto Sun* special sections editor who has been running her own business since 2004.

Kim Wheeler
History Retabled • Page 10

Kim Wheeler has brought positive Indigenous stories to mainstream and Indigenous media since 1993. She has carved out a career as a writer, publicist and producer across a variety of disciplines. Her audio work has been recognized by the New York Festival, ImagineNative, the Indigenous Music Awards and the Prix Italia. Currently, she works from her treehouse media office with multiple clients in publicity, magazines, film and podcasts.

Michael Carter-Arlt
A Holographic Future • Page 14

Michael Carter-Arlt is a creative technologist with a passion for UX design, education and interactive tech. Since completing his master's degree in digital media in 2018, he has presented work at festivals and institutions such as the Festival for International VR and AR Stories, the Toronto Kids Digital Festival, the Ontario Science Centre, and the MuseWeb Virtual Conference. In 2020, he served as lead developer for the Aga Khan Museum's *Remastered* exhibit. He currently works as an immersive technology specialist at Ryerson University Library, where he explores the use of 360 VR environments in pedagogy.

Lenny Lishchenko
Imagining Worlds and Characters • Page 40

Lenny Lishchenko is not a boy. She is an illustrator, graphic designer and comic maker who will never give up the chance to draw a good birch tree. Ukrainian-born and Canadian-raised, she's interested in telling stories that people remember years later, in the early mornings, when everything is quiet and still. She is based in Burlington, Ontario.

Nunami

An Inuit-Inspired Tabletop Game

BY STEPH WONG KEN

Games are often competitive, but what if a game encouraged cohabitation and collaboration, rather than individual gain? That's the idea behind Nunami, a tabletop game created by Inuk-Québécois designer Thomassie Mangiok, which combines beautiful design with rules that promote working with other players, rather than against them.
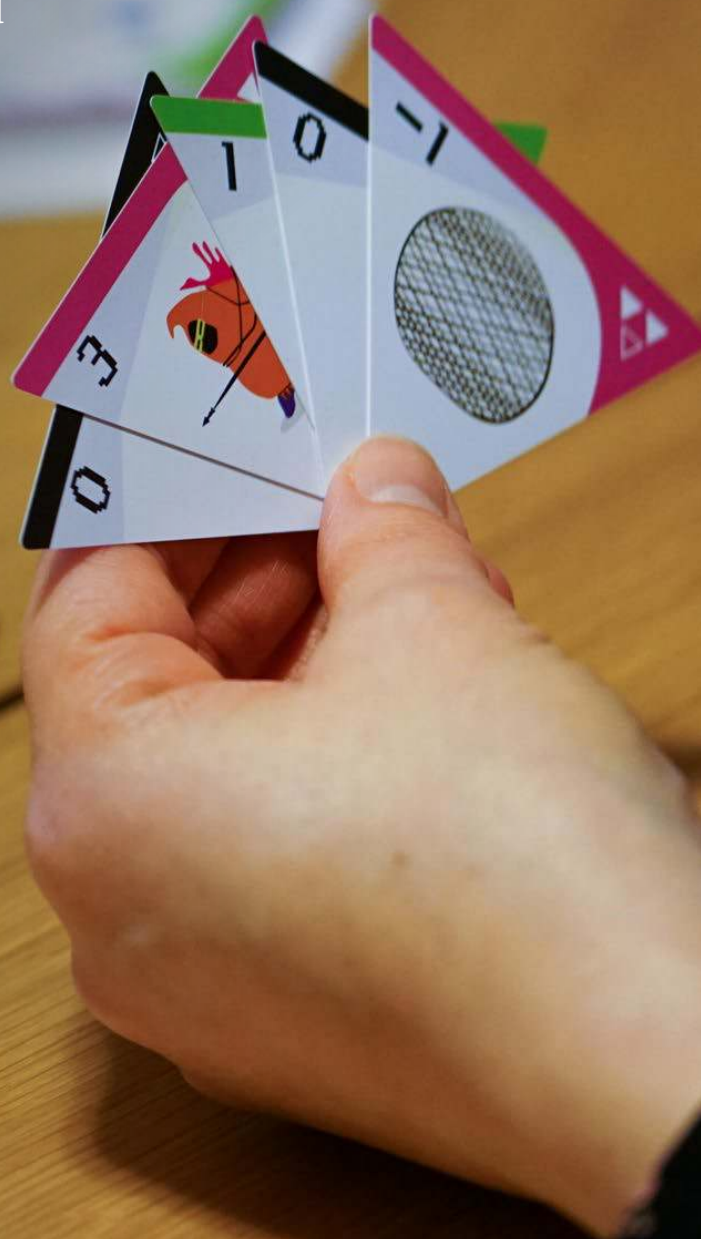
Mangiok was inspired to make Nunami—an Inuktitut word that translates as "into the land"—after noticing the lack of representation of Inuit culture in the gaming world.

"I'm exposed to so much English when I go to the store or step outside," he says. "What about Inuktitut? How are we sharing our history and our values? I felt it was important to remind people that our culture doesn't live in the past, we can also exist in the future."

Mangiok has operated his company, **Pirnoma Technologies**, in the small community of Ivujivik, Nunavik, since 2006. His design projects are often inspired by the remote openness of the land, as well as the town's strong connection to Inuit culture.

With Nunami, Mangoik connects his passion for preserving Inuktitut with his love for exploration and nature. Drawing on the forms found in the game of Sternhalma (also known as Chinese Checkers; see sidebar), which he watched his aunt play as a kid, Nunami has rules that run counter to popular tabletop games, such as Settlers of Catan, in which players compete to exploit resources and out-develop each other. Mangiok was also inspired by Inuit stories of humans turning into animals, stressing the importance of seeing the land and animals as equal in value to people. He set out to create a game that would encourage respect and admiration for the diversity of animals and people.

"Our culture and our traditions allowed us to stay healthy in this environment, without pollution or war," he notes of his Inuit roots.

"So, I thought it might be useful to share Inuit values with others, to teach and to learn."

To develop Nunami, Mangiok drew from his background as a graphic designer and computer programmer, as well as his propensity for learning new skills.

"I had no idea how to make a three-dimensional game, and I had to teach myself how to work with specific programs and materials," he says. "It's always a learning process."

The tactile elements of Nunami, from the game pieces to the hexagon-shaped board, are designed to encourage outdoor exploration, hearkening back to Mangiok's childhood in Ivujivik, when he was surrounded by nature. All of the game pieces are waterproof, made to last and hold up in the elements, and the game itself is easily portable. Mangiok's design includes drawings by his daughter, and his mother was involved in creating the structure of the game, making for a collaboration across three generations. His hope is that Nunami will encourage players to appreciate different cultures, as well as see the value of sharing knowledge to support one another.

"We need more games that promote critical thinking and that address the well-being of nature, of the land and of creatures," Mangiok says.

After a successful **Kickstarter campaign**, Nunami is currently available for purchase online and in stores, sitting on the shelves next to other tabletop games in Ivujivik, ready to be enjoyed. When he created Nunami, Mangiok wasn't sure if anyone would want to play it, but he's been happily

surprised by the overwhelming interest in a game that promotes cohabitation and connection. The game is just one part of Mangiok's ongoing mission to bring Inuit values and languages to a broader audience.

"I'm just happy when something I've made is in the world," he says. "I'm compelled to make things, and I'm happy if people respond to them or find them useful." **&**

Chinese Checkers: Names Matter

The German board game Sternhalma is based on an earlier British game called Hoppity, which was popular in the 19th century. When the star-shaped German version was brought to the United States in 1928, the Pressman Toy Corporation released it under the name Hop Ching Checkers and then Chinese Checkers, employing racist, Orientalist iconography in its branding. The term "Chinese Checkers" is still commonly used today—proving that representation in games can have a lasting impact on our language and culture.

TECHNOLOGY AND SOCIETY

DESIGN

Passa Mangiuk Thomassie Mangiok Pasa Mangiok

Access Denied

Seeking Better Broadband in Rural and Remote Communities

BY AHMAR KHAN

If you still think video games and streaming are all just for fun, you're missing the bigger picture. Canada's video game industry contributed $3.7 billion to the economy in 2017 and is a key driver of a changing economic and social culture. Following the emergence of COVID-19, the Entertainment Software Association of Canada found that Canadians increased their frequency of video gameplay as a way to stay connected and entertained during lockdown.

Yet, as the next generation of console gaming systems was rolling out to Canadians eager to experience the new age of online gaming, many people outside big cities were having issues with online connectivity. As of 2018, only about 41 per cent of rural households and 31 per cent of Indigenous reserves had access to high-speed internet. As COVID-19 forced many schools to shift to online learning, this disparity became even starker. And unless it is addressed, it could have a lasting negative impact on the ability of gamers in these communities to access a growing economic opportunity: the chance to play for a living.

Over the past decade, professional gaming has become a legitimate career path. On platforms like Twitch, Facebook and YouTube, players can use their skills to boost their follower and subscriber counts and grow businesses based on subscriptions, donations and influencer marketing. According to Twitch, the largest video-game streaming service in the world, approximately two million people are watching streams on the Twitch platform at any given time. Initially focused on video games, the platform has expanded to allow users to stream anything: live music performances, card-pack openings, painting tutorials, stand-up comedy and more. Tens of thousands of steamers are a part of the Twitch Partner program, which allows them to monetize their channels with ads, subscriptions and merchandise sales.

For most people living in large cities, getting online and tapping into the necessary bandwidth speeds is easy. Yet a significant part of what we call Canada remains profoundly underserved, stuck in a kind of broadband black hole. At present, the internet speeds needed to deliver high-quality video-game streaming are simply non-existent in the majority of rural Canada.

Consider the numbers. An active online gaming stream requires users to have access to upload speeds between 3 and 6 Mbps. Much of rural Canada has internet infrastructure that struggles to, or is incapable of, providing these speeds. According to data released by the Canadian Internet Registration Authority (CIRA), measurements taken between May 2019 and April 2020 show that upload speeds in rural Canada are, "on average, ten times slower than urban speeds." Moreover, during the COVID-19 pandemic, median speeds for rural users have continued to fall, while urban users have found themselves with new options for faster, more reliable connections.

"The data we released shows a massive gap between the speeds that rural and urban Canadians are receiving—a gap that feels even larger in light of widespread social distancing and working from home," says a statement from Dave Chiswell, Vice-President of Product for the CIRA. The group is urging the federal government to expedite the rollout of additional broadband funding for rural and underserved communities.

In November 2020, Prime Minister Justin Trudeau launched the $1.75 billion dollar Universal Broadband Fund, and announced that the government is on track to connect 98 per cent of Canadians to high-speed internet by 2026. As part of efforts to improve access to high-speed internet in rural areas, Innovation, Science and Economic Development Canada has given billionaire Elon Musk's SpaceX regulatory approval to begin operations of its Starlink Constellation satellite network in Canada. The company has already sent out beta invites to interested Canadians, as consumer enthusiasm around the product grows following successful results in rural areas of the United States.

Starlink's arrival in Canada could help some gamers living in areas with shoddy internet get online to showcase their talents in a booming industry. Until then, thousands of people across the country will be left isolated on the wrong side of the great digital divide. &

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COYOTE & CROW

™

History Retabled

Coyote & Crow is an RPG Like No Other

BY KIM WHEELER

Imagine a world where colonization never happened. Connor Alexander, a Cherokee game designer, did just that, when he invented Coyote & Crow—a tabletop role-playing game (RPG) that launched its **Kickstarter fundraising campaign** in March 2021. Demonstrating the significant appetite for Indigenous game content, the campaign hit its initial funding goal of $18,000 in 45 minutes. Within ten days, they had raised over half a million dollars, and counting.

This tabletop RPG is akin to Dungeons & Dragons: using a handbook, players create their own characters and take on their roles by describing what their character is doing. Alexander and his team of developers are preparing to launch a 300-page hardcover book that, according to him, introduces "a fully realized fictional world that takes place in this alternate history."

The story of Coyote & Crow begins with a meteor wiping out most of Europe about 700 years ago, setting it back to the Dark Ages. Thus, Europeans never came to North America and the Indigenous population thrived and evolved.

Alexander had been working on Coyote & Crow for a couple of years, doing his own research and personal development on the game, before he started hiring a team of Indigenous experts who could bring their perspectives to the task of world-building. Cherokee Chef Nico Albert contributed a whole section on food, while linguist Travis Roberts created a fictional trading language that is based on real Indigenous languages.

Coyote & Crow is set in North, South and Central America. "They're not really continents in the same [way we define them today] but in the game, players refer to North America as *Makasing*, Central America as *Azayang* and South America as *Abayang*," says Alexander.

"We're putting a lot of time and thought into creating a place that not only feels lived in—one of our goals was to create something that felt optimistic and hopeful but was not a utopia, and did not fall into a lot of noble savage tropes."

The game is aimed at both Indigenous and non-Indigenous players, which creates some unique challenges.

"We had to create snippets in the game where we say, 'Hey! If you're Native we're inviting you to skin your culture and heritage over this role in a way that adds flavour to the game. And if you're not Native, we ask that you don't do that and just stick to [the predefined game role],'" said Alexander.

Twelve fictional nations populate the game and those encompass several tribes. (It is an American-made game, so their use of the term 'tribes' would be known in Canada as First Nations).

"What does 700 years of innovation look like for [Indigenous] cultures who didn't have to worry about colonialism and all the ripple effects?" asks Alexander. It will be up to players to answer that.

As for what happened to the Europeans when the meteor hit them? Alexander's answer is: "I don't really care."

For Coyote & Crow, the future looks bright. Following the huge success of their Kickstarter campaign, Alexander hopes to have the game to their Kickstarter backers by the end of 2021 and in stores in time for Christmas. However, he acknowledges that classic comic book warning about what comes with great power.

"I'd love to say it feels joyful or that I'm ecstatic [about the Kickstarter results], but the truth is that with this kind of success, we have a lot more responsibility now," he says. "We're good with that. It just means that it's even more vital that we provide a quality game that speaks to our Indigenous players and presents a positive view of Indigenous people to our non-Indigenous audiences. These kinds of opportunities don't come along often and we want to have the best impact we can.

"I hope other publishers take note that this kind of representation isn't throwing people a bone. It's what people want." **&**

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To learn more about Coyote & Crow, visit **coyoteandcrow.net**

We're Jammin'

Hosting the Nunavut Global Game Jam

BY JAMIE STEEL

In his classic song "Jamming," Bob Marley sings about pride and truth. They're big sentiments for a song about having fun—but they speak to the ways in which play can build confidence and help tell stories.

Each year, **Global Game Jam**, an organization founded in 2008, holds game jam events. Jam sites are created around the world and participants create games based on the theme announced at the beginning of the jam. Event sites have been hosted in more than 100 countries, and thousands of games have been created.

The Nunavut Global Game Jam was registered with Global Game Jam in early January 2021 as an official jam site. From January 29 to 31, our Iqaluit Makerspace had the privilege of playing host. Attended by six members of the community, three of whom were students from Inuksuk High School, the event encouraged game development as a way to approach problem solving, collaboration and expression.

"Through the jam, participants created art, composed music, developed stories and coded two games," says Alex Smithers, Manager of Computers for Success (CFS) Nunavut, one of Lichen's partner organizations. Smithers led the jam, virtually assisted by Logan MacDonald, an intern with CFS.

"The weekend was filled with fun and laughter as we discussed wacky game ideas and some suspect art," Smithers went on. "Spirits were high from Friday night to the deadline at 5 p.m. on Sunday. In the end, participants said they'd learned a lot about game development, and had discovered that it was an activity they could participate in and contribute to. Everybody seemed keen to try out new ideas and build upon the skills they learned in future jams."

The Games

Participants of the jam formed two teams, the Wildcatz and Team Kuusta-paw. Over the course of the event, each team created their own game using a variety of storytelling and digital skills.

The Wildcatz created a game titled _Snow Rescue_, in which you play as Charlie, who must battle anxiety while snowmobiling out on the tundra as part of a search-and-rescue team. The game was built in Scratch and consists of side-scrolling levels of increasing difficulty where you drive your snowmobile, collect items, dodge obstacles and even have to avoid villainous snowmen. The team created original art, composed an intricate story that is weaved into the action and even composed the original music that can be heard throughout.

Team Kuusta-paw created _Find Poster Nutbag_, an RPG-style adventure that takes place in Iqaluit. As a player, you wake up one morning to find that your dog, Poster Nutbag, has gone missing and you must traverse town to find him. Along the way you'll visit iconic Iqaluit landmarks such as QuickStop, the Road to Nowhere and the Inuksuk High School, and meet some townsfolk. The game was created using Unity and also features original art art and music.

Both games are available to play through **Pinnguaq's Itch.io page**.

▲ Participants gather real-world audio to add to their game

Participants' Point of View

For the participants, the game jam was an opportunity to learn new skills, meet new people and engage in an activity they may not have otherwise had the chance to explore. Some of them even noted that the event helped them learn about themselves.

"I had a lot of fun participating in the Global Game Jam," said Cole Tucker, a high school student. "I learned that I was good at pixel art. I had always thought [I might be] but now I know that I'm good at making music. I learned that making games is a lot of fun and hope to do it again in the future." Tucker also said he told many of his friends at school about the event and they were excited to participate in the next jam.

For others, the weekend shone new light on the tasks themselves.

"It was cool, I learned a lot from it, like that programming isn't always just scripting," says Adam Guimond-Pishuktie.

Courtney, another student participant, spoke of how the time constraints of the
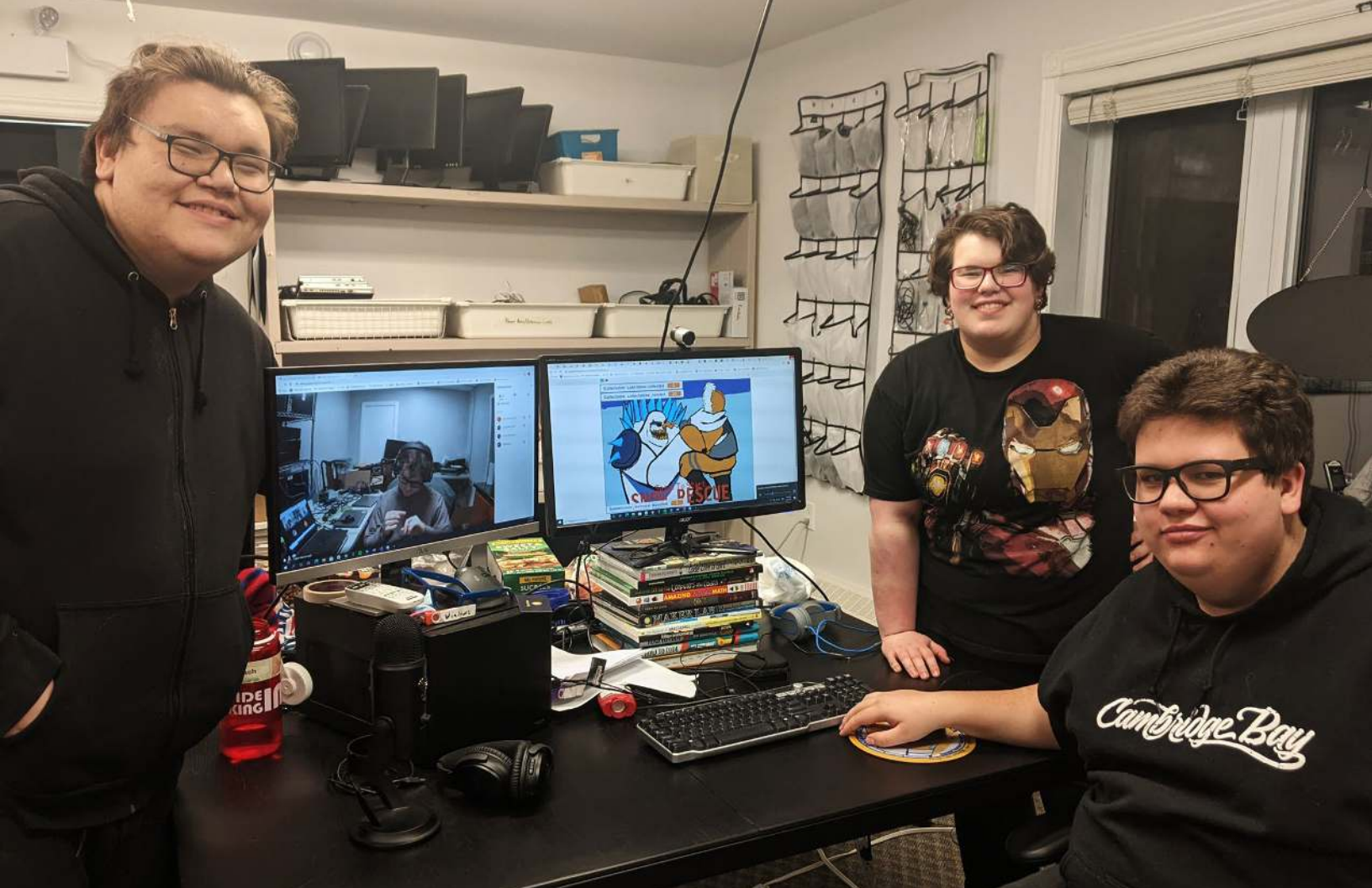
event allowed her to sidestep the pressures of perfectionism. As such, she was able to have fun and experiment in ways she otherwise might not have.

An Educator's Perspective

"I had a lot of fun! I loved having the opportunity to create a game set in Iqaluit and tell local stories. I liked meeting new people in the community that I wouldn't have otherwise and that we were brought together by a shared storytelling project," says Lael Kronick, a teacher at Inuksuk High School.

"I was able to learn about photo editing, digital art and animation in the context of a game. I hadn't realized how many different roles are involved in making a game and how anybody can contribute, even if they don't have technical skills."

Kronick says she was particularly inspired by the talent of the high school students who participated and looks forward to seeing what they create next.

"As a teacher it was wonderful to see these youth in a different context and see their creativity and skills shine through a medium that they don't always have an opportunity to explore at the school. I was impressed by the amount of work they put in, their independence and their excitement to learn new things. I hope they can find more opportunities to continue learning game development and showcase talent and creativity."

Next Level

Smithers says the Nunavut Game Jam proved to him there are numerous stories to tell in the Iqaluit community but that, due to the constraints of the event, both teams were only able to touch on the complex stories they prepared for their games. He looks forward to hosting another jam in the future and says based on the response from participants and the community at large, it seems like the momentum behind these events will only continue to grow.

"Everyone mentioned how it was a lot of fun and the event was well received by the community," says Smithers, noting high engagement in the town's Facebook group.

"I think people liked seeing the accomplishments of local talent and their commu-

nity as well as their environment being represented in the game format."

As for the greatest takeaway from the jam, Smithers says it was the personal development of those involved.

"Perhaps the most significant outcome of the event was that participants emphasized how participating demonstrated to them that they have skills that may not have been realized otherwise. They feel more confident in their digital skills and learned that game development is a pursuit that is available to them," says Smithers.

"Cole, Courtney and JJ [the third high school student who took part] are all talented digital artists and participation in the game jam helped display their work." &

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A Holographic Future

Exploring the Capabilities of the Looking Glass Holographic Display

BY MICHAEL CARTER-ARLT

ME: *"Hey SIRI. What do you look like?"*
When I was completing my master's degree, I pondered this question a lot. If SIRI or any artificial intelligence had a face, what would it look like?

SIRI: "I imagine I probably look like colourful sound waves."

I believe that the future of artificial intelligence (AI) will have a face—or, more accurately, many faces. But, rather than a device or the company that makes it determining what an AI looks like (inevitably giving us 3D variations on an old Winamp visualizer), appearances will be determined and customized by individual users—and will be every bit as varied as the live human beings interacting with them.

In 2018, I demonstrated this idea in front of a class by creating the illusion of myself as an AI hologram. The set-up was simple—just a hacked CD jewel case and a cellphone video of my face, shot in a dark room with blue light—but the effect was convincing enough to capture the attention of my entire class, almost as if nothing else mattered but me and what I was presenting—as though I were the Wizard of Oz.

This experience made me realize just how useful holograms (or the illusion of them) could be in helping increase engagement and combat distractions in a classroom.

As is often the case, my curiosity eventually led me through the Looking Glass.

When we use the word *hologram*, we often associate it with movies like *Minority Report* or *Star Wars*, in which characters interact with free-standing, three-dimensional images made of projected light that are visible to the naked eye. But we still don't really know if these kinds of holograms will ever become a reality. Since as long ago as the mid-1800s, people have been experimenting with numerous interpretations of so-called holograms. However, the examples we see in science fiction are technically not holograms—rather, they are 3D free-space volumetric images, which involve much more complicated technology than the would-be holograms that many people are familiar with from theme parks or music festivals.

The vast majority of these familiar "holographic" images are created using the Pepper's Ghost illusion—the same trick I used to wow my class. John Henry Pepper's technique, which he first achieved in 1862, simulates the effect of a hologram but is actually more like a clever parlour trick. Used in everything from Disney theme parks to news teleprompters, the illusion is usually created using a piece of glass that is angled to reflect an image displayed on a screen, so that a ghostlike reflection of the image appears on the glass. A simple version of this illusion can be created using a **smartphone and a CD case**, much like the one I used for my class demonstration. However, the same illusion can also be executed on a much grander scale. Notable examples from recent years include the hologram of the late Tupac Shakur, which performed with Dr. Dre and Snoop Dogg at the Coachella Music Festival in 2012, and Hatsune Miku, a software-generated pop star who is big in Japan and was scheduled to play the same festival in 2020.

These uses of Pepper's Ghost are convincing, but in order to achieve what we see in the movies, there would need to be some

‹ **Pepper's Ghost illusion.**
Photo courtesy of Michael Carter-Arlt

way of manipulating beams of light to simulate actual objects. Currently, no such technology exists. There is, however, an alternative to sci-fi holograms, which utilizes technology that goes far beyond mere smoke and mirrors.

What is the Looking Glass?

In 2018, the Looking Glass Factory launched the world's first desktop holographic display development kit, known as the Looking Glass. Featuring a cubical glass display capable of rendering 3D objects that appear almost lifelike, it is the closest thing to those sci-fi holograms that is currently available.

Put simply, the Looking Glass allows 3D creators to import their images and project them onto a block of clear acrylic, giving the appearance of a display in a glass box.

The Looking Glass is powered by proprietary volumetric light field technology, which projects up to 100 perspectives of a single 3D image onto the acrylic using a lenticular lens—an array of lenses designed to magnify different images when viewed from different angles. (Think of the cards or stickers made of ridged plastic that used to come in cereal boxes, with images that "moved" when you tilted them back and forth.)

What this means is that, as the viewer moves around the Looking Glass, the perspective of the projected 3D environment in the display moves with them, offering different views of the 3D object and making it appear like a form in space, rather than a projection on a screen.

One of the key advantages of the Looking Glass compared to other forms of immersive technology, such as AR or VR, is that it doesn't require headgear to view true 3D content. It can be used to view still images in 3D, 3D animations, and stereoscopic images, and it has support for Light Detection and Ranging (LiDAR), which uses lasers to scan objects and take digital measurements that can then be converted into images. In addition, the Looking Glass can integrate with popular game engines Unity and the Unreal Engine, allowing a wide community of 3D animators and game designers to create lenticular holographic content.

The Looking Glass Factory recently announced a new product called the Looking Glass Portrait, an even more accessible device that will allow anyone from casual photographers to advanced 3D modellers to render their content as lenticular holograms. In conjunction with the late 2020 release of the new iPhone 12 Pro, which has LiDAR functionality in its camera, this has the potential to prompt a bump in content creation for the Looking Glass—which, in turn, will help reduce the cost for educational institutions to use holographic displays, and could spawn a new generation of 3D hologram creators.

From Tim Burton's *Lost Vegas* exhibition.
Photo courtesy of the Looking Glass Factory

What is possible with the Looking Glass?

Since the first version of the Looking Glass was released in 2018, various industries have found their own ways to use the capabilities of holographic display. Schrödinger, a drug discovery and materials research company, incorporates the Looking Glass into its software workflow to enable teams of chemists to view complex 3D structures together, thus accelerating the discovery of medicines and materials. It has also been used in the medical field for cross-sectional imaging, and in engineering for visualizing 3D models of engines and other machines.

Photo courtesy of the Looking Glass Factory

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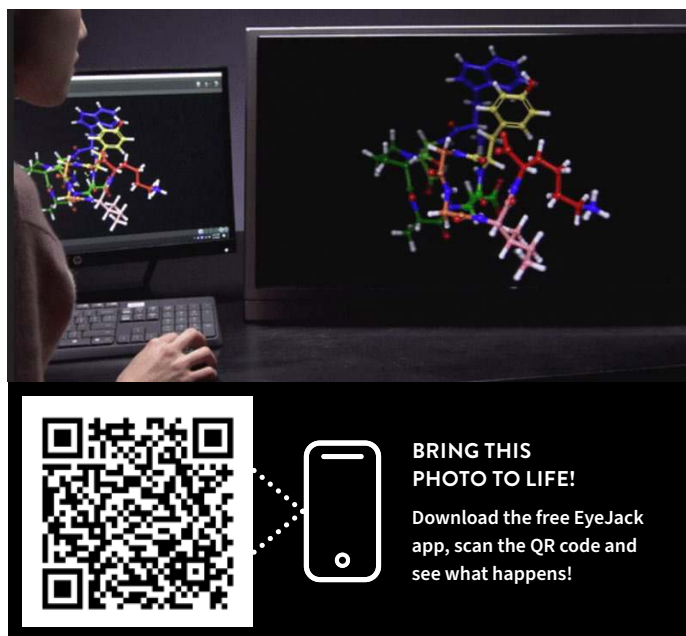
In October of 2019, filmmaker Tim Burton utilized the Looking Glass for his *Lost Vegas* exhibit at the Neon Museum in Las Vegas.

BRING THIS PHOTO TO LIFE!

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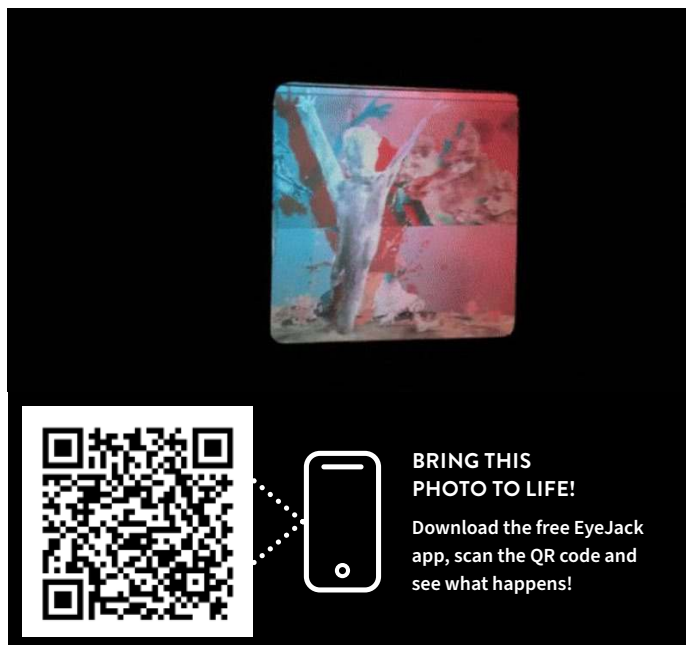
Several displays were used to create a new form of exhibition, adding a layer of depth to never-before-seen, original artworks by Burton himself. As was the case with Schrödinger, the Looking Glass proved to be an effective tool for viewing 3D content not only for its immersive properties, but also due to its accessibility. For *Lost Vegas,* it provided a technological purpose as well as a functional one, eliminating the need to wear headgear or equipment.

Developing for the Looking Glass

I first experimented with Looking Glass Factory tools in 2017, before the development of the current Looking Glass, when the company's flagship device was called the Holoplayer One. Today, it would be hard to find a Holoplayer One; most people other than Looking Glass Factory insiders won't even know it existed. Ever since the creation of the Looking Glass in 2018, I have been using it for purposes related to research and education—particularly around how holographic displays can be incorporated into classrooms.

The project I worked most recently on that involves the Looking Glass was for the *Remastered* exhibition at the Aga Khan Museum in Toronto. The exhibit focuses on digitally re-imaging paintings by early Islamic masters, and utilizes the Looking Glass in a way very similar to that used for Burton's *Lost Vegas* exhibit. Instead of creating 3D lenticular artworks from illustrations, however, the museum's collection of oil paintings were used as a reference for digital

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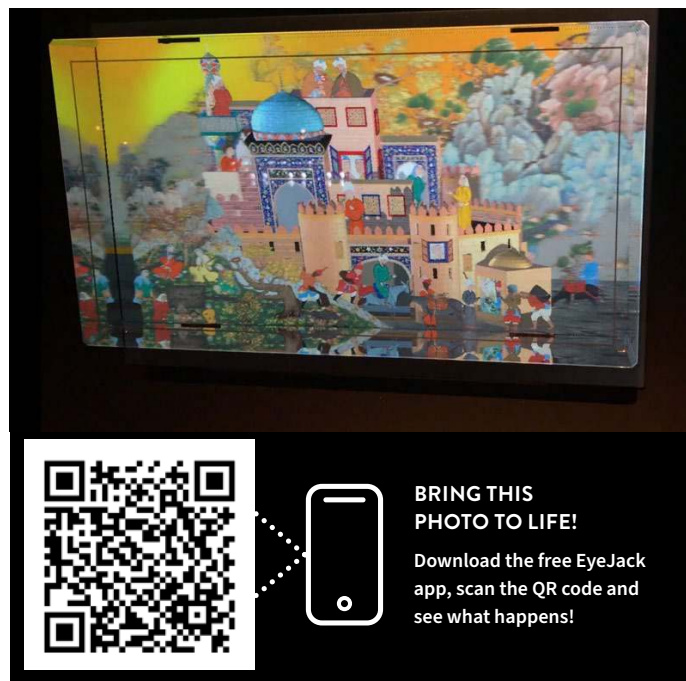
▲ Photos from the *Remastered* exhibition at the Aga Khan Museum in Toronto

3D scenes. This was accomplished using a combination of software tools, including Adobe Photoshop for graphic design, Blender for 3D modelling, and Unity for texturing, lighting and 3D animation.

The 3D renderings for each of the artworks not only provides a modern take on classic artworks, but also provides additional educational and pedagogical context. Islamic artworks from many early manuscripts eschew the use of linear perspective, and their planar style presents challenges for the accurate rendering of architectural elements in space. Adapting the images for the Looking Glass allows the viewer to experience a sense of depth and volume that helps us understand the complexity of the structures depicted.

In the era of COVID-19, contactless interactions with digital media are more a necessity than a trend. This means technologies that require the user to wear or handle equipment could be hit hard in terms of educational adoption. VR headsets, for example, will likely have far less appeal than they once did, given that they come into physical contact with the face of the wearer, and are commonly shared among a number of people in a social setting. In the *Remastered* exhibit, the Looking Glass provides a way of interacting with a 3D scene without the need to wear or touch any additional equipment. This was already a consideration when developing the exhibit, since it also meant being able to offer an interaction with 3D content that did not need any prior explanation—a key consideration for accessibility with older audiences. It will no doubt become much more of a priority for many institutions after the COVID-19 pandemic.

Further Reading

The Looking Glass Factory provides an abundance of resources for learning more about its technology, and also how to develop content for it. In order to develop for the Looking Glass, it's best to start with Unity or Unreal for creating 3D designs. Blender is also useful for 3D modelling. Although each program has its own level of complexity, each is user-friendly in its own way, and can be picked up easily once you learn the basics. (See Pinnguaq's online resources on Blender at **pinnguaq.com/learn/blender-print-a-piece**.) On top of this, each program is free to use for hobbyists, making Looking Glass development more accessible to a much wider audience. ❧

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▦ **CODING AND PROGRAMMING**

▦ **COMPUTING AND NETWORKS**

▦ **TECHNOLOGY AND SOCIETY**

▦ **DESIGN**

For more information on the Looking Glass, visit **lookingglassfactory.com**

Using Open Broadcaster Software to Deliver Better Lessons

BY BRANDON BUNNIE

Virtual teaching comes with many challenges. As is clear to anyone who has watched teachers and young kids try to adapt to school closures during the COVID-19 pandemic, it's not easy to hold the attention of a group through the small window of a flat screen. Luckily, there are novel ways to make the experience more engaging and interactive. With virtual learning becoming increasingly common, new tools and technologies are helping improve the process for both instructors and learners.

Open Broadcaster Software, or **OBS Studio**, is a free, **open-source platform** for **video recording and live-streaming.** It's available for Windows, macOS and Linux, and can be downloaded at **obsproject.com**. It has a wide variety of applications, and is useful for anyone looking for a way to make online teaching a more intimate, dynamic experience for learners. Using OBS, you can customize your desktop by adding media elements that can take virtual lessons beyond the standard lecture mode, to enable something more interactive, stimulating and interesting.

To set up OBS for virtual teaching (this tutorial is for Windows; the process differs for Linux and macOS), you'll need to download two programs—OBS and the **OBS-VirtualCam** plugin, which is available at **obsproject.com/forum/resources/obs-virtualcam.539**.

First, download and install OBS. Once installed, it will run a wizard that will configure your streaming settings based on the machine you're using and the quality of your internet connection. When the setup wizard is complete, close the program.

Next, go to the VirtualCam plugin page. On the right side of the page, you'll find a rectangular button labeled Go to Download. Clicking on this will download an .exe file. Complete the download by running the .exe. Now OBS is all set up to allow you to present almost anything via your video window.

In OBS, start by building your scene. Three windows will be your main focus: **Scenes, Sources** and **Canvas.**

The **Canvas** is the window that displays what you're sharing with your audience. It will be the largest and central window of the application. Use the red handles to resize images or move them around to ideal positions.

The **Scenes** windows are similar to pages on a website—much as any webpage can have a different setup and information displayed on it, the same is true for scenes.

Sources is where you will find and link to the content you want to display. To add elements, use the plus-sign button at the bottom or right-click in the window.
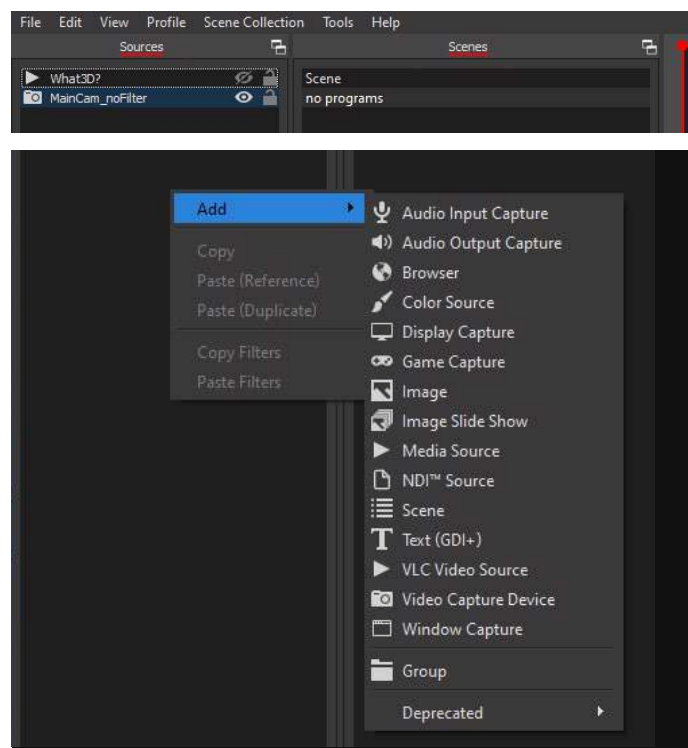
Select a **Video Capture Device** element and link to your webcam. Select a name for the element (for example, "Me"). After that, another window will appear (shown in the top right image), asking you to choose which device you wish to use. Select your camera.

Now, to get the OBS image into your camera, go to **Tools** on the top toolbar and select **VirtualCam** from the drop-down menu (shown in the bottom right image).

A dialogue box will pop up—press **Start** and then go to your online meeting application (Zoom, Meet, etc.). Here, you'll need to configure the video to use the OBS Camera instead of your regular camera.

Add further elements to a scene by selecting them in the drop-down menu and pointing to where the content is housed—a website, video, images, etc. Ordering your sources determines how they will be layered or stacked on the page; the source at the top of the list will be the top layer, and so on.

Using this method produces a virtual classroom that brings remote learning one step back toward the interactivity of a physical classroom. The instructor can remain onscreen in the meeting app alongside the content, and some applications allow users to minimize and pin the video feed from their own camera, so they can still see video streams of what all the students are doing. Instead of relying on static slides, educators can introduce motion graphics.

All in all, using this OBS setup might not solve all of the challenges of virtual teaching—but it can make it a lot more fun. **&**
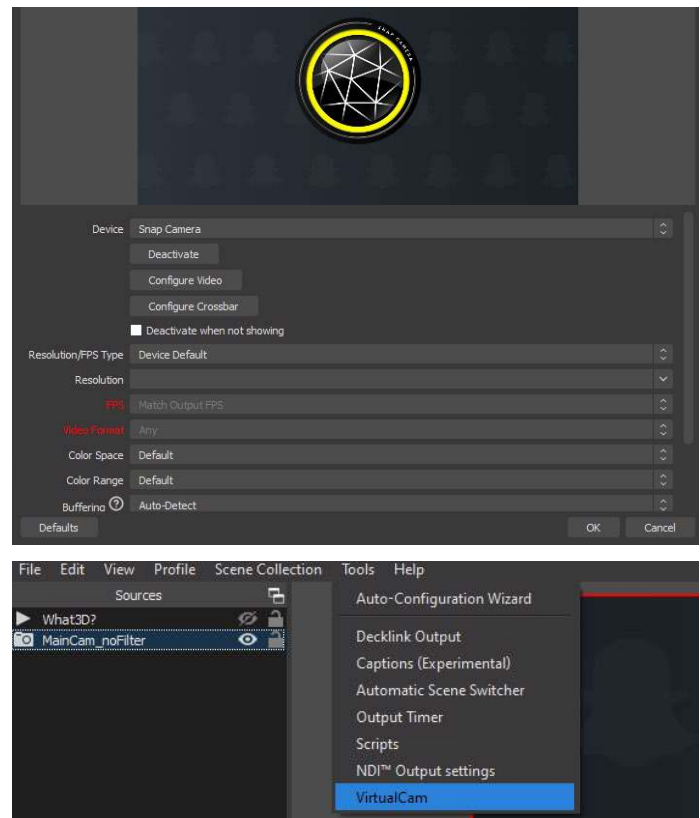
COMPUTING AND NETWORKS

TECHNOLOGY AND SOCIETY   DESIGN

A setup with three layers: window capture for my program (1), camera capture of me (2), browser capture for the wheel spinner (plus chroma filter to add transparency) (3)

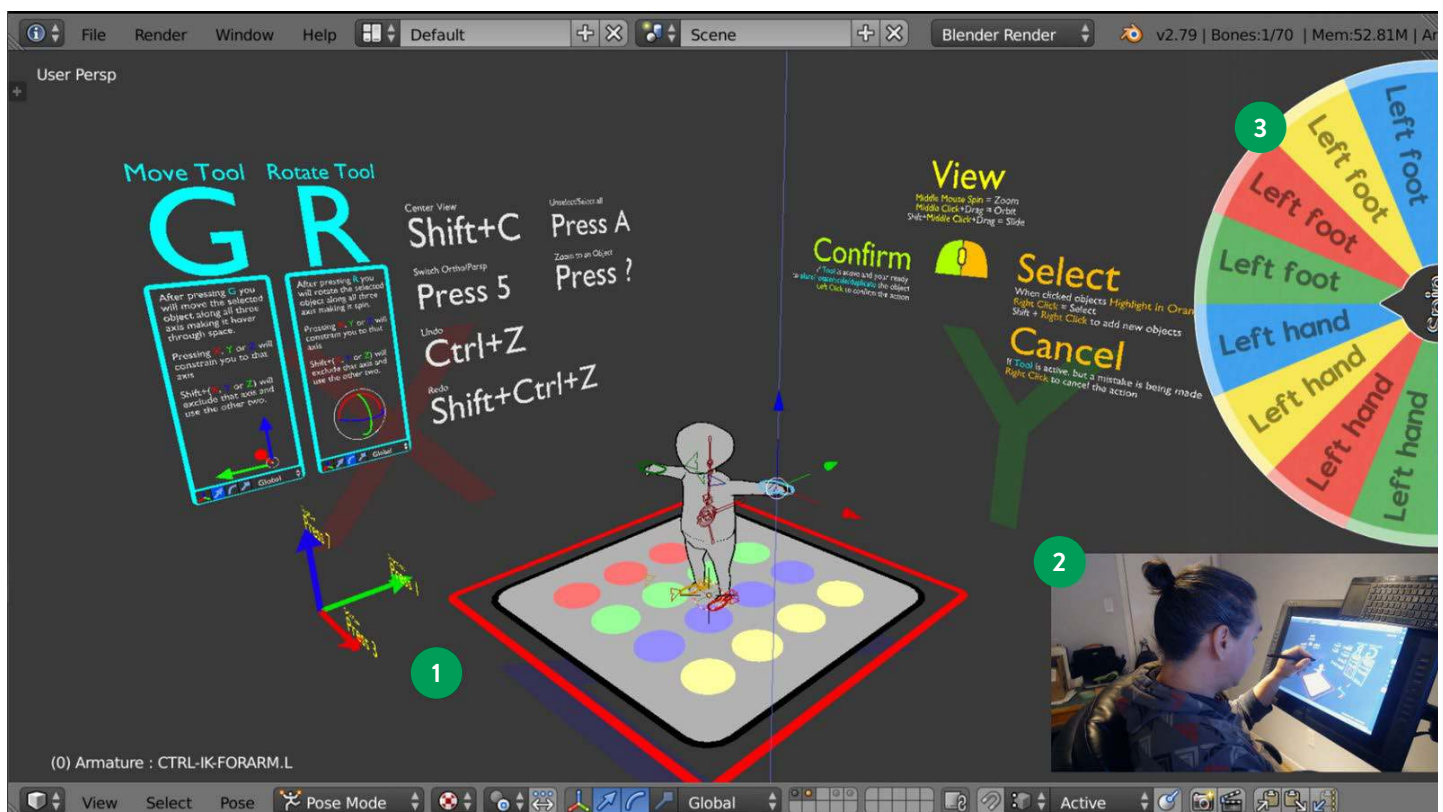❯ Student Sophie Lecour (middle) and what she invented in the space (bottom)

Algonquin College Joins the Maker Movement

BY SHARON ASCHAIEK

📍 **Algonquin College DARE Dictrict MakerSpace, Ottawa, Ontario**

Course assignment: Design and build a model of a kiosk destined to operate in the ByWard Market, Ottawa's shopping, dining and arts hub.

Process: With the guidance of a technician, students fabricate models in their school's maker environment using computer-aided drafting software, a 3D printer and a laser cutter.

Result: An acrylic model of a mini-library and cozy reading space—and student's ideas and creativity brought to life through a hands-on DIY project.

"It was neat, because I'd never done anything like that before—it made me feel smart to pull off something like that," says Sophie Lecours, a third-year student in the Architectural Technology diploma program at Algonquin College who completed the assignment for a first-year visual communication course. "I remember sitting in front of the 3D printer as it was working and thinking, this is so cool."

The MakerSpace at the college's Ottawa campus is a place where students, faculty members, researchers and the community at large can explore, tinker and invent. Through innovation, creativity and collaboration, makers engage in activities that build and reinforce competencies in science, technology, math and engineering.

The showstoppers in this 90 square-metre workshop are its diverse range of entry-level maker tools and technologies: not only those Lecours used, but also virtual reality headsets, a vinyl cutter, Lego Mindstorms (programmable robots), kits for building electronic circuits, and software for 3D design, building websites and apps, and developing animated films, among other options. But equally vital are the two skilled technicians who help users conceptualize and craft their creations.

"Exploring new ideas and learning new skills is how innovation happens," says Matthew Jerabek, Associate Manager of Marketing and Communications for Algonquin College's Office of Applied Research, Innovation & Entrepreneurship. "People get excited about what they can achieve—that is where the magic happens."

That magic has manifested itself in many projects produced by students from a variety of academic disciplines, including graphic design, information technology, media arts and civil engineering technology. One such project involved a group of students conducting pioneering research into polylactic acid, a biodegradable, corn-based plastic. Others have been more playful—3D-printed objects such as a robot pencil holder named Pangolin and an elaborate mask from the movie *Black Panther*.

To date, much of this creative work has evolved as users in the space share ideas, techniques, challenges and solutions—what Jerabek terms "creative collisions." During the COVID-19 pandemic, safety measures prevent in-person access to the space, but the technicians provide design and production support through remote, virtual consultations. The team is also continuing to offer workshops—all online—on topics such as 3D design basics, the electronic prototyping platform Arduino, and Twitch, a live-streaming video service for gamers.

Algonquin launched its MakerSpace in 2018 as one element of its DARE (Discover, Applied Research and Entrepreneurship) District, a high-tech, multidisciplinary learning and innovation hub. Two years in the making, at a cost of almost $45 million, half of which came from the federal and provincial governments, the three-floor facility features a Multimedia Production Facility, an Energy Research Lab, a Data Analytics Centre and a Digital Literacy Lab.

The driving idea behind the MakerSpace—that making something with one's own hands fosters creativity, critical think-

ing and collaboration—is one that has been reshaping how schools deliver technical education over the last decade. Developments such as widely accessible internet, inexpensive digital tools and society's increased prioritization of STEM skills have propelled the rise of makerspaces in K-12 and post-secondary institutions. Also known as hackerspaces and FabLabs ("fab" standing for "fabrication"), makerspaces embrace a constructivist pedagogy, in which teachers engage students in experiential building projects ranging from the simple—for example, elementary students making a whack-a-mole game using cardboard, scissors and tape—to the sophisticated—such as using 3D printing technology to create prosthetic limbs.

Like many other school-based maker facilities, Algonquin's is open to local businesses and other organizations. In May, amid concerns about shortages of personal protective equipment during the first wave of the pandemic, it participated in a community drive to produce face shields that involved the Children's Hospital of Eastern Ontario, University of Ottawa medical students, the grassroots health-care movement Hacking Health Ottawa, and the Thistledown Foundation, a private charity that focuses on tech solutions for decarbonization but pivoted to COVID support efforts when the global pandemic hit.

And then there is 14-year-old Aaryan Harshith, who recently made good use of the MakerSpace to realize a medical innovation: an AI-powered, non-invasive device that uses light waves to identify cancer cells. Over three months, the technicians at the MakerSpace helped Harshith design and develop a prototype, assisting with building electric circuits, 3D printing and solving technical issues. The resulting hand-held probe allows surgeons to determine whether cells are cancerous or healthy in real time so they can operate more effectively.

"If you want to invent something, there are a lot of barriers to entry. With its equipment and expertise, the MakerSpace removes a lot of those barriers," says Harshith, who is now working to bring his medical device to market. "Without that space, this would still be a theoretical rather than a real-life project, so it made a huge difference." **&**

▣ **TECHNOLOGY AND SOCIETY**

◉ **DESIGN**

To learn more about the space, visit
algonquincollege.com/makerspace

UP YOUR GAME

How Video Games Empower K-12 Learners

BY ALLISON POMENTA

The predominant way in which youth today interact with each other online is through video games. According to a study released by the Entertainment Software Association of Canada, 89 per cent of Canadians aged 6 to 17 played video games in 2020. The way they spend their time playing is healthier than you might think: the most popular genre in this age group across the country is puzzle and word games.

The move to remote learning during school closures has shone a spotlight on several significant problems in current educational systems. The situation has underscored the urgency of solving the digital divide that exists for schools and for students who do not have computers and internet access at home. Many teachers found they lacked the adequate educational technology skills and knowledge that allowed other educators to pivot quickly to online teaching.

Student motivation became a major problem in 2020. One contributing factor has been the sluggish integration of experiential learning into virtual classes—especially in middle and high school—given that most common e-learning tools used by school boards were designed with traditional lecture models in mind. Collaborative learning is at the heart of project-based education models, and this key component has been lacking in current online schooling. Now that teachers have got their bearings, some are trying to promote conversations among classmates and restore engagement with students.

To find out more about the importance of incorporating video games into K–12 learning, we asked six game designers, developers and educators for their thoughts on the role video games play in 21st-century education.

Interview material has been edited and condensed for clarity.

What Games Offer

When planning how to teach their curricular objectives, teachers typically try to find activities and media resources to introduce variety into their lessons and promote active participation by students. For the current generation, video games have become more popular than other forms of media, so it stands to reason that educators might be weighing the pros and cons of using video games in school.

LINDSEY TROPF

Founder and CEO of Immersed Games, a company that provides students with deep learning in science via its flagship platform Tyto Online, *a massively multi-player online game in which students complete quests and engage in sand-box-like learning applications.*

"Games can be used to essentially replicate authentic experiences, what you would call 'field work', [in a shorter amount of time]. For example, in *Tyto Online*, we have a councilwoman character announce they're about to have a food shortage and there's going to be a huge hunger problem. The students will have to help solve this problem by working with a botanist, learning about Punnett squares and selective breeding, while increasing crop yield. They're doing things like trying to balance ecosystems so that everything inside doesn't die. They run experiments on water and light levels in this lab that they're working in.

"These simulations have goals that require students to demonstrate their knowledge and build that understanding. They are collecting evidence, looking at the data and using it. They're creating flowcharts, they're analyzing probabilities. They're creating arguments from the evidence, within this context of trying to solve a really important question. For a teacher, that's an authentic product that's being created by the students.You can start seeing that learning come out, both from the work product your student shows, and from the conversations that you can then prompt in the classroom.

"We had students use *Tyto* for a day [to test its effectiveness]. We recorded them talking, and had a researcher do an analysis of the discussion, and only 3 per cent of the discussion was off-task. We looked at the amount of time students were spending coordinating, collaborating, and talking about science itself, making debates and hypotheses, was really incredible."

Q: What can video games offer teachers who are already having trouble balancing the demands of school boards, the expectations of parents, and the needs of students—especially for those who might not feel comfortable using video games as a learning tool?

CHRIS CROWELL

Professor of Game Design at Sheridan College, and a game designer with 20 years of experience as a creative director in both educational games and AAA commercial games.

"Games are a natural learning environment. The power of games is that they're all about usable life skills: agency, experimentation, planning and evaluating. All the 21st-century skills that we want our students to have as adults are part of learning how to be successful in games. All of life is interactive—it's not a linear, pre-authored flow of information like a video is.

"We accept the rationale that sports teach teamwork, planning, patience, good sportsmanship, an ability to understand [and analyze] failure. In video games, you're able to identify what the challenge is, think about the tools that you have available, predict different scenarios based on the different choices you have, choose one, craft your own solution, and then assess the results. The feedback loop in games will tell students where they went wrong: 'Was I wrong in my analysis of the initial situation? Did I have the wrong idea just by looking at this? Was my plan bad? Did I execute it poorly?' This is the cognitive cycle of gameplay. That's where the comprehension really happens.

"For students, it's a much deeper learning experience. In terms of learning outcomes, the student understands how and when to use these concepts, and is able to do something with them. That's the era we are in now: people need to be able to translate the information that is readily available into some sort of usable outcome."

ALAN GERSHENFELD

President and Co-founder of E-Line Media, developers of __Never Alone__ (Kisima Inηitchuηa). Based on traditional Iñupiat folklore, this game was created in partnership with Upper One Games, an enterprise created by the Cook Inlet Tribal Council. Previously, Gershenfeld was Chairman of Games for Change.

"There is a lot of good research about the pedagogical value of game-based learning. **Games need to be part of the learning ecosystem, and be effectively integrated into it.** In almost every school district everywhere in the world, you will find at least one teacher who is an advocate of game-based learning. There are amazing teachers all around the world that are using sandbox games effectively, often because they are gamers themselves, or because they see the engagement in the kids. And there are lots of communities online to share best practices."

CARA YARZAB

General Manager of Online Tutoring at Prodigy Education, a math game platform. An educational publishing and digital media professional with 20 years of experience, she has worked at companies like Nelson Education, McGraw-Hill Ryerson, D2L and TVOntario.

"Think about it in the same way that you would select other instructional materials for your courses. Start off with what it is that you're trying to achieve. It all starts

> **A still from *Never Alone*.**
> **Courtesy E-Line Media**

with your learning objectives and meeting your students where they are. There's lots of material available to help teachers out.

"For example, in Prodigy we introduced something called a Focus Mode, where you will cover more content in a session. If you don't use those features, the kids may wander around playing in the fantasy worlds, and not cover as much curricular content. But teachers often don't know that. It needs to be easy for a teacher to understand what is happening in the experience for the students, what they will be encountering—that's making onboarding and training easy for teachers. Many vendors are willing to help, and teachers just don't know that they can ask, or they don't have the contact with the vendor's customer service.

"I do think it's difficult for individual educators to figure out what works. It's really hard because there's a variety of products sold by a variety of vendors, with different standards and approaches. Some products are basically not much different than worksheets. In most products, they show you what the standards are. If you are an educator, you need to know what the curriculum coverage is, and if the product meets those requirements. Check what evidence from third parties the product has. There are purchasing consortia, or clearinghouses, that do some of this work and evaluate software. For example, there's the What Works Clearinghouse. There are [Ed Tech reviews] on the Common Sense Education site."

Game Creation as a Portal

In many schools, games may not be used to support core curricula, but game creation may be introduced in computer or technology classes. When students are given the opportunity to learn how to make games, they are introduced to skills like planning, systems thinking, storyline creation, design, programming and teamwork, among others.

Q: How important is it to introduce game creation activities for K–12 students?

JOHN ROMERO

COO of Romero Games. Descended from Yaqui, Cherokee and Mexican grandparents, he started out living a precarious childhood and ended up winning multiple video game industry awards and recognitions for his game designs. To date, Romero has co-founded eight successful game companies.

"**If learning a language is mandatory, I think learning a programming language should also be mandatory.** Games can be a gateway subject to getting kids excited about programming, and becoming fluent in that language. Kids love games, and the idea that they could actually help to create something like a game is super-engaging for them. It's a

really fun thing for them to feel like they just made something. I was 11 when I started teaching myself how to code. Kids can use any free computer and program it. Writing code and knowing what it's like to fix something, to add to something, to change values, and really understand [a program]. You don't really need a powerful computer either. There are some environments right now that are set up to be super interactive—you could be typing code and watching your game change on the screen as you're typing the code. If you have a good enough environment that makes it easy for iteration, to fix a mistake and see the result instantly, the immediacy in getting feedback is what keeps kids going. If it took a long time to get feedback, they would be less interested.

"Whether you live in a remote location or not, you don't need to move out of your hometown to make games, especially now. You have the internet, you can learn. You don't have to be in an urban centre to develop games. You can find people that are interested in the same thing. Our entire team of 30 people is making a game over the internet—they don't need to be together. **The end goal is to have a code-literate generation.** Whether they decide to go into a game development [career] or not is up to them, but the fact that they are comfortable with technology has a massive positive effect on them. Even if they do not end up making games as adults, or programming, just being familiar with technology allows them to come up with solutions that can help the whole town. They could think of a business to sell products made in their village, or provide a service that can bring in money to the village."

> Never Alone was developed in collaboration with the Cook Inlet Tribal Concil. Image courtesy E-Line Media

> **ALAN GERSHENFELD**

"We've been promoting game design by youth since we started E-Line Media. We did workshops all over the country with Gamestar Mechanic, a platform for learning to make videogames. What we found in every community we went to, whether urban or rural, is **that there are always kids who are just passionate about making games.** When kids have access to computers and to internet connections, there are incredibly talented kids who are very capable of making really fun games, and could certainly have career pathways into games or technology. Right now, we are working on another sandbox game-creation platform called the Endless Mission, in partnership with Endless Network,[1] to make it easy for youth to learn the Unity game engine, which allows them to make 3D games, and coding in the C# programming language."

> Developing Indigenous characters for Romero Games' *Empire of Sin*

CARLOS ROCHA

CEO of Dreams Uncorporated and SYCK Studios, developers of Cris Tales *(to be released in June 2021.) Rocha was previously CEO of Below the Game, a Colombia-based studio that designed literacy games for American companies.*

"**Making video games allowed me to build my future the way I wanted it to be.** I decided to study computer science after starting out in electronic engineering, because I loved the idea of creating a virtual space. Creating games that could be deemed 'educational' wasn't a conscious decision, it was a consequence of who I was. I like to wonder 'Why?' I like games that make you question your purpose in the world. I started designing serious games in Bucaramanga, and our company is still in this mid-sized [Colombian] city after a decade. Fortunately,

game development doesn't move around a main city, like New York. It doesn't matter where you're from, but you have to attend industry events. In 2012, while attending a game developer conference in the United States, I met Zach Barth [founder of Zach-tronics and Zachademics], who introduced me to a person from Amplify [an educational technology company]. They hired us to make a new version of the literacy game we had designed. That started my real career in game development."

Empowerment and Identity

In addition to their use as a pedagogical support and as a natural environment for practicing flexibility, initiative, and other 21st-century skills, video games can play a key role in the social and emotional development of youth.

Q: How can video games promote kids' confidence, self-expression, social relationships and feelings of empowerment?

> **CHRIS CROWELL**

"Our current students in K–12 have an expectation of agency and interactivity, of being able to do things with the world. They are exercising a huge amount of agency in the rest of their life. Then they come into a school structure, where not only they do not have agency, [but] the notion of agency is generally being stomped on. That's the opposite of the internet, it's the opposite of a multiplayer game experience, which is so much more energetic, creative and fault-tolerant. The world that we live in now, with constant change in every way, requires a growth mindset to be successful. In a lot of modern companies, you want people who can think on the fly, assess the situation and try something new, and who also understand how to collaborate. We're trying to co-operate for the success of the team, and be outcome-oriented."

> **LINDSEY TROPF**

"There's a ton of research on the social value of video games. We know that players who play online games are actually more likely

to vote and volunteer, and be more civically oriented, and end up having a better perspective about people from other cultures that are different from them. Our character design in Tyto is very diverse in terms of race, gender identity and body types. We also built in strategies that support English-language learners. When we did our in-depth study, we got qualitative feedback. There was one student who, according to the teacher, tended to struggle due to being a newcomer, and at the end of the day of testing **they said that the game just made them feel incredibly smart and expressed how powerful of an experience that was for them**. And that's one thing that games can bring to the table for students. Often when students are trying to explain what they know, they need language skills to write it out or verbalize it. In this case, being able to do different challenges and show what they know by using a simulation, and not having to be a good English writer or speaker, can be really powerful for people."

❯ CARLOS ROCHA

"I learned English through video games. As a teenager, I was very different from my classmates, who only liked soccer. I liked weirder things. I watched anime and read manga. What I wanted to do was to create art. **Games allow me to blend the scientist in me, my love for art, and my desire to express a message.** Throughout my university years, my art was my way to escape. I was inspired by Colombia's Magical Realism literature, by authors like Gabriel García Márquez. In our title currently in development, *Cris Tales*, there are elements of Colombian culture."

❯ ALAN GERSHENFELD

"We're currently working with the Mississippi Band of Choctaw Indians to make a game based on a sport called stickball, which is one of the oldest North American sports. As we develop that project out, we have a fifth-grade class and a high school class working very closely with our development team.

"When we created *Never Alone,* we didn't make a game about the Alaska Native community—we made a game with them. **Our team at the Cook Inlet Tribal Council was really committed to learning about video games and putting together a great team of Alaska Native writers, storytellers and community members**. When we talked with [representatives from the major commercial game marketplaces] they were saying: 'We would love to highlight authentic games, as long as they're good. A game [can] be differentiated by the fact that it's really bringing an authentic voice, look and set of stories and cultural elements. But it has to be at the level of the other independent games that we highlight.' At E-Line Media, we're now looking at genres and systems that might be able to work across different cultures so that we don't have to reinvent the game each time."
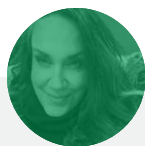
BRENDA ROMERO

CEO of Romero Games. She is a BAFTA-winning game director and designer who has worked on 50 games. She is also a Fulbright scholar, activist, author and artist.

"The most successful game designers that I know have come from backgrounds where there was often addiction in the home, certainly a lack of money, and housing sometimes at risk. One of the things that I realized is common with many kids who come from underprivileged backgrounds—which would include John and me—is tremendous resilience. I really do believe that there is something in that early struggle that ultimately leads to an understanding, and a creativity, and an ability to produce fun, too.

"Right now, the most popular form of media in the world is games. It's not books, it's not TV. Even if you add film, radio and other media together, it's still not as strong as games. So, kids of all cultures are experiencing largely an American view created by mostly American white men. **There's a cultural emergency to this.** What stories are being told? What percentage of games being played are [Indigenous-created] content? And that is the cultural emergency: to get Indigenous voices in there, to get people of colour, to get women in there. There's a lot of opportunity for people to tell stories. It's about continuing to come up with ideas, pushing your narrative, and getting more people excited about it. There's a lot of room for Indigenous creativity. A Canadian Indigenous legend or a historic character can be developed into a well-known intellectual property. Once it gets bigger, if it blows up, a big company will want to license the intellectual property and promote it. Then it can become huge."

• • •

The potential for using video games as a medium to convey cultural or personal identity is greater now due to their pervasiveness. People across the age spectrum are using video games as vehicles for self-representation, and cooperative or competitive play. As our experts have described, video games are also capable of engaging students in extended practice of a variety of competencies, simulating real-life contexts, and providing deeper dives into curricular subject matter. They can also be used as springboards for expanded discussions that lead to greater comprehension. Furthermore, involving young people in making games introduces them to digital technology and design, and their creations become a tangible product of 21st-century skills. Considering the hard and soft skills that can be supported through video games, incorporating this type of interactive media designed specifically for educational purposes has become a key learning resource in educators' toolkits. **&**

🧠 **DESIGN**

🏛 **TECHNOLOGY AND SOCIETY**

`</>` **CODING AND PROGRAMMING**

> "When we created *Never Alone*, we didn't make a game about the Alaska Native community— we made a game with them."

ALAN **GERSHENFELD**

"JUST LIKE US"
COLE PAULS

WE WERE IN WHITEHORSE, AT MY COUSIN'S HOUSE
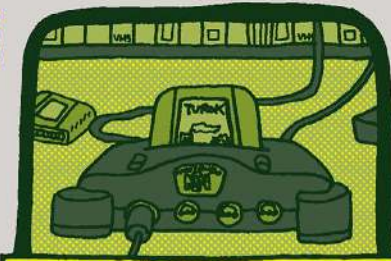
PLAYING TUROK: DINOSAUR HUNTER FOR NINTENDO 64

I DISTINCTLY REMEMBER MY BROTHER SAYING:

DON'T YOU KNOW?!

TUROK IS NATIVE, JUST LIKE US!!!

AND I REMEMBER THINKING IF HE LOOKS LIKE THIS... ←

AND WE LOOK LIKE THIS →

WHERE IS TUROK FROM? WHAT IS HIS NATION?

TUROK, ORIGINALLY A COMIC FROM DELL COMICS IN 1954, WAS ABOUT TWO NATIVE WARRIORS, TUROK AND ANDAR WHO ARE TRAPPED INSIDE A PREHISTORIC WORLD, DEFENDING THEMSELVES FROM DINOSAURS AND ANCIENT BEASTS. IT PASSED MANY PUBLISHERS BUT IN 1997, ACCLAIM COMICS TOOK OVER AND TUROK: DINOSAUR HUNTER FOR THE NINTENDO 64 WAS RELEASED.

TUROK: DINOSAUR HUNTER — 1997
TUROK 2: SEEDS OF EVIL — 1998
TUROK: RAGE WARS — 1999
TUROK 3: SHADOW OF OBLIVION — 2000
TUROK: EVOLUTION — 2003
TUROK — 2008
TUROK: ESCAPE FROM THE LOST VALLEY — 2019

THE SERIES WAS CRITICALLY ACCLAIMED AT THE TIME; IT WAS THE FIRST 3RD PARTY GAME FOR THE N64 & ONE OF THE FIRST THIRD PERSON SHOOTERS ON THE CONSOLE. TUROK HAD 3 GAMEBOY & 3 N64 SEQUELS YEAR AFTER YEAR FOLLOWING THE FIRST RELEASE. A FEW REBOOTS HAVE HAPPENED, WITH THE MOST RECENT BEING PILLOW PIG GAME'S 2019 "TUROK: ESCAPE FROM THE LOST VALLEY".

23 YEARS LATER, THIS IS STILL JUST A RACIST SHOOTER!

IN 2015, NIGHTDIVE STUDIOS REMASTERED TUROK 1 + 2 FOR THE PS4. A XBOX ONE RELEASE FOLLOWED IN 2018 AND IN 2019 IT WAS PORTED TO THE NINTENDO SWITCH.

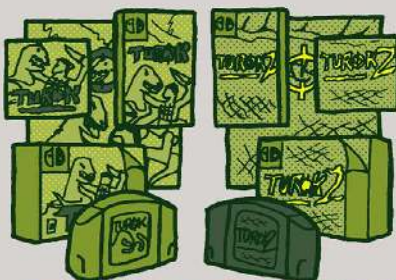LIMITED RUN GAMES, AN AMERICAN PHYSICAL VIDEO GAME PUBLISHER, RELEASED A PHYSICAL VERSION OF THESE REMASTERS FOR PS4 & SWITCH IN 2019. THEY EVEN MADE COLLECTORS EDITIONS WITH METAL N64 CARTRIDGES! THIS WAS THE VERSION I PLAYED FOR THIS REVIEW. KINDA BLOWS MY MIND THAT EVEN IN CURRENT TIMES, PUBLISHERS & DEVELOPERS CAN LOOK PAST TUROK'S PROBLEMATIC STORY AND FRANCHISE.

READING THE 1997 COMICS, YOU LEARN "TUROK" IS A TITLE, NOT ONE PERSON.

INCERT OF NORTHEAST CORNER

IN DINOSAUR HUNTER, YOU ARE TAL'SET - A NATIVE WARRIOR FROM THE "SAQUIN" NATION WHO MUST DEFEND THE "LOST LAND" FROM AN EVIL CYBORG NAMED "THE CAMPAIGNER".
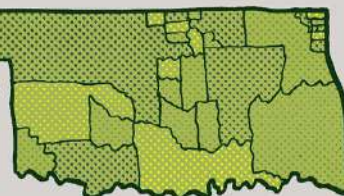
THE SAQUIN NATION IS A FICTIONAL TRIBE LOCATED IN OKLAHOMA, USA. THERE ARE 39 DIFFERENT TRIBAL NATIONS IN OKLAHOMA! IF THE DEVELOPERS WERE WISE ENOUGH, THEY WOULD HAVE COLLABORATED WITH AN EXISTING NATION TO MAKE THE CHARACTER CULTURALLY APPROPRIATE.

THE "LOST LAND" IS ALSO PROBLEMATIC BECAUSE TAL'SET IS SUPPOSED TO BE OKLAHOMA FIRST NATION, BUT HE'S TRAPPED SAVING AN UNDERGROUND JUNGLE FULL OF CULTURALLY APPROPRIATED AZTEC RUINS, WARRIORS, DINOSAURS, REPTILIANS & ALIENS. IT'S RACIST STEREOTYPES FIGHTING SCI-FI TROPES. DINOSAURS LIVED ON THIS EARTH BETWEEN THE TRIASSIC (250-200 MILLION YEARS AGO), JURASSIC (200-145 MILLION YEARS AGO) & THE CRETACEOUS PERIOD (145-65 MILLION YEARS AGO), WHILE EVIDENCE OF HOMO SAPIENS GO AS FAR AS 2.5 MILLION YEARS AGO. IT'S IMPOSSIBLE FOR THIS TO HAVE HAPPENED AND PLACES FIRST NATIONS WITHIN A FALSE HISTORY.

THE "NOBLE SAVAGE" HAS BEEN A TROPE IN POPCULTURE FOR GENERATIONS AND HAVING AN INDIGENOUS PERSON VIOLENTLY KILL DINOSAURS IS NO DIFFERENT.

THIS IS WHAT TRADITIONAL OKLAHOMA FIRST NATIONS WOULD WEAR →

KIOWA COMANCHE FIRST NATIONS, 1890 (NATIONAL COWBOY MUSEUM)

THANKFULLY, TODAY MORE INDIGENOUS VIDEO GAME DEVELOPERS ARE PROVIDING ACCURATE DEPICTIONS OF THEIR OWN CULTURE.

IN 2014, UPPER ONE GAMES (THE FIRST INDIGENOUS OWNED COMMERCIAL VIDEO GAME COMPANY) & E-LINE MEDIA CREATED THE FIRST ALASKAN INDIGENOUS VIDEO GAME.

NEVER ALONE
≪ KISIMA INNITCHUNA ≫

COMPLETELY DEVELOPED & SUPERVISED BY ALASKAN FIRST NATION ELDERS & CULTURAL PRESERVERS, NEVER ALONE IS A 2.5D PUZZLE PLATFORMER THAT TEACHES YOU THE CULTURE AND LEGENDS OF IÑUPIAT FIRST NATION. EVEN THE ART DIRECTION IS BASED OFF OF TRADITIONAL IÑUPIAT ART WORK.

ISHMAEL (ANGALUUK)

FRANNIE (KUUTUUQ)

BROWER (TIĠITQUURAQ)

OVER 40 IÑUPIAT COMMUNITY MEMBERS CONTRIBUTED TO NEVER ALONE! THE GAME'S NARRATOR SPEAKS IÑUPIAT, THE GAMEPLAY TEACHES YOU ABOUT TRADITIONAL IÑUPIAT LEGENDS & SACRED ANIMALS. THE GAME EVEN OFFERS IN-BETWEEN LEVEL VIDEO COMMENTARY WHERE COMMUNITY MEMBERS SPEAK ON THE CULTURAL SIGNIFICANCE OF EACH LEVEL. INDIGENOUS HISTORY & CULTURE HAS ALWAYS BEEN TAUGHT ORALLY & NEVER ALONE PUTS THAT INTO PRACTICE. NO NON-INDIGENOUS HISTORIAN IS SPEAKING FOR THE IÑUPIAT, THEY SPEAK FOR THEMSELVES.

MULAKA

ANOTHER INDIGENOUS GAME IS MULAKA (2018), BY LIENZO, A DEVELOPER BASED IN CHIHUAHUA, MEXICO. IT'S A 3D ACTION ADVENTURE GAME BASED OFF OF THE NORTHERN MEXICAN TRIBE, THE TARAHUMARA. YOU PLAY AS A TARAHUMARA SHAMAN THAT'S CULTURALLY & HISTORICALLY DEPICTED APPROPRIATELY.

THE SCORE, LANDSCAPE & ENEMIES ARE ALL TRUE TO MEXICAN CULTURE AND THE TARAHUMARA TRIBE. MULAKA IS A PRIME EXAMPLE OF TAKING STEREOTYPES AND TROPES & GIVING THEM AN AUTHENTIC INDIGENOUS PERSPECTIVE. EVERYTHING IN THIS GAME IS CULTURALLY APPROPRIATE TO ITS SOURCE MATERIAL. IF YOU WANT A VIDEO GAME THAT IS BASED OFF REAL CULTURE BUT DOESN'T FEEL LIKE A HISTORY LESSON, THIS IS A GREAT TITLE TO PLAY.

THUNDERBIRD STRIKE

BY ELIZABETH LAPENSÉE

RELEASED IN 2017, THUNDERBIRD STRIKE IS A 2D SIDE SCROLLING SHOOTER WHERE YOU ARE A THUNDERBIRD THAT PROTECTS TURTLE ISLAND FROM THE TAR SANDS TO THE GREAT LAKES, STRIKING HEAVY MACHINERY WITH LIGHTNING BOLTS. THE GAME IS COMPLETELY BASED OFF OF TRADITIONAL ANISHINAABE FIRST NATION ARTWORK!

IT WAS PRODUCED THROUGH GRANTS, RESIDENCIES AND MICHIGAN STATE UNIVERSITY. IT'S ALSO FREE TO DOWNLOAD ON IPAD, TABLET OR PC!!

TUROK ISN'T THE ONLY PROBLEMATIC INDIGENOUS VIDEO GAME CHARACTER:

T HAWK

MICHELLE CHANG

NIGHT WOLF

GALUDA

SUPER STREET FIGHTER II 1993

TEKKEN 1994

MORTAL KOMBAT 3 1995

POWER STONE 1999

BUT I WILL GLADLY TRADE THEM ALL IN FOR THIS NEW GENERATION OF CULTURALLY APPROPRIATE INDIGENOUS CHARACTERS! — COLE PAULS 2020

Sustainability
CUBED

New Brunswick Educator Taps Minecraft's STEAM Power

BY SHARON ASCHAIEK

In a place that is both near and far, there is a cluster of 17 quaint villages brimming with bright ideas and industrious, compassionate people. Many homes here are powered by wind, solar, geothermal and other sustainable sources. One has wildflowers planted to give the bees a chance; another, a farm run by robots. There is a government-subsidized shop selling affordable food and goods, and a hospital that never discriminates against the poor or marginalized. The dispossessed can rest their heads for a while in a community of mini-homes. The landscape may be blocky and the structures crudely built, but the people care about each other and the planet.

This place may seem far away, because human evolution can be slow and bumpy. But it is close at hand. It exists in the digital gaming universe, and it sits very close to the hearts of its inventors—youths of all ages from around the globe who have come together to plan, design and build a better world in the top-selling 3D world-building video game, *Minecraft*. It's called the SDG Shuffle Village, and it's the brainchild of a passionate STEAM educator from rural New Brunswick who, together with forward-thinking educators right across the world, empowered hundreds of students to devise science, technology, engineering, arts and math (STEAM) solutions to solve humanity's most pressing problems.

"*Minecraft* is basically its own culture at this point, and it's not just about mining for diamonds or killing zombies," says Benjamin Kelly, an award-winning teacher in the small New Brunswick village of Hillsborough, and a **Global Minecraft Mentor**. "We can enable our students to use it in more powerful ways for education—to raise awareness about problems and solve them in creative ways."

The SDG Shuffle Village is the outcome of Kelly's ambitious and admirable educational initiative: the **Sustainability Shuffle**. A multinational, multi-school lesson spanning five continents, the Shuffle involves teachers engaging their pupils, from kindergarteners to college-goers, to address the 17 **United Nations sustainable development goals** (SDGs). Adopted by all UN member states in 2015, the goals are a universal call to action as well as a blueprint for ending poverty, hunger, inequality, injustice and global warming by 2030. Kelly launched the initiative in 2017 in response to the **World's Largest Lesson**, a campaign the UN introduced the same year to inspire educators to include SDG learning in their practice.

Kelly's vision for the Shuffle was a cooperative global build, in which classes would create 17 villages representing each participating country and focusing on one specific SDG. As facilitator, Kelly started a single shared *Minecraft* world for everyone to work in, created resource materials for instructors, and organized a calendar where access was automatically "shuffled" from class to class every two weeks. One textured cube at a time, students from Canada to Israel to India to Ireland and 13 other countries built a quasi-utopian 3D world that fulfilled Kelly's vision of "STEMpathy": learning that engages the head and the heart.

"The Sustainability Shuffle came from me considering what would be a global topic that everyone would care about—the SDGs are a topic that unite us all. They're a natural fit for teaching both STEM and empathy, because you are solving practical problems for all of us, not just for yourself," says Kelly.

Kelly teaches at Caledonia Regional High School, which serves 247 students in Grades 6 through 12. Caledonia is the only high school in Hillsborough, a 13 square-kilometre village situated on the Petitcodiac River, the eastern gateway to the Bay of Fundy. For Hillsborough's approximately 1,300 residents, recreation often happens in nature—hunting, fishing and riding horses. The village is known for birthing a Father of Confederation—a museum pays tribute to William Henry Steeves—as well as for being the province's centre of gypsum mining in the 1900s.

Like other schools in rural or remote regions with relatively small populations, Caledonia wasn't flush with resources for computer hardware and software to allow for using *Minecraft* actively in teaching. But that didn't deter Kelly, a technophile—as an eight-year-old he got hooked by his family's Commodore 64—who innately understands the value of using digital tools and programs to make learning meaningful and fun. In 2015, he began noticing growing buzz about the game among his students as well as his then six-year-old son, and began experimenting with it. Soon after, he decided to organize a version of the TV reality game show *Survivor* that incorporated STEM competitions. In 2017, he led his students in creating a **Battle of Vimy Ridge tribute** to mark the centenary of Canada's celebrated but costly military victory in the First World War. "I don't teach *Minecraft*, or in *Minecraft*; I teach lessons, and let students show their understanding through *Minecraft*," he notes. Kelly came to fervently believe in the game's educational value, and decided to start raising funds to buy more iPads for his school. Over the last two years, has been able to raise about $200,000 through several educa-

tional grants from organizations such as the World Wildlife Fund and corporations like Staples and Best Buy.

"For rural schools, it's tremendously tough to bring in the solutions you need to take game-based learning to a new level," Kelly says. "It's not going to change from the top down, but by teachers fighting to get what they need."

Kelly is not alone in using *Minecraft* as an educational technology: in recent years, more and more educators worldwide have discovered the 11-year-old video game's pedagogical merits. It is now used in numerous K–12 schools worldwide to teach curricula in subjects such as math, science, social studies, languages, critical thinking, and even social and emotional development. Several studies attest to its strengths in **bolstering students' understanding and enjoyment of math concepts**; **promoting cognitive, affective and psychomotor functioning**; and **increasing students' motivation, collaboration skills and computer-science competencies**.

When Microsoft bought *Minecraft* in 2014 for US$2.5 billion and then introduced ***Minecraft: Education Edition*** in the fall of 2016, it became clear *Minecraft* was going to be— well, a game-changer for education. The game is available for free to schools with

a Microsoft 365 for Education licence, or else through yearly US$5 subscriptions per user or via a district-wide licensing model. While the rate of *Minecraft* use in education isn't being tracked, we have long known that when they are accessible, video games are hugely popular among youth as they are **played by up to 9 in 10 youngsters**, pointing to the potential of the format for learning. The COVID-19 pandemic, which has shifted much of our lives online, may only accelerate the game-based learning trend: in May of 2020, the number of general *Minecraft* users spiked by 25 per cent, reaching 126 million players per month and 200 million copies sold.

Kelly spread the word about his idea on Twitter, and after much retweeting, the enthusiastic responses quickly rolled in. From 2017 to 2019, teachers and students from 18 countries took part in the Sustainability Shuffle. To guide educators in exploring their chosen SDG with their students, Kelly developed a variety of **teaching resources**, including a lesson plan that outlines how to introduce the Shuffle and support students in completing their builds and a list of 11 thought-provoking questions that can be used to get students to consider the utility of their builds, how they co-operate with each other, and which SDGs they

care about most. Finally, digital cards with build challenges suggest projects to address SDG targets, such as "Build clean and renewable energy solutions for a rural village," "Make internet accessible in remote areas" and—apt for our times—"Design a classroom environment that prevents virus transmission." From there, it is up to each teacher to incorporate STEM concepts and activities into the learning process. Each build needs to include signs explaining the key issues they try to address and, ideally, pertinent facts and figures, and explanations of their prototype solutions. Upon completion, students upload their work to a shared Microsoft OneDrive, so that a class in another country can access and add to the file.

"The idea is that every class takes a turn contributing to the same build, and we hand over the file from one class to the other, almost like [a relay] around the world, and at the end, we have this sweet file with two years of building solutions," Kelly says.

The final result demonstrates the power of using digital gaming to engage young people in STEM learning, and the ways that inspires them to solve real-world problems. Nestled among the forests, mountains and lakes of SDG Shuffle Village are well-planned, progressive communities that demonstrate the creativity, cooperation

and compassion of young problem-solvers who are limited only by their imagination. Students in Portugal built a friction-powered neighbourhood in which passing cars generate power to light homes. The Australian village features a toilet contraption that allows for the safe use of human excrement to fertilize crops. Malaysian students focused on providing housing for stateless youth to reduce the inequality experienced by those without citizenship. To solve hunger, Kelly's students developed a climate-controlled biome with a space-saving vertical garden. In the Indian village, a financial literacy bus roams the streets to educate villagers about banking. Other innovations include a windmill-powered home, co-ed professional sports teams, shared economies, underwater farms, a "small-mart" with minimal product packaging, an electric hyperloop for transporting people and goods, and nets that capture garbage in the oceans without harming marine life.

Each of the villages consists of about four to five builds, each made by small groups of students. For instance, Grade 7 math students in France tracked their own water usage for a week, then displayed the results in a colour graph that complements the rainwater collection system in their build.

The Swedish village notes that it takes nearly 10,000 litres of water to make just one pair of jeans. A detailed explanation of how solar panels work accompanies the Malaysian Sun-powered homes. Kelly's students explored the physics of using a water wheel to pump river water for irrigating crops. Over in Ireland's village, we learn about why a wildflower garden helps the world's struggling bee population, and how feeding cows seaweed helps reduce their farts, which means fewer emissions of methane, a harmful greenhouse gas.

"*Minecraft* is an excellent teaching tool; because students are so engaged, you can sneak in math and science concepts, and they barely notice," Kelly says.

Kelly has bundled all of the components into a single **_Minecraft: Education Edition file_** that other educators can explore and contribute to with their students. Going forward, he will continue to develop and share new build challenges linked to specific SDG targets. It's possible to learn more about the project from Kelly's **retrospective blog post**, the enthusiastic tweets by participating educators (Kelly encourages them to share their work on Twitter using the hashtag #SDGshuffle; others that have arisen are #TeachSDGs and #sustainabilityshuffle) and from Kelly's participation

on a panel in **_MINECON Live 2019_**. Among those who have noticed Kelly's passionate commitment to STEM education is our country's leader—in both 2018 and 2019, Justin Trudeau awarded Kelly the Canadian Prime Minister's Award for Excellence in Teaching STEM. That distinction is among several Kelly has earned over the years for his extensive STEM education work, which this year contributed to Caledonia Regional High School's being recognized by the Future of Education Technology Conference as the top STEM Excellence High School in North America.

Says Kelly: "There is a fear of not knowing what one is doing as a teacher, but you don't have to be an expert at *Minecraft*—students are the experts, just give them a mission that challenges and excites them, and they will show you what they can do." **&**

- CODING AND PROGRAMMING
- COMPUTING AND NETWORKS
- TECHNOLOGY AND SOCIETY
- DESIGN

PINNGUAQ
MAKERSPACES

Community spaces for people to explore, make, create, think, play, share, learn, unlearn, hack and discuss

pinnguaq.com/makerspace

Digital Kit

PAST ISSUES

If you missed the Spring 2020 or Fall 2020 issues of *Root & STEM*, you can find them online at
pinnguaq.com/work/root-stem

RESOURCES

We have developed additional digital resources for educators to use in their classrooms—including lesson plans, video tutorials and handouts. They can all be accessed online via the links that follow.

Tutorial: Chase Game for Beginner Game Designers

This is a beginner level lesson introducing learners to game development in Scratch. They will design a simple "chase" game where a monkey chases bananas around the jungle to score points.
pinnguaq.com/learn/chase-game-for-beginner-game-designers

Tutorial: Colour Hunt Scratch Game

Learners create a simple Scratch game from start to finish. They learn how to create code to make clones, add a scoreboard and add a timer to their game.
pinnguaq.com/learn/learn-to-make-a-colour-hunt-scratch-game

Tutorial: Lost in Space Scratch Game

Using keyboard inputs, touch sensors, conditional statement and a variety of movement blocks, learners work in Scratch to design a simple game in which an alien must find its way through a maze to return to its home planet.
pinnguaq.com/learn/lost-in-space-maze-game

Lesson Plan: Introduction to Serious Gaming Grade Level 4–6

20-minute video (Didactic Component)
This video highlights the relationship between serious games and other video games, provides a brief overview of serious game design and development, and presents several examples of serious games.
youtu.be/852y1PQoe3w

Lesson Plan: Introduction to Serious Gaming Grade Level 7–8

33-minute video
This video presentation highlights the relationship between serious games and other video games, provides a brief overview of serious game design and development, and presents several examples of serious games.
youtu.be/wntp-iaZSVM

Lesson Plan: Introduction to Serious Gaming Grade Level 9–12 (Part 1)

27-minute video (Didactic Component 1)
Introduce serious games to students using this PowerPoint-based video. The video provides introductory information about serious games and highlights the relationship between serious games, video games and simulations.
youtu.be/DltfP4ZFGs8

Lesson Plan: Introduction to Serious Gaming Grade Level 9–12 (Part 2)

27-minute video (Didactic Component 2)
Following the completion of Activity 1 (in Module 4 on page 49), students should watch this PowerPoint-based video, which focuses on serious game design and will provide insight regarding the questions answered in Activity 1.
youtu.be/Dnt2d_BNrlU

On this page, you have a world ready to be explored, but no character to explore with.
Draw the kind of character you think might live in this world.
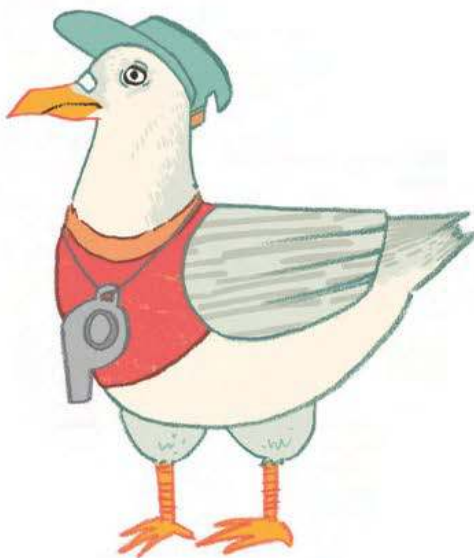
On this page, you have a character, but you are missing a world for it to have adventures in.
Draw the kind of world you think this character would like to explore.

Message to Educators

During lockdowns resulting from the coronavirus pandemic, educators have been tasked with finding new ways of engaging students in virtual environments. Strong engagement has long been associated with higher academic achievement, and video games can help provide that engagement in the virtual classroom.

The lesson plans that follow suggest opportunities for educators to explore video games whose primary purpose is educational. Students will use online games to explore online safety, provide critical analysis and consider how to design games of their own to address challenges they want to solve.

— **JENNIE CROSS**

Module 1

Grade Level: K–3
Subject: Game Design
Time Required: 65 minutes
Authors: Bill Kapralos

> **Topic:** A Brief Introduction to Serious Games and Their Design

Introduction

Serious games are games whose primary purpose is education and training as opposed to entertainment. They take advantage of the ability of computer games to attract and engage players/learners for a specific purpose, such as to develop new knowledge or skills. With respect to students, strong engagement has been associated with higher academic achievement. The use of serious games within a wide range of educational and training applications is becoming widespread, particularly given the current generation of learners who are growing up spending a large amount of time playing video games. Serious games are being used across a large number of educational and training settings, from teaching children basic math skills in primary school, to teaching surgical residents (trainees) about surgical techniques. For example, *Interland*, an online adventure game recently launched by Google, allows youth to learn about the fundamentals of internet safety and cybersecurity in a fun, engaging manner.

Learning Goals

Upon completion of this lesson, students will have:

- Developed an understanding of serious games and their purpose
- Developed an awareness of the importance of strong passwords and internet security
- Played one or more serious games

Vocabulary

- **Cybersecurity:** The technologies, processes and practices designed to protect networks, devices, programs and data from attack, damage or unauthorized access
- **Digital citizenship:** A person who responsibly participates in social and civic activities online to ensure prevention of cyberbully, online safety, and digital health & wellness
- **Game:** A formalized/structured form of play
- **Game-based learning:** The use of games to teach through repetition, failure, and the accomplishment of goals
- **Motivation:** Stimulating people to actions that accomplish goals
- **Play:** Doing something (an activity) only because it is fun and enjoyable
- **Video game:** An electronic game where players control images on a video screen
- **Serious game:** A video game whose primary purpose is education, training, advertising, or simulation as opposed to entertainment

Guiding Questions

1. Do you play video games? If yes: What is your favourite video game? What do you like most about your favourite video game? What do you like least about your favourite video game? How do you feel when you play your favourite video game?
2. What makes video games so much fun?
3. Do you learn anything by playing video games? Explain.
4. Can video games be used in school to help you learn? Explain.

Curriculum Links

As part of this lesson plan, students will be asked to play the freely available, online (web-based) *Interland* serious game. According to Games for Change, "*Interland* is an online serious game to teach kids about digital safety and citizenship in an interactive and fun manner. Kids will help their fellow Internauts combat badly behaved hackers, phishers, oversharers and bullies by practising the skills they need to be good digital citizens. In the game, players can explore four floating islands (sub-games): i) *Kind Kingdom* (encourages children to be kind to others and report cyberbullies), ii) *Reality River* (focus is on staying away from fake profiles and phishing), iii) *Mindful Mountain* (focus is on sharing information online only to people kids trust), and vi) *Tower of Treasure* (learning about building strong passwords). Each island features a different mini-game with a different internet

lesson. *Interland* is part of Google's Be Internet Awesome Program, which teaches kids and youth the fundamentals of digital citizenship and provides parents and educators with resources to help youth navigate the web and their online interactions." Links to several YouTube videos describing *Interland* in greater detail are provided below.

Brief overview of *Interland:*
www.youtube.com/watch?v=uC3rSyzQ0rk

Materials

- Pen or pencil and paper
- Computer (Mac or PC) with a web browser installed (Edge, Chrome or Firefox)
- Internet access

Interland is available at **beinternetawesome. withgoogle.com/en_us/interland**.

Activity 1

Time Required: 15 minutes

Students should answer the Pre-Activity questions individually and discuss their answers with the class.

Computer Activity

Time Required: 20 minutes

Playing *Interland*
Students play *Interland*—specifically, the *Tower of Treasure* sub-game—to learn about building strong passwords. Students can scroll to the *Tower of Treasure* or access it directly at **beinternetawesome.withgoogle.com/en_us/interland/landing/tower-of-treasure**.

Activity 2

Time Required: 30 minutes

Pose the questions listed below to students. Students should answer the questions individually or in small groups, and a group discussion should follow. Many of these questions are subjective and there are no correct or incorrect answers. The purpose of this activity is to promote discussion about *Interland* while increasing awareness of serious games.

Your Feelings About *Tower of Treasure*

1. How did you feel while playing *Tower of Treasure?*
2. Did you find *Tower of Treasure* fun?
3. Did you find *Tower of Treasure* frustrating? If so, what made you frustrated?
4. Will you play *Tower of Treasure* again?

Tower of Treasure and Learning

1. Was *Tower of Treasure* easy to use?
2. Do you think playing *Tower of Treasure* will help you become a better internet user?
3. What are the parts of a "super strong" password?
4. Will you do anything differently after playing *Tower of Treasure*?
5. Come up with three practice "super strong" passwords
6. List some examples of sensitive information that must be protected

Revisiting Pre-Activity Questions 3 and 4

Answer these questions from the Pre-Activity again and explain any differences between the answers you provide here and your answers to these questions before you played *Tower of Treasure*.

1. Do you learn anything by playing video games? Explain.
2. Can video games be used in school to help you learn? Explain.

Improving *Tower of Treasure*

Would you make any changes to improve *Tower of Treasure?* You can consider any part of the game, including:

- Graphics
- Sound
- Instructions

Note regarding the Improving *Tower of Treasure* questions: These are open questions without correct or incorrect answers. *Tower*

of Treasure (and the *Interland* suite of games in general), is well-designed and appropriate for children. The purpose of these questions is to promote discussion among students, who generally come up with good ideas with respect to improving video games.

Additional Resources

Websites

- Serious Game EduTech Wiki: **edutechwiki.unige.ch/en/Serious_game**
- Five Things that Make an Awesome Learning Game: **elearningindustry.com/awesome-learning-game-5-things-make**
- *Interland* serious game: **beinternetawesome.withgoogle.com/en_us/interland**
- Cybersimple.be—collaborative effort between Google and Test-Achats to promote a safer internet while making consumers aware of how they can best protect themselves against the risks they may encounter on the internet: **www.cybersimpel.be/en**

Books

- *Don't Bother Me Mom, I'm Learning* by Marc Prensky (ISBN-13: 978-1557788580)

Games & Apps

- Learn4Good Games for Kids: **www.learn4good.com/games/kids.htm**
- PBS 27 Best Educational Games for Kids Who Get Bored Easily: **www.prodigygame.com/blog/educational-games-for-kids**

Organizations and Companies that Produce Serious Games

- Serious Games Society: **seriousgamessociety.org**

- Top Serious Gaming Companies: **www.ventureradar.com/keyword/Serious%20Gaming**

YouTube Videos

- RBC Cyber Security—*Powerful Passwords:* **www.youtube.com/watch?v=IhlXtBNNuKs**
- BBC Horizons 2015 Documentary—*Are Video Games Really That Bad?* (45:40): **www.dailymotion.com/video/x38qzq8**
- *What Are Serious Games?* by Karl Kapp: **www.youtube.com/watch?v=JmG3fdptY_k**

Social Media Resources

- 12 Game Gurus to Follow for Inspiration on Games for Learning: **wearesponge.com/insights/2017/10/12-learning-game-gurus-to-follow**

About the Author

Bill Kapralos is an Associate Professor within the Game Development program at Ontario Tech University. He is also the Technical Lead of the Collaborative Human Immersive Interaction Laboratory (CHISIL) at Sunnybrook Health Sciences Centre. His current research interests include immersive technologies, serious gaming, multi-modal virtual environments/simulation/reality, and 3D (spatial) sound. He has led many medical-based virtual simulation/serious gaming projects over the past 15 years.

CODING AND PROGRAMMING

TECHNOLOGY AND SOCIETY

DESIGN

Module 2

Grade Level: 4–6
Subject: Game Design
Time Required: 85 minutes
Authors: Bill Kapralos

Topic: A Brief Introduction to Serious Games and Their Design

Introduction

Serious games are games whose primary purpose is education and training as opposed to entertainment. They take advantage of the ability of computer games to attract and engage players/learners for a specific purpose such as to develop new knowledge or skills. With respect to students, strong engagement has been associated with higher academic achievement. The use of serious games within a wide range of educational and training applications is becoming widespread, particularly given the current generation of learners who are growing up spending a large amount of time playing video games. Despite the growing popularity of serious games, however, designing them is a difficult task. It is an interdisciplinary process, requiring expertise in a variety of fields including game design and development, computer science/engineering, education (instructional design), and content expertise (e.g., medicine/surgery when considering the creation of a serious game for surgical education). Although serious game designers are not expected to be experts in instructional design and the specific area of game content, possessing some knowledge in these areas will, at the very least, promote effective communication between interdisciplinary team members.

Learning Goals

Upon completion of this lesson, students will have:

- Played and reviewed a serious game
- Developed an understanding of serious games and their purpose, their advantages and limitations, and their relationship to video games
- Become familiar with what is involved in developing a serious game

- Become aware of the many career opportunities in the serious gaming field

Vocabulary

- **Engagement:** Fully occupied in, giving your full attention, curiosity, interest, optimism, and passion to a task or activity
- **Fidelity (realism):** The degree to which the simulator replicates reality
- **Game-based learning:** Using games to teach through repetition, failure, and the accomplishment of goals
- **Motivation:** Stimulating people to actions that accomplish goals
- **Play:** Doing something (an activity) only because it is fun and enjoyable
- **Prototype:** An early iteration of a game, created with the intention of determining the feasibility of the gameplay concept
- **Video game:** An electronic game where players control images on a video screen
- **Serious game:** A video game whose primary purpose is education, training, advertising, or simulation as opposed to entertainment

Guiding Questions

1. Do you play video games? If yes: How many hours per week do you play? What is your favourite video game? What do you like most about your favourite video game? What do you like least about your favourite video game? How do you feel when you play your favourite video game?
2. What makes video games so much fun? Why can people play video games for so many hours?
3. Do you learn anything by playing video games? Explain.
4. Can video games be used in school to help you learn?

Curriculum Links

Serious game design is a subset of game design. Below is a game design resource available from Extra Credits.

Making Your First Game: Basics—How to Start Your Game Development:
www.youtube.com/watch?v=z06QR-tz1_o

Materials

- Pen or pencil and paper
- Computer (Mac or PC) with a web browser (Edge, Chrome or Firefox) and Adobe Flash installed
- Internet access

Activity 1

Time Required: 15 minutes

Students should answer the Pre-Activity questions with a partner, then discuss their answers with the class.

Didactic Component

Time Required: 20 minutes

Introduce serious games to students using the PowerPoint-based video available at **youtu.be/852y1PQoe3w**.

The video highlights the relationship between serious games and video games, provides a brief overview of serious game design and development, and presents several examples of serious games.

Computer Activity

Time Required: 25 minutes

Playing a Serious Game
Students play *Foodbot Factory*, a serious game recently developed by researchers at Ontario Tech University and Health Canada to educate youth about nutrition. Students play the web-based version and control the game using a mouse. No instructions are provided—players should be able to determine what they are to do easily. Upon starting the game, students will be prompted to begin (they must click "OK"), and will be taken to the "Level Selection" screen. It is recommended that students play all four levels (Drinks, Protein Foods, Veggies and Fruits, Grain Foods).

Foodbot Factory is available at **bodyzoneontariotechu.github.io/Foodbot-Factory**.

Activity 2

Time Required: 25 minutes

Pose the questions listed below to students. Students should answer the questions individually or in small groups, and a group discussion should follow. Many of these questions are subjective and there are no correct or incorrect answers. The purpose of the questions is to promote discussion about *Foodbot Factory* and have students think about it with respect to the video presentation from the Didactic Component.

Your Feelings about *Foodbot Factory*

1. How did you feel while playing *Foodbot Factory*?
2. Did you find *Foodbot Factory* fun?
3. Did you find *Foodbot Factory* frustrating? If so, what made you frustrated?
4. Will you play *Foodbot Factory* again?
5. Who are the target learners for *Foodbot Factory*?
6. What do you think of the characters in *Foodbot Factory*?

Foodbot Factory and Learning

1. Was *Foodbot Factory* easy to use?
2. Did you learn anything by playing *Foodbot Factory*?
3. Do you think playing *Foodbot Factory* will help you become healthier?

Improving *Foodbot Factory*

Imagine you have just been hired as a serious game designer and your first job is to improve *Foodbot Factory*.

1. Provide some comments and details regarding *Foodbot Factory*, taking into consideration:
   • Graphics
   • Sound
   • How you use *Foodbot Factory*
   • Instructions
2. What changes or additions would make *Foodbot Factory* easier to use?
3. What changes or additions would make *Foodbot Factory* a better teaching tool?

Note regarding the Improving *Foodbot Factory* questions: *Foodbot Factory* was developed by a large team of interdisciplinary experts, including game developers/computer scientists,

educators, and nutrition experts, and has gone through extensive testing. As a result, there may not be any major glaring problems with it. The purpose of the questions is to promote creativity and critical thinking in students. Some possible answers:

- **Graphics:** Students may comment on adding 3D graphics, changing colours, etc.
- **Sound:** Addition of voices to the characters instead of text (the smartphone version of the game includes character voices)
- **Instructions:** Provide instructions at the start of the game
- **Interactions:** Hard to move the robot back and forth using the mouse

Additional Resources

Websites
- Serious Game EduTech Wiki: **edutechwiki.unige.ch/en/Serious_game**
- On Serious Games: **www.onseriousgames.com**
- 10 Serious Games that Changed the World: **elearningindustry.com/10-serious-games-that-changed-the-world**
- Five Things that Make an Awesome Learning Game: **elearningindustry.com/awesome-learning-game-5-things-make**

Books
- *Don't Bother Me Mom, I'm Learning* by Marc Prensky (ISBN-13: 978-1557788580)
- *End-to-End Game Development: Creating Independent Serious Games and Simulations from Start to Finish* by Nick Iuppa and Terry Borst (ISBN-13: 978-0240811796)

Games & Apps
- Learn4Good Games for Kids: **www.learn4good.com/games/kids.htm**
- *3rd World Farmer:* **3rdworldfarmer.org**
- Play Serious Games: **www.scoop.it/topic/play-serious-games**
- 50 Great Sites for Serious, Educational Games: **www.onlinecolleges.net/50-great-sites-for-serious-educational-games**

Organizations and Companies that Produce Serious Games
- Serious Games Society: **seriousgamessociety.org**
- Top Serious Gaming Companies: **www.ventureradar.com/keyword/Serious%20Gaming**

YouTube Videos
- BBC Horizons 2015 Documentary—*Are Video Games Really That Bad?* (45:40): **www.dailymotion.com/video/x38qzq8**
- *What Are Serious Games?* by Karl Kapp: **www.youtube.com/watch?v=JmG3fdptY_k**
- *Rethinking Education & Learning Games* with Karl Kapp: **www.youtube.com/watch?v=D1bVH3KWaC4**

Social Media Resources
- 12 Game Gurus to Follow for Inspiration on Games for Learning: **wearesponge.com/insights/2017/10/12-learning-game-gurus-to-follow**

About the Author

Bill Kapralos is an Associate Professor within the Game Development program at Ontario Tech University. He is also the Technical Lead of the Collaborative Human Immersive Interaction Laboratory (CHISIL) at Sunnybrook Health Sciences Centre. His current research interests include immersive technologies, serious gaming, multi-modal virtual environments/simulation/reality, and 3D (spatial) sound. He has led many medical-based virtual simulation/serious gaming projects over the past 15 years.

CODING AND PROGRAMMING

TECHNOLOGY AND SOCIETY

DESIGN

Module 3

Grade Level: 7–8
Subject: Game Design
Time Required: 90 minutes
Authors: Bill Kapralos

Topic: A Brief Introduction to Serious Games and Their Design

Introduction

Serious games are games whose primary purpose is education and training as opposed to entertainment. They take advantage of the ability of computer games to attract and engage players/learners for a specific purpose, such as to develop new knowledge or skills. With respect to students, strong engagement has been associated with higher academic achievement. The use of serious games within a wide range of educational and training applications is becoming widespread, particularly given the current generation of learners who are growing up spending a large amount of time playing video games. Despite the growing popularity of serious games, however, designing them is a difficult task. It is an interdisciplinary process, requiring expertise in a variety of fields including game design and development, computer science/engineering, education (instructional design), and content expertise (e.g., medicine/surgery when considering the creation of a serious game for surgical education). Although serious games designers are not expected to be experts in instructional design and the specific area of game content, possessing some knowledge in these areas will, at the very least, promote effective communication between interdisciplinary team members.

Learning Goals

Upon completion of this lesson, students will have:

- Played and reviewed a serious game
- Developed an understanding of serious games and their purpose, their advantages and limitations, and their relationship to video games
- Become familiar with what is involved in developing a serious game

- Become aware of the many career opportunities in the serious gaming field

Vocabulary

- **Engagement:** Fully occupied in, giving your full attention, curiosity, interest, optimism, and passion to a task or activity
- **Fidelity (realism):** The degree to which the simulator replicates reality
- **Game-based learning:** Using games to teach through repetition, failure and the accomplishment of goals
- **Motivation:** Stimulating people to actions that accomplish goals
- **Play:** Doing something (an activity) only because it is fun and enjoyable
- **Prototype:** An early iteration of a game, created with the intention of determining the feasibility of the gameplay concept
- **Video game:** An electronic game where players control images on a video screen
- **Serious game:** A video game whose primary purpose is education, training, advertising, or simulation as opposed to entertainment

Guiding Questions

1. Do you play video games? If yes: How many hours per week? What is your favourite video game? What do you like most and least about your favourite video game? How do you feel when you play your favourite video game?
2. What makes video games so much fun? Why can people play video games for so many hours?
3. Do you learn anything by playing video games? Explain.
4. Can video games be used in school to help you learn?

Curriculum Links

Serious game design is a subset of game design. Below is a game design resource available from Extra Credits.

Making Your First Game: Basics—How to Start Your Game Development:
www.youtube.com/watch?v=z06QR-tz1_o

Materials

- Pen or pencil and paper

- Computer (Mac or PC) with a web browser (Edge, Chrome or Firefox) and Adobe Flash installed
- Internet access

Activity 1

Time Required: 15 minutes

Students should answer the Pre-Activity questions with a partner and then discuss their answers with the class.

Didactic Component

Time Required: 34 minutes

Introduce serious games to students using the PowerPoint-based video available at **youtu.be/852y1PQoe3w**.

The video highlights the relationship between serious games and video games, provides a brief overview of serious game design and development, and presents several examples of serious games.

Computer Activity

Time Required: 15 minutes

Playing a Serious Game
Students play *DriversEd*, a "fun driver education simulator game for kids." *DriversEd* is available from the Learn 4 Kids website at **www.learn4good.com/games/simulation/driverseducation.htm**. Instructions for using the game are available on the website.

Students should follow the instructions and should be encouraged to experiment freely with the game. There are some problems with this serious game and the intention of this activity is that students discover some of them.

Activity 2

Time Required: 25 minutes

This activity includes a series of questions related to *DriversEd*. While completing the activity, students will have the opportunity to discuss some of the problems in the game and suggest

potential improvements. Pose the questions listed below to students. They should answer the questions individually or in small groups, and a group discussion should follow.

Your Feelings about *DriversEd*

1. How did you feel while playing *DriversEd?*
2. Did you find *DriversEd* fun?
3. Did you find *DriversEd* frustrating? If so, why?
4. Will you play *DriversEd* again?
5. Who are the target learners for *DriversEd?*

DriversEd and Learning

1. Is *DriversEd* easy to use?
2. Did you learn anything by playing *DriversEd?*
3. Do you think playing *DriversEd* will help you be a better driver?

Improving *DriversEd*

1. Provide some comments or details regarding *DriversEd*, considering the following:
   • Graphics
   • Sound
   • Interaction (how do you interact with the game, e.g., how do you drive the car?)
   • Instructions
2. What changes or additions would you suggest to make *DriversEd* easier to use?
3. What changes or additions would you suggest to make *DriversEd* a better teaching tool?

Possible Answers for Activity 2 Questions

• Graphics: generally, the graphics for this style of game are OK. Students may suggest adding 3D graphics or changing colours, etc.
• Sound: might be annoying—loud, sound playing prior to start, sound does not correspond to the state of the game (i.e., it is consistent regardless of what the player is doing)
• Instructions: unclear
• Interactions: hard to control the car with the arrow keys; not intuitive
• Improvements: better scoring mechanism, leaderboard to list top scores, provide a "big" reward at the end if player is successful (e.g., a driver's licence) or graphic guides to assist players with tasks (e.g., having arrows guide the user while parallel parking)
• Portrayal of female instructor—is she appropriate?
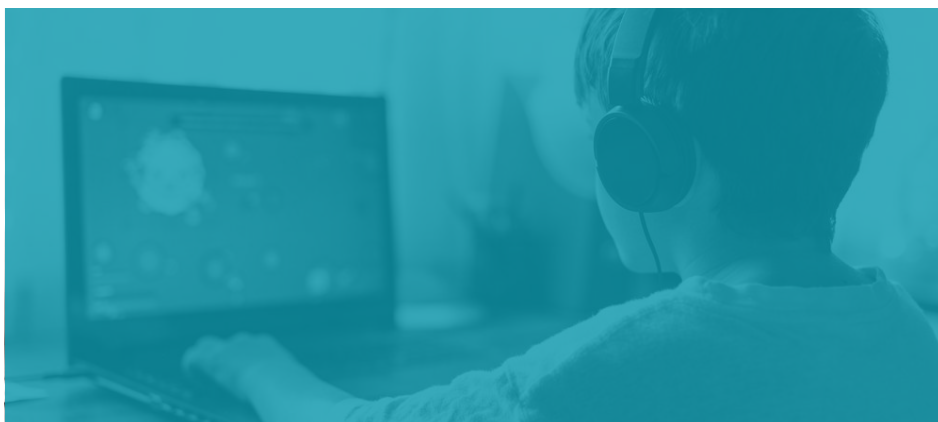
Additional Resources

Websites

• Serious Game EduTech Wiki: **edutechwiki.unige.ch/en/Serious_game**
• 10 Serious Games that Changed the World: **elearningindustry.com/10-serious-games-that-changed-the-world**
• Five Things that Make an Awesome Learning Game: **elearningindustry.com/awesome-learning-game-5-things-make**
• Learn4Good: **www.learn4good.com**

Books

• *Don't Bother Me Mom, I'm Learning* by Marc Prensky (ISBN-13: 978-1557788580)
• *End-to-End Game Development: Creating Independent Serious Games and Simulations from Start to Finish* by Nick Iuppa and Terry Borst (ISBN-13: 978-0240811796)
• *Developing Serious Games* by Bryan P. Bergeron (ISBN-13: 978-1584504443)4

Games & Apps

• *3rd World Farmer:* **3rdworldfarmer.org**
• *FoodBot Factory:* **bodyzoneontariotechu.github.io/Foodbot-Factory**
• Play Serious Games: **www.scoop.it/topic/play-serious-games**
• 50 Great Sites for Serious, Educational Games: **www.onlinecolleges.net/50-great-sites-for-serious-educational-games**

Organizations and Companies that Produce Serious Games

• Serious Games Society: **seriousgamessociety.org**
• Top Serious Gaming Companies: **www.ventureradar.com/keyword/Serious%20Gaming**

YouTube Videos

• BBC Horizons 2015 Documentary—*Are Video Games Really That Bad?* (45:40): **www.dailymotion.com/video/x38qzq8**
• *What Are Serious Games?* by Karl Kapp: **www.youtube.com/watch?v=JmG3fdptY_k**
• *Rethinking Education & Learning Games* with Karl Kapp: **www.youtube.com/watch?v=D1bVH3KWaC4**

Social Media Resources

• 12 Game Gurus to Follow for Inspiration on Games for Learning: **wearesponge.com/insights/2017/10/12-learning-game-gurus-to-follow**

About the Author

Bill Kapralos is an Associate Professor within the Game Development program at Ontario Tech University. He is also the Technical Lead of the Collaborative Human Immersive Interaction Laboratory (CHISIL) at Sunnybrook Health Sciences Centre. His current research interests include immersive technologies, serious gaming, multi-modal virtual environments/simulation/reality, and 3D (spatial) sound. He has led many medical-based virtual simulation/serious gaming projects over the past 15 years.

CODING AND PROGRAMMING

TECHNOLOGY AND SOCIETY

DESIGN

Module 4

Grade Level: 9–12
Subject: Game Design
Time Required: 125 minutes
Authors: Bill Kapralos

> **Topic:** A Brief Introduction to Serious Games and Their Design

Introduction

Serious games are games whose primary purpose is education and training as opposed to entertainment. They take advantage of the ability of computer games to attract and engage players/learners for a specific purpose such as to develop new knowledge or skills. With respect to students, strong engagement has been associated with higher academic achievement. The use of serious games within a wide range of educational and training applications is becoming widespread, particularly given the current generation of learners who are growing up spending a large amount of time playing video games. Despite the growing popularity of serious games, however, designing them is a difficult task. It is an interdisciplinary process, requiring expertise in a variety of fields including game design and development, computer science/engineering, education (instructional design), and content expertise (e.g., medicine/surgery when considering the creation of a serious game for surgical education). Although serious games designers are not expected to be experts in instructional design and the specific area of game content, possessing some knowledge in these areas will, at the very least, promote effective communication between interdisciplinary team members.

Learning Goals

Upon completion of this lesson, students will have:

- Developed an understanding of serious games and their purpose, their advantages and limitations, and their relationship to video games and simulations
- Become familiar with the serious game design and development process

- Become aware of the many career opportunities in the serious gaming field

Vocabulary

- **Computer (virtual) simulation:** A recreation of real world phenomena employing mathematical models that can be visualized through a computer generated scene
- **Fidelity (realism):** The degree to which the simulator replicates reality
- **Play:** Doing something (an activity) only because it is fun and enjoyable
- **Prototype:** An early iteration of a game, created with the intention of determining the feasibility of the gameplay concept
- **Serious game:** A video game whose primary purpose is education, training, advertising or simulation, as opposed to entertainment
- **Simulation:** The re-creation of a real world process in a controlled environment, involving the creation of laws and models to represent the world, and then running those models to see what happens
- **Video game:** An electronic game where players control images on a video screen

Guiding Questions

1. Do you play video games? If yes: How many hours per week? What is your favourite video game? What is your favourite video game genre (e.g., first-person shooter, puzzle, adventure, sports, etc.)?
2. What makes video games so much fun? Why can people play video games for so many hours?
3. Do you learn anything by playing video games?
4. Does simulation have value in sports? List some examples of simulation in sports.
5. How do animals learn?

Curriculum Links

Serious game design is a subset of game design. Below is a game design resource from Brackeys.

How to make a Video Game in Unity:
www.youtube.com/watch?v=IlKaB1etrik

Materials

- Pen or pencil and paper
- Internet access

Didactic Component 1

Time Required: 27 minutes

Introduce serious games to students using the PowerPoint-based video available at **youtu.be/DltfP4ZFGs8**. The video provides introductory information about serious games and highlights the relationship between serious games, video games, and simulations. The material presented in this video won't necessarily provide explicit answers to the questions of Activity 1.

Activity 1

Time Required: 30 minutes

In groups of three or four, students should answer the questions listed below about serious game design. Provide the questions in a hard-copy format with space to answer each one. With the assumption that the majority, if not all, of the students have limited knowledge of the serious game development process, this hands-on activity will introduce students to the design and development process and inform them of potential issues and problems that may arise. Students should be encouraged to speak aloud, and discuss their thoughts among the members of their group, but they should not speak to students from other groups.

Defining Your Serious Game
- Describe a serious game that you would like to design and develop
- When and how will the serious game be used?
- What do you hope the game will achieve? What is the goal of your game?
- Who are your target learners?

The Design and Development Team
- Describe your development team
- What resources do you need to design and develop this serious game?

The Design and Development Process

Provide some details regarding your serious game. Some things to consider:

- What type of serious game will this be (e.g., puzzle, adventure, role-playing, simulation, sports, etc.)?
- What fidelity (realism) will your game have?
- How will learners advance through your game?
- How will learners know how they are progressing while they play?
- Is this a single- or multi-learner game?
- What is the process you will follow to develop your game (i.e., What are the steps from inception to implementation that you will take)?

Assessing Your Serious Game

What process you will follow to assess your game (i.e., How do you know your game will do what it is supposed to do)?
Some things to consider:

- How will you evaluate your game?
- What will your evaluation reveal?
- What will you do with the information your evaluation reveals?

Didactic Component 2

Time Required: 27 minutes

Following the completion of Activity 1, students should watch the PowerPoint-based video available at **youtu.be/Dnt2d_BNrlU**, which focuses on serious game design and will provide insight regarding the questions answered in Activity 1.

Computer Activity

Time Required: 20 minutes

Playing with Serious Games

Students will have the opportunity to experiment with (i.e., play) a serious game—specifically, *Re-Mission2: Leukemia*, which is available at **www.re-mission2.org/games/#/leukemia**.

The students' task is to provide a one-paragraph review of the game. There is no required format for the review; it should, however, at least consider: i) the purpose of the game; ii) who the game's target audience is; iii) whether the game is fun and engaging; iv) whether or

not the game is an effective learning tool; v) whether the game is easy to understand/learn to play; and vi) the interface (e.g., how players interact with the game, graphics, sound, etc.).

Activity 2 (Conclusion)

Time Required: 20 minutes

As a class, revisit the questions of Activity 1 with a focus on whether answers would change given the material discovered while conducting Didactic Component 2.

Additional Resources

This is not limited to but might include:

Websites

- Serious Game EduTech Wiki: **edutechwiki.unige.ch/en/Serious_game**
- 10 Serious Games that Changed the World: **elearningindustry.com/10-serious-games-that-changed-the-world**
- Five Things that Make an Awesome **Learning Game: elearningindustry.com/awesome-learning-game-5-things-make**
- Serious Gaming Course (Coursera): **elearningindustry.com/awesome-learning-game-5-things-make**

Books

- *How Computer Games Help Children Learn* by D. Shaffer (SBN-13: 978-0230602526)
- *Don't Bother Me Mom, I'm Learning* by Marc Prensky (ISBN-13: 978-1557788580)
- *End-to-End Game Development: Creating Independent Serious Games and Simulations from Start to Finish* by Nick Iuppa and Terry Borst (ISBN-13: 978-0240811796)

Games & Apps

- *3rd World Farmer:* **3rdworldfarmer.org**
- *PeaceMaker:* **www.peacemakergame.com**
- *FoodBot Factory:* **bodyzoneontariotechu.github.io/Foodbot-Factory**
- Play Serious Games: **www.scoop.it/topic/play-serious-games**
- 50 Great Sites for Serious, Educational

Games: **www.onlinecolleges.net/50-great-sites-for-serious-educational-games**

Organizations and Companies that Produce Serious Games

- Top Serious Gaming Companies: **www.ventureradar.com/keyword/Serious%20Gaming**

YouTube Videos

- Discovery Channel—*History of Video Games:* **www.youtube.com/watch?v=empni1yCPqw**
- BBC Horizons 2015 Documentary—*Are Video Games Really That Bad?* (45:40): **www.dailymotion.com/video/x38qzq8**
- *What Are Serious Games?* by Karl Kapp: **www.youtube.com/watch?v=JmG3fdptY_k**
- Serious Games and Gamification Development Secrets: **www.youtube.com/watch?v=g2CXB-Chsk0**

Social Media Resources

- 12 Game Gurus to Follow for Inspiration on Games for Learning: **wearesponge.com/insights/2017/10/12-learning-game-gurus-to-follow**

About the Author

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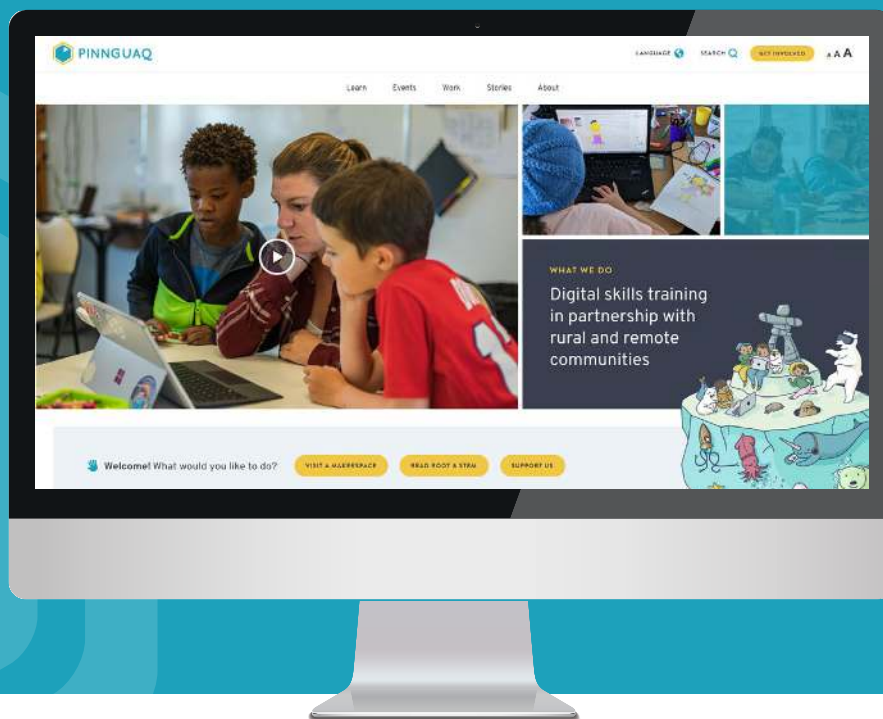
<div>⟨/⟩ CODING AND PROGRAMMING</div>

<div>TECHNOLOGY AND SOCIETY</div>

<div>DESIGN</div>

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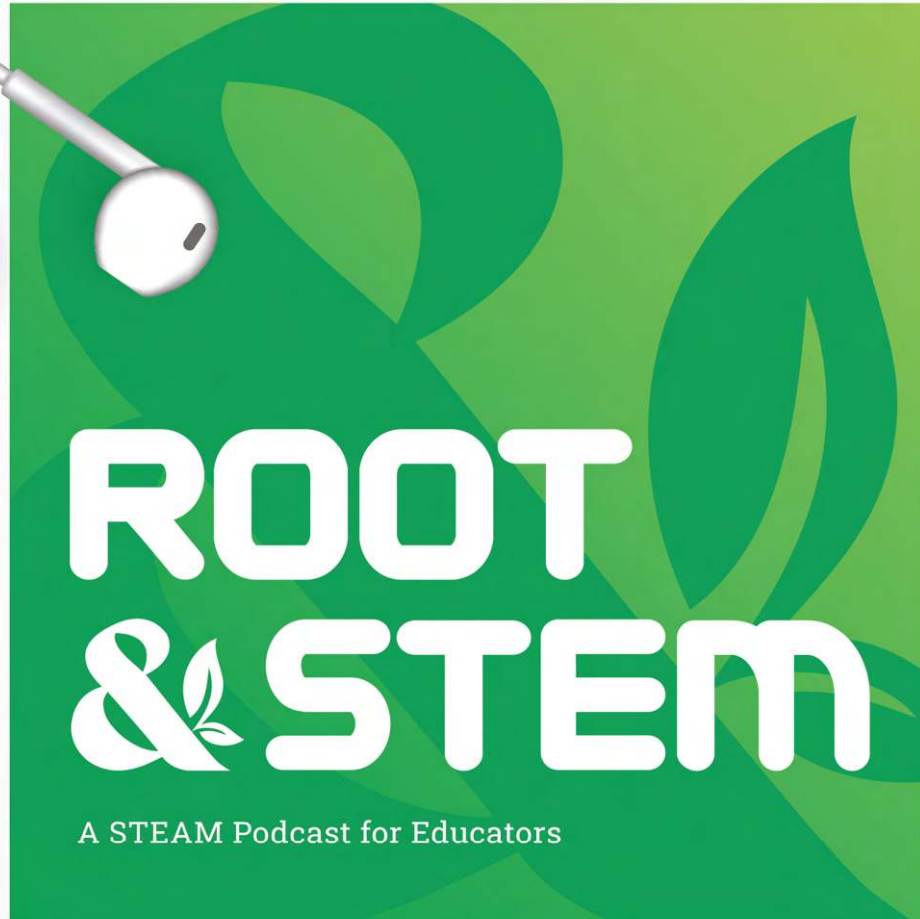
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