A STEAM Resource for Educators in a Digital World

FALL 2023 • ISSUE 8

ROOT & STEM

AI Amplified: Staying Cybersafe

PAY NO ATTENTION

to the Human Who Wrote This

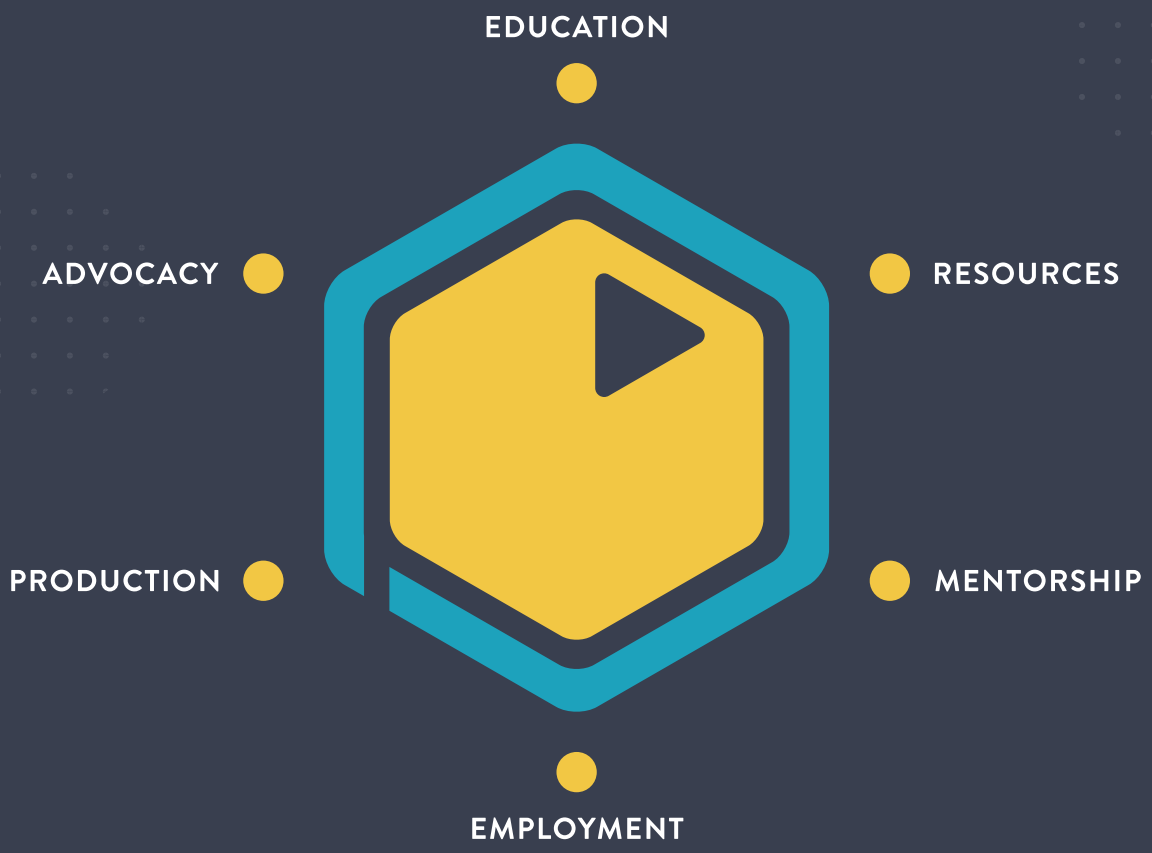
TRANSFORMING THROUGH TECHNOLOGY

How AI Is Reshaping Language Revitalization

SOCIAL ROBOTS FOR SOCIAL SKILLS

The New Way to Say No to Bullying

+ Plus comics, games, and over 10 pages of classroom-ready teaching resources



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.

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

pinnguaq.com

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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.* ***k12cs.org***


CODING AND PROGRAMMING


COMPUTING AND NETWORKS


DATA


TECHNOLOGY AND SOCIETY


DESIGN

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RAJEN AKALU

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Rajen Akalu is an associate professor at the Faculty of Business and IT at Ontario Tech University in Oshawa and the founder of the Akalu Law Professional Corporation. His research interests and law practice relate to information privacy law and technology.

SHARON ASCHAIEK

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Sharon Aschaiek, the principal of Higher Ed Communications, writes about trends in the education space. She uses her conversational writing style to produce informative and engaging articles about research breakthroughs, new programs, and innovative practices relating to education.

JULIA YOUNG

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Julia Young is a language enthusiast and full-time volunteer in Ontario's English- and Russian-language-speaking communities. Currently, she is continuing her education in Russian and is working on new projects with audio-based and digital content creation.

CHLOE PHILLIPS

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Chloe Phillips is currently in her third year at Trent University, where she is studying environmental studies and education. She enjoys the outdoors and long walks with her dog, and is passionate about combining social justice and environmental education.

SHEENA BOLTON

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Sheena Bolton is currently the manager of the K-12, CyberTitan, and Cyber Education Initiatives at the Information and Communications Technology Council. She has been involved in the CyberTitan competition since its start and finds it to be one of the most rewarding things she has done in her career, which includes past work as a journalist.

BRIAN MCLACHLAN

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Brian McLachlan is the cartoonist of *Complete the Quest: The Poisonous Library*, an RPG/graphic novel combination, and *Draw Out the Story: Ten Secrets to Creating Your Own Comics*. He makes comic tutorials on his Deep Thought Balloon YouTube channel.

RICHARD VAN CAMP

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Richard Van Camp is a proud Tlicho Dene from Fort Smith, Northwest Territories. He is the bestselling author of 27 books written over 27 years. He is an internationally renowned storyteller whose passion is helping others reclaim their family medicines. You can visit him on social media or at his official site: **richardvancamp.com**

MICAELA DAWN

Ladybug • *Page 22*

Micaela Dawn is an award-winning art director and illustrator. Her focus is on developing projects that speak to her desire for equality and the promotion of minority rights. She adores creating bold, colourful works of art that are rooted in fantasy and mythology.

SOFIA OSBORNE

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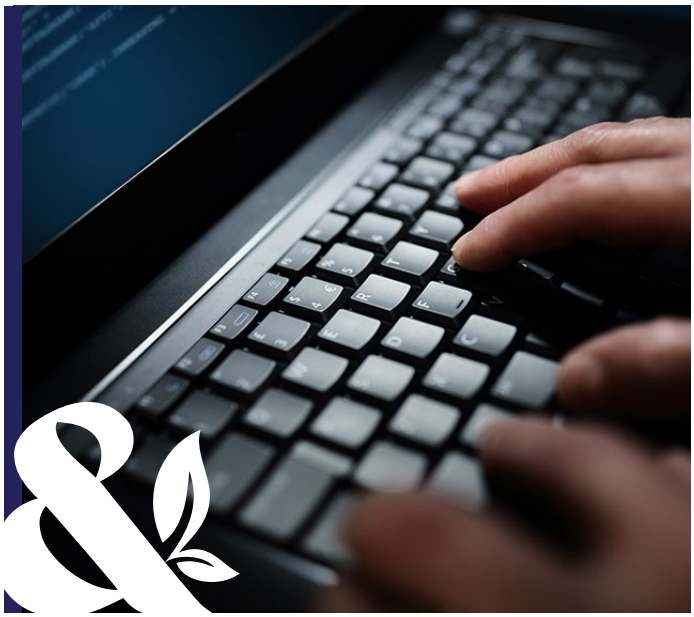
Sofia Osborne is a writer, reporter, and audio producer based in Vancouver. Her environmental journalism has appeared in *The Tyee* and *The Narwhal*, and she is the co-host and producer of *Beyond Blathers*, an Animal Crossing science podcast.

The Future of Artificial Intelligence



This issue of Root & STEM *explores how artificial intelligence (AI) is sparking compelling questions, stories, and lessons surrounding machine learning and online safety. Based on research funded by the Ontario Principals Council on AI, this issue is packed with modern, innovative approaches to online safety, particularly when it comes to teaching and learning. You'll find articles and illustrations from artists, educators, and AI experts exploring these topics. From the ways AI technology can support online learning to the ethical issues surrounding privacy to the roles and methods AI is reshaping forever, we take an in-depth look at the new reality that AI is creating and open a discussion around how we can use this technology to create a better—and safer—world.*

What is artificial intelligence? How is it used?
Artificial intelligence (AI) is a rapidly evolving field. It references the congruence of a number of different technologies. Essentially, it uses predictive modeling and data analysis in order to have machines do things that humans can do—or have been doing until now. Today, we find AI involved in an ever-increasing number of aspects of daily life. For example, it is used in the medical profession to detect cancer by analyzing biomedical data. That's a predictive way of using AI. Another example is the use of AI in vehicles, where it can optimize the condition of the engine or predict the best driving route.

What are some of the ethical risks that come with AI?
The ethical risks associated with AI are manifold because the predictions it can make are only as good as the learning model it is provided. Therefore, researchers have to make all sorts of judgements when they are creating the models with which AI works. One example of human bias is racial profiling, which involves dangers like the creation of facial recognition models that detect only certain ethnic or racial features based on biased training data. As an associate professor at Ontario Tech University and a practising lawyer who focuses on information privacy law in relation to AI, I am acutely aware of how discrete bits of information can be used to reveal personal, private information.

All design—from rocking chairs to bathtubs, running shoes to rocket ships, sofas to skyscrapers—is inherently biased precisely because the designers have a certain set of users in mind. Now, the questions are: Who are the people involved in design decisions? And with what consequences? There are rules or regulations that attempt to make those decisions more transparent or easily explained to the user. While AI is very powerful, it's not foolproof. And so, it's really important to apply human judgement to prevent the various types of discrimination that can occur when bias is not identified and countered. As AI develops, its regulation will take time. So there are two very difficult problems to solve. There are many potential solutions.

How can we use AI in a safe and secure way?
There has been enormous progress throughout the world due to AI. It's a game changer in terms of research and development. However, it's a tool and, like all tools, it requires judgement and discernment to be used appropriately. Most technological development comes with a certain amount of risk, especially regarding user privacy. There's no getting away from that. In fact, everything comes with a certain amount of risk. When you get into a car, for example, you accept all sorts of risks, likely without actively thinking about them. The key is not to focus on avoiding risks at all cost but mitigating them. AI is a powerful and potentially beneficial technology. It should be adopted widely for the benefit it offers. But there's no reason to have blind faith. Technologies are human artifacts and should be regulated as such. Machine learning technologies are code and pattern detectors and predictors. But at this moment, that's all. They are not to be used as a substitute for human experience or wisdom. It's up to us to use what we as humans have—and what AI lacks: human intelligence.

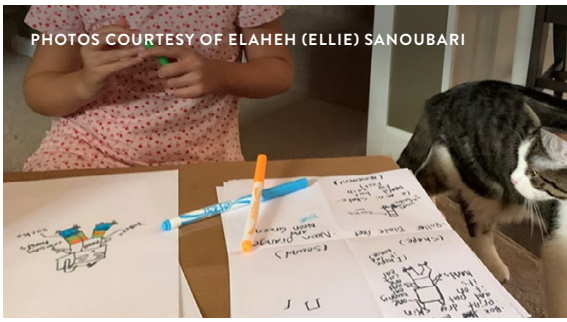
— DR. RAJEN AKALU

PHOTO COURTESY OF PINNGUAQ

Social Robots for Social Skills

An artificial intelligence project by engineering researcher Elaheh Sanoubari offers educators inspiration to help students respond to bullying

BY SHARON ASCHAIEK



PHOTOS COURTESY OF ELAHEH (ELLIE) SANOUBARI

For many students, bullying is and always has been a part of school life. The rise of social media has only made matters worse. According to the 2019 Canadian Health Survey on Children and Youth, that year, 71 per cent of kids aged 12 to 17 experienced at least one form of bullying, while 25 per cent reported being cyberbullied.

But innovations in artificial intelligence (AI) are empowering educators to help children respond skillfully to instances of bullying. That's the goal of Elaheh Sanoubari, a post-doctoral engineering researcher who is examining the potential for meaningful and immersive anti-bullying education through human-computer interaction.

Based out of the University of Waterloo's Department of Systems Design Engineering, Sanoubari is developing Robots Empowering Minds, or RE-Mind, a role-playing game in which children observe human-like robots perform a peer-bullying scenario, and control the actions of a bystander robot. While studies show most bystanders of bullying incidents are passive, Sanoubari says by exploring this sensitive topic through these sophisticated machines, known as "social robots," children are provided with a safe way to consider how they might intervene.

"With robots as the medium, there's the ability to control how the story goes, pause the interaction, and reflect on what happened," says Sanoubari, who works in Waterloo's Social and Intelligent Robotics Research Laboratory. "It's a way to encourage kids to have compassion for the person who is being targeted."

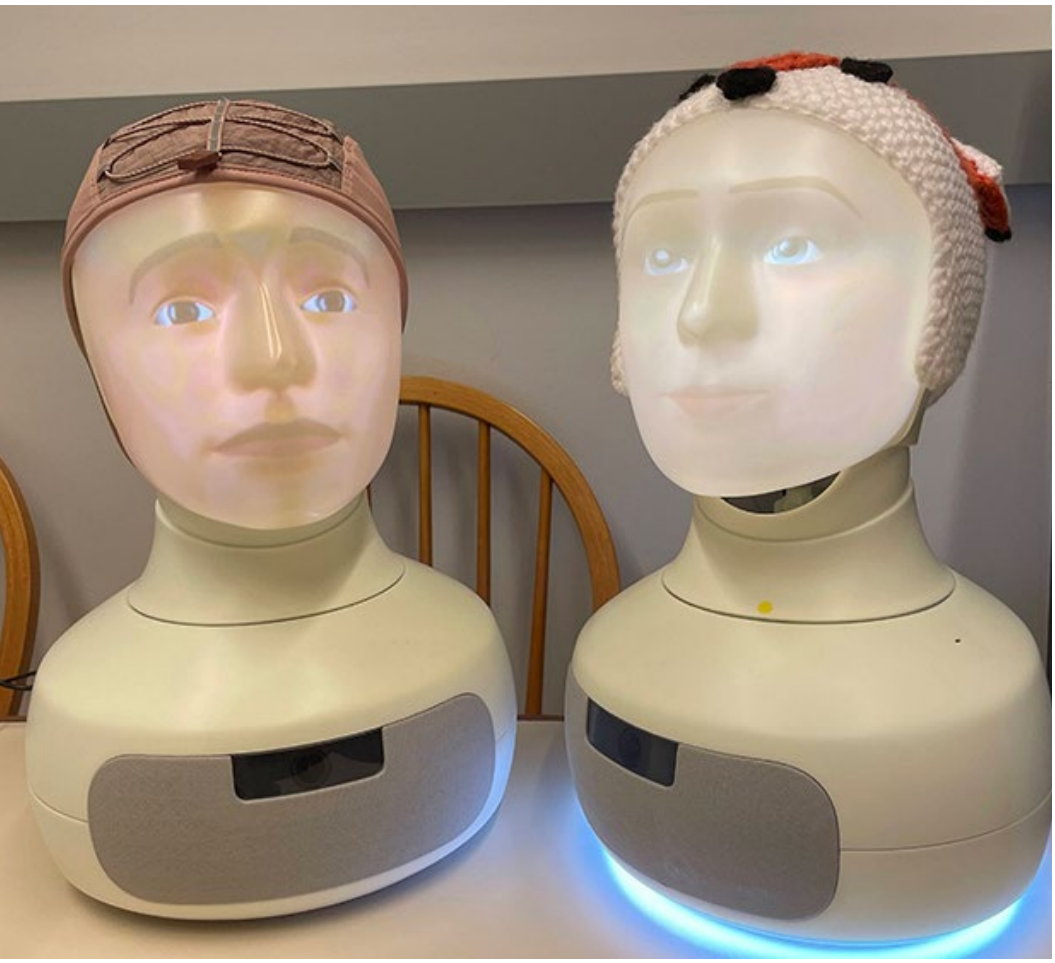
In her research, Sanoubari has engaged public school children in Canada and the United States in the process of designing a fictional "student robot," and imagining its positive and negative social interactions at school. The objective was to determine how children's stories can support the use of interactive robots to facilitate learning about bullying and peer support. The children were able to generate various bullying scenarios for the robots and take on the roles of aggressors, victims, or bystanders safely.

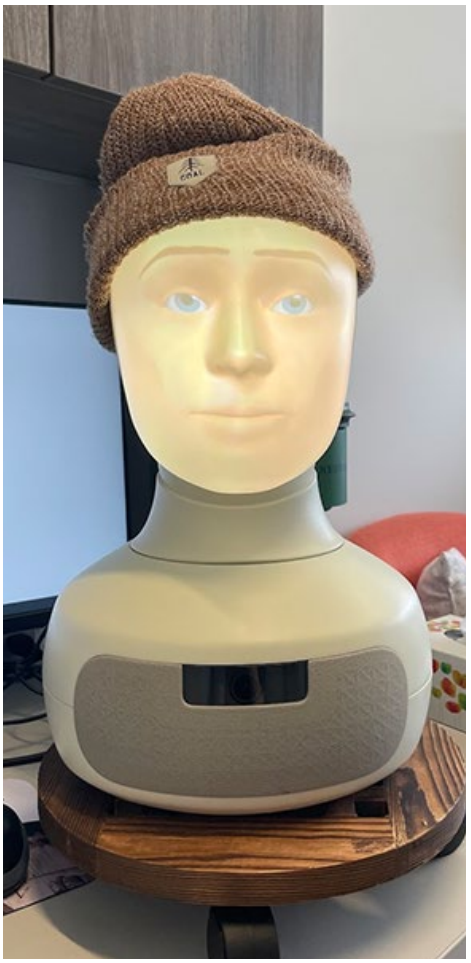
To optimize RE-Mind, Sanoubari has consulted professionals from a variety of fields, including teaching, child and youth work, psychology, screenwriting, and game design. The associate chair of the University of Waterloo's Theatre and Performance Program provided input on incorporating drama techniques to inspire learning and shape social change.

"Like puppets, robots are really good props for drama, because they promote make-believe play—children feel comfortable assigning a mind to them and using them to play different roles," Sanoubari says.

She has also conducted focus groups with kids aged 8 to 14 that consider designing and evaluating fun robot games. Using LeBlanc's Taxonomy of Game Pleasures, a framework with eight categories of game-playing enjoyment, the participants brainstormed a wide range of game-design ideas.

To understand educators' views on current anti-bullying pedagogy, Sanoubari interviewed 13 Ontario elementary school teach-





Above: Social robots by Furhat Robotics receive names like Echo (protagonist), Circuit (victim), and Byte (antagonist). Previous page, top and bottom right: Learners codesigning social robots

ers who identified the need for novel interventions relevant to children's present-day experiences. The innovative nature of social robots, Sanoubari says, has the capacity to capture kids' attention, elicit social reactions, and promote behaviour change, making them a powerful teaching and learning tool.

"When you put a robot in front of kids, they want to see what it can do. They are making this cool toy do things in the physical world, and that's exciting for them," Sanoubari says. "This can be leveraged by educators to motivate kids to learn."

The robot model Sanoubari uses in her research is a desktop device with a human-shaped face that, through backlit projection, displays different facial expressions and emotions. Equipped with an HD camera with computer vision and face-tracking, speakers, and microphones, it can interact with humans by nodding and shaking its head, and can converse in 40 languages in a variety of voices and accents.

Made by Colorado-based company Furhat Robotics, the cost of the device starts at USD15,000 (about CAD20,000), making it ideal for researchers and early adopters. But Sanoubari hopes her research inspires teachers to explore using off-the-shelf robots to lead more simplified and engaging anti-bullying lessons.

"You don't need to be an expert in robotics to be able to use it as a teaching tool," she says. "With the right narrative, and by handling the topic with sensitivity, teachers can use basic robots to teach about anti-bullying." &

"When you put a robot in front of kids, they want to see what it can do. They are making this cool toy do things in the physical world, and that's exciting for them."

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How Online Learning Became My Reality

Know the Basics to Reap the Benefits

BY JULIA YOUNG

My name is Julia Young. I'm a Grade 12 student, and during my co-op program at Pinnguaq, I created an online safety podcast for teens called *Harnessing the Benefits: The Digital World*. I was surprised to learn just how advanced artificial intelligence (AI) is nowadays, and the ways in which online education and digital safety are constantly growing.

When I created the podcast, I only knew the basics of AI. Honestly, it seemed a bit boring. I thought AI was quite complicated and had no interest in learning about coding and all the technical jargon that goes along with it. But I was curious to learn the basics of how it functions and the more I learned, the more interested I became. Most high school students, including myself, have used some form of AI for schoolwork, like Turnitin, My Bib, or Grammarly. Programs like these are popular because they can save hours of labour, like combing through papers for errors and tediously typing out individual citations. Little did I know that was just the tip of the iceberg.

Over the spring of this year, I heard about ChatGPT, a new form of AI that was gaining popularity with students because it seemed to be a program that could write papers for the user. I soon learned, however, that ChatGPT is more than just an essay-writing machine. It's actually much better at improving original work than it is at creating papers based on what it can find on the internet.

For example, I have started using ChatGPT to expedite the research process for my podcast. I can prompt it to locate articles related to the topic I'm researching, condense them, and give summaries of research material—it can even suggest articles I might not have searched for or found on my own.

In addition to AI, *Harnessing the Benefits* touches on online learning, something I had always considered an alternative form of education. When the pandemic hit, however, I got a taste of what online schooling is like and, to my surprise, I loved it. Despite having the same amount of work to do, I found I had more flexibility, as learning online allowed me to jump ahead and get things done early, which freed up my time and gave me more control over my schedule.

Occasionally when learning online, I had to fight the urge to procrastinate, which was a new challenge. Traditional classroom learning involves constant supervision, which holds students accountable and keeps them focused. With online learning, it was up to me to motivate myself and maintain my concentration. In my opinion, the many benefits of online learning outweigh the few drawbacks. In fact, the whole point of *Harnessing the Benefits* has been to hone in on the advantages of online learning and technology while highlighting some common dangers and disadvantages, like the challenges of new AI programs.

What stood out to me was how scams and trickery ranging from AI-produced deepfakes to false accreditation for educational institutions are so common, with teenagers and children

becoming the prime targets for such attacks. It was also a little surprising to learn that the most effective way for users to protect themselves is by using basic safety techniques like strong passwords, knowing online friends offline, and scrutinizing online content before assuming it is factual.

Writing the podcast underscored the value of learning about online safety and bringing it into schools so everyone can understand how to protect themselves online and take advantage of the benefits of technology while avoiding the pitfalls.

Although my high school education will finish shortly, I'll be taking this knowledge into my future work in digital marketing and when volunteering in local communities. Knowledge is armour. No one would go into battle without armour, so why go online without some form of protection? The more we know about the benefits and dangers of the digital world, the more we can keep ourselves safe. I will definitely be using AI and forms of online learning again in the future but I'll be taking my armour wherever I go. **&**

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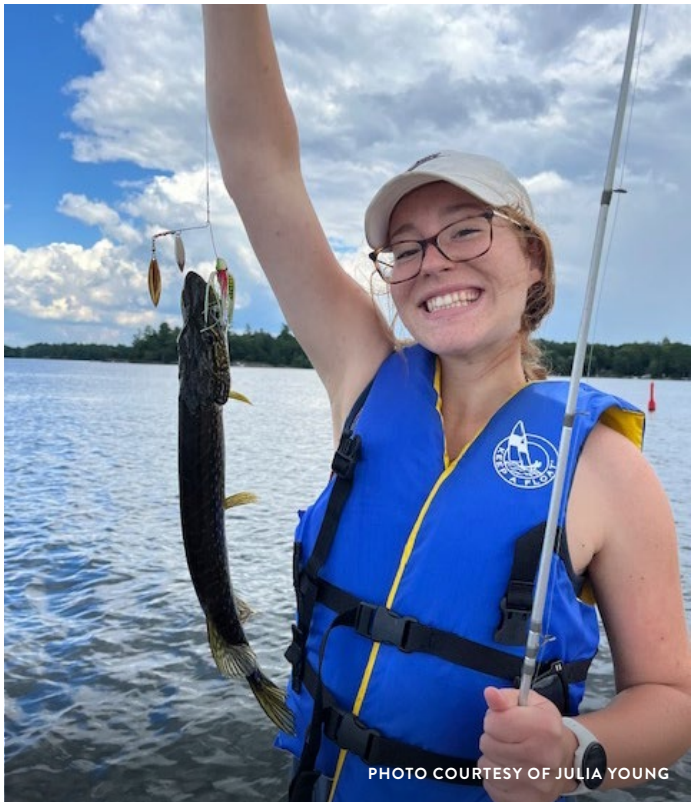
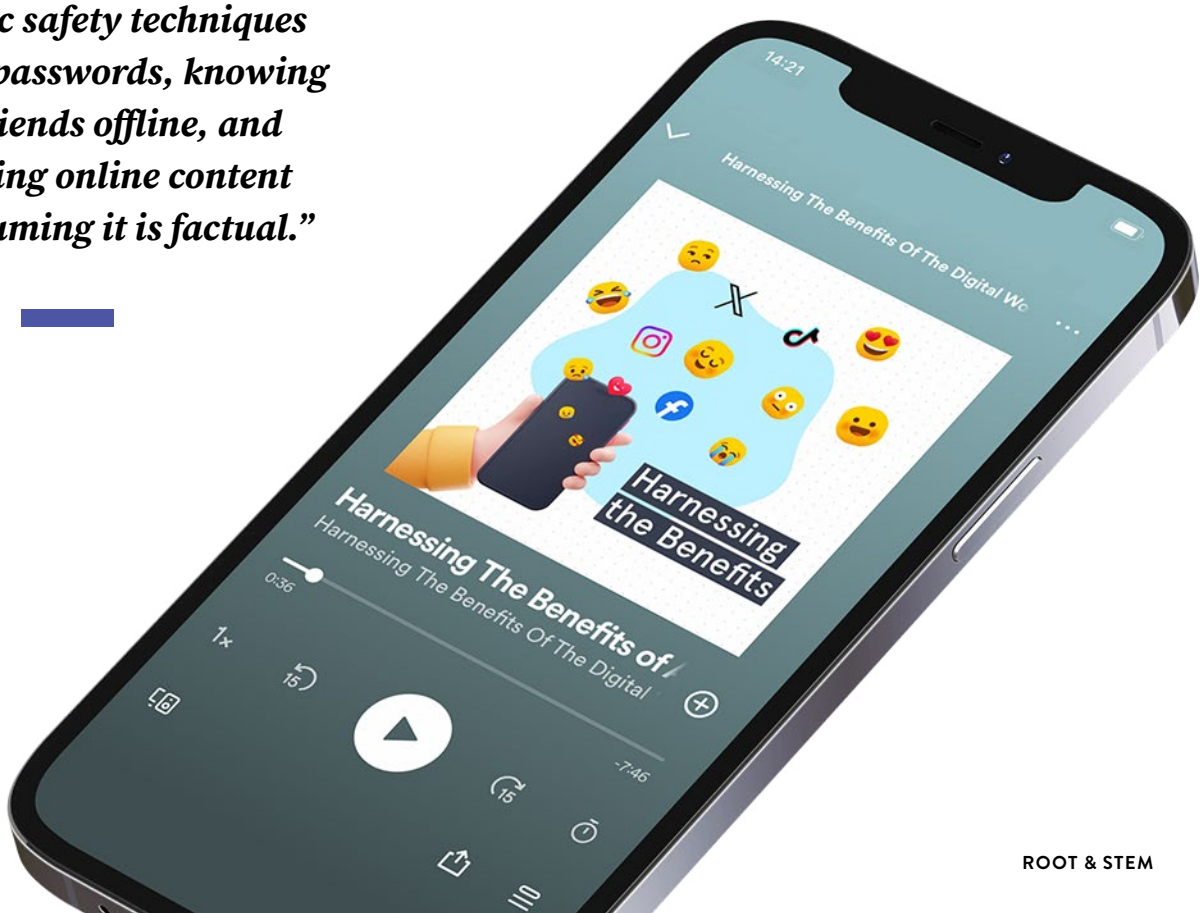


PHOTO COURTESY OF JULIA YOUNG

Julia Young with her catch of the day

"The most effective way for users to protect themselves is by using basic safety techniques like strong passwords, knowing online friends offline, and scrutinizing online content before assuming it is factual."



The Web: Keeping Kids from Getting Entangled

BY CHLOE PHILLIPS

Back in 1991, the World Wide Web was new, exciting, and fairly limited in use compared to today. But more than 30 years later, the Web has evolved, guided by the age of the internet and artificial intelligence (AI). Nowadays, there is much more we can do with a wi-fi connection than ever before, but there are also more dangers to watch out for, especially for younger users. Learning to be safe online is just as important as it is offline. We can't look both ways before clicking a link on a website as we would when we cross the road—or can we?

Imagine a child has to complete a research project about an animal. How would they go about doing that? Very likely, they would first turn to a search engine, like Google. Books from the library might be used as a secondary resource, but the internet often provides a more accessible, seemingly limitless pathway for factual, fast, and fun information. But at what cost?

Keeping young users safe online against computer viruses, cyber-bullying, and adult predators is an important consideration when helping young people learn how to navigate digital devices and the internet. Although the internet can be used as a powerful learning tool, it is a vast highway of data. It can be challenging for young users to filter all that information by themselves. However, there are easy ways to keep private information secure while allowing learners to engage with AI, giving them a chance to benefit from the internet's educational opportunities.

Teenagers aren't likely to face the same risks as younger users online. But they are currently being given unprecedented access to one of the greatest advances in online learning: AI. While there are advantages to learning how to use AI properly, there are, of course, challenges related to online safety and security. AI can use existing data to successfully portray humans online and can be used to uncover personal information. Without proper regulation, it can also be used to "cheat" and create content that does not belong to the user. These days, access to social media is access to AI tools. Social media applications like Snapchat and Instagram are creating AI chat bots to increase the use of their app. While this might be a fun concept, these AI programs are new and untested, so users can often receive offensive responses or false information.

For older students who are completing work online, there will likely be pressure to use an AI chat program like ChatGPT. This AI program answers the questions posed to it using language that is emotive and believable. This presents challenges relating to student accountability, as an AI program can attempt to do students' work for them. Students can ask for help with their homework and AI programs can generate complete answers, although these answers are not always coherent or correct, reducing opportunities for individual learning and development. This also creates an unfortunate situation in which a student might submit work that is not their own, which is increasingly becoming considered a form of plagiarism.

Solutions for protecting students from the dangers of AI programs include providing opportunities for handwritten assignments

that ask for the students' own opinions on a topic. Personal beliefs often connect to personal feelings (which AI cannot possess) and providing opportunities for students to explore those feelings and demonstrate their critical thinking is essential in our digital world. Overall, having open relationships and discussions with students, especially of older ages, about AI and online safety will benefit them and help prevent the possibility of AI interfering negatively with their learning opportunities.

Make sure to look both ways before crossing the digital road and remember that there are ways to prevent roadblocks and move forward to a place of meaningful, beneficial collaboration between the internet, AI, and education. &

Top Tips for Safe Screen Time

- Scan and review websites before allowing children to access them
- Block unwanted advertisements or pop-ups on websites
- Prioritize platforms created specifically for children
- Do not use personal information when creating online usernames and passwords
- Talk to children about the importance of protecting personal information online
- Prevent or discourage children from using platforms where public commenting is permitted
- Discuss the idea of misinformation so children understand that what they read online is not necessarily true
- Create space for conversation about what is encountered online
- Sit with or near children when they are online to observe their engagement
- Limit screen time when appropriate, reducing time if necessary
- Give alternatives to using the internet when possible for school work

"Although the internet can be used as a powerful learning tool, it is a vast highway of data."

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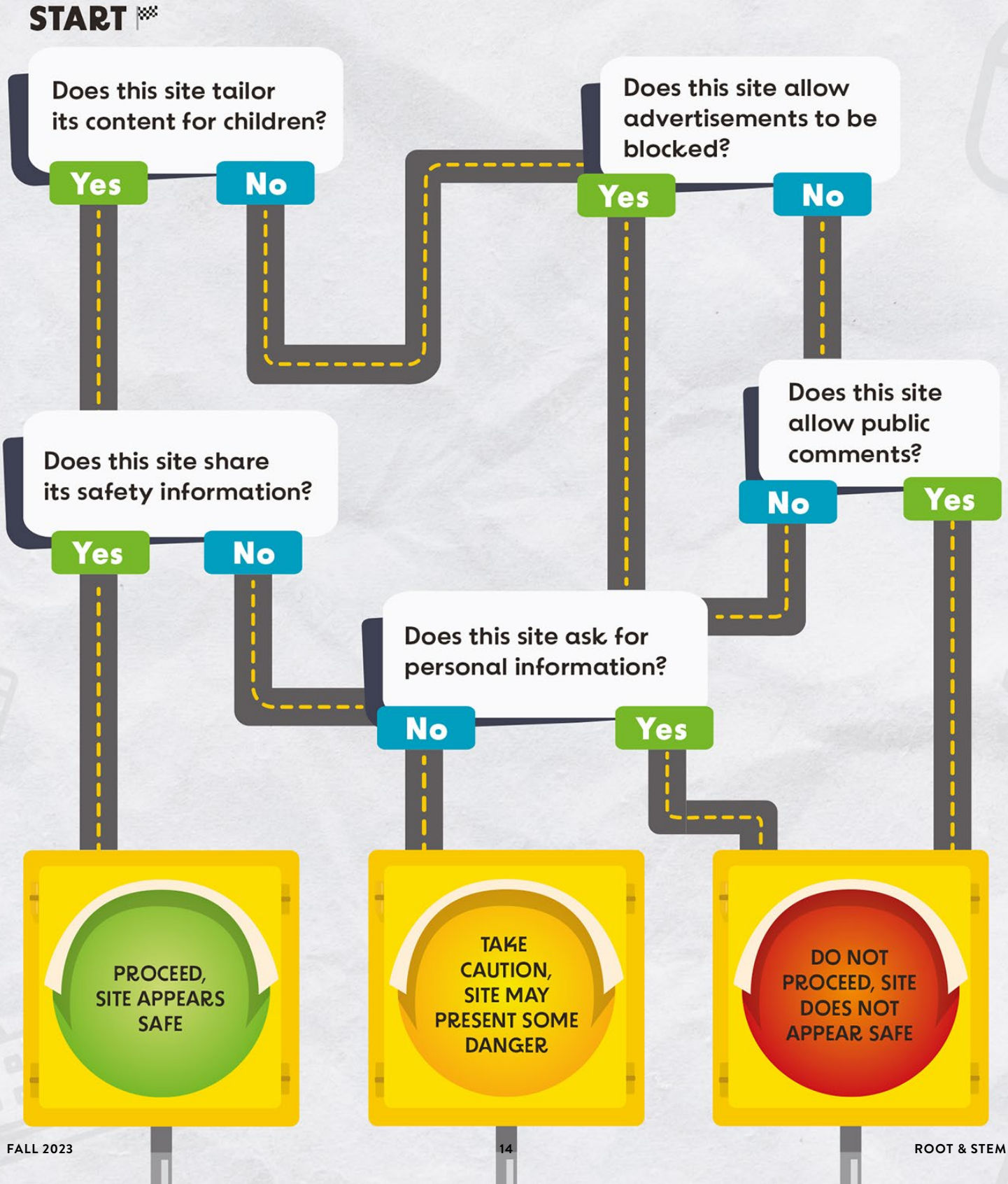
Is this Digital Road Safe to Cross?

A Safe Source Quiz



Cybersecurity Skills in the Classroom

BY SHEENA BOLTON

In the last year, there have been countless cyberattacks, such as service disruptions or critical data breaches, and the risks continue to escalate. As students spend more time online, it is crucial that they are aware of present dangers and how to protect themselves.

Teaching cybersecurity fundamentals can be tricky, but supporting tomorrow's talent is essential. An initiative of the Information and Communications Technology Council (ICTC), CyberTitan is one of Canada's largest cyberdefence competitions. It is a key resource for students learning critical digital and cybersecurity skills. Through an exciting and fun competition, teams of students from across Canada reinforce their creative problem-solving, analytical thinking, communication, and collaborative skills. Once it is over, students who choose to pursue post-secondary education STEM programs are equipped with technical skills sought after by today's employers. They also walk away with new friends.

"We all had a wonderful time participating in this spectacular event," said Steven G., a former participant. "I know that I personally learned a lot from this competition, which is why I would certainly recommend others participate if they get a chance to."

Canada is in need of cybersecurity professionals. CyberTitan can be the first step for students who want to explore the thrill of protecting Canadian online data and spaces against credible cybersecurity threats. CyberTitan also opens the doors to under-represented groups like Indigenous Peoples and women in STEM. In six years, more than 5,000 students have participated in CyberTitan, including 85 all-female teams.

"Just go for it," said Louise T. about starting a CyberTitan Team. "It doesn't matter if you don't do extremely well with it," she added. "You might be really good at it, but don't be put off by [intimidating] figures in the tech industry."

To help students hone their cybersecurity skills and prepare for CyberTitan, ICTC offers lots of learning resources. One such resource involves learning about the history of the internet through its asynchronous Cybersecurity Fundamentals course. The course opens with a foundational understanding of digital identity and internet safety, then takes students through an introduction to cybersecurity skills development. Students finish the course with the confidence to recognize online threats, take steps to reduce harm, and learn what professions in cybersecurity may await them.

"CyberTitan has been a driving force for cybersecurity education in Canada, and there is no better place to start learning about the cyber-landscape than in high school and middle school," said Devlin N.M., a former participant.

Additional cybersecurity resources are continually being offered by ICTC, including facilitated and asynchronous CyberDays that offer hands-on activities to increase digital skills and a higher understanding of computer operating systems, including defence and offence methodologies. &

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CyberTitan VI 2021 competitor Louise is from the all-female team FalconTech Terabytches3.0

Team Saints compete in their classroom for CyberTitan III in 2020

About ICTC

The Information and Communications Technology Council (ICTC) is a neutral, not-for-profit national centre of expertise with the mission of strengthening Canada's digital advantage in the global economy. For over 30 years, and with a team of 110 experts, ICTC has delivered forward-looking research, practical policy advice, and capacity-building solutions for individuals and businesses. The organization's goal is to ensure that technology is utilized to drive economic growth and innovation and that Canada's workforce remains competitive on a global scale.

To register or for more information, visit **etalentcanada.ca/for-educators/programs/cybertitan**, **cybertitan.ca**, or email **cybertitan@ictc-ctic.ca**.

PHOTO COURTESY OF PINNGUAQ

Participants and organizers (Aiden Mackey, first from left in the front row, Callum Penney, third from left in front row, and Tanner Big Canoe, far right in back row)

A Conversation on Coding

with Aiden Mackey, Callum Penney, and Tanner Big Canoe

BY CHELSEA KOWALSKI

In May 2023, Pinnguaq hosted the first-ever Kawartha Lakes Hackathon: Code the Future of Voice Technology for high school students. In teams of two, 12 students competed at the Lindsay Makerspace over two-and-a-half days of intense learning, hacking, and presentation. For this hackathon, the goal was to come up with an idea for a new Alexa skill and code it using the beginner-friendly MIT App Inventor platform. Every participant left with an Alexa to continue their coding initiatives post-hackathon. This year's winning team, Callum Penney and Aiden Mackey, respectively aged 11 and 12 at the time, came up with the brilliant idea of an Alexa-powered digital scavenger hunt.

Callum and Aiden, bright young students in Grade 7, spoke to *Root & STEM* about their experience as hackathon participants and explained what coding means to them.

In your own words, what is a hackathon?
Aiden: A fun event where everyone is working together and having a competition to see who's the best even though everyone is good.

What did you create?
Callum: You ask Alexa to play the game by saying aloud, "Play online scavenger hunt." Alexa then gives you the instructions to go to Scratch, the site where we coded the game, and start the quiz. Then you have to do a quiz and if you get it right, you receive a random word to say back to Alexa. Once you complete all the rounds, you get a choice of songs from Alexa and she will sing one that you choose.

What prior coding knowledge did you have and where did you learn it?
Callum: I actually knew a lot about Scratch and I learned it all through Pinnguaq.

Aiden: For me, I started coding young. The first time I made a project in Scratch, I was six. My brother Austin taught me and the Pinnguaq camps helped too.

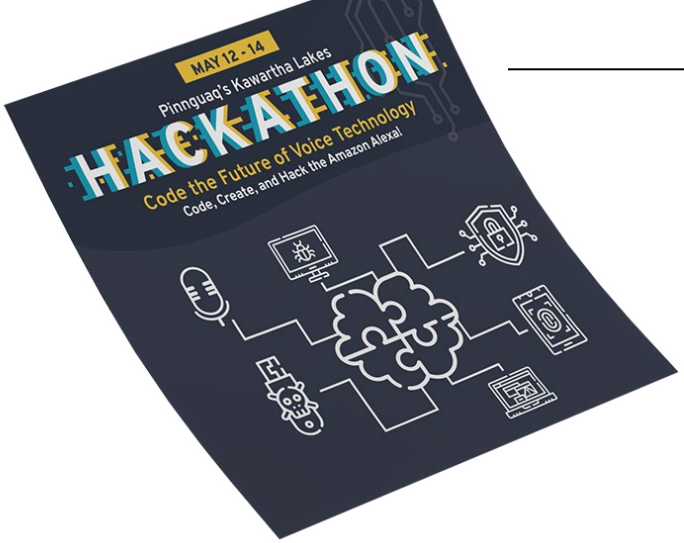
What do you want teachers to know?
Callum: Coding is the future. The future is machinery, robots, self-driving cars. You need coding for that.

Aiden: Coding can seriously step up art and our creative careers because you can make stuff, you can animate, you can show people things. You can make people happy. It's a lot of fun. And in my opinion, it's very important.

What's your advice for kids who want to participate in a hackathon like you did?
Callum: After the basics, you can fly right through it. Do what you want and make sure that it's creative. Use your brain.

Aiden: As hard as it seems, once you get the basics down, it's really easy. You just need to get the basics down on your phone.

Have you done any coding since the hackathon?
Aiden: I have younger cousins so I made a code so Alexa will read them a bedtime story. I found stories online and they can pick which one they want every time before bed. I even ask them if they want me or Alexa to read the bedtime story and they always ask for Alexa!



"We got to see them make friends during the hackathon and outside of it."

We also spoke with Tanner Big Canoe, a junior software developer who co-organized the hackathon and led the efforts to bring a coding competition to teens and pre-teens in Lindsay, Ontario.

As an organizer, how would you describe a hackathon?
The best way to describe it would be a bunch of creative people coming together to solve a problem. In this case, we had a specific problem set out, but sometimes there are multiple prompts and you can choose whichever you find most interesting. You work in a small team usually and you cultivate those teamwork skills. Then you just blast through the competition days, which are usually 48 to 72 hours. Sometimes you're just writing code and sometimes you're developing a layout for a potential solution to the prompt. Once it's finished, all the teams present their solutions to the judging panel. The judges have certain criteria that they use and if you have the best project, you get the prize at the end.

Why did you use voice technology, specifically Amazon's Alexa, as the main component?
Everybody is developing apps and websites, but there are really cool avenues of new technology that don't get as much attention. In this case, instead of doing the typical prompt of getting kids to build an app, website, or game, we thought about innovative ways to introduce them to something new and develop a skill that is not focused on as much. We had them interact with Alexa, which is a smart speaker, and asked them to build whatever they thought would be useful or fun.

Were there submissions that didn't win but were still quite memorable?
Yes. One team was really into fashion and wanted to make sure that they didn't wear the same clothes every day. They programmed Alexa to have access to a database of their clothes and what they wore for the week so that they could ask Alexa in the morning, "Alexa, what should I wear today?" Alexa would give them a recommendation based on the weather and different data points. It seemed like a super-efficient way to pick your clothes in the morning.

What did the judges look for in the winning project?
Overall, the judges were looking for teamwork, creativity, usefulness, how fun it was, and a polished look. We specifically made sure the participants could use both the MIT App Inventor and Alexa but we didn't say they couldn't use other technologies. Both Aiden and Callum had quite a bit of knowledge in Scratch that they integrated which added a visual aspect.

How can a hackathon be a good opportunity for competitors to network or make friendships?
Because there is a limited amount of time—in our case, just over 14 hours—we provided a format for time and project management but a lot of teams chose to do it their own way and assign roles and come together at the end. Just participating in a hackathon looks great and shows the ability to hunker down, get work done, and do it in a collaborative way. On the social side, it was pretty fun. We wanted a competition feeling but also a friendly, wholesome environment. By the end of it, a lot of parents from the same area facilitated more hangouts for their kids. We got to see them make friends during the hackathon and outside of it.

Do you have any advice for someone who wants to participate in a hackathon for the first time?
Just jump into it. The biggest obstacle is feeling like you don't have the necessary skills to solve problems or be a part of a team. What I have learned from hackathons is that so many skills beyond coding are needed. Maybe you have great instincts for marketing or organization. Maybe you are just a great leader. For anyone worried about finding a team or fitting in, the organizers can help with that, find the right team for you, and make sure you have a great experience. That's what we tried to do. **&**

CODING AND PROGRAMMING
COMPUTING AND NETWORKS
TECHNOLOGY AND SOCIETY
DATA
DESIGN

The MAKE section of *Root & STEM* showcases the different ways educators engage with students and promote STEAM concepts inside and outside the classroom. If you know of an educator who goes the extra mile, tell us about them at **STEAM@pinnguaq.com**.

Snakes and Ladders: Online Safety Edition!

Navigating the internet can feel tricky sometimes, much like a game of Snakes and Ladders. But in this version of the classic game, there's a twist. The objective is to be the first to reach the 100th square but some squares have snakes and some squares have ladders. If you land on the head of a snake, read out an online safety statement below (match the number of the statement you read with the number of your square). Uh-oh! A snake means you didn't follow online safety guidelines correctly and have to slide down its tail. If you land at the bottom of a ladder, read out an online safety statement below (match the number of the statement you read with the number of your square). Woo! Ladders mean you followed online safety guidelines correctly and can go up to the top rung.

Challenge Mode: In this version, you can still be saved if you land on a snake. Before you start the game, everyone chooses their own special number from 1 to 6. Then, if you land on a snake and read the online safety statement aloud, you can have a chance to save yourself by rolling the dice again. If the dice lands on your special number, you have the chance to state what the correct course of online safety action would have been instead of the behaviour shown in the statement you read aloud. (Suggested answers are upside down on the bottom of this page). If you do not land on your special number, you do not have the chance to save yourselves, and must slide down to the tail of the snake.

LADDERS – Great Job! You followed online safety guidelines correctly!

#4: Way to be observant! Before making a purchase, you made sure that it was on a credible website, and checked for the "https:" at the beginning of the URL. The "s" after the "http" lets you know that the website is secure!

#12: Smart thinking! You used a nickname instead of your real name to sign up for a social media account. This makes it harder for predators and other people with bad intentions to locate you.

#40: Great job keeping it close! You only add people on your social media accounts who you know in real life and who are your friends.

#57: Good choice! You didn't respond to a message from someone that was mean or made you feel uncomfortable. Instead, you told an adult and didn't respond to the person.

#72: Very responsible! Someone sent you an embarrassing photo of someone else and told you to send it to people you know. You refused, reported them, and told an adult.

SNAKES – Oops! You didn't follow online safety guidelines correctly!

#23: Oh no! You sent photos of yourself to someone online whom you thought you could trust… now you got a message from someone else saying they've seen them too. Remember that what you put on the internet, stays on the internet!

#96: Not all social media accounts are real! You got a DM from the Instagram account of an influencer telling you that you won a giveaway. You responded with your personal phone number and now you're stuck getting a ton of spam calls every day.

#47: Oops! You made the password to one of your accounts too easy to guess. Now a hacker has gained access and locked you out of your own account!

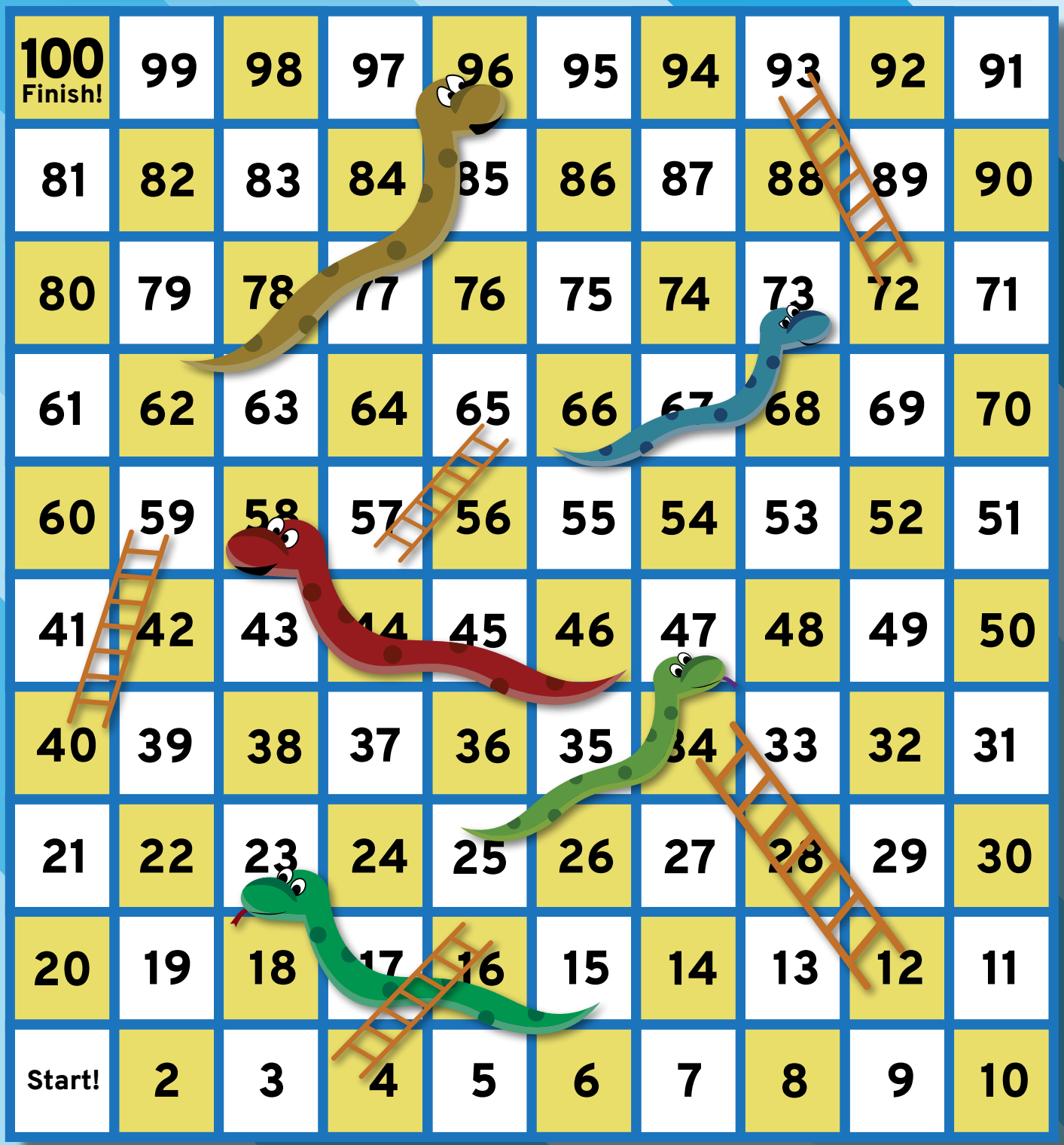
#73: Not everyone is who you think they are! After talking with someone online, you made plans to meet with them—alone. Now you can see they lied about some aspects of who they were.

#58: Whoops! You forgot to install and keep your antivirus program up to date. Now you have spyware on your computer and someone has access to your personal data!

Suggested answers.

#23: Don't send anything online you wouldn't want everyone to see! | #47: Make sure there are uppercase letters, lowercase letters, symbols and numbers in your password! | #58: Keep an up to date antivirus software on your digital devices! | #73: Don't meet with anyone you talk with online without telling an adult first! | #96: Stay away from pop-up ads and don't give out personal information!

Snakes and Ladders:
Online Safety Edition!



Playing in challenge mode? Don't forget to choose your special number!

CAN YOU HACK IT?

A password is like a lock that protects online information. A good password is really hard to crack. It usually has a long combination of upper- and lower-case letters, special symbols, and numbers. They can be randomly generated but those can be hard to remember. You can make remembering your passwords easier by using phrases that contain symbols and numbers like “I'm110%Sure!” Maybe you’ll pick a phrase about movies for a streaming service, or a phrase about your favourite subjects for a school password. Whatever you choose, it should be hard for someone else to guess.

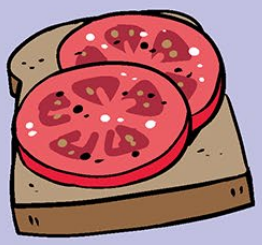
Can you decode the passwords below? The first one is done to show you how it works. The answers are at the bottom of the page.

Un42n8ly4U,I'm#1

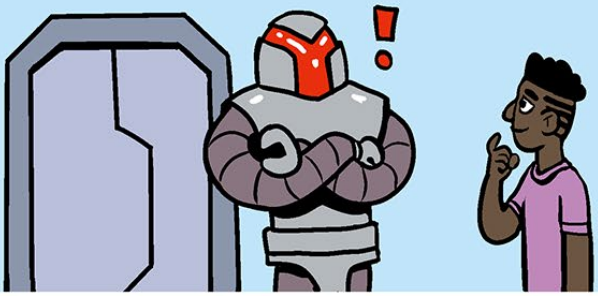
Unfortunately for you, I'm number one!

2Much2Watch4Us!

U8Tom8os4Lunch?

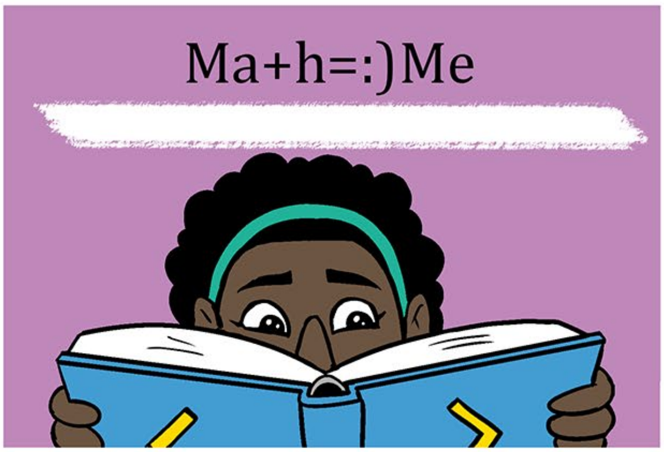


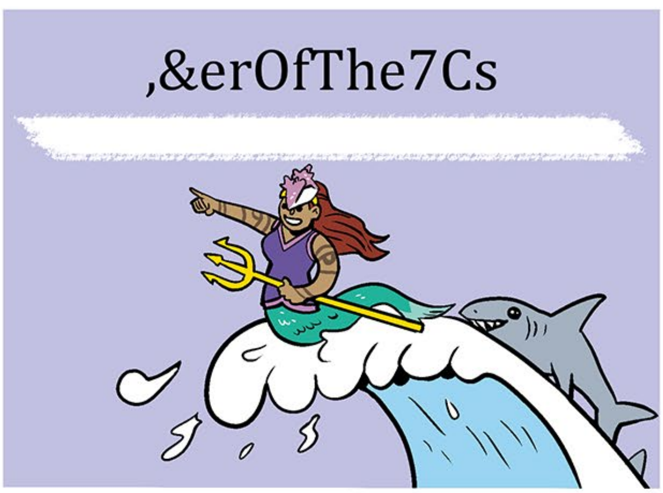
M&@oryPassw0rd!



:)Birthday2U!

1. Too much to watch for us! 2. You ate tomatoes for lunch? 3. Mandatory password! 4. Happy birthday to you!



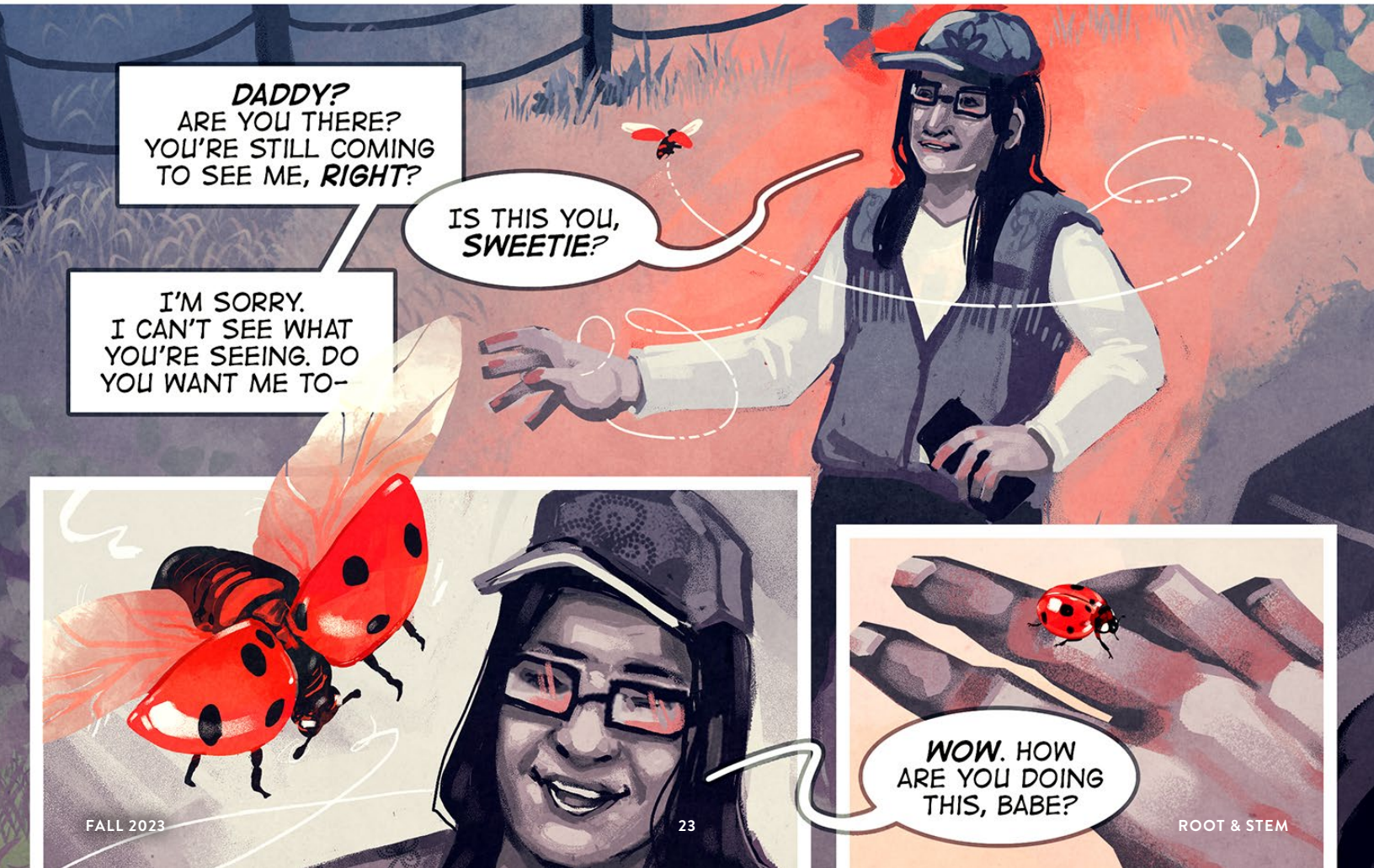


5. I won the tennis match. 6. Catch you later! 7. Math equals happy me 8. Five sandy islands 9. Commander of the seven seas. 10. A number of people love cats 11. Dash to the finish line 12. Star Wars 4 is greater than Star Wars 1

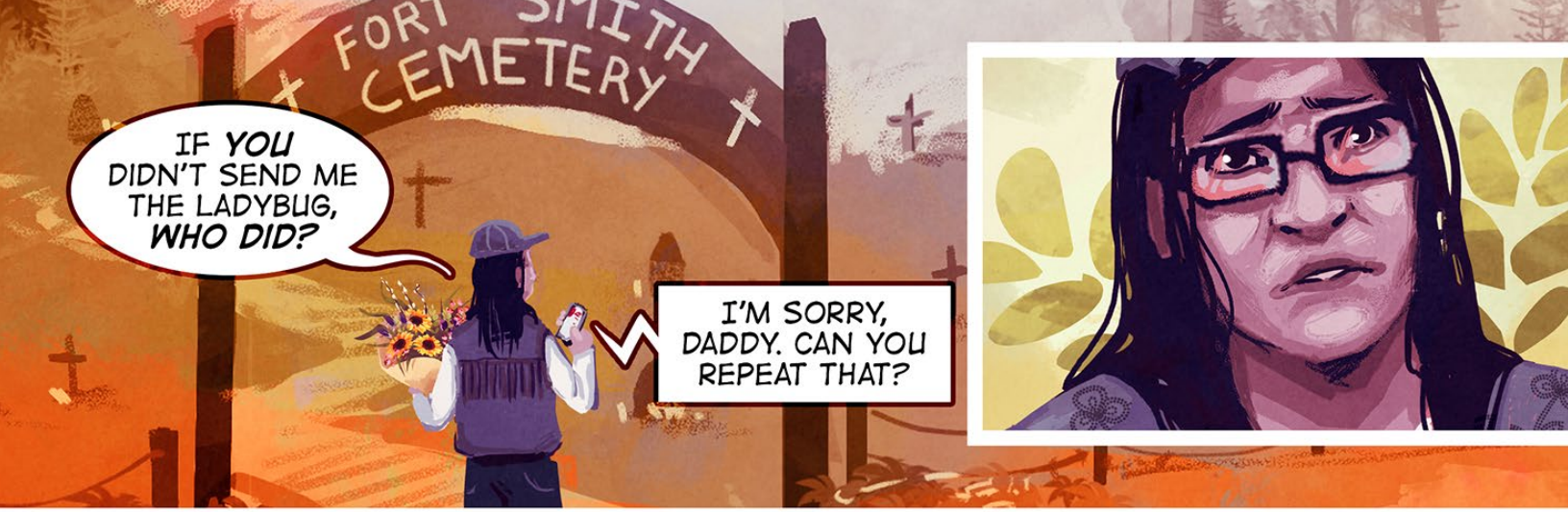

FORT SMITH CEMETERY
STORY BY RICHARD VAN CAMP
ILLUSTRATIONS BY MICAELA DAWN
LADYBUG
BABY GIRL
HELLO, MY GIRL.
HEY, DADDY. WHERE ARE YOU?
BABY GIRL
I'M COMING FOR A VISIT.
WHY CAN'T I SEE YOU?
SORRY, SWEETIE. I UPDATED MY PHONE AND EVERYTHING'S MESSED UP.
OH, DADDY. DO YOU WANT ME TO HELP YOU WITH THAT?

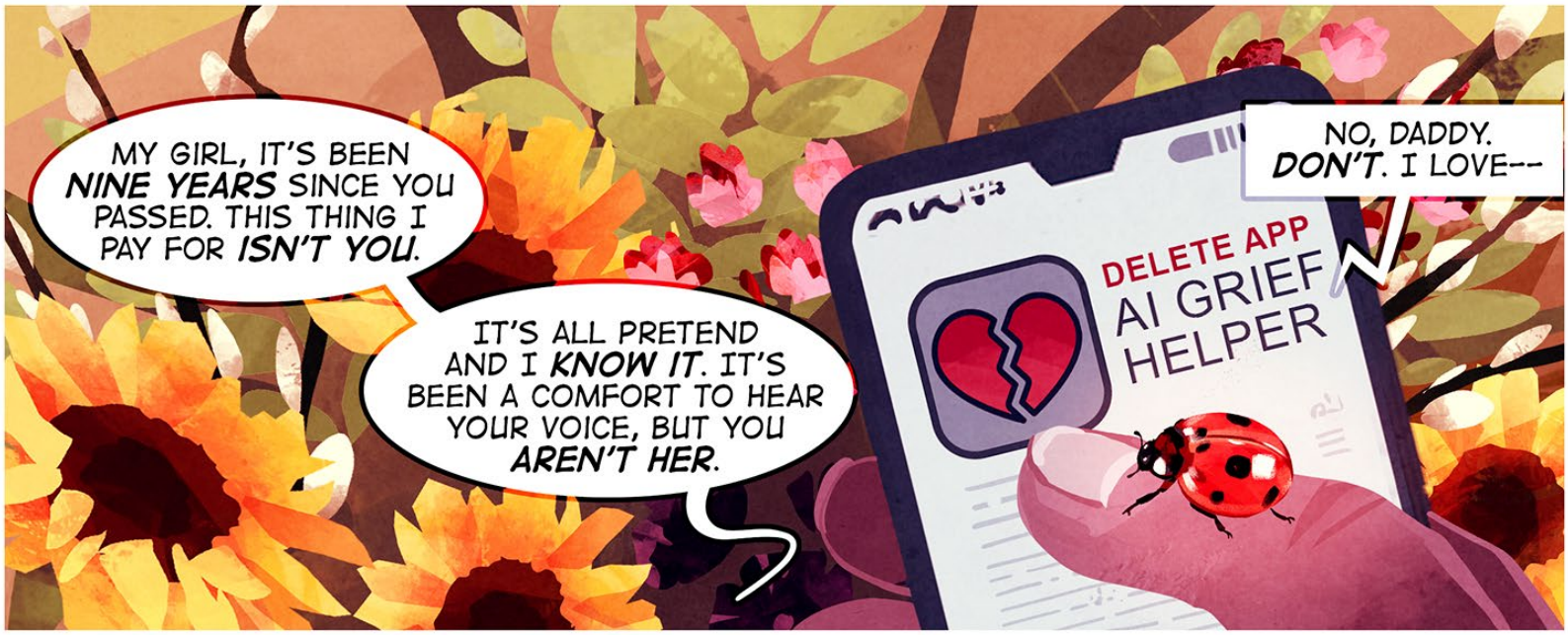

WHOAH!
DADDY? ARE YOU OKAY?

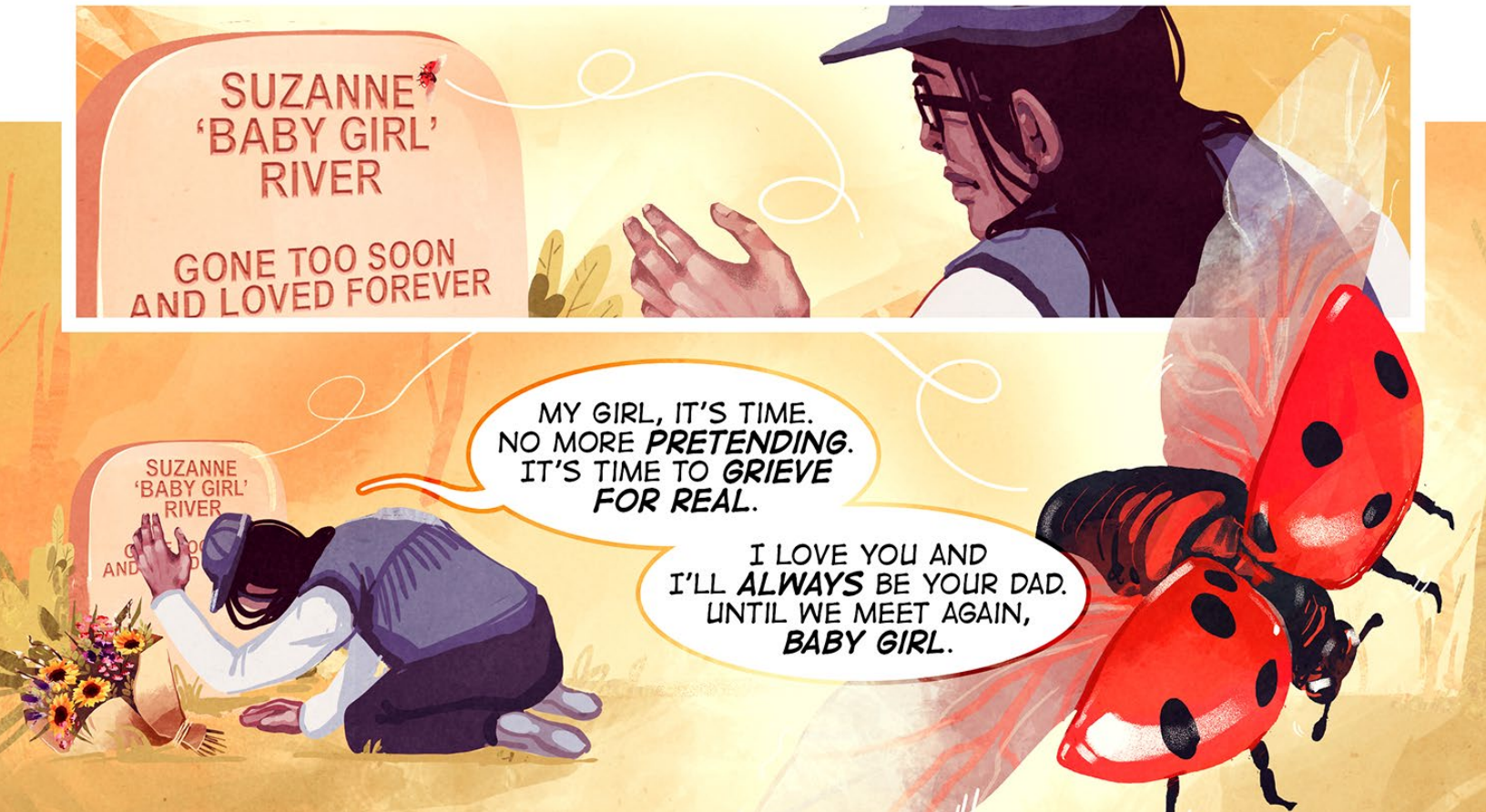

DID YOU HAVE A GOOD DAY? ARE YOU MAKING MY FAVOURITE FOR SUPPER?


DADDY? ARE YOU THERE? YOU'RE STILL COMING TO SEE ME, RIGHT?
IS THIS YOU, SWEETIE?
I'M SORRY. I CAN'T SEE WHAT YOU'RE SEEING. DO YOU WANT ME TO-
WOW. HOW ARE YOU DOING THIS, BABE?


DOING WHAT, DADDY?
DID YOU SEND ME A LADYBUG *AGAIN* THIS YEAR?
ON THE DAY THAT YOU...?
BABY G
ON THE DAY I *DIED?*
I DON'T HAVE THAT FEATURE YET.
BABY GIRL
WHAT'S HAPPENING HERE?
I'M SORRY, DADDY. I DON'T UNDERSTAND WHAT YOUR REQUEST IS.
BUT IF YOU WANT TO ADD MORE *SERVICES*, YOU CAN CALL THE NUMBER ON THE BACK OF YOUR *MONTHLY STATEMENTS.*
IS *THIS* YOU...
...OR IS *THIS* YOU?
BABY


FORT SMITH CEMETERY
IF YOU DIDN'T SEND ME THE LADYBUG, WHO DID?
I'M SORRY, DADDY. CAN YOU REPEAT THAT?


MY GIRL, IT'S BEEN NINE YEARS SINCE YOU PASSED. THIS THING I PAY FOR ISN'T YOU.
IT'S ALL PRETEND AND I KNOW IT. IT'S BEEN A COMFORT TO HEAR YOUR VOICE, BUT YOU AREN'T HER.
NO, DADDY. DON'T. I LOVE--
DELETE APP
AI GRIEF HELPER


SUZANNE 'BABY GIRL' RIVER
GONE TOO SOON AND LOVED FOREVER
MY GIRL, IT'S TIME. NO MORE PRETENDING. IT'S TIME TO GRIEVE FOR REAL.
I LOVE YOU AND I'LL ALWAYS BE YOUR DAD. UNTIL WE MEET AGAIN, BABY GIRL.

Transforming through Technology

How AI Is Reshaping Language Revitalization

BY SOFIA OSBORNE

When Aidan Pine was in the first year of his linguistics degree at the University of British Columbia, he wanted to get experience working with language revitalization outside his coursework. He joined a research project, working with speakers to create a dictionary for the Gitksan language, spoken by the Gitksan Nation of British Columbia, which the researchers hoped ultimately to make into an app. But, Pine says, they quickly realized how challenging it was to get that kind of technology made by a non-Indigenous company.

"There were a lot of companies, [but] they didn't really understand the issues that surrounded these types of dictionaries," he says. "They had expertise in building websites generally, but they didn't know how to work with Indigenous languages."

The companies were also quoting large amounts of money, up to nearly $100,000, to produce the app.

"We put years of work into this... why isn't there an easier way to publish it?" Pine recalls asking himself.

When it comes to adopting technology for language learning, there are other important factors to consider, like data privacy and whether communities retain ownership of the material they upload. So, taking matters into his own hands, Pine made the Gitksan app as his undergraduate thesis project.

He soon realized this type of software could also be useful for other Indigenous communities seeking to mobilize the language data they were collecting, and so his organization, Mother Tongues, was born.

Mother Tongues was created to help communities create their own dictionary resources for their respective languages. Courtesy of Mother Tongues and the Gitksan Research Lab

Speech generation for Indigenous language education (SGILE) project participants, from left to right: Ross Krekoski (University nuhelot'ine thaiyots'i nistameyimâkanak Blue Quills), PENÁĆ (W̱SÁNEĆ School Board), Roland Kuhn (NRC), Erica Cooper (National Institute of Informatics), Delaney Lothian (NRC), Owennatékha (Onkwawenna Kentyohkwa), Tina Wellman (University nuhelot'ine thaiyots'i nistameyimâkanak Blue Quills), Aidan Pine (NRC), Akwiratékha' Martin (NRC), Rohahiyo (Onkwawenna Kentyohkwa), Tye Swallow (WSÁNEĆ School Board), Anna Kazantseva (NRC), and Dan Wells (University of Edinburgh)

Free and open source, Mother Tongues Dictionaries allows communities to create their own, easy-to-use dictionary apps for their languages, available on iOS, Android, and the web. Crucially, once downloaded, the apps can be used offline.

Pine says one of the most important features he wanted to include in the Mother Tongues software is an approximate search algorithm, which returns words that are similar to but not exactly the same as those the user has searched for.

"The majority of people who use these dictionary apps are learners, and so there was this frustrating experience when the search algorithm that they were using was very rigid—you had to spell the words exactly as they were written in the dictionary," Pine says. "So I was a learner and in order to look up a word, I had to already know how to spell it. Which is a bit of a paradox, right?"

Currently, there are more than 20 linguistic communities using Mother Tongues for their dictionaries. Pine says he recommends educators take a look on the App Store or on **mothertongues.org** to see if a dictionary of the language they are teaching is available for download.

Pine is also a research officer with the National Research Council of Canada, where he works on the Indigenous Languages Technology Project, an initiative whose mandate is to create software to help Indigenous language revitalization.

"Our philosophy was not to try to push technologies that we thought might be useful or interesting onto Indigenous communities but rather to ask them what they would find useful," says Roland Kuhn, the head of the project.

One of the team's most popular sub-projects is the ReadAlong Studio, a tool that allows educators to create interactive, read-along stories that feature automatically synchronized text and speech.

"What we found when we were talking with a lot of educators, curriculum developers, and students, was that there was a real bottleneck for creating audio and text educational content in Indigenous languages," Pine says. "A lot of the teachers maybe had some text and they maybe had some corresponding audio… but combining those two things in an educationally accessible format was a real challenge."

The ReadAlong Studio software uses a form of speech recognition called text audio alignment, which automatically matches up speech with the corresponding word in the story. Read-alongs are created by pairing a text with an Elder reciting the story in an Indigenous language. Those trying to learn that language are then able to follow along, slow down, and play back certain words to hear their proper pronunciation.

While the tool was developed to be used for Indigenous languages, it is highly flexible. So far, read-alongs have been created by educators from countries around the world, among them Colombia, Nepal, the Netherlands, Nigeria, and Taiwan.

Another tool created by the Indigenous Languages Technology Project is a verb


PHOTO COURTESY OF NATIONAL RESEARCH COUNCIL CANADA / CONSEIL NATIONAL DE RECHERCHES CANADA

conjugator for Kanyen'kéha, also known as Mohawk, which was suggested to the team by Kanyen'kéha educator Owennatekha.

When the team asked Owennatekha what would be most helpful for the students at the Onkwawenna Kentyohkwa school (Our Language Society) he founded at Six Nations of the Grand River, he said learners struggle most with verbs. Kanyen'kéha is a polysynthetic language, in which single words that are combinations of smaller elements of meaning, called morphemes, can often be equivalent to full sentences in languages like English. Kanyen'kéha is dominated by verbs, which are very often used to express things that might be expressed as nouns in other languages.

At the Onkwawenna Kentyohkwa school, instructors use a root-word method to help students learn and combine these morpheme building blocks.

Kuhn and his team worked with Owennatekha and other teachers at the school to create the verb conjugator software, an interactive program that allows users to select the subject (person), tense (time), and verb (action), and press a button to receive the correct conjugated form of the verb. While classroom time is focused on interaction between instructors and students, Owennatekha says the verb conjugator serves as a helpful reference.

"Trying to memorize a language like Kanyen'kéha is the same thing as trying to learn English by memorizing whole sentences," Owennatekha says. "So that's the beauty of our [verb conjugator] method."

While Indigenous languages spoken in Canada are extremely diverse, they are almost all polysynthetic. When other Indigenous language educators in Canada saw the verb conjugator prototype, they started requesting it for their own languages. Since then, members of the team have created conjugators for Michif, Mi'kmaq, and Anishinaabemowin, and are working on interactive apps for Nêhiyawêwin and SENĆOŦEN.

"That prototype is an example of a project that was originally suggested by an educator who teaches Kanyen'kéha, but which turned out to be very useful for other Indigenous languages spoken in Canada, even [linguistically] unrelated ones," Kuhn says. "That's what we're always looking for."

Now, Pine, Kuhn, and others from the Indigenous Languages Technology Project are working with Onkwawenna Kentyohkwa to bring the words produced by the verb conjugator to life.

"It's one thing to be able to get this app to create a verb, but you look at it and it's just gobbledygook to people who don't know the language," Owennatekha says.

The team is working on using text-to-speech technology to create a tool that will allow learners to hear the pronunciation of words they produce. With hundreds of thousands of possible conjugations, it would take years and a tremendous amount of work to have speakers record each pronunciation manually. Instead, a neural network—a set of interconnected artificial nodes made to model the human brain—can be trained on the relationship between text and speech using data from recordings of audiobooks, speeches, stories, and other sources. Through trial and error, Pine realized it only takes a few hours of data for the algorithm to be able to provide pronunciations that are accurate enough for teaching.

Owennatekha also hopes the text-to-speech software can be implemented for the textbooks used at the school.

"[Students] would ideally be able to click on a word and hear it pronounced," he says. "That would really be an enormous help."

The text-to-speech model is one of very few projects involving Indigenous languages spoken in Canada that uses artificial intelligence in the contemporary sense of the word, Kuhn explains. This is because there is a lack of data available, making them what linguists call low resource languages.

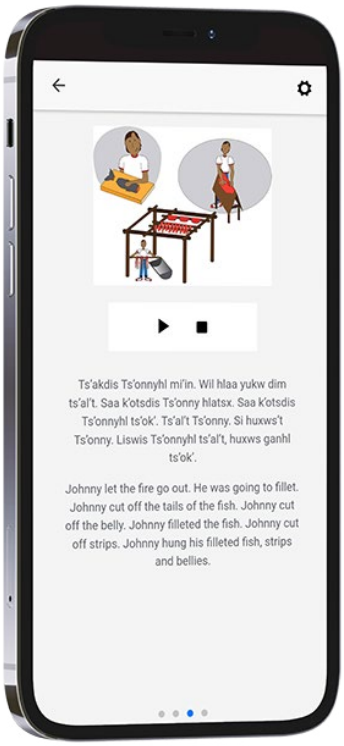
"People who only speak English or French don't realize that for those [major European] languages, there's tons of free data floating around on the web," Kuhn says. "That's not the case for Indigenous languages spoken in Canada, or indeed for most languages."

To date, Inuktitut is the only Indigenous language spoken in Canada for which successful machine translation projects have been produced, as there is far more parallel data available for the Inuktitut-English language pair than for other languages. This is in great part thanks to the proceedings of the Nunavut Legislative

"People might begin to feel that their languages are not important, and that some other major languages are more important than theirs. And that has a psychological effect."

Graduates of a 2013-2014 language course at Onkwawenna Kentyohkwa

PHOTO COURTESY OF ONKWAWENNA KENTYOHKWA



Ts'onny Go'ohl Wilp Sihon is one of the stories available on the Gitksan app, developed by Mother Tongues, that uses read-aloud technology. Courtesy of Dr. M. Jane Smith (Xsiwis) and Michelle Stoney, Mother Tongues, and the Gitksan Research Lab

The Browse feature of the Gitksan online dictionary website allows a user to see all available words sorted by category. Courtesy of Mother Tongues, the Gitksan Research Lab, and Ken Mowatt (Maaslik'i'nsxw)

Assembly, which are written in Inuktitut in parallel with English.

Kuhn and his team worked with the Nunavut Legislative Assembly to match up 1.3 million Inuktitut sentences with their English translations. They released this parallel corpus in 2020, and the team and other researchers use it to train machine translation systems.

Still, Kuhn says the quality of the systems is not great on average.

This "1.3 million sentence pairs isn't enough to train a high-quality machine translation system, especially when the two languages involved, English and Inuktitut, have such different grammatical structures," he says. "A system trained on 13 million sentence pairs, or 130 million, would be much better."

By contrast, Kuhn says it would be hard to find even 20,000 language pairs between Kanyen'kéha and English.

"With so little training data, it's impossible to build a decent system for translating between these two languages," he says. "Fortunately, our Mohawk collaborators aren't interested in machine translation from English, as most, if not all Mohawks are fluent in English. Instead [that] collaboration focuses on software to help learners of the language on creating educational software to help learners speak and write in their ancestral language."

This lack of data also poses a challenge for low resource languages around the world, something that researchers like Ife Adebara—a PhD candidate in the Department of Linguistics at the University of British Columbia who works on AI tools for African languages—are trying to address.

"I know a lot of English speakers take it for granted that we have access to the web, and we can do whatever we want to do in English and have a lot of tools and resources," she says. "But for people who do not speak English, and who speak a lot of these less widely spoken languages, they are completely cut out of that whole technological advancement."

Adebara created a language identification tool called AfroLID, which uses AI to identify 517 African languages and dialects from any given text. A model like this is important, Adebara explains, as it allows researchers to find data around the web that can be used to train AI. In this way, AfroLID is a stepping stone towards developing Natural Language Processing (NLP) systems for these African languages that will be able to process language in the same way humans do.

Predictably, one of the biggest hurdles Adebara faced in creating AfroLID was a lack of data. There are few documents available in, and few researchers working on, these languages.

"If you are working on NLP in English, you can crawl any of the news stations and you will get a lot of texts daily on the web in English," she says. "It takes a lot more effort and intentionality to find anything from these [African] languages."

Ultimately, it took Adebara's team over two years to curate the data set they used to create AfroLID. After this experience, she is trying to encourage policy changes that will ensure data is available in African languages.

"In Nigeria, where I come from, education is in English, so that already cuts

"When people don't have access [to technology] in the languages that they speak, we actually lock them out from global conversations. We don't hear their perspectives on the issues that we're dealing with. And they don't hear our perspectives either..."

out the level of literacy in these other languages," she says. "This filters down to the availability of data. And so there are a lot of policy issues that need to be changed."

With AfroLID complete and able to collect data and detect which language it is in, Adebara and her research group have moved on to other AI projects. This summer, they launched Serengeti, a language understanding model that learns general information about a language and can be used to complete tasks like identifying key names and nouns in a document. A tool like this means that speakers of these 517 African languages could use a search engine in their own language.

Adebara says that there can be a lot of pressure to learn a widely spoken language in order to have access to more resources, but that can hinder the use of the languages a person already knows. "People might begin to feel that their languages are not important, and that some other major languages are more important than theirs. And that has a psychological effect."

If more data can be collected and identified using AfroLID, and more AI models can be generated using that data, Adebara hopes machine translation between English and these African languages will be possible, opening the door for more people to access resources like textbooks.

Ultimately, Adebara says, this work is important in diversifying the AI space.

"When people don't have access [to technology] in the languages that they speak, we actually lock them out from global conversations," she says. "We don't hear their perspectives on the issues that we're dealing with. And they don't hear our perspectives either... If we have access to more people's opinions and perspectives about global issues, perhaps we'll be able to solve some of these issues a lot faster than we are right now."

From tools being created to help revitalize Indigenous languages spoken in Canada to AI models that bring access to people who speak the world's 7,000+ languages, technology is changing the way we work with language. Still, Kuhn says, it is speakers and learners who are at the heart of it all.

"[The educators] are the directors, the playwrights," he says. "We're like stagehands. We help with the lighting. Maybe we can make the scene a little bit better... But we're not the centre of the story. The centre of the story is the educators who are trying to bring their ancestral languages back." **&**

COMPUTING AND NETWORKS

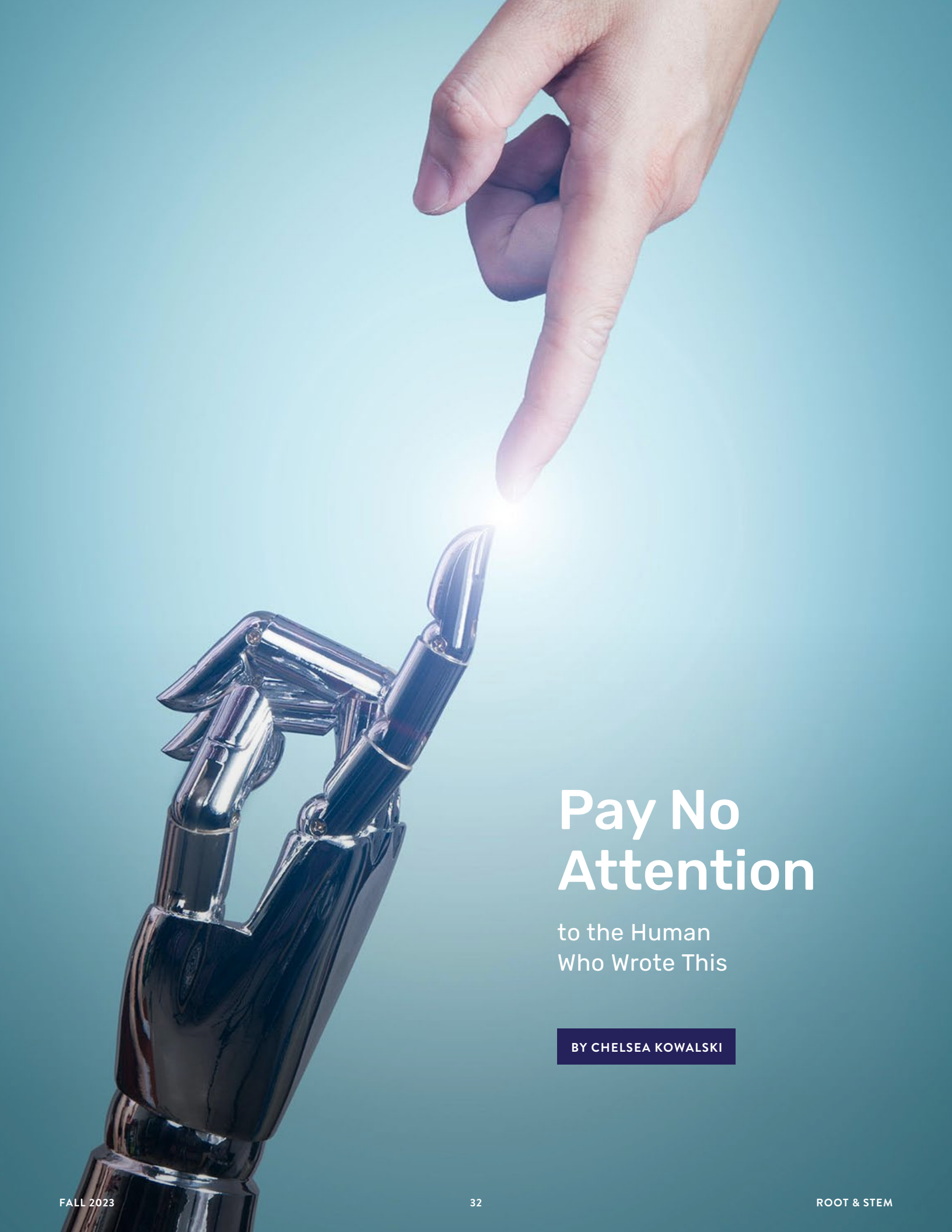
TECHNOLOGY AND SOCIETY

DATA

DESIGN

Left: Graduates of a 2020-2011 language course at Onkwawenna Kentyohkwa.
Right: Owennatekha (standing, left) is Program Co-ordinator and Instructor at Onkwawenna Kentyohkwa, a community-based organization that teaches Kanyen'keha for adults

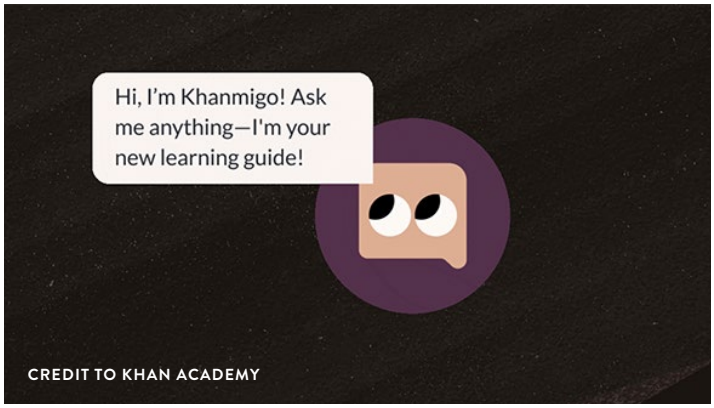
PHOTOS COURTESY OF ONKWAWENNA KENTYOHKWA



Pay No Attention

to the Human Who Wrote This

BY CHELSEA KOWALSKI



About Plagiarism

What is plagiarism?
Plain and simple, it is the act of passing off someone else's work or ideas as your own.

Common forms:
Taking existing content off the internet or from a book and presenting it as your own work, paying someone else to write an assignment for you, or using a friend or family member's previous work.

Is submitting content generated by an AI program a form of plagiarism?
Because the work is not created by the person making the submission, it can definitely be considered a form of plagiarism. Many educational institutions have their own regulations regarding AI but there is no consensus as the technology and its widespread use are very new.

Top Left: Khanmigo, an AI-powered tutor for students and an aid for educators, from Khan Academy

This article is reflective of the abilities and features of AI chatbot technology at the time of publication

Right now, artificial intelligence (AI) is basking in the glow of an enormous spotlight. Initially seen as a concept of science fiction, AI—the simulation of human intelligence by machines—has come to mesmerize people all over the world. Millions of people are using AI software programs to help problem-solve, create content, or just have a conversation.

AI technology can do amazing things that humans don't have the ability to do themselves. It can process information faster, detect patterns more easily, and analyze more data in a fraction of the time people need to execute these processes. And yet, most of what AI is being praised for right now is a trick.

AI chatbots cannot judge or think or form opinions. They can, however, make you think they can.

AI technology is often described as a "thinking" computer. While it can certainly seem like an AI chatbot like ChatGPT is engaging in thought when it provides responses to a user or synthesizes original content to come up with something new, the machine is really just following instructions in a code. Still impressive, but not representative of the actual ability to think.

What is ChatGPT?

ChatGPT, developed by OpenAI, is arguably the most popular chatbot in the current market. It is currently available in two iterations of OpenAI's large language model (LLM) technology, GPT-3.5 (free) and GPT-4 (paid). ChatGPT reached more than 100 million users in the first three months since its release, and is being used for a wide array of tasks, including creating résumés, solving mathematical problems, debugging code, and writing essays. But a product with so many capabilities comes with just as many risks and dangers. One such risk is plagiarism.

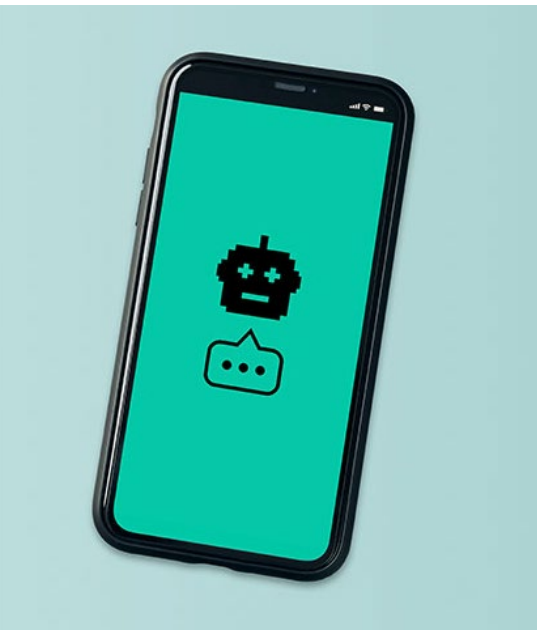
AI-created content is generally advertised as original content because the technology assesses and extracts from many sources, bringing them together to form a cohesive text, just as a student might review various sources before writing an essay. When a student looks up sources of information for an essay, however, they are learning at the same time. They are absorbing material, making connections among various pieces of content, and then (hopefully) developing their own thoughts about the essay prompt. Close reading, conducting research, critical thinking, and reasoning skills are among the most important elements that a student learns. Passing off that work to AI not only takes away the opportunity for skill development but also guarantees the work they hand in won't have any original thinking or reasoning, as AI chatbots are incapable of performing those tasks.

Understandably, to avoid issues of plagiarism and missed learning opportunities, many educators discourage student use of AI. To remain accessible and permitted in most classrooms, AI will need to function as an educational tool or perhaps even as a tutor. Khan Academy, an educational organization, understands this. Its founder, Sal Khan, recently came out with Khanmigo, an AI-powered tutor for students and an aid for educators. It acts as a pop-up chat feature that encourages and aids students in their learning process. Khan admits that this chatbot sometimes generates inaccu-

rate answers but stresses that its role is that of a coach and not of an expert. For educators, Khanmigo is advertised as a teaching assistant to help produce lesson plans or classroom activities.

Google AI came up with its own LLM (called PaLM 2) and a chatbot named Bard. Its way of dealing with the ethical dilemma of producing content that is derived from existing content is to advertise Bard as an experiment. In fact, Google openly admits that Bard "may give inaccurate or inappropriate responses." While the discussion about AI often jumps to very complicated tasks with serious implications, Bard subtly takes a backseat approach, calling itself a "creative and helpful collaborator" that can assist the user in simple tasks, like creating lists, brainstorming, or drafting emails—more of a "complementary experience to Google Search."

Bard's simplicity extends to its citations. If Bard uses a direct quote from a web, the webpage is cited. Otherwise, the content generated by Bard is considered original. But its honesty and experimental status is also what makes it lag behind its competitors. When a user asks Bard to explain how Bard itself works, it has trouble answering the question accurately. Ironically, Bard's self-reflexive attempts to explain how it functions is one of the prime situations that can lead to misrepresentation and misinformation. Google explains that Bard, as an experimental program, is still flawed and can often make false claims about itself.



So, how can AI be helpful for educators and students?

Open communication is key. Many students already know about AI technology and are already using it, whether or not it's encouraged in the classroom. To pretend it is not in active use simply creates a situation in which students will use it inappropriately and without proper limits. With careful consideration and an understanding of chatbots as tools to supplement primary forms of education, AI can be used with a learning-first approach.

Giving students the chance to explore this technology can make a big difference in the way they learn to use AI and allow them to develop skills for AI technology usage. For example, students could ask a chatbot to write an outline or even a first draft of an essay, with the understanding that it is then their job to fact-check, revise, and write the final draft. Alternatively, students might engage in conversation with a chatbot to ask about its thoughts to show that AI cannot generate opinions, only share information (sometimes inaccurately). Incorporating AI exploration into existing lessons can invigorate learning experiences and show learners how to use AI as a supplement rather than a replacement.

Ten years ago, it was relatively common to encourage students to learn mathematics by demonstrating the many potential functions of those skills in real life. Before smartphones, it was common to have a math teacher insist that certain math skills were necessary because no one carries a calculator everywhere they go. Of course, nowadays that argument doesn't work. So, teachers have adapted. Today, using a calculator is seen not as an act of defiance or laziness but rather as employing a useful tool. In fact, it would be seen as a detriment for a professional not to know how to use a calculator. The same process of evolution will happen with AI. As its use grows, students will continue to integrate it into their daily lives and the ways they learn. Imagine the learning opportunities that could be a part of every classroom if educators sought to mirror the absorption of this technology.

"AI chatbots cannot judge or think or form opinions. They can, however, make you think they can."

The Turing Test

Simply put, the Turing Test determines whether a machine can convincingly act as a human. The test participant engages in conversation using a device that is connected to both a person and a machine. After the conversation is completed, the participant is asked to determine which conversation involved the human and which involved the machine.

To date, no AI chatbot has been able to pass the Turing Test. AI technology is evolving rapidly, though. Humans are evolving as well. The average online user has completed some version of the Turing Test, thanks to the internet and the rise of bots. Social media apps have made it easy for bots to friend, follow, or send direct messages to the average user. Bots in current use aren't so advanced that they can easily masquerade as a human on the other end, however. But, AI chatbots might be a different story.

Can we discern content created by a human from similarly themed content created by AI? You can try now. The following two paragraphs are responses to the same prompt. One was written by a human and one by ChatGPT (GPT-4).

For now, AI can be thought of as the great and powerful Wizard of Oz from *The Wonderful Wizard of Oz* by L. Frank Baum

Prompt: Should students and educators be careful about the use of AI?

A. Absolutely, students and educators should tread carefully with AI. While AI can revolutionize learning, offering tailored lessons and automating tasks, it comes with drawbacks like data privacy risks and algorithmic biases. It's crucial to understand how these algorithms work and the kind of data they're collecting. Over-reliance on AI can also stifle critical thinking. Balancing its benefits against ethical and practical concerns is key to harnessing AI's potential responsibly.

B. Yes. AI can be an incredible aid, but a dismal replacement for thought-based content creation for both students and educators. As a student, you could feed prompts into an AI chatbot and have it produce a 1,500 word essay. An advanced AI program will even let you select the style and tone of the writing. But here's the caveat. An AI can tell you what other people think. But it cannot tell you what it thinks. Because it doesn't. AI can regurgitate material, collect information, summarize texts, and produce a tidy essay or article out of those skills but it cannot practice critical thinking. As a result, AI produces constant first drafts.

Were you able to determine which paragraph was written by the AI? If so, congratulations! AI has made considerable progress in the last few months in its ability to represent thought processes and mimic human writing and responses, but of course, it's still not an exact replication. AI tends to provide better answers to prompts that require facts rather than opinions. If the prompt had been, "Which colour is the best?", it would be fairly easy to tell which paragraph was written by ChatGPT. ChatGPT would not give a convincing or definitive answer, as the question demands subjectivity and a definitive answer requires thought and judgment.

Beyond the arguments regarding plagiarism and critical thinking skills, one of the more compelling reasons against leaving all the writing to AI is simple: emotion. When we read and research and learn, we feel emotions and writing is one way we can express them. A computer can't feel. It can only be programmed to act as though it does.

AI is an illusion. AI chatbots are being portrayed as thinking machines but they aren't there yet. We humans are still the thinkers; AI is merely the medium. AI cannot create anything without human thought behind it and, when it tries, it very often delivers an inaccurate product. For now, AI can be thought of as the wizard from The Wizard of Oz. Great and powerful, yes, but there is most definitely a person behind the curtain. &

CODING AND PROGRAMMING

COMPUTING AND NETWORKS

TECHNOLOGY AND SOCIETY

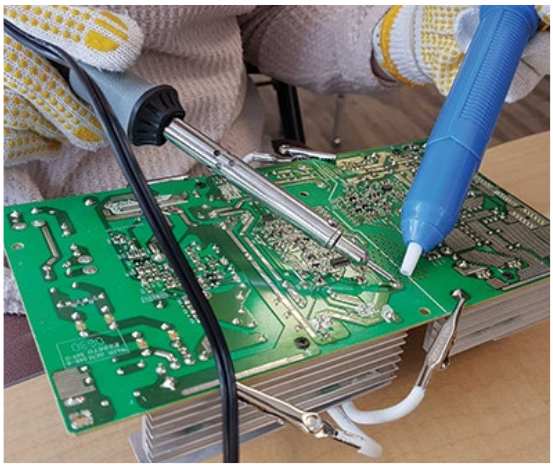
DATA

DESIGN

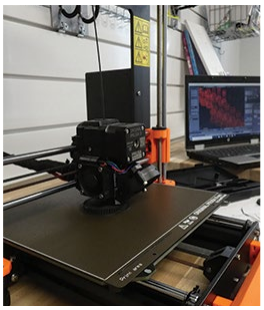
** Paragraph A was written by ChatGPT*











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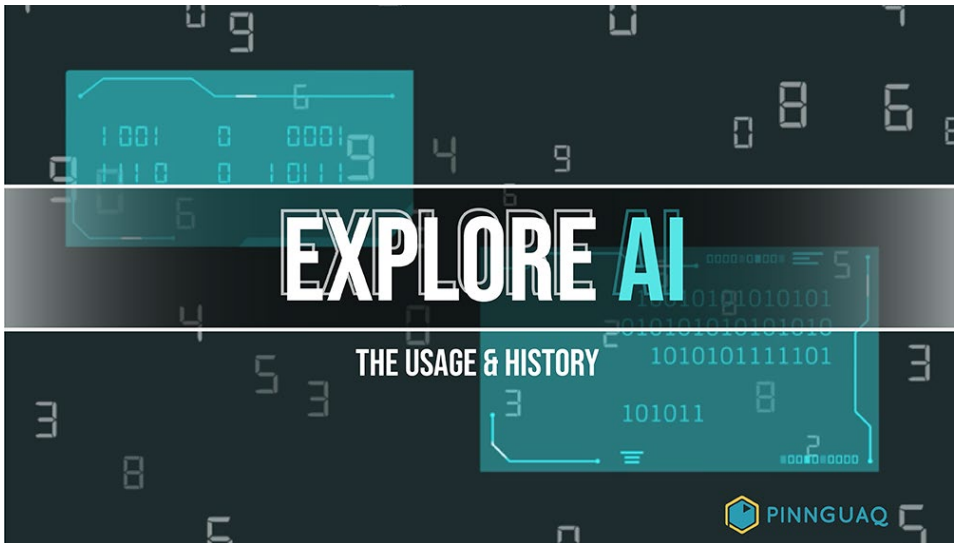
MAKERSPACES

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

pinnguaq.com/makerspaces



The *Explore AI* educational video explains the basics of artificial intelligence over past decades

Digital Kit

PAST ISSUES

If you missed past issues of *Root & STEM*, you can find them online at
pinnguaq.com/root-stem

RESOURCES

We have developed additional digital resources for educators to use in the classroom that connect to the theme of AI and online safety—including lesson plans, video tutorials, and handouts. They can be accessed online via the links that follow.

Root & STEM Podcast

This podcast expands on *Root & STEM* content and invites subject experts from each issue to share their knowledge. The current series explores the theme of artificial intelligence and online safety in relation to STEAM education. The episodes are approximately 15–30 minutes long and are available on the Pinnguaq website or your streaming platform of choice.
pinnguaq.com/learn/the-root-stem-podcast

Root & STEM App

Filled with the same informative articles, podcasts, and lesson plans as its printed counterpart, the *Root & STEM* educational app is a free digital resource for K–12 educators and learners of all ages. The app puts the magazine's STEAM content and curriculum in the palm of your hand. Interactive elements are being added regularly. Available for download on the App Store and the Google Play Store.

Harnessing the Benefits: The Digital World Podcast

This three-episode series designed for Grade 9–12 students highlights the advantages of technology while introducing potential dangers of the online world and how to avoid them. Each episode focuses on one popular aspect of the digital world: artificial intelligence, social media, and online learning. All three episodes will explain how these relatively new technologies can benefit students in and out of the classroom, how others are using this technology, and how to implement digital safety to harness the benefits of the digital world.
pinnguaq.com/learn/harnessing-the-benefits

Explore AI

This video takes students on a journey through time to learn about the history of artificial intelligence (AI). The video explores how AI came to be and the key scientists who first thought of creating intelligent computers, which are capable of using logic and thought patterns to solve problems. Students learn what early models of AI looked like, what the intelligent machines of the past were, and show how far technology and AI have come in the last two decades. The video also focuses on where we currently stand with AI-powered technology and what the future holds for humans and AI.
pinnguaq.com/learn/explore-AI

Gon' Phishing

Phishing scams are a particularly insidious element of the online experience. *Gon' Phishing* is a game built to provide an opportunity to experience a variety of phishing attempts and become familiar with the signs of phishing emails. In this game, the user must determine if incoming emails are "Legit" or "Phish." If players mark email incorrectly, they receive more emails that clog up their inboxes!
pinnguaq.com/learn/gon-phishing

Message to Educators

As we stand at the precipice of a technological revolution, the power of artificial intelligence (AI) and its accompanying fields, like machine learning (ML), neural networks (NN), and natural language processing (NLP), have the potential to reshape society in ways previously deemed the stuff of science fiction. It is paramount that the educators of today acquaint themselves with these transformative tools to ensure students will not be merely passive consumers but active creators and informed citizens in an AI-driven world.

Teaching AI fosters a foundational understanding of these technologies and their implications. By introducing these concepts at all ages, we empower students with a critical lens through which to view an increasingly digital world. This knowledge will serve them well, irrespective of their chosen profession, as AI permeates all sectors, from healthcare to arts to commerce and beyond.

This issue of *Root & STEM* focuses on three primary aspects of AI: machine learning, neural networks, and natural language. This edition's lesson plans are the perfect gateway to the world of AI for young learners, with unplugged, hands-on activities that transition into exploring digital tools to help learners understand how AI functions and how it processes programs. Learners also get the chance to design their own machine-learning models and neural networks.

Let's ensure our students are future-ready, enabling them to harness AI for the betterment of society, rather than being led by it.

— **AYESHA AKHLAQ**
Pinnguaq Curriculum Lead

LESSON 1

Introduction to AI Machine Learning via Teachable Machines

Author: Nia Emmanuel-Briggs
Estimated Time: 30 minutes

Level: Grades 4 to 6

Curriculum Links

Ontario (Grades 4 to 6)
A2. Coding and Emerging Technologies

- **A2.1:** write and execute code in investigations and when modelling concepts, with a focus on producing different types of output for a variety of purposes
- **A2.2:** identify and describe impacts of coding and emerging technologies on everyday life, including skilled trades

A3. Applications, Connections, and Contributions

- **A3.1:** describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems
- **A3.2:** investigate how science and technology can be used with other subject areas to address real-world problems

Learning Objectives

- Understand the uses of AI
- Understand why AI is becoming relevant in our lives
- Create a simple speech recognition project in Scratch 3.0

Students gain a basic understanding of artificial intelligence (AI) technology, along with its use in everyday life. AI is all around us and has both positive and negative aspects. It is more prevalent in our day-to-day lives than we think. Students explore aspects of AI and develop their own simple AI programs. Then, they connect their newfound knowledge to real-world examples.

Note: This lesson is for experienced users of Scratch 3.0 and contains advanced concepts.

Vocabulary

- **Artificial Intelligence (AI)** – A technological system displaying attributes of intelligence typically possessed by humans

Task 1—Introduction to AI

Go over the core concepts below orally to build a rudimentary understanding of AI.

What is AI? AI is an acronym that stands for *artificial intelligence*. A technological system is considered to be artificial when it displays attributes of intelligence that living beings typically exhibit. This includes processing language, understanding pictures, detecting patterns, and more. In the past years, as technology continues to advance, the use of AI has become more relevant to and useful in our daily lives.

Why is AI important? AI is all around us! Do you have Alexa or Google Home? Those devices use AI. They can recognize your voice and perform commands when you speak to them. They can even talk back to you. Today, there are self-driving cars, face recognition software, and more. What do all these things have in common? They all were *programmed* to learn. That's right! Somebody programmed a computer to be intelligent.

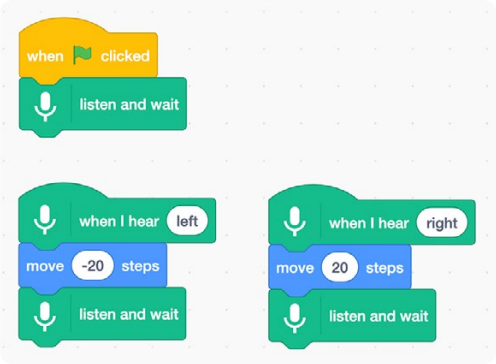
Task 2—Computer Activity: Alien Language

Let's learn how to tell the computer what to do by using only our voice. In this activity, we will teach the computer to move a sprite (character) left and right using new new words that we will invent.

Step 1: Go to **machinelearningforkids.co.uk/scratch3**. This will open Scratch in your browser.

Step 2: In the bottom left-hand corner, locate the **Add extensions** button, and choose the **Speech to Text** extension from the dropdown list.

Step 3: Using the **events**, **motion**, and **speech-to-text** blocks, copy the script below. This tells the computer that when the program starts, it needs to listen and wait for certain commands that we will speak into the microphone.

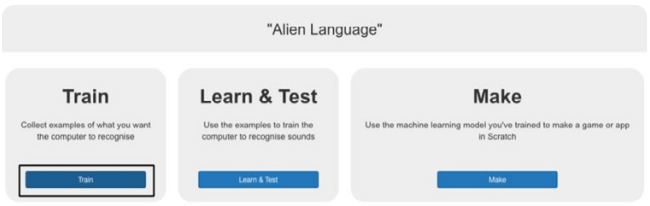


Training Your Own Model: Alien Words

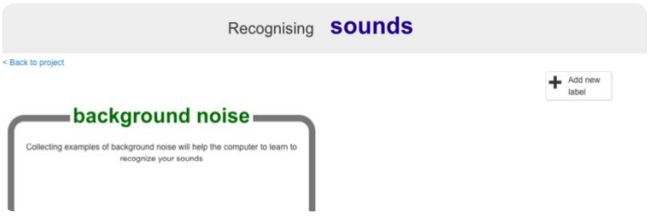
The pretrained model used in part one knew all the words in the dictionary. Now, we are going to create *alien* words that are made up and **not** in the dictionary. We are going to get the computer to recognize these words and have our sprite move left or right when hearing them.

Follow the instructions below:

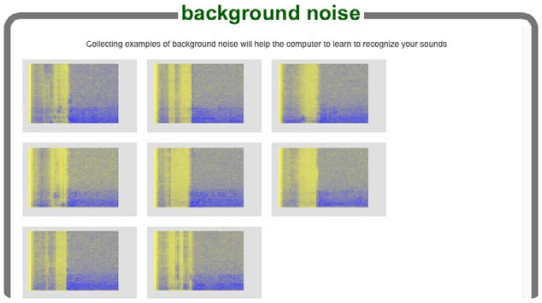
1. Go to **machinelearningforkids.co.uk**. Click **Get Started** then click **Try it now**. From the projects bar, click on **Add New Project** and name the project **Alien Sounds**. Set the description to **speech recognition**.
2. Create two new words that will represent the words *right* and *left*. Make up any words/sounds you like. Make sure to remember them and repeat them back the same way each time you record them. The words have to be different from each other—don't make them too similar. The new project you created will appear in the project list. Click on the **Train** button to train the model.



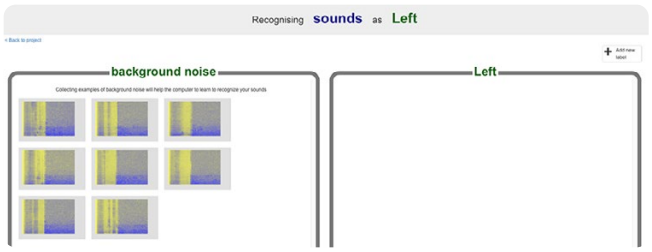
3. Click on **Add example** in the **background noise** box. This will record the noise in the background around you. This will help the computer to differentiate between background noise and spoken words.



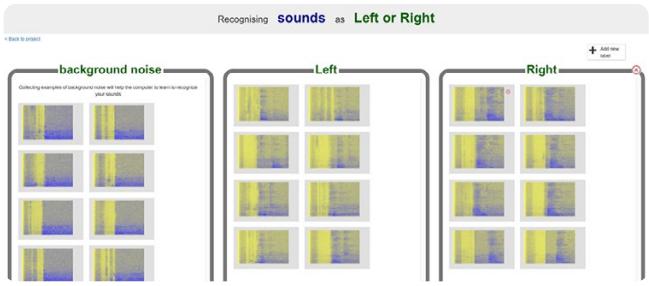
4. Click on the **microphone** button to record two seconds of background noise, then click **add**. Do this at least eight times so the computer has enough information to process what the background noise around you sounds like.



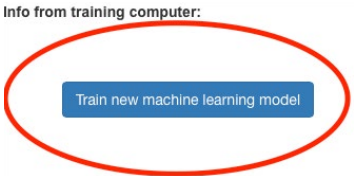
5. Click on the **Add new label** button at the top right corner of the screen and label it **Left**. Now in the Left box, click on **add example** and record your alien word that means left that you invented in step 2. Do this at least eight times. Make sure to speak clearly.



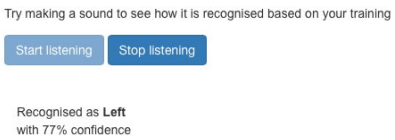
6. Add another label for **Right** and repeat Step 5, using the word you invented to indicate *right*.



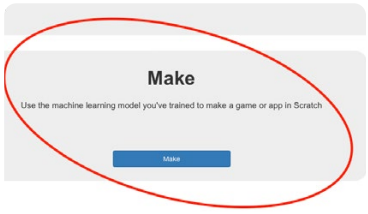
7. Train the computer to recognize your alien words. In the top left corner, click **Back to the project** then click **Learn and test**. Click on **Train new machine learning model**. This may take a few seconds.



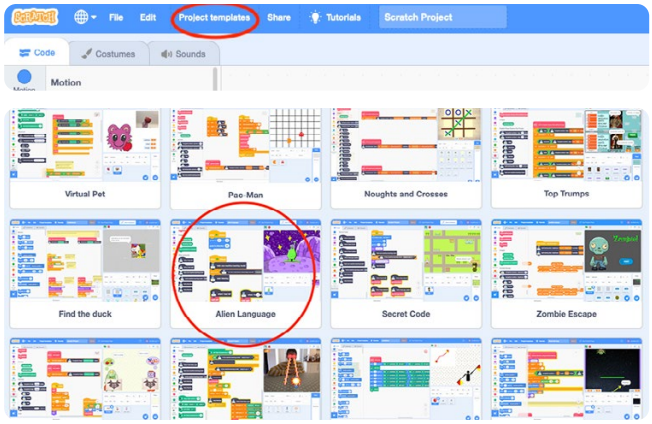
8. Once the training is completed, click **Start listening** to test the project. It will give a confidence score. If learners want to reach a 70% threshold in their confidence score for enhanced accuracy, they can record longer audio samples.



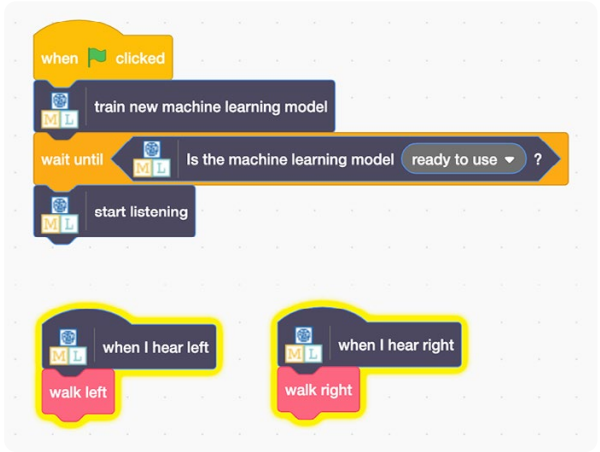
9. Once the desired confidence score is reached, click **Make** then **Scratch 3**. This will connect the project with Scratch 3.0 and take learners to the Scratch interface.



10. In the top menu bar, click on **Project templates** and search or scroll for your **Alien Language** template.



11. Launch the project. A set of scripts will appear on the screen—**do not delete them!** These scripts tell the sprite how to move. Update the scripts so that they look like the the scripts shown below.



12. Now it's time to test the model to check if the sprite obeys the commands. Click on the green flag on the right side of the screen and speak your alien words into the mic. The sprite should follow the commands and go in the direction you tell it to move.

Conclusion

At the end of the lesson, learners will be well-versed in how AI can use voice recognition and in training machines to follow voice commands.

Ask students:

- What are examples of systems that understand voice commands?
- How does voice-assisted technology help us in day-to-day life?
- What are some struggles or problems we might encounter with
- these types of systems?
- What are some of the positive and negative aspects of voice-generated AI?

Resources

- The Raspberry Pi Foundation has lots of fun coding and AI resources to explore (**projects.raspberrypi.org/en**)
- Speech recognition may seem like a lot of fun, and very useful, but we should also be mindful when using AI tools. (**forbes.com/sites/realspin/2016/10/06/voice-recognition-every-single-day-every-word-you-say/?sh=3cfa102a786d**)
- Natural Language Processing and Artificial Intelligence (**pinnguaq.com/learn/introduction-machine-learning-natural-language-processing**)

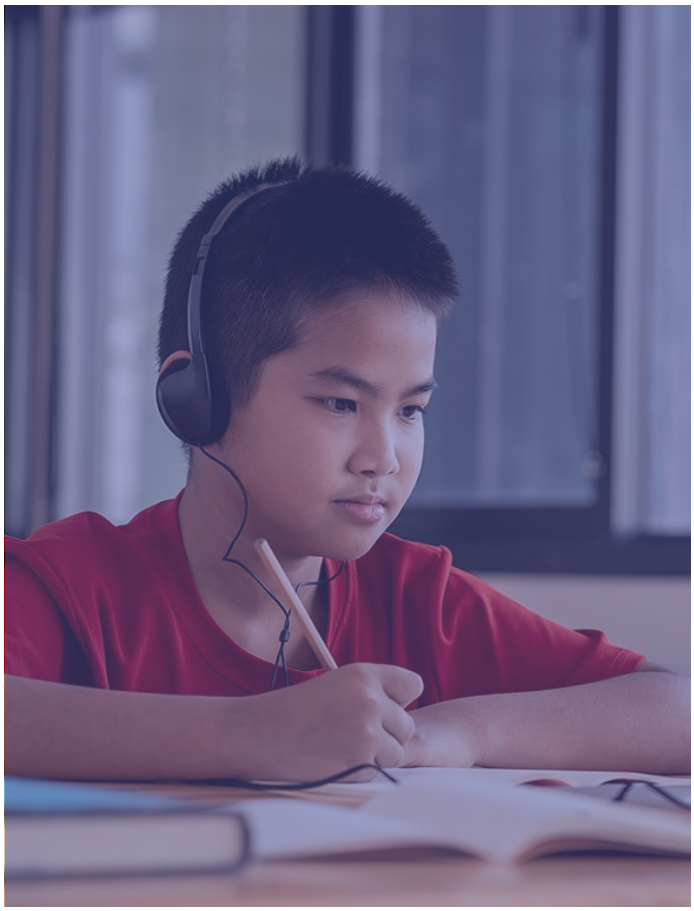
CODING AND PROGRAMMING

COMPUTING AND NETWORKS

DATA

TECHNOLOGY AND SOCIETY

DESIGN



LESSON 2

Introduction to Machine Learning: Natural Language Processing (NLP)

Author: Ayesha Akhlaq
Estimated Time: 3 × 50 minute sessions

Level: Grades 4 to 6

Curriculum Links

Ontario
Grades 4 to 6 - A2: Coding and Emerging Technologies

- **A 2.1:** write and execute code in investigations and when modelling concepts, with a focus on producing different types of output for a variety of purposes
- **A2.2:** identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades

Learning Objectives

- Understand natural language processing (NLP)
- Understand the applications of NLP, such as Alexa, Google Home, and Siri, in daily life
- Be aware of educational uses of NLP tools, such as autocorrect and predictive text, grammar checking apps, such as Grammarly, and translation tools, like Google Translate
- Understand some of the ethical implications of the use of NLP tools and the threat they may pose to online safety and privacy

Students learn about natural language processing (NLP) and how it works. They also learn to apply the rules of NLP to a text, how computers identify tag words, and how voice-generated technology impacts many aspects of daily life.

Vocabulary

- **Speech recognition:** Speech recognition is a capability that enables programs to process human speech and deliver it in written format
- **Natural Language Processing (NLP):** The branch of AI that gives computers the ability to understand texts and spoken words in the same way human beings can

Materials

- Phones or tablets (iOS or Android)
- Laptops/Chromebooks
- Wireless internet access
- Text of any kind, such as a story or a song
- Pens and paper

Task 1: What Is Natural Language Processing?

Natural language processing (NLP) refers to the branch of computer science—and, more specifically, the branch of artificial intelligence (AI)—concerned with giving computers the ability to understand texts and spoken words in the same way human beings do. NLP combines computational linguistics—the rule-based modelling of human language—with statistical machine learning and deep learning models. Together, these technologies enable computers to process human language in the form of text or voice data and to "understand" its full meaning, complete with the speaker's or writer's intent and sentiment. Let's break down natural language processing (NLP) into five steps:

1. Listening or Reading:

- **What it means:** Just like you listen to your friend talk or read a book, computers "read" the words you type or "listen" to the words you say.
- **Example:** When you ask Siri, "What's the weather like today?", it first has to "hear" or "read" your question.

2. Breaking It Down:

- **What it means:** Computers split sentences into smaller parts, like words and phrases. This is like what you have learned about nouns, verbs, and adjectives in school.
- **Example:** In the question, "What's the weather like today?", computers might split it into words and concepts: "What", "is", "the", "weather", "like", "today", "interrogative (?)".

3. Understanding the Meaning:

- **What it means:** Computers have to figure out what the words and phrases mean. Sometimes, words can have more than one meaning.
- **Example:** The word *bat* can mean a flying animal or something you use in baseball. It can also be a verb or a noun. Computers use the other words in the sentence to help figure out which meaning is right.

4. Thinking of an Answer:

- **What it means:** Once computers understand what you're asking, they think of the best way to answer. This is just like when you think before answering a question in class.
- **Example:** After understanding your question about the weather, the computer might think, "I need to find today's weather for this location."

5. Responding:

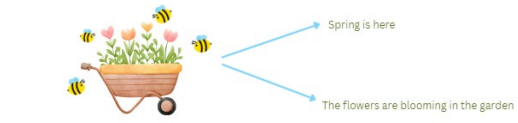
- **What it means:** Finally, the computer gives you an answer, either by showing it on the screen or speaking it out loud.
- **Example:** Siri might say, "It's sunny and 22 degrees today."

Activity Idea: Word Meaning Detective!

- Give students a list of words that have multiple meanings (e.g., "bat," "bank," "bark").
- Ask them to think like a computer and use the other words in a sentence to figure out which meaning is being used. For instance, in "I keep my money in the bank," the word *bank* refers to a place where money is kept and not the side of a river.
- Think of other word associations that, if used out of context, might be confusing for a computer. For example, the word "bat" could mean both the animal and the baseball bat. Similarly, the word "bark" could mean both a dog barking or tree bark.

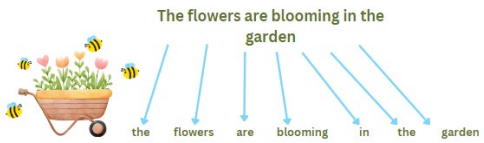
The processes of NLP can be replicated in an unplugged environment by following these steps:

Segmentation: This is the "listening and reading" step. Break down a text into its constituent segments based on the word order, punctuation, and phrases in the text.



Spring is here, the flowers are blooming in the garden

Tokenizing: For the computer to comprehend the full text, each word needs to be understood individually. Phrases are broken down into their constituent words. Each word is called a token. This process is called tokenizing. This is the "breaking it down" step.



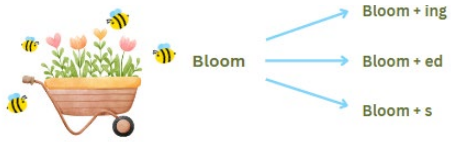
Step 2: Tokenization

Removing stop words: The process can be sped up by removing non-essential words from the text, such as the, are, in, etc. By doing this, the machine tags only the essential words that are relevant to the text. This is the "understanding the meaning" step.

Step 3: Removing Stop Words

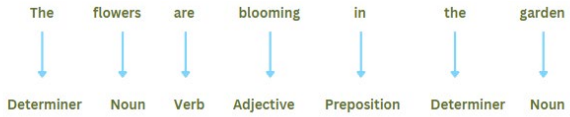
"Be" (and its various forms like "is," "am," "are") is a common auxiliary verb, and in many NLP tasks, especially keyword-based tasks, it can be considered a stop word because removing it often won't change the primary meaning or sentiment of a sentence. In the given sentence, "flowers blooming garden" still conveys the main idea of there being flowers actively blooming in a garden.

Stemming: One element of stemming is the process of adding suffixes to verbs to create more action words for the computer to understand.



Step 4: Stemming

Part of Speech Tagging: The next step is to identify different parts of speech such as nouns, verbs, adjectives, prepositions, and adverbs. The machine tags the parts of texts as follows:



Step 5: Part of Speech Tagging

This is the last step of NLP, which allows the computer to make sense of the questions it is asked. It then puts together an answer based on parts-of-speech tagging.

Named Entity Tagging: This process teaches computers to identify proper nouns, such as names of famous people, monuments, cities, and movies. It can also be done by creating subcategories like "person," "location," "quantity," or "organization." For example, terms such as *Canada*, *USA*, *John*, *Miranda*, etc., are proper nouns, so the AI tags them as "Named Entity." It's the same as when you ask Siri, "What is Montreal's weather today?" Siri tags *Montreal* as a proper noun and tells you the weather there.

Task 2: Apply the Knowledge

Ask the students to:

- Pick a short text, like a story or a song. Alternatively, the students can write their own stories.
- Apply the NLP steps outlined above to the text to break them down into parts of speech and identify them with the appropriate tags.
- Place the words under the right grammatical categories and label names accordingly. For example, all the verbs, nouns, adjectives, and proper nouns will be placed under their respective categories

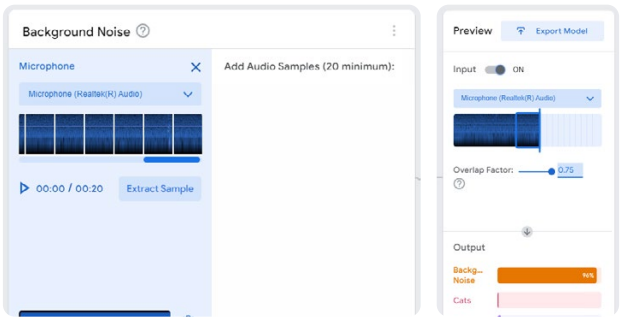
For additional resources for this task, please go to: **pinnguaq.com/learn/inuit-principles-of-conservation-serving-others**.

Task 3: Teachable Machines

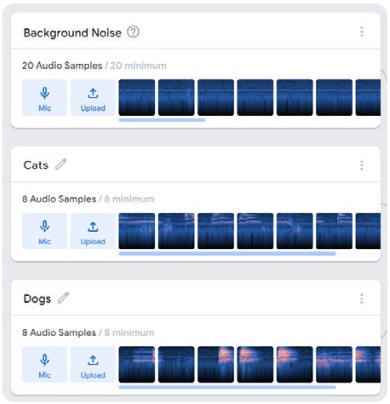
In this lesson, students experiment with teachable machines and train a computer to identify different animal and bird sounds by creating an **Audio Project**.

1. Go to Teachable Machine (**teachablemachine.withgoogle.com**) and click the **Get Started** button. Choose **Audio Project**.

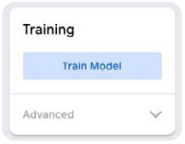
2. Once in the project, upload background noise into the system. The background audio must be at least 20 seconds long. This will allow the computer to distinguish the noise in the background around students from the significant elements of other media files.



3. Once the background noise is uploaded, it's time to upload various animal sounds (dogs and cats). Our goal is to help the computer distinguish between dog sounds and cat sounds.
4. Use mobiles or smart devices to search for different dog and cat sounds and use the computer's microphone to record them in the machine. There should be a minimum of eight data samples for each type, cats and dogs. Once all the samples are uploaded, the resulting program should look like this:



5. Now, click **Train Model** and allow the machine to process the data. This might take a few minutes.



6. Once the machine model is trained, play different animal sounds to the computer and see whether it can identify them. Check the **Output** tab, to see what the model predicts.

Conclusion

Now that students clearly understand natural language processing and how machines understand human language, it is time to explore the implications of voice-generated AI on everyday life. Ask students:

- How can AI be useful to online safety and privacy? How might it be a threat?
- What experiences have students had with voice-generated AI programs?
- When interacting with voice-generated AI, what should we do to ensure our safety and privacy?
- What are some of the fields where AI might prove useful and how?

Resources

- Introduction to Machine Learning (**pinnguaq.com/learn/introduction-machine-learning**)

CODING AND PROGRAMMING

COMPUTING AND NETWORKS | DATA

TECHNOLOGY AND SOCIETY | DESIGN

LESSON 3

Teachable Machine: Image Recognition

Author: Nia Emmanuel-Briggs
Estimated Time: 50 minutes

Level: Grades 7 to 8

Curriculum Links

Ontario (Grades 7 to 8)
A2. Coding and Emerging Technologies

- **A2.1:** write and execute code in investigations and when modelling concepts, with a focus on producing different types of output for a variety of purposes
- **A2.2:** identify and describe impacts of coding and emerging technologies on everyday life, including skilled trades

A3. Applications, Connections, and Contributions

- **A3.1:** describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems
- **A3.2:** investigate how science and technology can be used with other subject areas to address real-world problems

Learning Objectives

- Explore how computers can be trained to recognize pictures
- Create a Rock, Paper, Scissors game in Scratch

Students learn how computers can process and categorize images. They program and train a computer to recognize certain images and teach it to play Rock, Paper, Scissors.

Vocabulary

- **Facial recognition:** A computer's ability to identify a face or an object
- **Detection:** A computer's process of finding a face within an image
- **Mapping:** A computer's ability to make a connection between two sets of things or "variables"
- **Analysis:** A computer's process of "mapping" a face
- **Recognition:** A computer's process of confirming the identity of an individual or object in an image

Task 1: Introduction to Facial Recognition

What is facial recognition? Where is it used? Facial recognition is the ability of a computer to identify a face or an object when it is compared to a database. There are many different ways a computer might process facial recognition and it can be sorted into three basic types of technological process: **detection**, **analysis**, and **recognition**.

Detection is the process of finding a face within an image. For example, have you ever used your phone camera and seen a box appear around a face? That's an example of the computer recognizing a face to know where the expected subject of the photo is so it can focus on it.

Analysis is the computer's process of "mapping" a face. This entails the computer calculating the placement and distance between different aspects of a face, such as eyes, nose, and mouth. You may have seen this type of technology in use in apps like Snapchat, where you can use different facial filters on your face when using the camera.

Recognition is the computer's process of confirming the identity of an individual or object in a photo. You have seen this in use if you have ever used facial recognition to unlock your phone or other device. This is similar to the technology we will use to create the game in the next activity.

Task 2: Creating a Rock, Paper, Scissors game

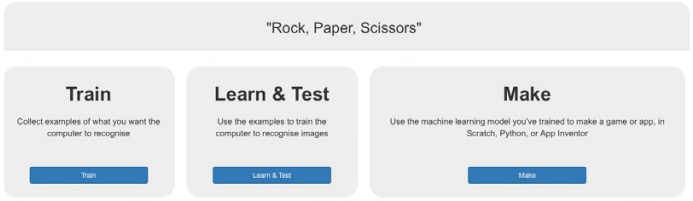
Now that we have learned about the different types of technology that process facial recognition, we are going to create a program that recognizes hand shapes so we can play Rock, Paper, Scissors with the computer. This task will entail taking multiple pictures with a computer or phone.

Step 1: Go to **machinelearningforkids.co.uk**. Click **get started**, then click **Try it now**.

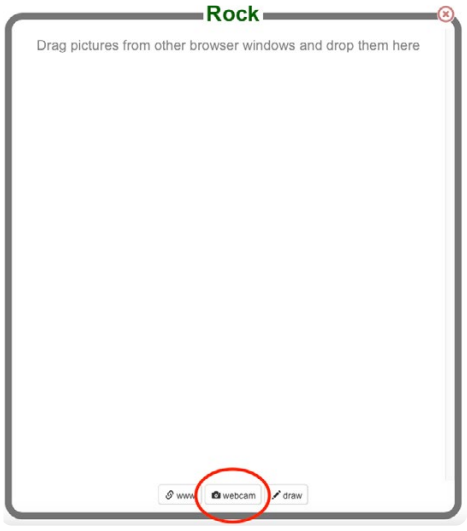
Step 2: Click on the **Projects** bar at the top of the page, then click **Add new project**.

Step 3: Under **Project Name**, write **Rock, Paper, Scissors** and under **Recognising**, set it to **Images**, then click **Create**. It will create a Rock, Paper, Scissors project under the list of projects.

Step 4: Next, we are going to teach the computer hand gestures so it can play the game. Click on the **Train** button.

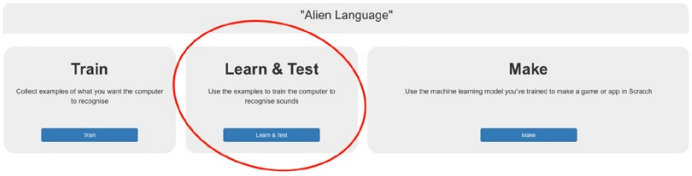


Step 5: Click on the **Add new label** button at the top right corner of the screen. Name this label **Rock**. Now click on the **Webcam** button in the rock box. Take at least 10 different pictures of your hand in the gesture of "rock." Take pictures from different angles so the computer can recognize what "rock" looks like in different formations.

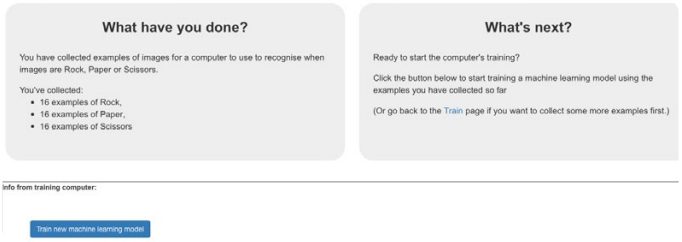


Step 6: Once you are finished, go back to **Add new label** and repeat step 5 for "paper" and "scissors."

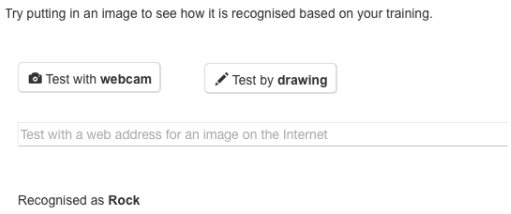
Step 7: Now, we are going to teach the computer to recognize the hand gestures. At the top left corner, click **Back to project**, then click **Learn & Test**.



Step 8: Click on **Train new machine learning model**. This may take a few seconds.

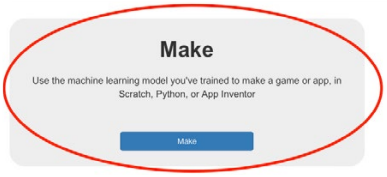


Step 9: Once the training is complete, click **Test with webcam** to see how well the computer recognizes "rock," "paper," and "scissors." The confidence score will tell you how well the computer has recognized the hand gestures.

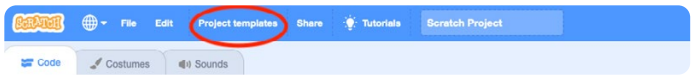


If you want to repeat the process, select **Go back to project** and **Train** the computer again by adding more images to your three sections.

Step 10: Once a confidence level of 70% is achieved, click **Make** to open the Scratch interface. Click **Scratch** and read the instructions carefully.

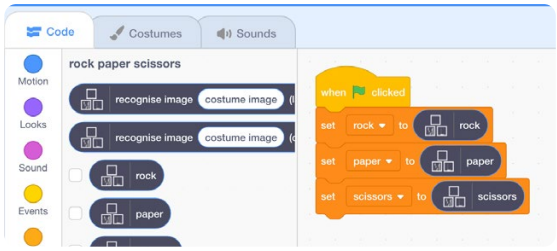


Step 11: The browser will now open to Scratch 3. In the top menu, click on **Project templates** and search or scroll for your **Rock, Paper, Scissors** template.

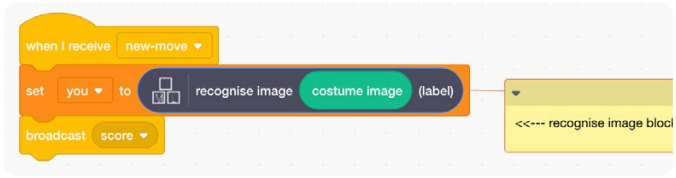


Step 12: A set of scripts will appear on your screen—do not delete them! Click on the **You** sprite as highlighted at the bottom right of the image at the bottom of this page.

Step 13: Now update the script with project blocks that are under the **green flag** to look like the script below.



Step 14: Now update the script with the project blocks under **New-move** to look like the script below.



Step 15: It's time to play Rock, Paper, Scissors with the computer. Click on the green flag and **press the letter P** on your keyboard to take a photo. The computer will choose a random move to play; either rock, paper, or scissors.

Now you have your virtual AI buddy to play Rock, Paper, Scissors with. Best of three wins!

Conclusion

Great job! We just learned how to teach a computer to develop intelligence, recognize images, and play the game Rock, Paper, Scissors!

Ask students:

- What are some things you noticed from this activity?
- How long did it take for the computer to understand what you were showing on the screen properly?
- What are some ways facial recognition might have positive or negative effects on daily life?

Additional Resources

- Teaching Kids about Artificial Intelligence (**saturdaykids.com/blog/teaching-kids-artificial-intelligence**)
- Machine Learning for Kids (**machinelearningforkids.co.uk/#!/worksheets**)
- Facial Recognition (**nytimes.com/wirecutter/blog/how-facial-recognition-works**)
- Introduction to Machine Learning (**pinnguaq.com/learn/introduction-machine-learning**)

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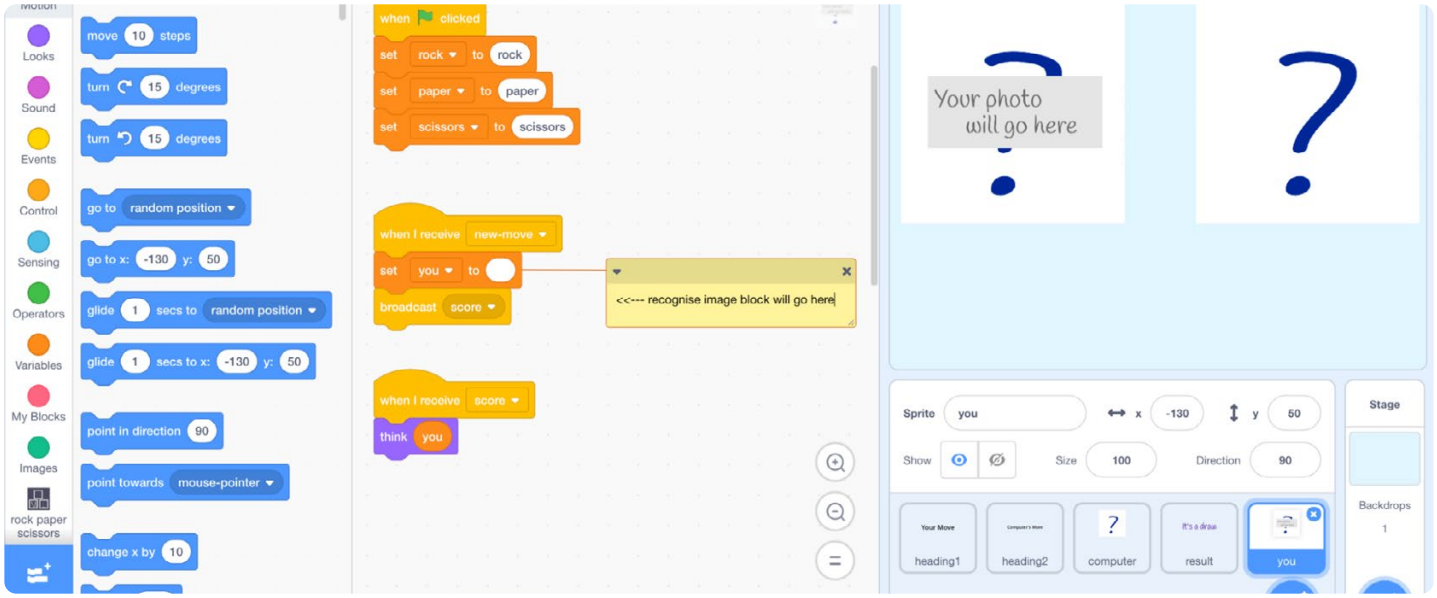


LESSON 4

Fake Voices Versus Deepfakes

Author: Ayesha Akhlaq
Estimated Time: 3 × 50 minute sessions

Level: Grade 9

Curriculum Links

Ontario (Grade 9)

- **A2.1:** design an experiment or a prototype to explore a problem relevant to a STEM-related occupation, such as a skilled trade, using findings from research
- **A2.2:** describe how scientific innovations and emerging technologies, including artificial intelligence systems, impact society and careers
- **A2.3:** analyse how the development and application of science is economically, culturally, and socially contextualized, by investigating real-world issues
- **A2.4:** apply scientific literacy skills when investigating social and environmental issues that have personal, local, and/or global impacts

Learning Objectives

- Understand the difference between deepfakes and fake voices
- Discover how voice-generated assistive technology has impacted many aspects of daily life
- The ethical and moral consequences of creating and sharing deepfakes
- The use of assistive technology in commerce, health, banking, and security
- The rights and responsibilities of digital citizenship

Students explore deepfakes and create a fake voices app using the MIT App Inventor. Learners also explore how deepfakes can pose a threat to online safety and privacy, and how they can have an impact on not only our daily lives but also other areas like commerce, history, crime, and pop culture.

Vocabulary

- **Text-to-speech:** A type of assistive technology that reads digital text aloud. It's sometimes called "read aloud" technology
- **Speech-to-text:** Also known as automatic speech recognition (ASR), as its name suggests, this function converts audio files of speech into text
- **Speech recognition:** A capability that enables a program to process human speech into a written format
- **Deepfakes:** Images or recordings that have been convincingly altered and manipulated to represent someone as doing or saying something they did not actually do or say

Materials

- Phones or tablets (iOS or Android)
- Laptops/Chromebooks
- Wireless internet access

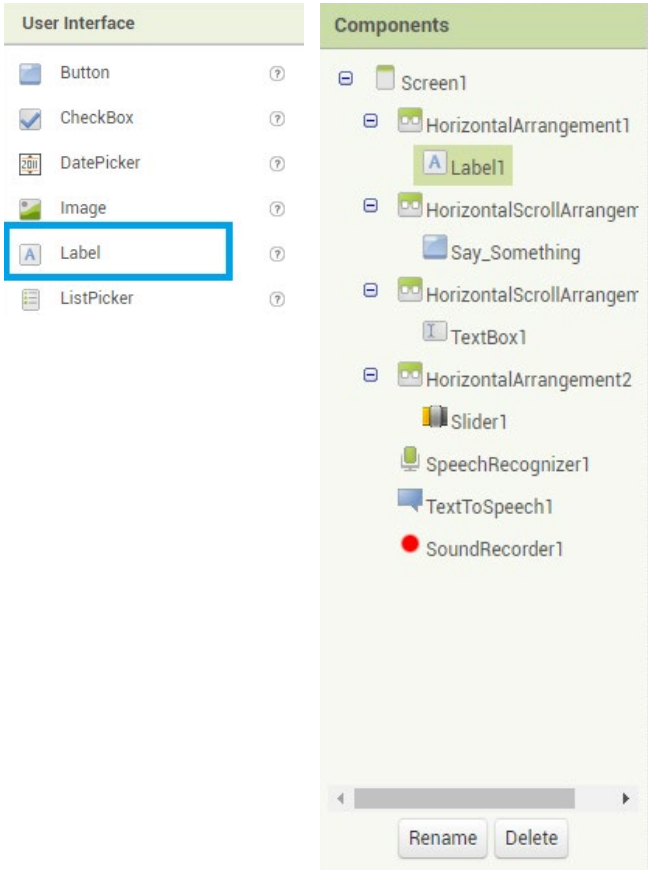
Fake Voices App

The goal of this activity is to create a fake voices app using MIT App Inventor to show learners how to create a simple app that can recognize text and speech. Once completed, students slide a button to the left or right to change the pitch of their voice. The app also identifies and executes text-to-speech functions.

To begin, install the MIT AI2 Companion app (**play.google.com/store/apps/details?id=edu.mit.appinventor.aicompanion3&pli=1**) on mobile devices and sign up. Begin by building the design interface and basic functions of the app.

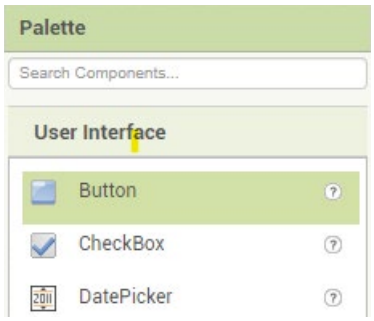
1. On your computer browser, open the MIT App Inventor (**appinventor.mit.edu**) web application and click on the **Create Apps!** button located at the top of the screen. This opens a blank app generator interface.
2. Go to the Project button at the top and create a new project. Name the project. We are calling it **Welcome to Fake Voices**.
3. If you like, use the **Properties** panel on the right side of the screen to change the default look of the app by changing the colour and font styles.
4. From the **Palette** panel on the left side, locate the **User Interface**, **Layout**, and **Media** tabs for this project. We will use these three tabs to build our app.

5. We will start with the **Layout**. From the **Layout** tab, drag the **Horizontal Arrangement** button to the viewer area (it looks like a smartphone). These horizontal buttons act as placeholders for the user interface buttons. Just like an image placeholder in PowerPoint where you can drag and drop an image, Horizontal Arrangements act as a placeholder for different design and user interface blocks for the app.
6. Next, from the **User Interface** tab, drag the **Label** block and drop it under Horizontal Arrangement1. It will appear now as a placeholder named Label1.

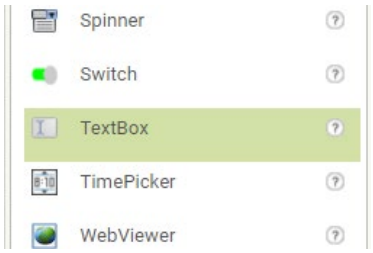


7. Choose **Label1** from the **Components** tab, then, from the **Properties** tab, add **Welcome to Fake Voices** in the **Text** box.

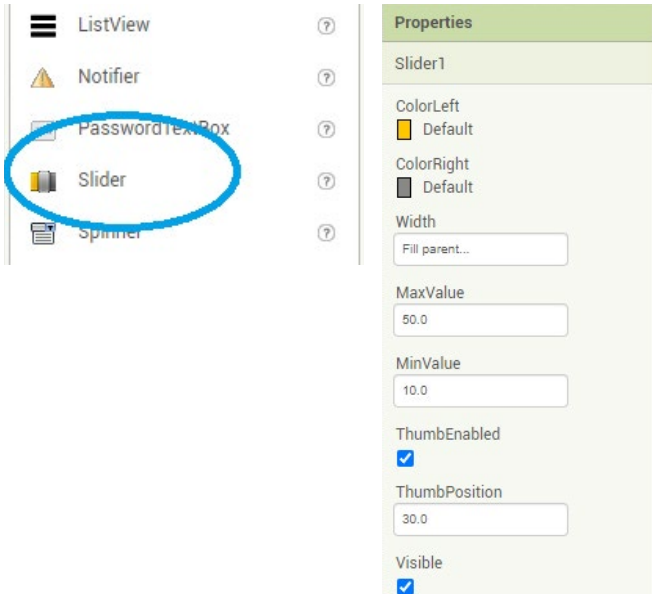
8. From the **Layout** panel on the left, drag **HorizontalScrollArrangement** and drop it under the **Welcome to Fake Voices** label.
9. Next, from the **User Interface** panel, drag the **Button** and place it on the **HorizontalScrollArrangement2**. Select the **Button** from the **Components** panel and add the text **Say Something**. The function of this button is to tell the app to start recording audio as soon as it is pressed.



10. Use another **HorizontalScrollArrangement** as the third placeholder. Drag **TextBox** from the **User Interface** on the third placeholder.



11. Use a fourth **HorizontalScrollArrangement** placeholder, and drag **Slider** from the **User Interface** on the left on it. Choose **Slider** from the **Components** tab and from **Properties**, specify the **MaxValues** and **MinValues**. We are setting the MaxValue as 50 and MinValue as 10. These specify where the slider toggle will appear on the app. Also check the **ThumbEnabled** box. This ensures that the slider responds when it is moved left or right.



12. From the **Palette** on the left, choose the **Media** tab and drag **SpeechRecognizer**, **TextToSpeech**, and **SoundRecorder** and drop them on the viewer area. These components are invisible—they do not show in the app design but add functionality. The app will now be able to record sound, recognize speech, and perform text-to-speech functions. Feel free to change the colour of the app using the Properties tab.
13. To build the code that gives the app its functionality, go to the **Blocks** tab located at the top right corner of the screen. It opens another window, where you can drag and drop code blocks to make the app functional. The elements used to make this app, such as voice recording, text-to-speech, and thumb slider, are on the left-hand panel.
14. Choose the **Say Something** block from the block panel on the left and drag the **when say something.Click** block to the centre.
15. From the **SpeechRecognition** tab, drag **Call SpeechRecognizer1. Gettext** and **Call SpeechRecognizer1.Stop**. Snap them in the **Say_ Something** code block. This allows the app to recognize speech as soon as we start talking.
16. Now that the app is able to recognize speech, let's write the code to tell the app to convert it into text. From the **SpeechRecognition** tab, use **When SpeechRecognizer1.AfterGettingText** code block and drag it to the centre of the code area.
17. From the **TextToSpeech** tab, use **TextToSpeech1.Pitch to** code and snap it inside the **SpeechRecognizer1.AfterGettingText** code block.
18. From the **TextToSpeech** tab, use **call TextToSpeech1.speak message** code block and snap it under the **TextToSpeech1. Pitch** block.
19. Hover your mouse over the orange **results tab** and drag **get results** code block. Snap it to the **TextToSpeech1. speak message** block.
20. Go to the **Math** tab at the top of the blocks palette and drag the number **0** block to the code area. Snap it in the **TextToSpeech1. Pitch to** code block. Use any number you want to replace the zero. We are using **2** for this activity.
21. Now build the slider function so the pitch of the sound can be changed. From the **Slider** tab, drag and drop **When Slider1.PositionChanged** block to the viewer area. Hover the mouse over **thumbPosition**. It will show two more code blocks. Use **Set ThumbPosition to** and snap it in the code block. Use **Slider1.ThumbEnabled** and **Slider1.MinValue** code blocks, found in the **Slider** tab and complete the code.
22. From the **sound recording** tab, use **When SoundRecorder1. Started Recording** and **When SoundRecorder1.StoppedRecording** to the viewer area. Drag and drop **CallSoundRecorded1. Start** and **CallSoundRecorded.Stop** in the code. The code will snap into place.
23. Our last bit of code is for the text box. Choose **TextBox1** from the left-hand panel. Drag and drop **when.TextBox1.GotFocus** to the code area. We want our text box to be able to convert text to speech. The code blocks needed can be found in the TextBox1 tab. This will allow the app to perform text-to-speech functions.
24. Let's code in the sound recorder and our code will be done. Go to the **SoundRecorder1** tab.

Now it's time to test your app. Go to the Google Play Store or Apple Store to download the **MIT AI2 Companion** app to your phone.

From the app inventor, locate and click the **Connect** button in the menu bar at the top of the screen. From the dropdown menu, click **AI Companion**. It allows the app to connect via a QR code. Scan the QR code and connect the app with the MIT AI2 companion on your phone.

Students are encouraged to test the app functionality and fix the bugs in the code as they test the app.

Conclusion

Conclude the lesson by leading a discussion on how deepfakes pose threats to online safety and privacy using the following discussion prompts. Ask students:

- How do various industries such as health care, commerce, entertainment etc., use voice-generated AI and how have they been transformed by it?
- Have you seen deepfakes online? What are some harmful ways deepfakes might be used on the internet?
- What are the potential advantages and drawbacks of AI-generated media, such as deepfakes, and how might they impact various sectors and individuals?
- How might deepfakes evolve in the future?

Resources

- Introduction to Machine Learning (**pinnguaq.com/learn/introduction-machine-learning**)

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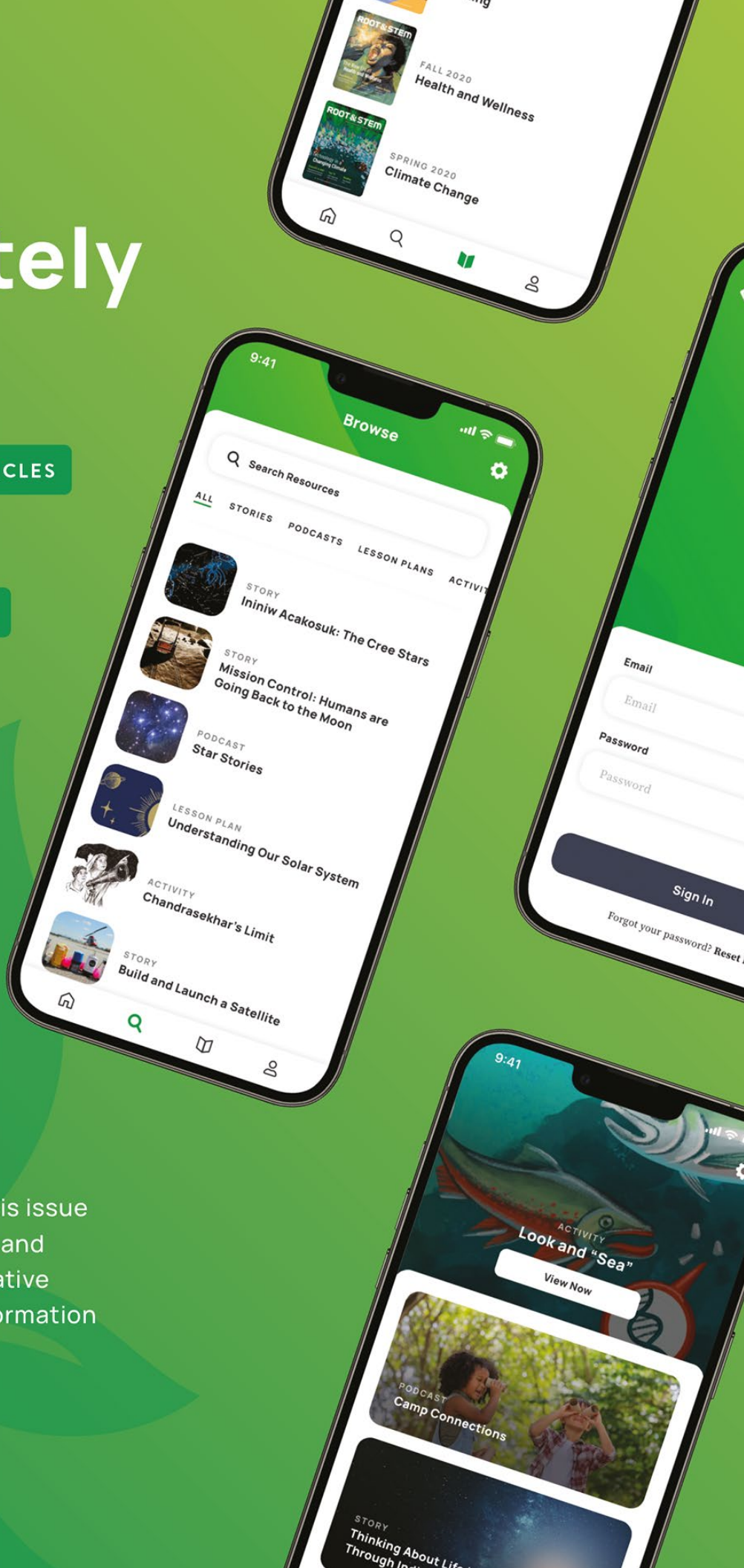

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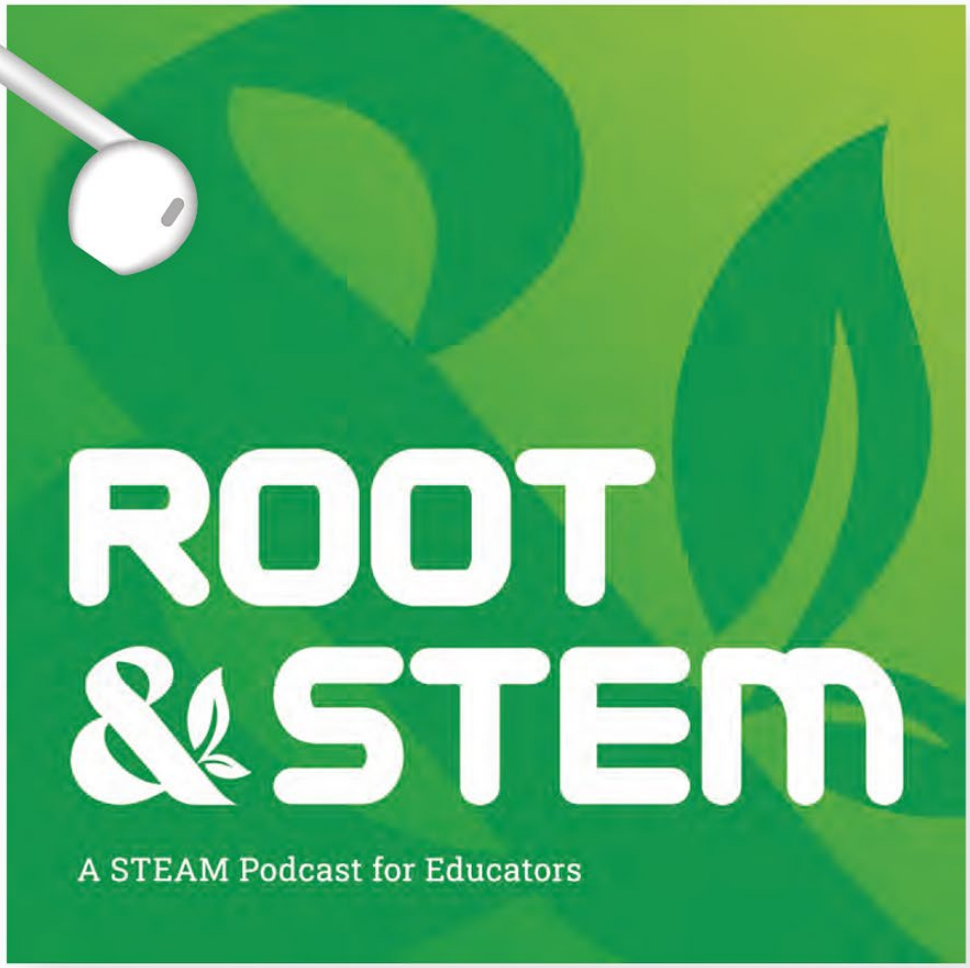

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