MOMENTUM

MOHAWK COLLEGE COMMUNITY MAGAZINE

SPRING 2018

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ABOUT MOHAWK

COVER FEATURE – THE DISRUPTORS

ABOUT MOHAWK: Mohawk College educates and serves 31,700 full-time, part-time, apprenticeship and international students at three campuses and City School locations at the Eva Rothwell Resource Centre, the Central Public Library and the City School mobile unit in Hamilton, Ontario. Mohawk has ranked first among all Greater Toronto and Hamilton Area colleges in student satisfaction for seven consecutive years and first in graduate employment*. Mohawk is among the top 25 colleges in Canada for applied research activity and has been named among Canada's greenest employers and the region's top employers for the past four years. **VISIT:** mohawkcollege.ca or mohawknewsdesk.ca to learn more. **COVER:** Image of Martin Ciupa. Location: FANUC lab at Mohawk's Fennell Campus.

*2016–2017 KPI Student Satisfaction and Engagement Survey.

FROM THE PRESIDENT

The changing landscape

We're on the cusp of something big at Mohawk.

It wasn't long ago that cellphones were a novelty, the internet was a handful of computers linked together in a lab and 3D printing was the stuff of science fiction. Today, 3D printing is mainstream, and it's hard to imagine a world where we aren't connected 24/7 via our smartphones.

As remarkable as it has been to watch these changes unfold, it pales in comparison to what is coming next. Our world is about to change in ways we can't even imagine, and these changes are going to come a lot quicker than we think.

"We are on the cusp of massive change. The techno-socio-economic landscape is on the precipice of revolution," says Martin Ciupa, Chief Technology Officer of calvIO Inc. and a leading expert on artificial intelligence, cybernetics, data science and the philosophy of technology.

We interviewed Martin for this issue to get his thoughts on the speed at which technology is advancing, the impact those changes will have on society, and the role of education in preparing people to adapt to those changes.

A recent report from the McKinsey Global Institute highlights 12 technologies from the Internet of Things to Renewable Energy that have the potential to change our lives completely. In this issue we explore how our faculty, staff, students and community partners are applying some of these technologies in the classroom, around campus and in the community to make sure we're better prepared for what the future will bring.

You'll also get a preview of the new Centre for Climate Change Management at Mohawk. Launched in December 2017, the centre brings together industry and government partners to amplify and accelerate the transition to a low-carbon economy. And we'll introduce you to a student who is putting his Mohawk education to work and making a difference in his native Peru as well as many other notable students, staff and grads who make Mohawk proud.

Regards,

Ron J. McKerlie

MASTERS OF CHANGE

Education is key to creating and adapting to coming changes in technology

The convergence of powerful technologies holds the promise of more fulfilling work and life for human beings, says noted cybernetics, artificial intelligence, data science and philosophy of technology expert Martin Ciupa.

"We are on the cusp of massive change. The techno-socio-economic landscape is on the precipice of a revolution," says Ciupa, Chief Technology Officer of calvIO Inc., part of the Calvary Robotics group of companies in Webster, N.Y.

"We are moving towards what experts call the technology singularity. The acceleration of technology across many areas is gathering pace. It's to the point that it's not really possible for an individual to grasp everything that is going on, strategic plans are less valuable than an agile mindset."

The technological singularity is in part influenced by the idea that the invention of Artificial Generic Intelligence (AGI), or Super-Intelligence, will continually and rapidly improve upon itself, and will eventually and abruptly trigger runaway technological advances, bringing with it unprecedented changes to civilization.

"I think it's fair to say the pace of technology is becoming harder to manage, we need help. AGI may deliver that support, till then we need a combination of specialists and generalists in engineering technology."

The future requires an influx of young people into sciences, technology, engineering and math (STEM) at institutions like Mohawk College, which provide foundational applied learning and research opportunities directly tied to industry needs, says Ciupa.

"Mohawk has done a wonderful job of applying itself where the rubber meets the road and using research funding to educate students, answer industrial challenges and provide well-educated talent. Companies can't easily build the knowledge experts with the competencies they require in the time frame needed. Partnerships with Mohawk provide that capability and build longer-term talent strategies."

Education is the key to creating and adapting – socially, economically and technologically – to a new future of automated automation, says Ciupa.

Chief Technology Officer of calvIO Inc. Martin Ciupa (left) and Mohawk's Dean of Engineering Technology David Santi.

"At its essence, engineering is about change, changing from the past to the future and changing to the right future and doing it with forethought – we need to develop 'ChangeMasters.'"

The McKinsey Global Institute says 12 core emergent technologies – from AI to robots, from Internet of Things (IoT) to mapping human genetics, from drones to blockchain, and from 3D printing to energy storage – have the power to truly disrupt the status quo and rearrange how we learn, live and work. The institute estimates that together, applications of the 12 technologies could have a potential economic impact between $14 trillion and $33 trillion a year in 2025.

The key is the convergence and collision that drives new technology. For example, Ciupa is supporting with Flaight Smart Media, a Fredericton, N.B. start-up that is using AI and drones to capture sporting events. AI can follow the action of a game, edit video and deliver virtual reality content to spectators inside the venue or outside, says Ciupa.

Mohawk College is firmly focused on a future of converging technology, says David Santi, Dean of Engineering Technology.

"There are several areas of technology just in that one application. The great convergence of technology means innovation requires a mastery of many areas. There is a tapestry of technology that requires multidisciplinary awareness. Students need to learn to be agile engineers."

Mohawk has been actively involved in the development and application of drone technology in building and construction sciences, has the only Civil Engineering Transportation Technology program in Canada designed to meet the needs of a low-carbon environment, and is a leader in energy storage.

"The new net-zero building, The Joyce Centre for Partnership & Innovation, will have advanced engineering and space for students to learn and experience building energy management and control systems," said Santi.

Mohawk is also a leader in education and certification in industrial collaborative robotics, 3D printing and smart system integration using sensors and predictive analytics powered by IBM Watson to improve factory performance, he said.

Disruptive and emerging technologies allow for new opportunities in applied research, creation of programs and advanced credentials and integration into existing programs, says Vice President Academic Paul Armstrong. Most certainly, inter-disciplinary learning that mirrors the real world is the new model at Mohawk.

"Disruption, innovation and the technologies facilitating new ways of working have eliminated silos and students are working in that collaborative and mutually supportive environment from the moment they set foot on our campus."

Armstrong says connecting diverse groups of students and faculty through applied research and other real-world projects is critical to Mohawk's vision and underpins investments to The Agency – an experiential learning facility – and a new focus on student enterprise initiatives.

The Joyce Centre and the creation of a completely integrated factory model at the Fennell Campus will allow industry partners to access technology and knowledge of Mohawk faculty, says Armstrong, and "build opportunities to connect students with experiences that will differentiate them from their peers in the workforce."

"Disruption, innovation and the technologies facilitating new ways of working have eliminated silos and students are working in that collaborative and mutually supportive environment from the moment they set foot on our campus."

Mohawk's strength in applied research is paying off with two new bachelor degree programs: Business Analytics and the recently approved Bachelor of Digital Health, the latter the result of almost 10 years of leading-edge digital health technology work out of the MEDIC Lab.

Mohawk is also a leader in augmented and virtual reality with a new state-of-the-art learning centre accessible to all schools and industry partners. Faculty in skilled trades, building and construction, and media and entertainment are already using AR/VR in their courses, says Armstrong, building on Mohawk's vision to be a leader in simulation learning.

"Through a virtual environment, students can enter nuclear power facilities, be inside operating rooms, develop proficiency in welding, learn how to operate large equipment and so much more. Mohawk will grow this area of expertise and, in partnership with leaders in the industry, will be well positioned to capitalize on this new and emerging strength area."

Ciupa says the next great wave of workplace transformation will come using AI to automate some knowledge functions, like the impacts of several decades of robotics in manufacturing.

AI will partially replace knowledge work, by augmenting it by taking on routine or tedious tasks – the black and white – and leaving people to perform the creative, caring, social, higher-knowledge, shades of grey, value-driven and decision-making aspects of their jobs.

"AI Deep Learning systems suffer from a black-box problem; they learn, but you can't ask them why they made a decision. A human doctor, for instance, can explain a decision and provide a rationale. An AI black-box system cannot do that easily."

Ciupa says a wholesale rethinking of work and society could create a world of lifelong education or look after others and the environment with the support of new socio-economic models such as Universal Basic Income.

"There would be a more humane use of human beings. There is an infinite need for the caring vocations. Humans will always need other humans to help them."

Electrical Engineering Technology – Control student Ngoc Doc Tran and Computer Systems Technician – Software Support student Deepkumar Sojitra (Deep).

INTERNET OF THINGS AND INDUSTRY 4.0

Industry 4.0 captures the power of the Internet of Things to create smart, hyper-productive factories operated and optimized through connected sensors capturing millions of data points daily, says Wayne Visser, Professor, Computer Sciences and IT.

Smart factories decentralize action and decision-making to individual machines and gadgets, and sensors know what's happening elsewhere, says Visser.

"These sensors have some intelligence and can do some of their own thinking. That is a big shift for industry. And if an assembly line is intelligent, what happens to a product depends on the product itself."

This means the same assembly line can create different bottles of dish soap for various customers or handle car parts in different ways. That's a tremendous productivity advantage.

Smart factories constantly crunch vast amounts of complex data in the cloud, adjusting for optimization, identifying bottlenecks and anticipating failures before they happen.

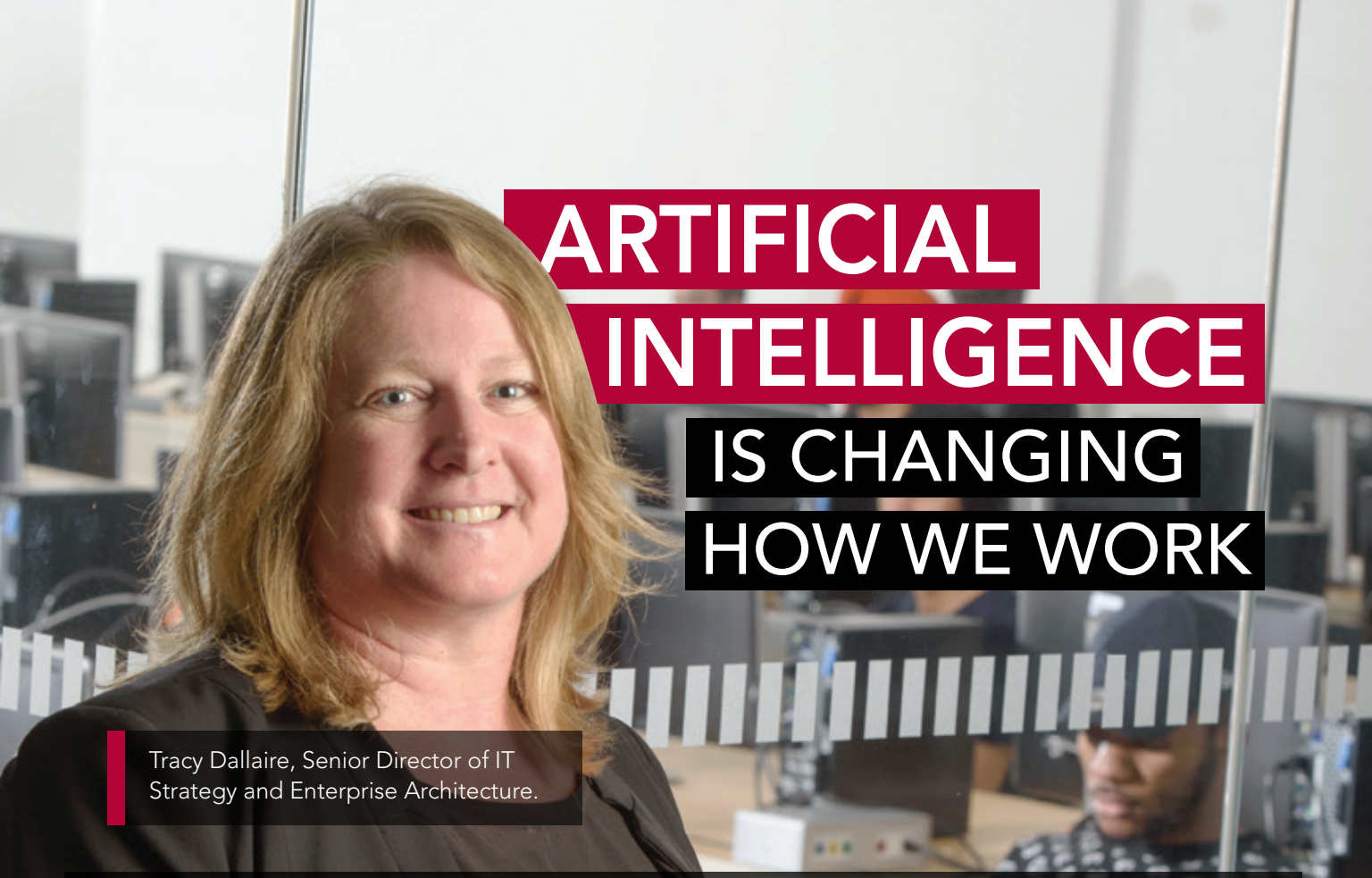
Transitioning to a smart factory requires both a huge capital investment and expertise, says George Miltenburg, Associate Dean of Engineering Technology.

"Big multinationals are on their way to being world-class smart factories, but smaller factories are far behind. That's where Mohawk wants to be: the college that can help small manufacturers become smart and join Industry 4.0."

Through experiential projects, Mohawk computer science and engineering students are being equipped with the skills to design, network and configure smart and secure connected industrial systems, build and program sensors, and move data through cloud protocols. Mohawk partners IBM, Rockwell, Siemens, Cisco and FANUC provide critical expertise and resources.

"We are developing our capabilities with the idea that Mohawk will be a leader in the ramp-up of Industry 4.0," said Miltenburg. "The big players see a commercial opportunity in smart factories, but they need us to help the smaller players adopt the technology."

ARTIFICIAL INTELLIGENCE IS CHANGING HOW WE WORK



Tracy Dallaire, Senior Director of IT Strategy and Enterprise Architecture.

Mohawk is working with industry to automate the collection and analysis of data

Rapid advances in artificial intelligence, machine learning, computational power, and user interfaces, such as voice recognition, are making it possible to automate many of the tasks of knowledge workers or, in some cases, resulting in the automation of entire jobs.

"The automation in the knowledge space is directly tied to the Internet of Things," said Tracy Dallaire, Senior Director of IT Strategy and Enterprise Architecture, a role formed at Mohawk a little more than a year ago. "All kinds of devices, like heating systems and lights in a building or robots in a factory, are collecting vast amounts of data. That flows to an algorithm that determines when a machine needs maintenance or to a system that maximizes energy, that automates work done by humans," she said.

"Eventually, there will be no human intervention. These systems will be smart enough to send messages back so that the machines themselves will learn and change their behaviour."

Automating the collection and real-time analyzing of data will leave humans to focus on higher-value tasks, says Dallaire. That is evident in a number of processes at Mohawk, everything from automated password resets that were once handled by IT staff, to automated reports of student registration numbers.

Auditors, quality control specialists, and cybersecurity experts rely on artificial intelligence tools to find anomalies and red flags in vast amounts of data. Humans are needed to set the context, parameters and risk scenarios, and then to investigate and make decisions based on what is flagged in the data.

"It will still be up to humans to find something meaningful in the data," said Dallaire.

"Mohawk is well-positioned to be a leader in this space. We have students, faculty and applied researchers working closely with industry on innovative data projects, creating new dashboards and applications."

The McKinsey Global Institute estimated in 2013 that the economic impact of the known applications of automated work will be $5.2 trillion to $6.7 trillion in 2025.

Students Ryan Stewart and Dawn Myers.

MOBILE DEVICES CREATING **UNPRECEDENTED OPPORTUNITIES** IN HEALTH CARE

Mohawk is working with McMaster and Hamilton Health Sciences to explore how remote monitoring devices can improve patient care in Ontario.

Powerful devices, ubiquitous online connectivity and mobile apps that link patients with practitioners are together transforming health care, and Mohawk College is at the forefront of the revolution.

"We walk around today with devices in our pockets that are more powerful than the computers that put the first man on the moon," said Duane Bender, Mohawk's director of digital health applied research and founder of innovation centre MEDIC.

"Mobile devices are personal and have a direct conduit to us, and therefore are a technology with an unprecedented opportunity to change human behaviour and improve health and wellness."

Mobile phones have already been disruptive but wearable health devices, from activity trackers to smart T-shirts with heart monitors woven into the fabric, are just beginning to impact lives.

"We will continue to see advancements in connected devices and also in our ability to monitor patients remotely, allowing us to discharge patients from hospital earlier without increasing the risk to those patients, and continuing to provide care coverage when they need it most."

MEDIC has conducted clinical trials, along with McMaster University and Hamilton Health Sciences, to evaluate the remote monitoring of patients.

Bender believes we will also soon see wide-scale integration of apps and devices into traditional health programs in Canada, bringing the data directly into hospitals, doctors' offices and other clinical settings. Around the world, artificial intelligence and machine learning could offer frontline health care in places with none.

"Canada and the world has a desperate need for digitally literate young innovators."

In-demand skills include information modelling, electronics and networking, information security, logic and coding, data analysis, and user experience design.

"All of these concepts are explored in the MEDIC Lab, as well as our related programs at Mohawk College, such as our Computer Systems Technology – Software Development program and our Network Engineering and Security Analyst program."

Laura Dobson, Chief Information Officer.

MOHAWK HAS ITS HEAD IN THE CLOUD

Cloud computing offers Mohawk students greater flexibility and better connections to prospective employers

A push to shift the majority of Mohawk College's software platforms to the cloud will allow it to keep up with exploding computing capacity demands needed to support their digital strategy.

"Higher education is in a time of great digital innovation. We need to leap to where things are headed. It's a delightfully exciting time," said chief information officer Laura Dobson.

Mohawk has implemented a cloud-first strategy, with a big shift coming in the next year or two, says Dobson. The College is also doubling its internet bandwidth and increasing network redundancy to ensure students, faculty and staff can always get to the information and systems they need.

"The single biggest thing is our network pipe to make sure our campuses are well connected to the cloud and people have fast access to learning systems and data."

The cloud offers great flexibility in e-learning, connecting students to employers to work on projects together, or in managing the growing volume of data coming from smart devices managing building systems to support our net-zero sustainability strategy, says Dobson.

"You would think going to the cloud would reduce our infrastructure needs, but with things like machine learning enabled analytics, big data applied research and artificial intelligence, it really just helps us keep pace. Cloud is becoming the vehicle for the future of IT."

Cloud providers – Amazon, IBM and Microsoft being among the leaders – are enabling rapid application development, prototyping, and experimentation that allows software to be delivered in a more agile fashion, says Dobson.

"When we bring enterprise thinking to what we offer, the possibilities are endless. We are constantly engaging in dialogue with our students and faculty about the tools and platforms that will enable what they are doing now and what they will be doing in the future."

YOUR FUTURE COWORKERS COULD BE ROBOTS

Mohawk students are learning to program, operate, set up and repair some of the world's most advanced industrial robots

Robots have been in industrial settings for decades, doing difficult, dangerous or dirty tasks – bolted down and fenced off to protect human workers.

But advanced robots, equipped with sensors, artificial intelligence and machine learning, now have the senses, dexterity and intelligence to work side-by-side with human workers. These collaborative robots are smaller and more adaptable, making them viable for a greater range of tasks in more settings.

"There has been a lot of progress and innovation in producing collaborative robots," said John van Loon, an electrical engineering technology professor at Mohawk. "They know the force they are exerting, they can determine the world around them, they respond to the presence of people, and they will stop if they come in contact with a person. That allows them to work alongside people."

Robots are becoming so advanced they can even sense and interpret human facial expressions, movement and tone of voice.

"It's all targeted toward interacting with people in all kinds of ways. The Renaissance Hotel in Las Vegas uses a delivery robot. It takes the elevators and travels the halls and calls the room to bring food or towels. That robot has to navigate through crowds of people, which is an inherently unpredictable environment."

And modern robots, big and small, can interact and work together, performing tasks they couldn't accomplish alone, for instance.

"On a search and rescue operation, a squadron of drones equipped with imaging equipment can cover a large swath of land in a search pattern. They understand where every other drone is, what each field of view is, and how everyone is moving so that nothing is missed."

Students in Mohawk's engineering technology programs learn to program, operate, set up, repair and maintain industrial robots.

Mohawk partner FANUC has developed some of Canada's first industrial collaborative robots, which are integrated into Mohawk's course offerings.

Mechanical Engineering Technology students Ian Kaminsky and Stephanie Childs.

"We are actually pushing technology into industry. That should be a role of educational institutions, to de-risk technology for our industry partners."

NEW IDEAS TAKE FLIGHT AT MOHAWK

Mohawk is teaching industry how drones, laser scanners and virtual reality can make time-consuming tasks like surveying faster and easier

Mohawk Building and Construction Sciences students are using bleeding-edge technology yet to be adopted by surveying and construction professionals, says Professor Richard Borger.

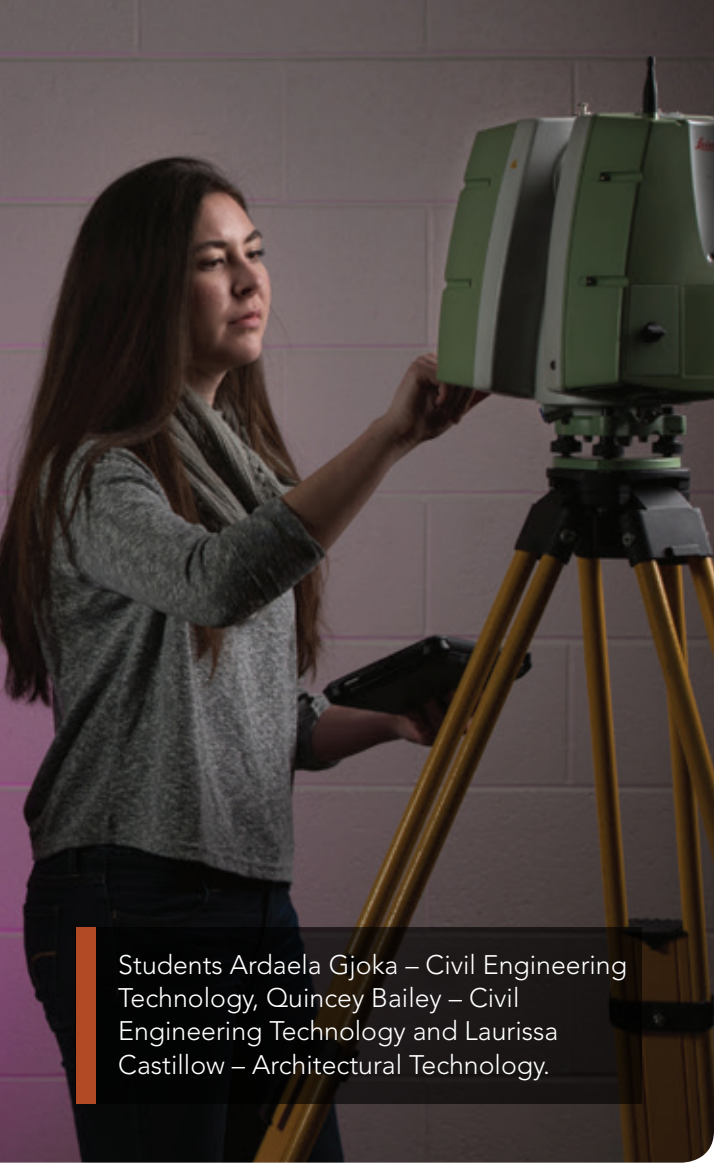
"We are actually pushing technology into industry. That should be a role of educational institutions, to de-risk technology for our industry partners."

Drones allow surveying of housing development sites in 45 minutes that would take a crew two or three days using traditional methods.

Combining drones with sophisticated 3D LiDAR scanners means entire buildings can be captured in minutes, right down to the locations of wall outlets and mechanical conduits. The data is used to build detailed floor plans without having to do any measurements.

Mohawk students used that technology to produce a 360-degree scan of the former Westinghouse office building using 3.6 billion data points. It's Borger's dream to generate a 3D image of the rock face of the American side of the Niagara Falls when the water is diverted to replace a pedestrian bridge sometime in the future.

"We are the only institution in north-eastern North America with this kind of capability," said Borger, who says this is thanks to the support of faculty, staff and college leadership.



Students Ardaela Gjoka – Civil Engineering Technology, Quincey Bailey – Civil Engineering Technology and Laurissa Castillow – Architectural Technology.

Drones and scanners can map mines and quarries and survey the conditions of trees, plants and crops, says chemical engineering professor Greg Matzke. "It's not widely used yet, so there is much potential. Drones allow access to places we could not have gone before."

Matzke, who has a drone operator licence, foresees a course built around the technology in the near future, perhaps eventually growing to a certificate program.

All of the data captured by drones and scanners can be taken into cutting-edge virtual reality to create 3D worlds.

"Architects, engineers, building owners and contractors can meet virtually, see what each other sees, and mark up drawings. Together, they are experiencing the model as it would be built," said Borger.

WHAT **AUTONOMOUS VEHICLES** CAN TEACH US ABOUT HOW MACHINES LEARN

All the components of a road-worthy autonomous car are contained in a model built by third-year computer software technician student Kugsang Jeong. The car is built on a Raspberry Pi single-board computer and uses machine-learning artificial intelligence, along with video cameras and sensors to navigate its environment.

Jeong had a special interest in a self-driving car, so Dennis Angle, Professor of Computer Science and Information Technology, asked for the funding to buy a basic kit.

"If it was on the road, it could detect traffic lights, pedestrians or other cars," said Jeong, whose main focus is on digital health. His goal was to learn about the machine learning, which will have an enormous impact on a vast number of sectors.

All Mohawk College software engineering students are able to write and work on the code that drives autonomous vehicles, said Angle.

Kugsang Jeong, student.

Faculty Member and Research Coordinator Rubaid Khan at the Sustainable Resource Centre, Stoney Creek Campus.

LEARNING TO KEEP THE LIGHTS ON

Mohawk is working to address a growing skills gap in the energy sector

Lithium-ion batteries power electric vehicles and billions of portable electronics. Storage performance is consistently going up while costs are falling. Batteries are crucial to feasibly integrating microgrids powered by solar and wind to the traditional grid.

Solar and wind aren't predictable generators and can't be relied on to supply power that matches demand.

"All the problems with current renewable energy systems are solved with energy storage solutions," said Rubaid Khan, Faculty Member and Research Coordinator of Mohawk's Energy & Power Innovation Centre. "If there is no immediate demand, energy can be stored and accessed when it is needed."

Late last year, the world's biggest battery — built by Tesla — was powered up in South Australia to store wind power. The battery is the size of an American football field and capable of powering 30,000 homes for short periods when the grid is taxed or down.

A huge imbalance in supply and demand means the state is plagued by frequent power failures and the highest electricity prices in the world.

"This shows that large-scale renewable energy infrastructure is viable," said Khan. But much more practical today is microgrid storage.

"So it would not be a one grid-scale battery per city idea but small pockets, in shopping malls or neighbourhoods where solar panels are tied to their own batteries."

IKEA has announced that all its stores will be net-zero by 2020, powered by solar panels and wind turbines. A neighbourhood of 130 homes in Brooklyn is tied together in an energy production and storage system.

Mohawk is advancing toward a microgrid research and training facility with industry partners that will bring together battery technology with renewable energy production and address a growing skills gap in the sector, says Khan.

RAPID CHANGES IN RENEWABLE ENERGY TECHNOLOGY COULD SOON CHANGE HOW WE POWER OUR WORLD

Mohawk students are working with utility companies and equipment makers to design and build the microgrids of the future

Rapidly evolving technology in renewable energy production — solar, wind, hydro-electric and even ocean waves — hold tremendous promise in addressing fossil fuel depletion and climate change while vastly reducing the cost of production.

Renewable energy is at the point of disruption, says Rubaid Khan, Faculty Member and Research Coordinator of Mohawk's Energy & Power Innovation Centre.

A new model of distributed solar and wind power resources in neighbourhoods, businesses and homes provides very localized energy that is much less prone to disruption from storms or natural disasters, terrorism or cyber-attack than traditional, centralized power generation.

Mohawk students are working with utility companies and equipment vendors to size, design and build microgrids that can be managed through sensors and dashboards in the cloud.

"The technology exists but there is a shortage of skilled workers. We are teaching about solar production, batteries and electronics but the next step is integrating it all together. That is where there is a skills gap."

The College already has a full-scale, two-storey house inside a lab that functions with smart appliances and smart meters. Students monitor energy use, design solar panel systems and battery storage to support that load, and learn how to integrate the home to the main grid, says Khan.

Mohawk is advancing toward a microgrid research and training facility with its industry partners that will be a real-world development and test environment coupling battery technology with renewable energy production, says Khan.

"The heart of the technology is batteries to store power when the wind isn't blowing or the sun isn't shining. We've come a long way with solar and wind energy but storage is where the bottleneck is because we can't control the clouds or the wind."

MOHAWK IS WHERE MANUFACTURERS COME TO LEARN ABOUT 3D PRINTING

Mohawk College is an established leader in 3D printing, a technology on the verge of disrupting advanced manufacturing.

The Additive Manufacturing Innovation Centre (AMIC) was home to the first metal 3D printer at any postsecondary institution in Canada and has carried out applied research alongside companies of all sizes.

"We have a mandate to explore additive manufacturing and help industry partners explore the technology in a low-risk, low-cost way," said Jeff McIsaac, General Manager of AMIC. "Partners typically come with a specific challenge and want to find out if 3D printing is the answer."

As costs for printers and materials continue to fall, the technology is becoming an ever-more viable option for manufacturers. "We are in the very, very early stages. There are processes we haven't even opened up. 3D printing is changing everything about what we are thinking."

The technology is driving new design approaches that replicate shapes found in nature, says McIsaac, such as curved holes, porous interiors or lattice structures, that were never possible with traditional manufacturing.

"We can print a tree but we cannot machine a tree. Nature has developed all kinds of shapes that are high strength and light weight. 3D printing allows the production of anything a designer can dream up."

Part of AMIC's mandate as an applied research lab is to take the knowledge gained with industry partners and work with faculty to feed that back into the curriculum.

AMIC is staffed with part-time and full-time student employees through co-ops and internships. It also takes volunteers, can be accessed for capstone projects, and is available to student entrepreneurs through SURGE.

"Students who learn in our lab leave with a very unique skill set. They have access to technology other schools haven't had and work closely with industry partners. They are well positioned for industry in Canada."

Jeffrey McIssac, General Manager of AMIC and student Weijia Zheng.

LEARNING FROM PAST EXPERIENCE

Faculty and students at Mohawk are exploring how old techniques developed by foundries can be used to improve products made through 3D printing

Developing new materials for additive manufacturing means using traditional techniques to create stronger, lighter-weight parts, says Elizabeth Martin, a professor of mechanical engineering technology. That will make 3D printing viable for mainstream manufacturing.

"We are borrowing from a lot of methods used in foundries for 50 years but applying them in new ways," said Martin, who has a PhD in polymer mechanics. "3D printing has completely changed the way we look at materials."

A core area of specialization for Mohawk's Additive Manufacturing Innovation Centre (AMIC) is materials development, said General Manager Jeff McIsaac.

"The catalogue of materials in metal 3D printing is limited. There are only a handful available for commercial use, so there is a lot of focus on the advancement of new alloys."

Martin says thermal treatment of powdered metals or polymers greatly improves the strength when the material is deposited in layers. Sintering or in-situ heating post-printing also results in better bonding between layers.

"If you think of a structure being printed one layer at a time as being like building blocks, the layers are attached but there is a crack between the layers. It's important to encourage the layers to attach together in a stronger way so the overall structure is stronger."

Materials development is key to realizing all the possibilities and benefits that 3D printing offers, says Martin.

"The more time we spend learning about the building up of layers, the better we are getting at developing strong materials. All foundry science relies on strength properties, and we can build that into 3D printing.

Mohawk students have many opportunities to learn and apply the technology, says Martin. The college's strong design curriculum in the manufacturing program is backed up by foundry techniques and opportunities to volunteer, study and work in the AMIC.

HOW DO YOU **STOP A HACKER?**

While cyber hacks of big businesses or online platforms make the news, the real cybersecurity battle is being fought on the personal level, says Dave Cole, an instructor and coordinator of special projects for engineering technology.

Mobile device apps that track location give hackers potential access points to individuals' homes and businesses. Smart devices in homes and cars give new access points to hackers that most people don't think about.

"Cybersecurity is a topic that should be as high a priority as learning English. Your data is everywhere and open to anyone who truly wants it."

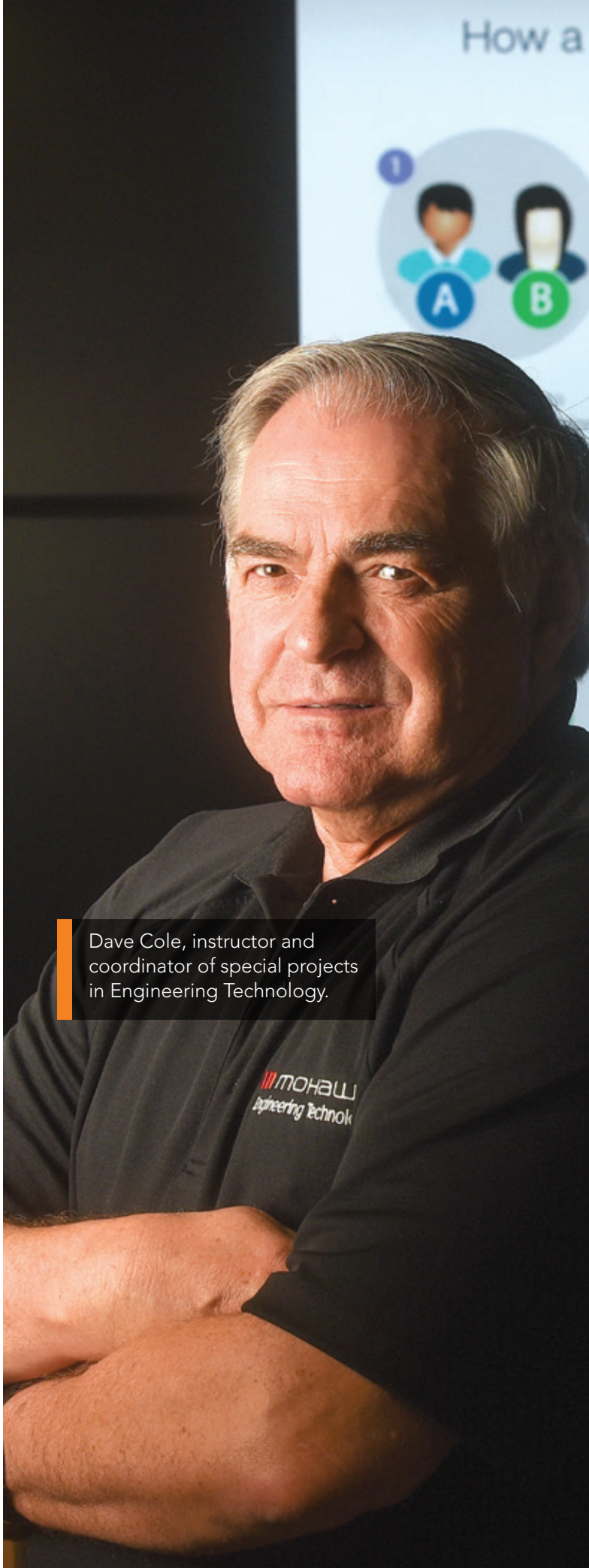
Mohawk College has developed a new graduate certificate program in cybersecurity analytics. One of the primary projects will be a simulation pitting one team planning and executing a cyber attack against another defending against it. The task will be executed over seven to nine weeks in a virtual cloud lab created with partner IBM.

"The big challenge is that the technology changes about 30 per cent a year. You just can't do normal course planning. The deliverables have to be dynamic," says Cole, who is vice-president of the Ontario chapter of the High Technology Crime Investigation Association.

"As educators, we are trying to stay ahead and graduate students who can design solutions before hackers are successful. We need more technology to keep ahead and more involvement with the community and more experiential learning for our partners."

That will be the mission of a lab at Mohawk that will incorporate scenarios to learn best practices in protecting mobile devices, smart homes and Industry 4.0 factories, says Cole.

"The preparation needed for this new environment is massive."



Dave Cole, instructor and coordinator of special projects in Engineering Technology.

HAVE YOU HEARD OF BLOCKCHAIN YET?

From banking to file sharing, blockchain is a game-changing encryption technology that is transforming how we manage transactions

Blockchain has opened up a new world of digital encryption that is leading to game-changing possibilities, says Dave Cole, an instructor and coordinator of special projects in Engineering Technology.

Blockchain is a method to encode digital transactions in a decentralized public ledger developed for digital currencies such as Bitcoin and hundreds of others. The ledger is hosted on millions of computers at the same time, making it open and public, unhackable and failure proof. It also cuts out any bank or other financial institution from a transaction.

Users are assigned an address or a public key – a long, randomly generated string of numbers plus a private key assigned to the transaction that functions like a password. Each transaction is a unique block in a chain that is constantly updated.

"Each block in a blockchain is related to another, in a continuous chain. Multiple copies of a transaction are recorded and if anyone tries to modify one, it becomes out of sync and is recognized immediately."

Modifying one block in the chain would require tremendous computing power to override the entire network.

Blockchain can be used for anything of value that can be shared digitally, including documents, photos and legal contracts. That is where the true disruption is coming, says Cole.

Ethereum, an open-source, blockchain-based platform that allows the execution of smart contracts, is "Bitcoin on steroids" and truly has the potential to be a game-changer, he says. It could eliminate sharing economy platforms such as Uber, eBay and Airbnb in favour of true peer-to-peer payments and underpin the vast number of micro-transactions that power a digital economy.

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- Expressive Arts
- Multimedia Storytelling
- Supply Chain Management
- And more

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FUTURE READY

MAPPING DNA

What once took 13 years and $2.7 billion can now be done in hours on a $1,400 mobile device

The rate of technological advancement in the sequencing of human DNA is enormous and raising complex social and ethical questions about how far it should go, says Mohawk College Biotechnology Professor Dr. Ethan Paschos.

Mapping the human genome can be done now in hours on a device the size of a cellphone and for less than $1,400 CAN. In 2001, the first time DNA was sequenced in its entirety, it had taken 13 years and cost $2.7 billion.

> "The technology also raises the potential for a future where diseases can be treated before they appear and even where the onset of aging can be 'turned off.'"

"Scientifically, it's very impressive. DNA contains all the information of a human, their height, the colour of their skin, hair and eyes, how they will age, the diseases they will develop as they grow older. It's all encoded in DNA," said Dr. Paschos.

The sequencing, matched with advanced computing power and big-data analytics, is producing powerful applications in health care, pharmaceutical development, agriculture, environmental science, and law enforcement.

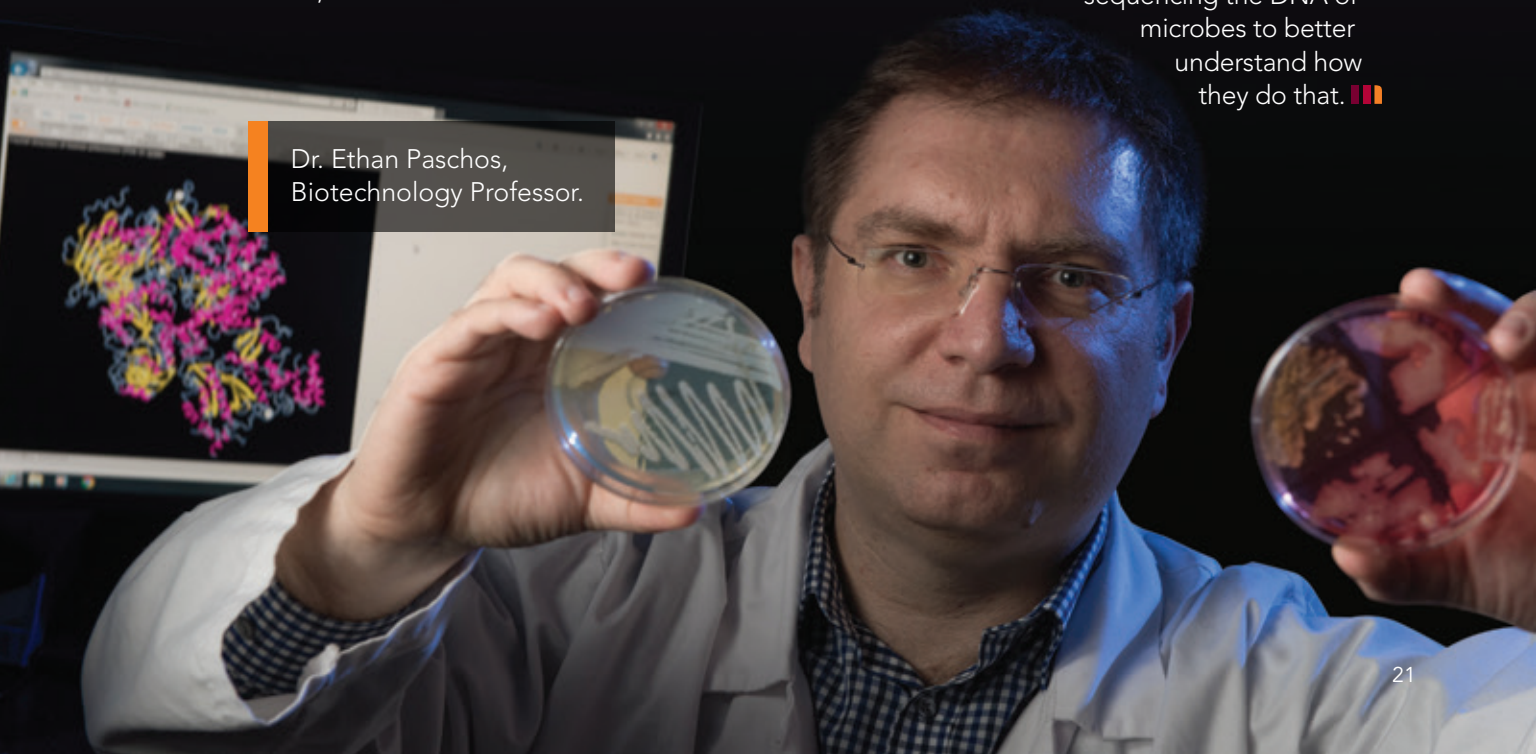
Dr. Paschos says at some point it will be just standard procedure to go to a doctor to get genomes analyzed. But science could also lead to testing babies at birth to determine their risk of developing a whole range of diseases. But who will have access to the data and for what purpose?

"There has been a remarkable pace of technological advancement but now we have to think about how far we want to go."

The technology also raises the potential for a future where diseases can be treated before they appear and even where the onset of aging can be "turned off."

Mohawk recently launched a fourth-semester bioinformatics course in the biotechnology program, in which students explore the science of sequencing and the interpretation of data.

Dr. Paschos and his team are researching the use of bacteria to remediate contaminated soil and sequencing the DNA of microbes to better understand how they do that.



Dr. Ethan Paschos, Biotechnology Professor.

MOHAWK IS HOME TO CANADA'S ONLY CARDIAC SONOGRAPHY PROGRAM

Nidhi Chudgar, student, and Jennifer Lisac, Program Coordinator.

Mohawk College's diagnostic Cardiac Sonography Program launched with its first full-time cohort in 2000 and remains the only such graduate certificate program in Canada.

Cardiac sonography is a subset of radiation sciences that is dedicated to one complex, critical organ. The program, offered at Mohawk's Institute for Applied Health Sciences at McMaster, provides a highly specialized, in-demand skill set to treat a population that is aging and experiencing a high incidence of heart disease, said Wendy Lawson, Associate Dean of Applied Health at Mohawk.

"It's something that Mohawk is very proud of, to be the only such dedicated program in the country and that our graduates have excellent reputations in the field. There is a real need in the labour market and tremendous demand for cardiac sonographers."

Cardiac sonography is a fast and non-invasive diagnostic tool to evaluate heart function, structure and blood flow in patients in which there is suspected to have been a cardiac event or heart disease or another systemic disease affecting the heart. Cardiac sonography, with the test result evaluated by a cardiologist, leads the way to the best treatment.

"Cardiac sonography provides images of the heart, a moving,

"It's something that Mohawk is very proud of, to be the only such dedicated program in the country and that our graduates have excellent reputations in the field. There is a real need in the labour market and tremendous demand for cardiac sonographers."

highly dynamic organ, and the diagnostic ability of it is really quite amazing," said Jennifer Lisac, Program Coordinator for the Cardiac Sonography Program and a graduate of the program.

Mohawk recently invested in two new high-fidelity training simulators that provide cutting-edge experiential learning to students, including complex case studies and sometimes difficult patients. Tough scenarios aren't possible to simulate when students are practising their skills on each other, said Lisac.

The condensed program is four semesters over 15 months, combining classroom and online learning with two semesters of clinical rotations. The program accepts 40 students, allowing for a low instructor-to-student ratio.

Graduates write a national accreditation exam and as of January 2018, sonographers are registered health professionals in Ontario. More than 95 per cent of program graduates are working in the field.

"If you are considering becoming a cardiac sonographer, Mohawk is the place to do it. The investment that they make in their staff, facilities and equipment is second to none," said Jason Michalakos, who graduated in 2007 and works as a cardiology clinical specialist for Philips Healthcare.

Kenneth Szeto, who graduated in 2017, says extra-curricular learning events and career guidance were invaluable and he landed a job immediately after graduation.

"The program offered both the necessary theoretical knowledge and the dexterous hands-on skills required to succeed in the career. The professors were passionate in their lectures and offered tremendous support after hours."

Demand for cardiac sonographers will only grow locally, nationally and internationally, says Lawson. Because the tools are portable and cost effective, they are ideal for remote locations.

Lisac and her colleagues are deeply involved with an Alberta-based project to teach health professionals in Guyana to use cardiac sonography. Mohawk College is a partner, providing travel, equipment, medical supplies and textbooks and many program faculty and graduates have volunteered their time.

"There are many passionate advocates of the profession here at Mohawk and they've invested a lot of themselves in this project."

ANSWERING THE CALL OF HEALTH CARE

Mohawk meets the growing demand for experts in Brain Injury, Mental Health and Disability Management with new programs

There are no other programs in Ontario like Mohawk College's new graduate certificates in Brain Disorders Management (BDM) and Mental Health and Disability Management (MHDM).

Neil McMahon, Dean of the School of Community, Justice and Liberal Studies, came up with the concept for the programs in 2015. He heard from industry experts who sit on program advisory committees in social service work, child and youth care, early childhood education and other Mohawk programs that there was a growing population with acquired brain injuries (ABIs), dementia, and mental health issues following a disability or illness that need programs, treatment and services.

"We were not preparing our graduates for those kinds of issues but there is a tremendous need in our community," said McMahon. "In the college system, industry is telling us as educators what they need. That's a perfect equation."

The programs launched in September.

Kim Ann Laush, the School's associate dean, says the graduate certificate model allows the curriculum to build on skills graduates already have. The programs also provide a great employment path for graduates.

The two-semester programs use a blended delivery model of online work and two evenings a week of in-class learning. From May to August, students work to compile 336 hours of experience in field placements.

"We expose our students to a multidisciplinary team, including people working in the field with clients, case managers, rehabilitation therapists, job coaches, art therapists, policy developers and applied researchers in labs or hospitals. We want to give students a sense of how they can contribute to a team," said Anne-Marie DePape, program coordinator and professor.

Both programs include training in Mohawk's Multi-Sensory Lab and with concussion experts at Holland Bloorview Kids Rehabilitation Hospital. Students are also given de-escalation training and work with front-line emergency workers to simulate the experiences of those in mental health crisis.

Student Jay Dukeshire – BDM Program, Dr. Anne-Marie DePape, Coordinator/ Professor of the MHDM Program, and student Melanie Extrance – MHDM program.

Both courses had opening enrolments of 50 students.

"We started these programs with a proposed enrolment of 30," said McMahon. "It was an aggressive target, and Anne-Marie did a terrific job executing her vision for these programs."

The team behind these new programs expects high demand for enrolment to continue, as will the calls for field placements and job openings. Students have already been working with organizations to develop mental health programs for staff, execute longitudinal research, and conduct assessments of patients.

Students include Jay Dukeshire, who suffered a massive brain injury in a 2009 motorcycle accident that affected his emotions and memory. He completed Mohawk's Recreational Therapy Program in 2016 and is now enrolled in the BDM certificate program and wants to work with others with ABI at Hamilton Health Sciences.

Student Melanie Extance, who is in the MHDM program, was among 22 university and college students chosen by the Ministry of Advanced Education and Skills Development to form the Minister's Advisory Council of Students. She will be providing recommendations about mental health and accessibility.

MOHAWK ADVERTISING STUDENTS CREATE LOGO FOR CITYLAB

CityLAB Hamilton gave four Mohawk advertising students a unique opportunity to put their creative talents to work.

The students created an official logo for the new community-building initiative that brings Mohawk, McMaster University and Redeemer University College students together with City of Hamilton staff. CityLAB is an innovation hub where students, academics and civic leaders work on real-world projects that help build a healthy, sustainable and vibrant Hamilton.

"It was fantastic working with CityLAB from start to finish," says third-year advertising student Cassandra Howey, who served as account manager. "This was definitely a beneficial opportunity. We had so much to do in such a short span of time. Our team really had to come together and accomplish something much greater than ourselves. It was a really challenging assignment that pushed us to work above and beyond our potential."

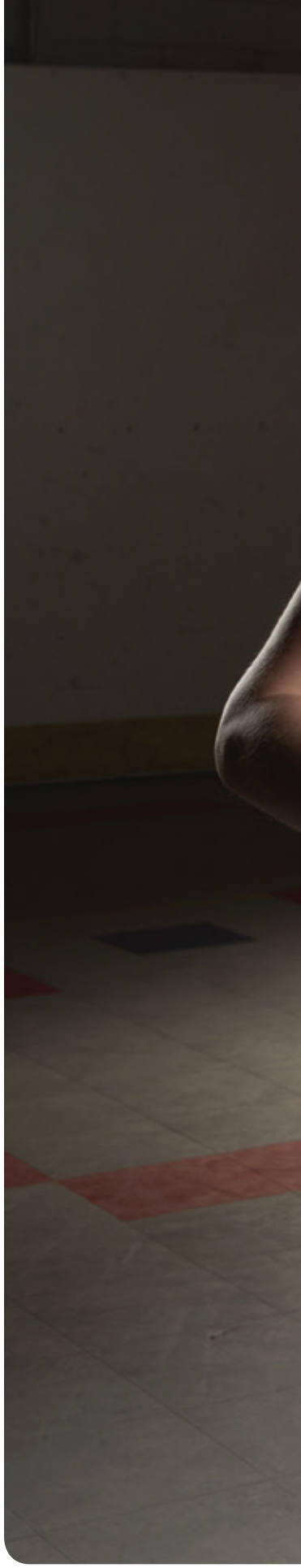
Joining Cassandra on the team were advertising classmates Justine Smith as project manager, copywriter Eric Kostelnik and art director Kira McNeill.

The students took on the logo project through The Agency at Mohawk in the McKeil School of Business. Students from programs including advertising, public relations, marketing, graphics and broadcast media collaborate on real-world marketing and communications solutions for Agency clients that include non-profits, start-up companies and other college partners.

To create the logo, Cassandra and her team consulted with students at CityLAB, City of Hamilton staff and Mohawk faculty. The team then presented four concepts at a CityLab Steering Committee meeting where their logo was approved and officially adopted.

"I was very pleased that we were able to partner with The Agency students to design our logo," says CityLAB project manager Patrick Byrne. "They brought energy, enthusiasm, and professionalism to the project and the result has been enthusiastically supported by our Steering Committee."

CityLAB HAMILTON



Theresa Merwin.

ANOTHER REASON TO CHEER FOR CANADA

Mohawk employee makes national dodgeball team

Mohawk graduate and employee Theresa Merwin is among a strong Mountaineer contingent on Canada's first cloth national dodgeball team through the World Dodgeball Association.

Merwin was among 27 players chosen for three squads in November. She was assigned as the co-captain to the mixed (men's and women's) team.

"I felt very honoured and humbled. I've never played on a national or international level before."

The Mohawk connections on the national team run deep, with two apprenticeship students and six graduates among the players. The coach is a Mohawk alumnus, too.

Mohawk health, wellness and fitness students even helped assess players at tryouts.

"I try to tie in Mohawk wherever I can because it's a great community resource and we're a community team," said Merwin, an operations manager in the School of Community, Justice and Liberal Studies and manager of Mohawk's Multi-Sensory Lab.

Merwin was recognized with a Mohawk Award of Excellence in 2016.

She's a business and business administration graduate and then earned a postgraduate certificate in human resources management through Mohawk Continuing Education.

Dodgeball has surged in worldwide participation in the last decade and has even been added to an Olympic watch list.

Merwin, 31, is most excited about playing in the World Cup in August at the iconic Madison Square Gardens in New York City.

She started playing eight years ago when a colleague needed an extra woman for a game.

"I just showed up and fell in love right away. I knew it was for me. I can jump, dodge and catch. Throwing is my weakness. I don't throw as hard as some of my other teammates, but I have great aim."

She plays in two Hamilton leagues, while also practising with Team Canada twice a month. Her manager and colleagues are very supportive and interested in her dodgeball life, she says. "They know my schedule and get excited about hearing about my games."

MOHAWK IS HOME TO ONTARIO'S FIRST CENTRE FOR CLIMATE CHANGE MANAGEMENT

The Centre for Climate Change Management at Mohawk brings together industry and government partners to amplify and accelerate the transition to a low-carbon economy

Mohawk College is an ideal home for the new Centre for Climate Change Management (CCCM), says its executive director Sandi Stride.

"Mohawk has done so much to reduce greenhouse gases on campus. It's a leader in engaging students on sustainability and climate change, and in developing best practices for other colleges," said Stride, who was appointed in November to lead the launch of the centre.

The $1.9-million CCCM, the first of its kind in Ontario, is a partnership of the City of Hamilton, the City of Burlington, Mohawk College and the Province of Ontario to amplify and accelerate the region's transition to a low-carbon economy.

> "It is absolutely urgent that we work together on climate change. We are dedicated to driving action on this because there is no time to waste anymore."

"We have some truly visionary leaders who saw a tremendous opportunity to make real advances on climate change. The key will be a collaborative approach," said Stride, who founded Sustainable Hamilton Burlington in 2011. It helps companies develop and implement sustainability plans and will be a key partner of CCCM's Industry Partnership Initiative.

The Bay Area Climate Change Coordinating Office will be located at CCCM, which will bring together staff from Cities of Hamilton and Burlington charged with leading a regional Climate Change Action Plan. The Campus Carbon Management Initiative will develop and pilot a toolkit of best practices for all of Ontario's colleges. CCCM will also be home to Mohawk's Sustainability Office.

The centre will draw on Mohawk applied research, and will work with faculty to build new climate change curriculum and provide experiential learning to students.

The CCCM will occupy the top floor of The Joyce Centre for Partnership & Innovation in the future. It will be a showcase of sustainability and a living lab within the region's first net-zero institutional building, said Stride.

"It is absolutely urgent that we work together on climate change. We are dedicated to driving action on this because there is no time to waste anymore."

Sandi Stride, Executive Director, Centre for Climate Change Management.

LEARNING, LIVING & LEADING SUSTAINABILITY AT MOHAWK

The Centre for Climate Change Management at Mohawk College will be a catalyst to support regional action on climate change and provide opportunities for students to live, learn and lead in the development of applied climate change mitigation strategies and initiatives that will:

- Support and strengthen a regional, coordinated approach to tackling climate change in partnership with the City of Hamilton and the City of Burlington
- Establish and share best practices for reducing, managing and measuring emissions among Ontario colleges
- Use work-integrated learning opportunities to support businesses to be successful in the low-carbon economy

FAST FACTS

1st college in Ontario to introduce an Environmental Management Plan

30% reduction in baseline carbon emissions achieved in six years

4th among North American associate colleges in the AASHE Sustainability Campus Index

16 local, regional and national sustainability awards

2017 CANADA'S GREENEST EMPLOYERS

stars

Smart Commute WORKPLACE 2016

Mohawk students Dawne Pierce and Ester Ay, trailblazer Roberta Tremain, recent graduate Aleksandra Bis and President Ron McKerlie.

A SIMPLE MISTAKE HELPED THIS TRAILBLAZER LAUNCH A SUCCESSFUL CAREER

Roberta Tremain made history at Mohawk because of a typo. It was 1958, when 17-year-old Roberta Tremain dreamed of a postsecondary education in technology.

She never thought that being a woman would limit her opportunities.

Roberta was thrilled when she was accepted to the Hamilton Institute of Technology, which would become Mohawk College in 1967.

However, the institute called just two weeks before school started saying, "you can't come here, because you're a woman."

Something had been lost in translation and the institute had thought Roberta was a Robert.

Roberta didn't back down. She told the principal she had paid her tuition and had already rented a room near the school on Wilson Street. The principal relented and allowed her to come on probation until Christmas.

Once at the institute, Roberta said her peers and teachers accepted her. However, she was the only woman in the school except for the secretary whom she had lunch with every day.

After Christmas, she switched into textile chemistry dyeing and finishing because she thought it sounded more interesting.

Roberta was the first woman to attend and graduate from the Hamilton Institute of Technology.

She went on to earn a bachelor of science and a master's degree in North Carolina.

Roberta continued to run into obstacles. She graduated with six job offers but was also rejected by employers who said that despite her strong grades, they wouldn't hire a woman.

Again Roberta persisted and went on to have a rewarding career in technology. In 2010, Roberta established a scholarship for women at Mohawk who are following in her footsteps.

Roberta encourages young people to "be true to yourself and do something you really like."

Mohawk President Ron McKerlie shared Roberta's story at winter convocation. He told the graduating students to remember Roberta's story when they run up against roadblocks and persist. "Don't surrender your ambitions or diminish your dreams. We must speak up and stand with all the remarkable women around us, and do our part to put the Robertas and Roberts of this world on equal footing."

Cesar Mejia.

"IT'S IN OUR HEARTS TO DO SOMETHING"

Mohawk student returns to native Peru to bring hope to others

Cesar Mejia uses his life as an example of hope to poor people in his native Peru and is focused on building an education centre to help children and families thrive.

Mejia, 33, grew up very poor in Lima. He was one of six children and frequently went to bed hungry.

"The first pair of shoes I got was at 12," says Mejia, who is in the second semester of a two-year educational support program at Mohawk College.

He left school at 14 to go to work for his family. But his life changed when he was asked to try out for jockey school. His small stature and athleticism made him an ideal candidate. He knew nothing about horses but realized it was his ticket out of poverty.

He finished jockey school at 16 and rode horses at racetracks across the U.S. He had the opportunity to come to Canada in 2011 and was eventually able to bring his parents and younger brother, too.

He's made a life here, marrying a Canadian woman he met at a racetrack after asking her for a date using Google Translate. They bought a house in Simcoe and have two children and another on the way. His wife taught him English and encouraged him to finish high school and then go to college.

But the pull of his home is strong. He feels it's his calling to spread hope.

"I've been blessed and it's time for me to bless others."

His fourth mission was in December, when he visited nine communities, backed by the support of his church. Mejia, his brother Manuel, and a pastor from Peru along with a small team of supporters taught music and nutrition, prepared food, and held church services. They delivered 300 soccer balls, bags of rice and noodles, and clothes.

The team travelled eight hours by boat to Nueva Luz, where nine Indigenous couples were getting married. The missionaries brought donated clothes and food for the celebration.

Mejia says he and his wife have gone into debt to finance their mission work. She is a veterinarian technician and he works full-time as a midwife on a pig farm, while also handling full-time studies.

But they are already planning the next visit, a medical mission in August to bring dentists, doctors and nurses to poor communities.

The dream is to secure land in the poor area of Pucallpa, a port town on an Amazon tributary, to build an education centre that will offer homework support, Christian fellowship, food, library resources, and recreation.

"It has no hospital, no school, they drink water from the river that looks like coffee or chocolate… The kids die young there. It's in our hearts to do something."

MOHAWK HAPPENINGS

HIGHLIGHTS

1 Beam signing with Walters Group and Mohawk team. **2** Mohawk launches Centre for Climate Change Management. **3** Mohawk celebrates eight outstanding alumni. **4** 2017 Distinguished Fellow Bertha Skye. **5** Mohawk a top employer for fifth consecutive year. **6** Mohawk Dean of Applied Research Gina Funicelli wins AUTM Award. **7** The Joyce Centre for Partnership & Innovation receives Engineering Project of the Year award in the Sustainable Engineering category. **8** 2017 Distinguished Fellow Ross Finnie. **9** Ontario partners with Greenbelt Fund to increase access to local food. **10** Mohawk honours first graduating class. **11** Mohawk wins Hamilton 2017 Trillium Award for Ward 8. **12** Hoop Dance receives Urban Design Award. **13** The Joyce Centre for Partnership & Innovation wins Innovation in Sustainability Award. **14** TSN 1150 Hamilton and Mohawk team up to offer Sports Broadcasting course. **15** Mohawk, McMaster, Redeemer and the City of Hamilton open CityLAB. **16** Mohawk takes City School on the road. **17** Greenbelt Fund recognizes Mohawk with Local Food Champion Award. **18** Ideaworks at Health Achieve Conference. **19** Professor Nick Petrella receives YMCA Peace Medal. **20** Port Authority partnership helps bridge transportation skills gap. **21** Ontario invests $210,000 in applied research projects at Mohawk College.

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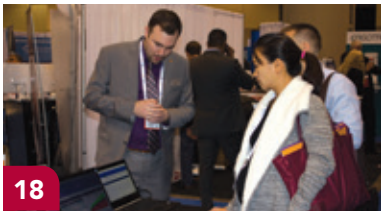
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OPENING FALL 2018

THE JOYCE CENTRE FOR PARTNERSHIP & INNOVATION

2017 Innovation in Sustainability Award
Canada Green Building Council

2018 Sustainable Project of the Year
Ontario Sustainable Energy Association

2018 Engineering Project of the Year
Ontario Society of Professional Engineers

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Building Innovation Canada

THE JOYCE FAMILY FOUNDATION

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MSA MOHAWK STUDENTS' ASSOCIATION

Architects: McCallum Sather, B+H Architects

Contractor: EllisDon

MOHAWK FUTURE READY