HUMBER

Applied Research & Innovation

WE ARE DRIVING INNOVATION

APPLIED RESEARCH & INNOVATION

A YEAR IN REVIEW | 2018 - 2019

SECTIONS

1) Who We Are

2) Applied Research Projects

3) Innovation Ecosystem

This annual report covers the period of April 1, 2018 - March 31, 2019. Data outside of this period is indicated with an asterisk. External sources are listed in the notes section.

"Applied research serves as a critical component in the academic experience for students by providing opportunities for experiential learning."

— Gina Antonacci, Associate Vice-President, Academic

Associate Vice-President's Remarks

Applied research supports student success by providing hands-on learning and real-world experience with industry and community partners. Coupled with Humber's unique institutional learning outcomes, our graduates stand out from the crowd. Developing career-focused graduates who are poised to be leaders in the workforce of the future is our aim.

Humber's Centres of Innovation (COIs) are intended to act as a catalyst for innovation and applied research. Two COIs specifically had tremendous progress this past year; the Centre for Entrepreneurship (CfE) and the Barrett Centre for Technology Innovation (Barrett CTI).

The CfE more than doubled the number of active members during the 2018/2019 fiscal year and hosted nine major events, including the Cisco Awards and the Global Forum for Entrepreneurship and Innovation.

The game-changing Barrett CTI recently opened its doors in April 2019. Driving the progress of Industry 4.0, it features cutting-edge makerspaces, interactive technology, and digital media studios which support applied research, skills development and STEAM outreach.

Applied research contributes significantly towards Humber being an exceptional place to learn. The projects and activities highlighted in this report include user experience design, system integration, sustainable architecture and much more. Humber recognizes the many forms of applied research and innovation, and I'm proud to be a part of it.

Gina Antonacci
Associate Vice-President, Academic

“This past year, we continued to focus on creating opportunities for students to participate in applied research and strengthen our relationships with industry and community partners.”

— Dr. Darren Lawless, Dean, Applied Research & Innovation

Message from the Dean

Innovation is a word we hear almost daily, but it runs the risk of only being a buzzword without the action to support it.

The focus for Applied Research & Innovation (ARI) in 2018/2019 was action, evidenced through the opening of the Barrett CTI; the introduction of innovation workshops for faculty and staff; and the development of new partnerships.

Identified as one of our institutional values, our commitment to innovation runs deep, further reinforced by our COI network.

Partnerships are essential to applied research; this past year, we focused on developing innovative approaches to industry-academia collaborations that directly benefit students and partners. The Advanced Manufacturing Skills Consortium is an example of partners who see the value of the model.

In order to prepare our graduates for the future of work, we need to continue to strive for next-generation education, enriched by technology, hands-on learning and the expertise of partners. We're on our way, and I can't wait to see what 2019/2020 will bring.

Dr. Darren Lawless
Dean, Applied Research & Innovation

"We want to move from the 'sage on the stage' classroom to the 'guide on the side' so that we're collaborating with students instead of instructing them."

— Dr. Ginger Grant, Associate Dean, Applied Research & Innovation

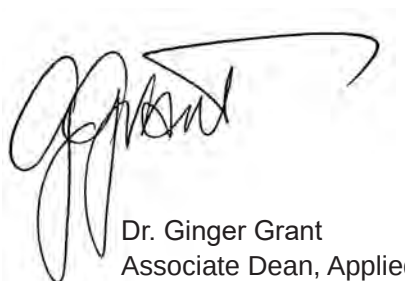
Letter from Associate Dean

Since joining Humber's Applied Research and Innovation in August 2018, I've had the pleasure of working alongside an incredible team of talented individuals to launch diverse programming and support applied research projects that facilitate ways for Humber to lead, transform and differentiate the educational experience.

Applied Research and Innovation is harnessing a multifaceted approach to its programming by targeting faculty, students and industry/community partners to further strengthen ties within and outside of Humber. We're continually assessing the needs of our audiences and delivering on their asks through engaging workshops and webinars. In the past quarter, our offerings have focused on creative problem solving, 21st century skills development, design thinking, and derisking and delivering on innovation.

To support the development of Humber's research culture, we assist faculty with grant proposals to provide access to funds for applied research. In the past year, we've led the submission of multiple SSHRC and NSERC grant applications by faculty members as well as submitting our own applications for a NSERC Industrial Research Chair, membership in the Canadian Pilot Cohort for the Carnegie Foundation's Classification for Community Engagement, and 21st century skills development programs and certifications.

In 2019/2020, we will look to build upon these new initiatives while continuing to find innovative ways to engage with faculty, staff and students. We will continue to break down obstacles to applied research and further develop a lively research culture at Humber.



Dr. Ginger Grant
Associate Dean, Applied Research & Innovation

Section 1

Who We Are

- > What is Applied Research?
- > Our Mission, Vision & Values
- > Research Infosource Rankings
- > Quick Facts
- > Research Excellence Award

What is Applied Research?

Applied research is the systematic and original investigation of a problem, need or new entrepreneurial opportunity with practical implications identified either by a third party (industry or community) or through analysis, with a goal of achieving a measurable and practical outcome.

For a project to be classified as applied research at Humber, it should have faculty, staff, and student involvement. In addition to government and externally funded projects, capstones are a form of applied research.

Our Mission, Vision & Values

The Office of Applied Research and Innovation supports Humber's vision of transforming postsecondary education through global, polytechnic leadership. Humber's institutional values of courage, innovation, equity, health & well-being, and sustainability are core to how we operate.

Our mission is to create a rewarding and sustainable environment in which relationships between Humber students, faculty, staff, and partners are strengthened through increased engagement in the applied research process.

Research Infosource Rankings

Applied research and innovation at Humber College is in growth mode, evidenced by a substantial increase in its ranking among Canada's Top 50 Research Colleges, leaping 12 spots to 8th place in only one year.

According to the annual report published by Research Infosource Inc., Humber ranked first in key areas, including research partnerships, corporate research income, and corporate research intensity. Humber also ranked second in paid student researchers. These metrics reflect the strong network of research partners Humber has built by creating alignment with the needs of industry, and by developing an integrated approach that helps companies with their technical challenges and the development of their talent pipeline.

Humber is encouraged by this year's results and continues to work towards the development of new collaborations and initiatives to further expand research activities and improve performance.

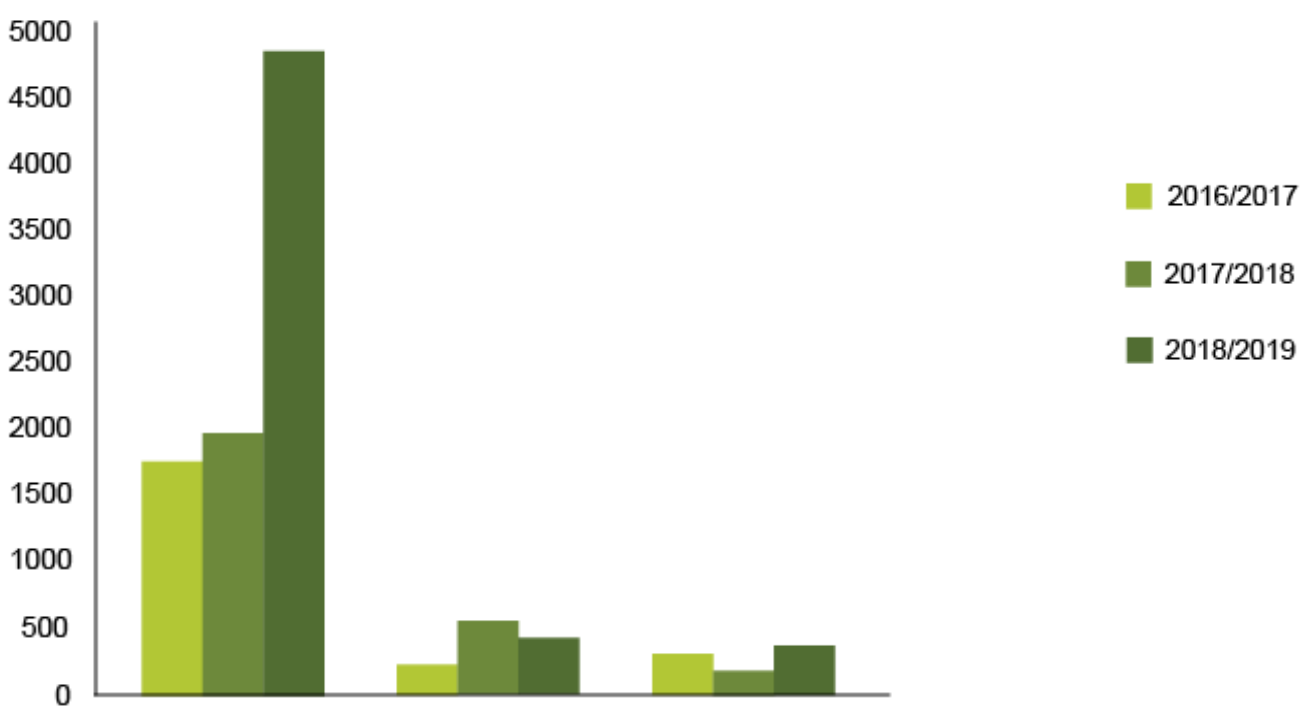
CANADA'S TOP 50 RESEARCH COLLEGES 2019 RESEARCH Infosource Inc.

"Through the collaborative efforts of faculty, students, and industry and community partners, we've been able to strengthen our position as a leader in the applied research space."

— Dr. Darren Lawless, Dean, Applied Research & Innovation

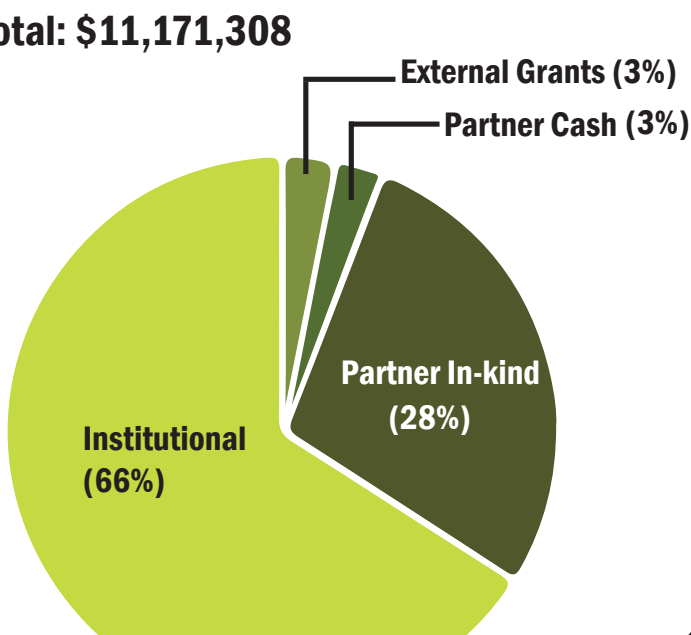
Quick Facts

Number of Collaborators



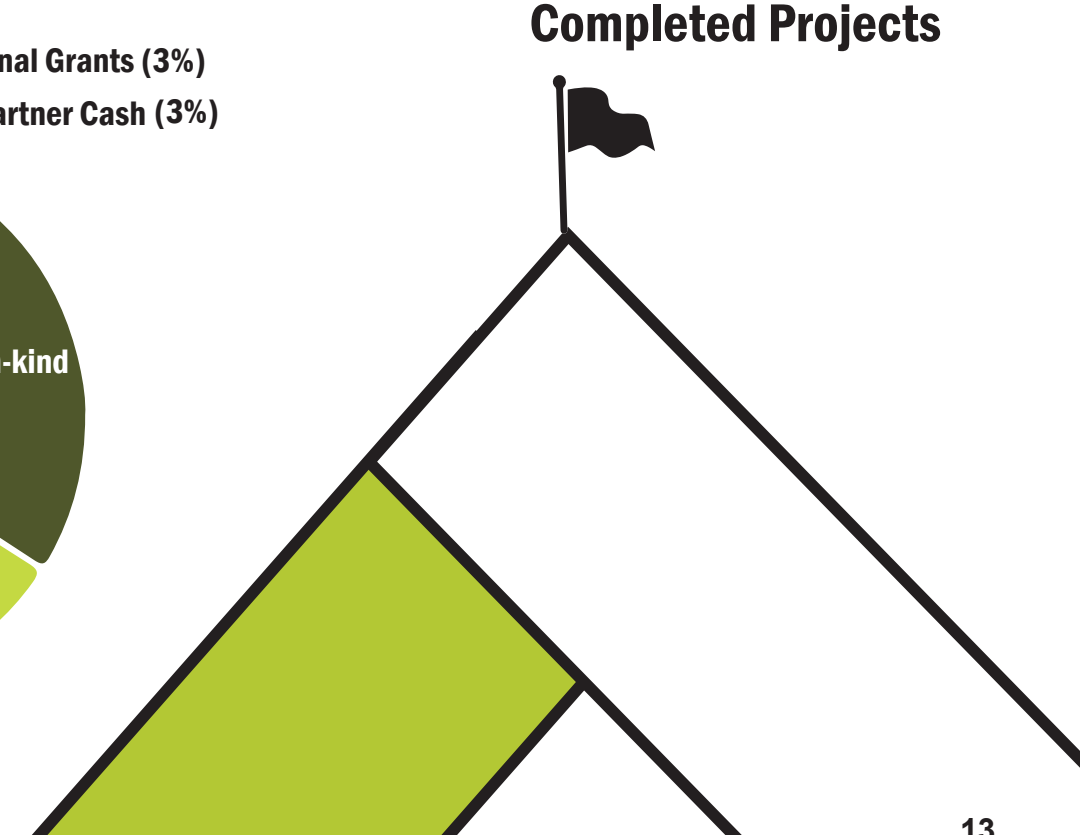
Research Dollars

Total: $11,171,308



300

Completed Projects



Research Excellence Award

About the Award:

The Research Excellence Award is designed to recognize faculty and staff members who have made significant contributions to the growth of Humber's applied research program and may include contributions such as applied research:

- involving students as research assistants or researchers. Ideally, the applied research will enable students to apply concepts they are learning in their program or;
- impacting on the researcher's field or industry (e.g. patents) as well as on Humber students and/or curriculum.

2018 Recipient: Dr. Rai Reece

Dr. Rai Reece is a professor in the Community Justice Services program in the School of Social and Community Services at Humber College. Since 2005 she has been involved with anti-prison work with prisoners and ex-prisoners.

In 2007 she conducted one of the first research projects in Canada to exclusively examine the intersection of race, incarceration, and the meaning of Canadian citizenship as it pertained to federally sentenced Black women in Canada.

Dr. Reece has published in the areas of 'race' and racism, feminism, and criminological studies and her most recent co-publication in the *Canadian Journal of Criminology and Criminal Justice* examines harm reduction practices in federal prisons. Dr. Reece holds a PhD in Women's Studies from York University and teaches in the areas of Canadian criminal justice, community justice, and institutional correctional practices.

Humber Greenhouse, a Horticultural Technician Pre-Apprenticeship Program Facility

"It was an honour to receive this award and to be recognized for this research by Humber. This work means a lot to me and I share this award with the incarcerated women who generously shared their experiences with me. My hope is that continued research in this area will impact policy, practice and social change."

— Dr. Rai Reece, Professor, School of Social and Community Services

One Seed at a Time

Dr. Reece's current research, for which she was awarded Humber's Research Excellence Award, is titled *"One Seed at a Time": Evaluating the Impact of the Horticulture Technician Pre-Apprenticeship Program on the Lives of Incarcerated Women*, which evaluated the efficacy of the Horticultural Technician Pre-Apprenticeship Program (HTPP) offered by Humber College's School of Applied Technology and developed and coordinated by Community Outreach and Workforce Development (COWD).

In partnership with the Elizabeth Fry Society of Peel/Halton Region, Landscape Ontario, and the Vanier Correctional Centre for Women, findings from this research indicated that social issues (addictions, poverty, and trauma) are directly connected to recidivism rates and women's access to resources. The HTPP allowed for women to identify social skills that empowered them while in the program and upon release.

Section 2

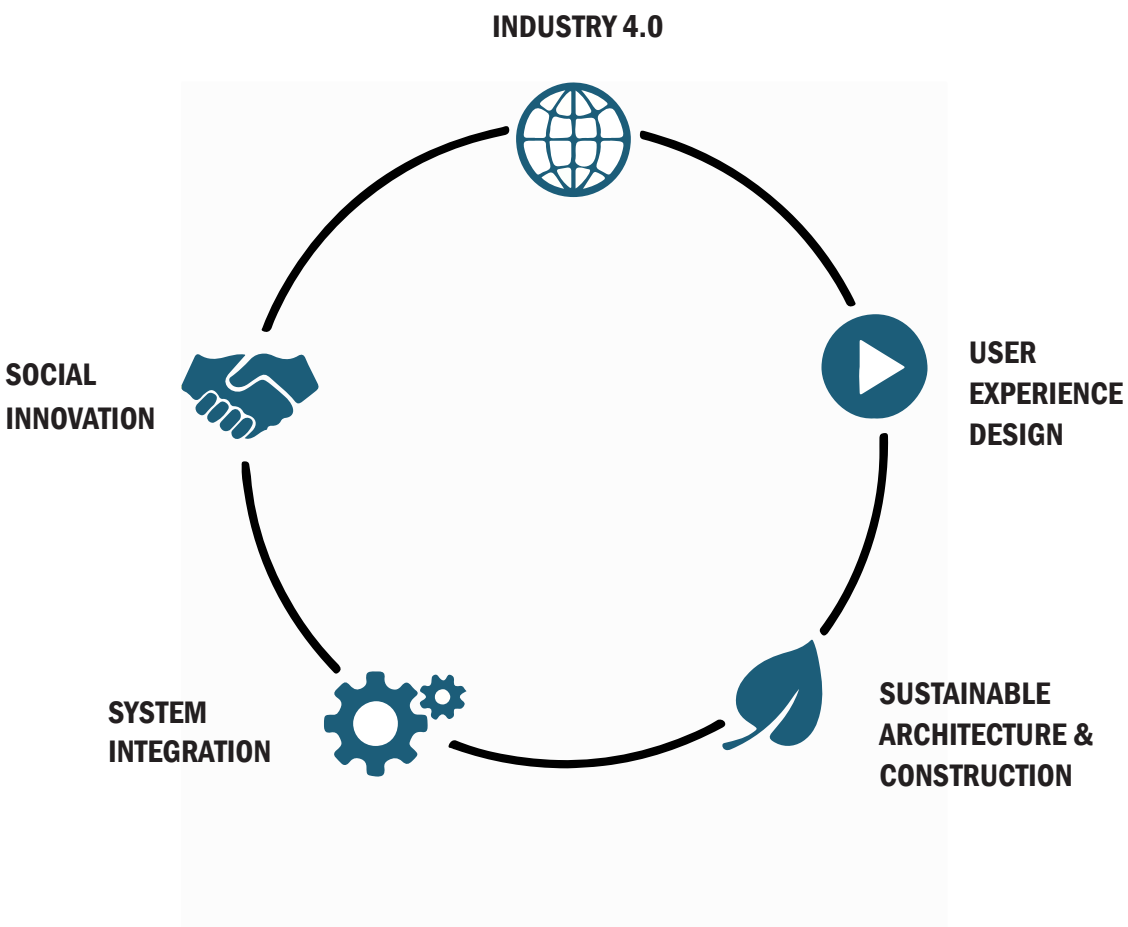
Applied Research Projects

- Introduction
- Industry 4.0
- Social Innovation
- User Experience Design
- Sustainable Architecture & Construction
- System Integration

Introduction

Each year, Applied Research & Innovation endeavours to grow applied research capacity in all schools by developing clusters of knowledge, encouraging and facilitating interdisiplinary applied research via the Centres of Innovation (COI) model, and supporting entrepreneurial activity.

Applied research projects at Humber are key to achieveing these goals. Projects focus around five strategic priority areas: Industry 4.0, Social Innovation, User Experience (UX) Design, Sustainable Architecture & Construction, and System Integration.




AI

Industry 4.0

Industry 4.0 is the rapidly-growing network of autonomous machines, appliances, systems and devices that are fueled by data & machine learning. Industry 4.0 objects are equipped with sensors, controlled remotely, and integrated into computer-based systems that result in improved efficiency, accuracy, and economic benefits.

Humber students from Computer Engineering Technology, Industrial Design, Web Design and Interactive Media, Wireless Telecommunications, and other programs are trained with the skills required to collaborate on Industry 4.0 projects and make these interconnected communications a reality.

2018-19 Industry 4.0 Applied Research Spotlights:

- ViewIT Product Configuration Tool
- A Mobile Solution to Facilitate Meaningful Social Engagement in Aging Adults

"Together we will be addressing the advanced manufacturing skills gap and working to move the economy forward by working with Canadian and global companies on applied research projects that will tackle real business challenges."

— Chris Whitaker, Humber College President and CEO [1]

Drive-based Automation

Project: Hawk AGV

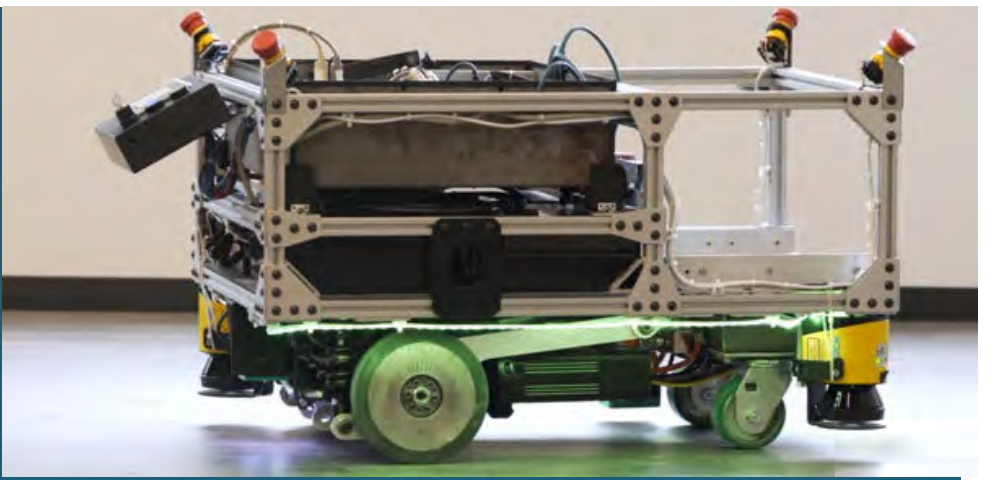
Partner: SEW EURODRIVE

Principal Investigator: Neal Mohammed

Funder: Humber College, SEW Eurodrive, Pepperl+Fuchs, Phoenix Contact and SICK Ltd

Students: Peter Abramowicz, Zachary Goodman and Bogdan Malynovskyy

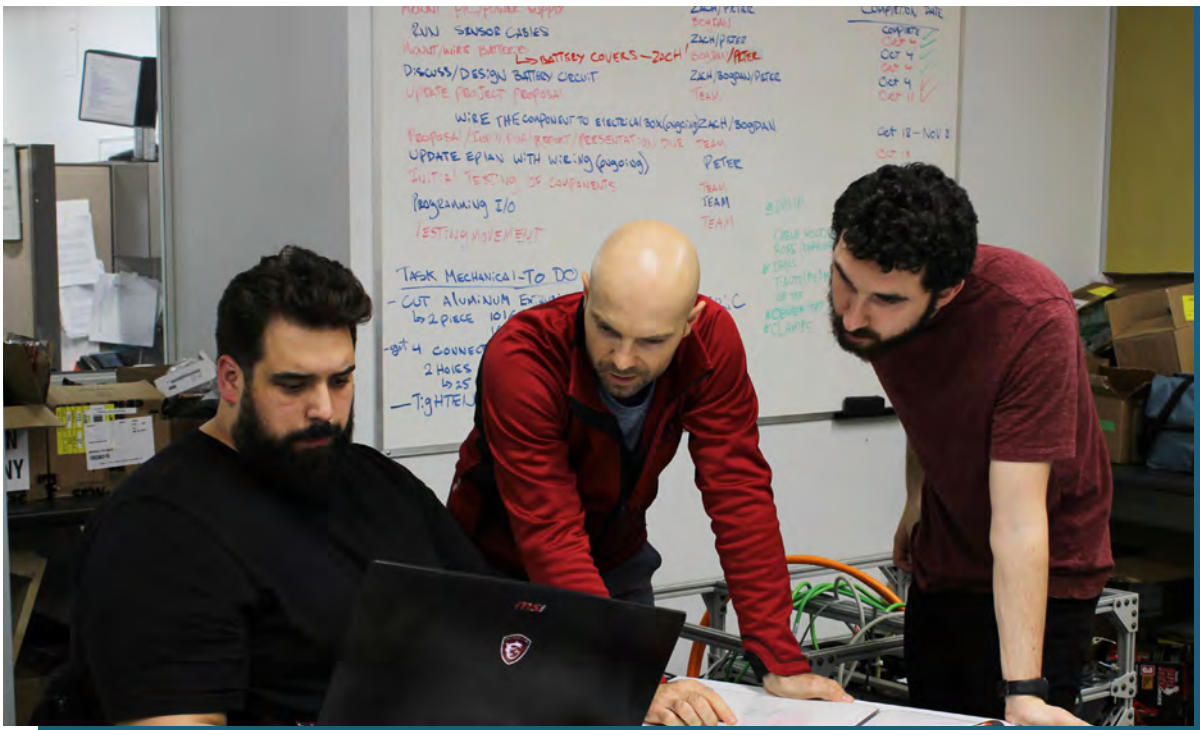
Hawk AGV Test Run



During the Barrett Centre for Technology Innovation (Barrett CTI)'s grand opening, Neal Mohammed, Director of the Centre, and his students unveiled the Hawk AGV. The culmination of years of hard work, the Hawk AGV is the first automated-guided vehicle of its kind built by a Canadian post-secondary institution.

> *"Because we have that hands-on experience, our hiring rate in the [electromechanical engineering technology] program is over 90%"*
>
> *— Bogdan Malynovskyy, Student, Electromechanical Engineering Technology* [2]

Peter Abramowicz (Left), Zachary Goodman (Right) and SEW EURODRIVE's Ogi Ruzic (Centre)



Neal Mohammed initiated the development of the Hawk AGV by recruiting SEW EURODRIVE, a world leader in drive technology and a pioneer in drive-based automation, as its key partner, as well as receiving industry contributions from Pepperl+Fuchs, Phoenix Contact, and SICK Ltd.

For students who participated in the project, learning and working alongside industry experts helped them perfect their programming and problem-solving skills, form vital relationships, and secure full-time employment. For industry partners, this applied research project, and others like it, ensure the continued growth and vitality of the Canadian manufacturing sector. There is currently a shortage of qualified technical personnel, so collaborating with Humber allows industry to help shape the future of Canada's workforce.

The Hawk AGV currently resides at the Barrett CTI where students can use it as a test bed. It marks the start of Humber's journey to becoming an education leader in AGV technology.

Flying High in the Sky

Project: Unmanned Systems for Geomatics Research Applications

Partner: Ryerson University and Sokkia Corporation

Principal Investigator: Akram Afifi

Funder: Cultivate Fund

Students: Baris Cokuysal and Brendan Woo

Drone Flight Test

As remotely piloted aerial systems (RPAS) and autonomous ground vehicles (AGV) enter the mainstream market, Humber is committed to providing opportunities for students and faculty to work hands-on with these technologies. Humber's Office of Applied Research & Innovation (ARI) is supporting this goal by funding Industry 4.0 applied research projects, including the first stage of development of an unmanned systems zone at Humber. Once established, the zone will function as a test area where students, faculty and partners can analyze various RPAS and AGV solutions utilizing high end sensing and navigation sensors such as LiDAR, integrated GNSS/IMU and simultaneous localization and mapping (SLAM).

Led by Principal Investigator Akram Afifi, Ph.D., the first phase of the unmanned zone project focused on the development, programming and testing of RPAS technology, and data collection. With the support of ARI, Afifi secured partnerships with Ryerson University and Sokkia Corporation, a world-leading manufacturer of precision measuring systems. The collaboration allowed for the sharing of Geomatics expertise and resources between the three parties and the prospect of future joint ventures.

Principal Investigator Akram Afifi (Right) and Student Brendan Woo (Left)

In addition to the support of partners, Afifi recruited electromechanical, mechanical and computer programming students to work on the project. As a result, the research team was able to establish an autonomous navigation solution for the AGV using SLAM. SLAM allows the end user to construct a map of an unknown environment (indoor or outdoor) while simultaneously keeping track of its location within it during the vehicle motion. The Ryerson University partnership also enabled Humber's student research assistants to collaborate with, and learn from, Masters and Ph.D. students from the institution.

The goal of the initial phase of the project was to display what Humber can do with drone technology. To disseminate the knowledge externally, Afifi has submitted the applied research findings to three journals. A second project phase is in development. It will focus on smoothing the trajectory tracking of the camera to enable real-time access to 5G. The ultimate vision for Afifi is to spark support and funding for RPAS and AGV projects of a larger scale in the future.

Social Innovation

Humber's strength in social innovation is focused in the area of community development. Projects in this area aim to address community challenges by collaborating with members of the community to take collective action. Social innovation projects create opportunities for students from programs such as Addictions and Mental Health, Criminal Justice, Child and Youth Care, Research Analyst, Food and Nutrition Management, Developmental Services Worker, and many others across all Humber schools.

Examples of previous social innovation projects supported by Humber include a collaboration with the Toronto Police Service where students helped to evaluate the Neighbourhood Policing Program, a project analyzing the effectiveness of a program for incarcerated women, and a project for a pre-college prep program to support marginalized students. Some of Humber's facilities that support this applied research are the Conflict Resolution Simulation Lab, the Crime Lab, and the Forensic Studio.

2018-19 Social Innovation Applied Research Spotlights:

- The Accessibility Toolkit
- Statistical Tool on Deafblindness

"The faculty of Community & Social Services is proud of the leadership we provide in cross-college social innovation activities, in collaboration with partners."

— Derek Stockley, Senior Dean, Faculty of Community & Social Services and Principal, Lakeshore Campus

Improving Arts Accessibility

Project: The Accessibility Toolkit

Partner: Tangled Art + Disability

Principal Investigator: Anne Zbitnew

Co-investigator: Jennie Grimard

Funder: Cultivate Fund

Students: Arts Administration & Cultural Management program

Textiles at Inclusive Art Exhibition

Access Labels

Partnering with Tangled Art + Disability, Humber faculty and students developed the Accessibility Toolkit: A Guide to Making Art Spaces Accessible, a resource to inform and educate students, artists, arts organizations, curators, program directors, volunteers and gallery staff on how to develop and implement inclusive programming and incorporate accessibility features into aspects of exhibition design.

The toolkit features recommendations such as artwork height and exhibition labelling. Humber students gained teamwork skills and engaged in positive debates as they strived to agree on the most inclusive gallery design recommendations for the toolkit.

Depictions of Inclusivity Tools by Jennie Grimard, Project Co-investigator

The final product is fluid in structure. As technology develops and societal views change, the toolkit will adjust to combat potential new physical, societal, and cultural barriers to inclusivity. The toolkit is available for download via the Humber College Applied Research & Innovation and Tangled Art + Disability websites.

> ***"Accessibility is a vital component of media, and our students will have the opportunity to both solve existing inclusivity problems and to include accessibility features from the first moment of creation."***
>
> ***— Guillermo Acosta, Dean, School of Media Studies & Information Technology*** [3]

Key benefits of this project:

- Increased awareness around barriers to accessibility and different accesibility needs.
- A final toolkit that can be added to students' resumes and portfolios.
- A starting place for arts organizations to learn about accessibility.

Closing the Knowledge Gap on Deafblindness

Project: Statistical Tool on Deafblindness

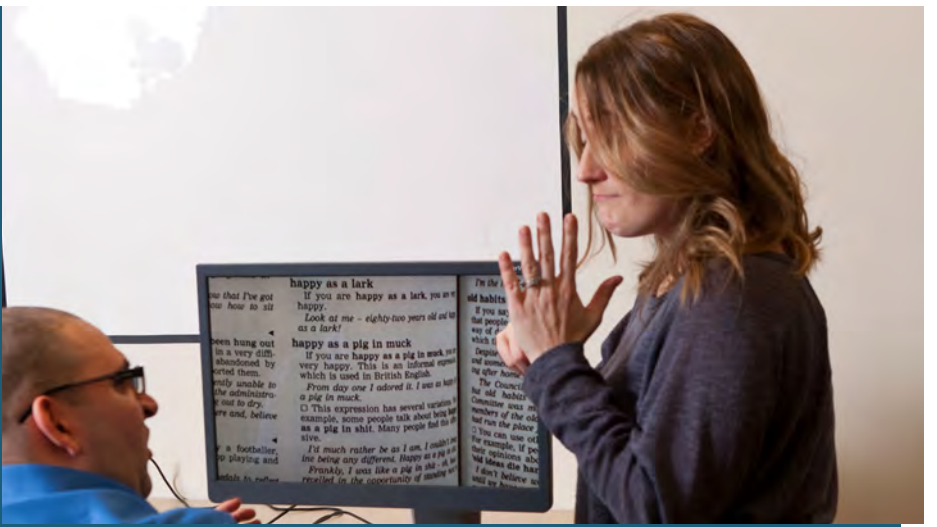
Partner: Deafblind Ontario Services

Principal Investigator: Sheri Adekola

Funder: Cultivate Fund

Students: Cara Harewood and Nicole Monette

Communication Using American Sign Language and Large Font



Deafblindness is a combined loss of hearing and vision to such an extent that neither the hearing nor vision can be used as a means of accessing information to participate and be included in the community. To improve deafblind services, it is vital to first identify the current number of citizens with deafblindness and age-related dual sensory loss (DSL) in Canada.

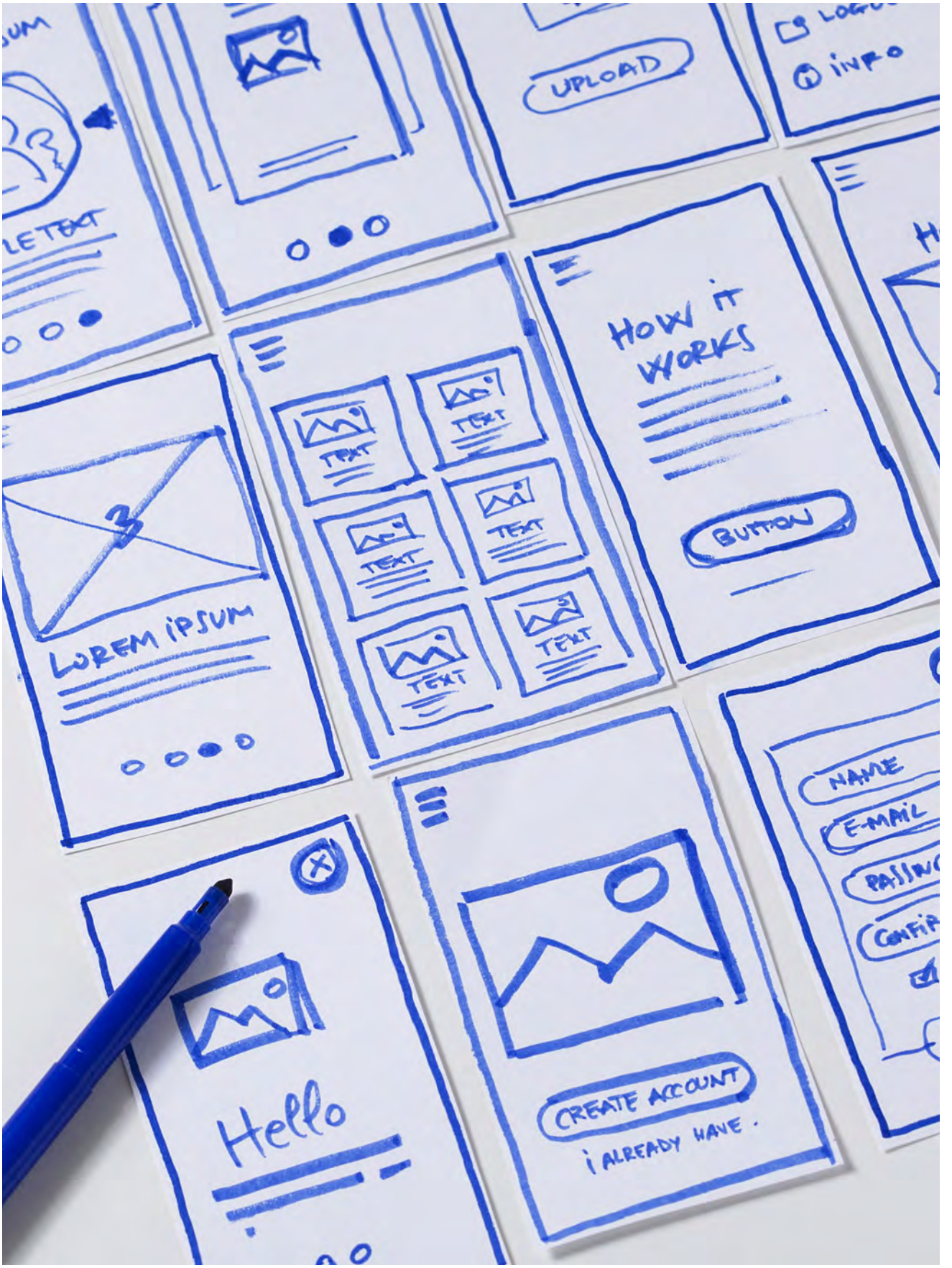
Using publicly available government data such as censuses, the Canadian Survey on Disablity, and other data sources, Humber students, with the support of Professor Sheri Adekola, used Microsoft Excel to create a macro-enabled workbook application as a search tool and prevalence calculation for dual sensory loss. This Excel tool can be used to search and analyze statistics through several levels of government such as city, region, and census metropolitan area. It can also be used provincially to estimate prevalence of deafblindness by age groups and future population censuses.

Principal Investigator Sheri Adekola

> ***"The research experience allowed our students to apply in-class learnings from their research analyst post-graduate certificate to solve a real-world problem."***
>
> ***— Sheri Adekola, Professor, School of Liberal Arts & Sciences***

With the preliminary work done, the tool will allow interested organizations to build awareness and rights-based advocacy campaigns needed to recognize deafblindness as a distinct disability and improve the quality of life of individuals with deafblindness. Using this tool, the project partner, DeafBlind Ontario Services, was able to generate an important resource paper titled, "Open Your Eyes and Ears – To Estimates of Canadian Individuals with Deafblindness and Age-Related Dual Sensory Loss."

Through this applied research project, Humber students were provided the opportunity to further develop both their hard and soft skills. They gained valuable knowledge on deafblindness and have helped improve services for countless individuals.


UPLOAD
INFO
HOW IT WORKS
BUTTON
LOREM IPSUM
TEXT
NAME
E-MAIL
CREATE ACCOUNT
I ALREADY HAVE .
Hello

User Experience Design

Applied research in the area of user experience (UX) design focuses on generating design problem hypotheses, structured design process plans, persuasive arguments for redesign, and compelling UX deliverables.

UX applied research projects draw from expertise in innovative web and mobile design, interactive storytelling, advertising and PR, 3D animation, journalism and more — and in all areas usability is at the forefront. These projects yield benefits for all parties. Partners discover insights about their client base through usability testing and prototyping; students are able to apply classroom learnings to real-world contexts and build design portfolios that will help them launch careers as UX design professionals; and faculty members can expand their research offerings in a quickly evolving field of study.

2018-19 UX Applied Research Spotlights:

- Pick Your Plants
- Grocery Gateway: “My Favourites” Redesign and VUI Development

“Design as a topic isn’t just how well something looks, it’s about how well something works. In User Experience Design, we’re interested in understanding what works, what do people want in a product, and what are their frustrations, goals, priorities... ”

— George Paravantes, Professor, School of Media Studies & Information Technology [4]

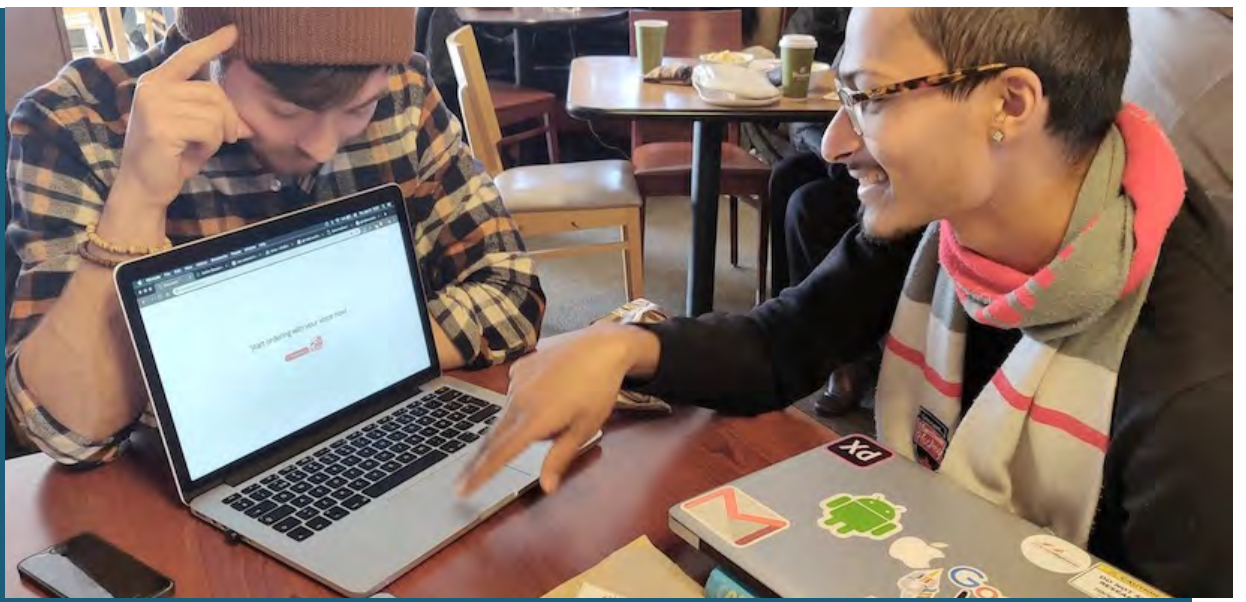
Grocery Shopping Re-invented

Project title: “My Favourites” Redesign and Voice User Interface (VUI) Development

Partner: Grocery Gateway

Principal Investigator: George Paravantes

Students: User Experience Design program



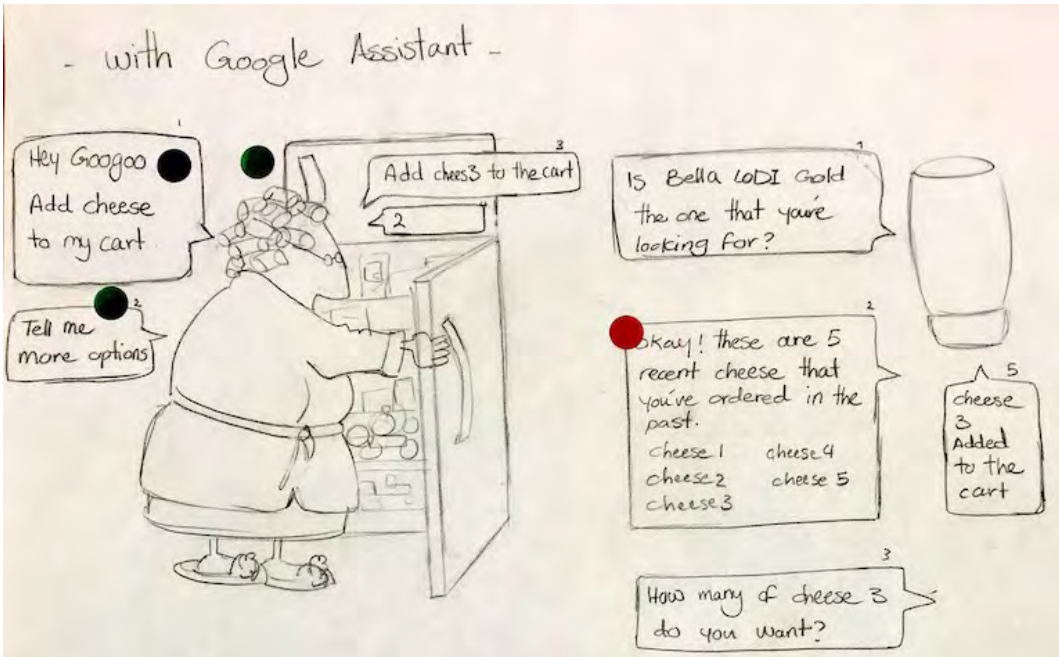
Students Working on Interface Design

Humber College and Grocery Gateway have an on-going partnership to develop and implement methods and tools to improve the user experience for Grocery Gateway’s online presence. During the 2018-2019 fiscal year, Humber embarked on two important phases of the project, re-imagining “My Favourites” and voice user interface (VUI) development.

Students from Humber’s user experience design program were tasked with providing recommendations that would allow digital grocers to shop in an efficient manner. This exposes them to new products and moments of inspiration, leading to increased incremental sales and brand loyalty. For the voice interface development phase, Humber students provided Grocery Gateway with insights into how this new feature impacts their business.

Both steps involved creating research questions, customer journey maps, affinity maps, sketches, storyboards, prototypes, as well as conducting usability testing.

Scenario Mapping



> ***"As a Humber graduate, I am incredibly proud to see the talent being harnessed at the college and to see the tangible solutions that programs like UX can deliver to businesses such as Longo's ."***
>
> ***— Anthony Longo, President and CEO, Longo's*** [5]

These two collaborative phases of the much larger overarching Grocery Gateway project have provided Humber students with the ability to work directly with a company's UX team and make sure client needs are taken into account throughout the duration of research and testing, and dive into mobile app design and voice user interface design, two rapidly-developing areas of focus for companies.

In the next phase of the on-going partnership, students will build upon previous work and develop a voice user interface for Grocery Gateway recommendations.

Gardening in the 21st Century

Project: Pick Your Plants

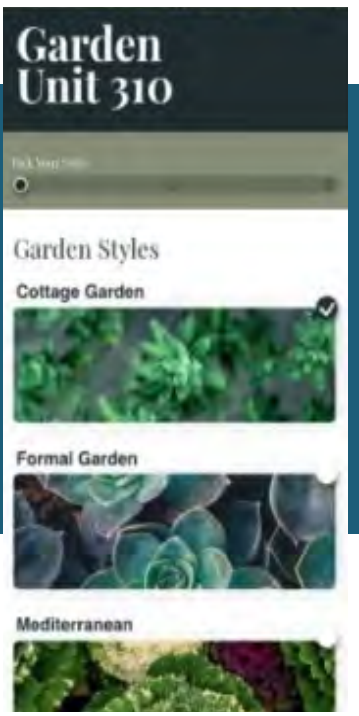
Partner: Rachel Manno Developments

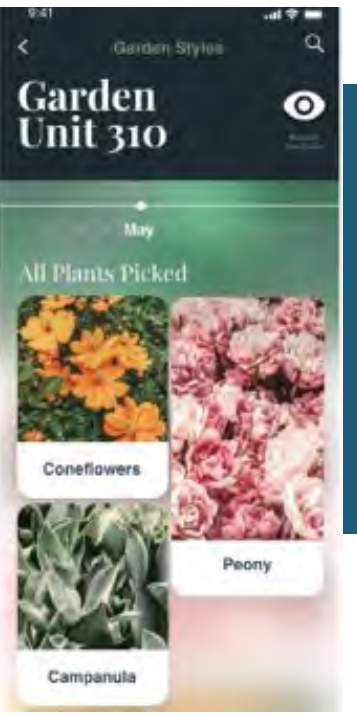
Principal Investigator: George Paravantes

Funder: Ontario Centres of Excellence - College Voucher for Technology Adoption

Students: Nicole Hanjing and Scott Minor

App Screenshots





Gardening is considered to be a relaxing hobby, but can quickly turn stressful when standing in a garden centre faced with the challenge of selecting the perfect plants for one's space.

To de-stress this portion of the gardening process, Humber faculty and students worked with Rachel Manno Developments to develop a mobile app which helps customers of garden centres with the custom selection of plants for their gardens. With its simple and brightly-coloured interface, customers can quickly filter through plant information and buy all the plants they need to successfully create their dream garden. The selection of plants on the app includes annuals, perennials, shrubs, evergreens, among others.

Winter vs Spring Plant

There were multiple phases in the development of the app.The interface design phase explored the colour and layout of touch interface components and took current brand style guidelines into account. The interaction design phase established best practices for the user interface animation and micro interactions. It also explored the goals, frustrations, and priorities users have for the app. Finally, the prototyping and testing phase was used to inform functionality of features along with any human factor evaluation of touch interface design. Eye tracking helped collect and quantify both quantitative and qualitative data.

> ***"It's been a great pleasure to have seen this app idea grow...I think it will positively impact a lot of people. For me, this is a labour of love, a way of accomplishing a task which makes people happy. "***
>
> ***— Rachel Manno, Founder, Pick Your Plants***

Students benefited tremendously from this applied research project by applying in-class learnings to a real-world situation.They considered the required specifications for the smartphone application, created a design for that application and illustrated that design using wireframes and interaction flows, prepared user interface specifications, and revised the design and corresponding work product to incorporate feedback from ongoing user testing.

Sustainable Architecture & Construction

Applied research in the area of sustainable architecture and construction involves projects that seek to minimize the negative environmental impact of buildings by efficiency and moderation in use of materials, energy, and development space, both in construction processes and resulting infrastructure. Partners collaborate with the faculty and students of programs like Architectural Technology, Computer Engineering, Project Management, and Sustainable Energy and Building Technology to work on these projects, creating more sustainable architecture.

Collaborators can work on sustainability projects at Humber in facilities such as the Sustainable Energy Labs, Energy Auditing Lab, Building Automation Systems Lab, and the Renewable Energy Lab.

Applied Research & Innovation has supported sustainable architecture and construction projects in the past, such as designing Passive Houses, energy modeling of building envelopes and insulation with Roxul, and analyzing the common wall air leakage quantification in solid masonry semi-detached homes.

2018-19 Sustainable Architecture & Construction Applied Research Spotlights:

- NX-Building Recladding
- N-Building Redesign

"In academia, you usually don't get the opportunity to communicate across the aisle, but in reality, a construction project is a team effort. I'm very grateful to the faculty at Humber for the extra time and effort that goes into such collaborations."

— Cameron Mitchelmore, Student, Humber College [6]

Saving Energy & Looking Good Doing It

Project: NX-Building Recladding

Partner: B+H Architects, Morrison Hershfield and BIRD Construction

Principal Investigator: Elizabeth Fenuta

Funder: Ignite Fund

Students: Laurianna Chadee, Jeff Church, Hrishikesh Gupte, Larry Hosein, Tiffany Jockheck, Ian Koerssen, Sonia Konarzewska, Osama Bin Liaqat Mir, and Andrew Penseney

Rendering of NX-Building

B+H Architects, Morrison Hershfield and BIRD Construction, along with faculty from various programs in the School of Applied Technology mentored a multi-disciplinary student team comprised of architectural technology, sustainable energy and building technology, project management and supply chain management students as they each worked collaboratively to deliver a design for Humber's NX-Building Recladding Project.

The students analyzed the existing building for user experience, energy efficiency and structural integrity and produced a 3D digital model, a physical model, presentation panels, and working drawings and details. They applied their training from various programs to this intensive and complex project, which is part of phase 2 of Humber College's Integrated Energy Management Plan (IEMP).

Recommended Perforated Mesh for NX-Building

Humber College is planning to undertake a series of deep energy building retrofits and roofing modifications to reduce building heating and cooling loads by improving building envelopes together with mechanical and electrical upgrades. The primary objectives of the IEMP is to maximize energy efficiency and durability, while improving the overall aesthetics of the campus.

> ***"The conceptual phase is always challenging – you have to work to create an image that merges what the client needs with the designer's vision for the space."***
>
> ***— Elizabeth Fenuta, Professor, School of Applied Technology*** [7]

Key benefits of this project for students:

- Being part of a multidisciplinary team to experience real-world team dynamics on projects.
- Opportunities to receive valuable feedback from industry experts to improve their skills and understanding of their particular discipline.
- Enhancing creativity skills by utilizing the knowledge received at Humber College.

Modernizing Humber's North Campus

Project: N-Building Redesign

Partner: B+H Architects and Morrison Hershfield

Principal Investigator: Elizabeth Fenuta

Funder: Ignite Fund

Students: Stefan Bedard, Curtis Deenah, Tanya Lupo, Aaron MacRitchie, Cameron Mitchelmore, Gayatri Mohapatra, Seyed Amirmehdi Pooladgar, Pradip Sharma, Mohammed Siddiqui, and Jeffrey Taylor

Screen Design Derived from Humber's Existing Branding

Partnering with B+H Architects and Morrison Hershfield, Humber College faculty and staff constructed a new design for the N-Building at North Campus to upgrade the existing building to current standards. This new building design demonstrates and recognizes aesthetics, greater energy efficiency, water efficiency, waste reduction, carbon reduction, the use of new material, building designs, and technologies that have emerged since the building was originally constructed in the 1980s.

This project was used as a learning integration tool for a selected group of final semester students who were required to complete a capstone. The students applied their knowledge and skills acquired throughout their various programs to effectively fulfill the deliverables of the project.

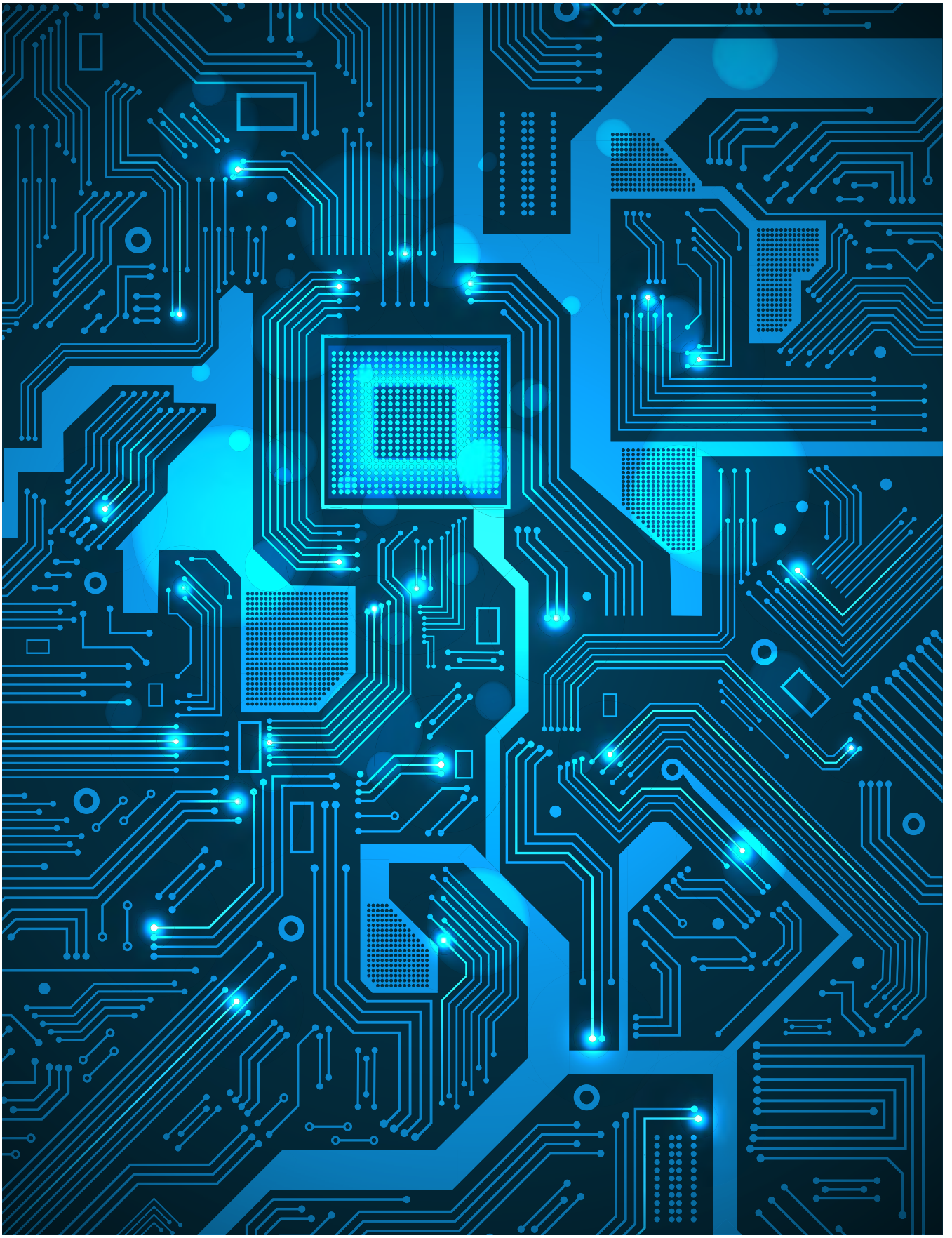
Northwest Screen and Wall Looking North

Guided by faculty representatives, a multidisciplinary team of students from the project management, architectural, sustainable development, structural and supply chain departments were involved in the successful completion of this applied research project.

> ***"As professionals, we are accustomed to working with very defined parameters. Students often don't have those restrictions and bring a fresh perspective..."***
>
> ***— Kevin Stelzer, Principal, B+H Architects*** [8]

Key benefits of this project:

- Humber fulfilling its goal of providing students with the highest level of polytechnic education through the support provided from industry to students.
- Humber acquiring additional information which can be used to increase its sustainability.
- The final design of the N-Building will facilitate an expansion of classroom space.



System Integration

System integration is the process of joining various subsystems used in a variety of industrial processes into a larger, more efficient and cohesive system. Students working on applied research projects in this area combine existing components into an integrated system and ensure that each subsystem functions in sync, supporting innovation. Considerable work has been directed towards supporting Ontario's manufacturing sector. These system integration projects often feature the skills demonstrated by students from Humber programs such as electromechanical engineering, mechanical engineering, computer engineering, electronics, and industrial design.

Humber Applied Research & Innovation has supported successful collaborations on system integration projects like automated car seat testing, combining engineered components to redesign, create new pieces for complex fountain installations, and having Humber alumni compete in World Skills competitions for Mechatronics.

2018-19 System Integration Applied Research Spotlights:

- MICROSA Water Purification Device
- Biofiltration versus Conventional Filtration in Drinking Water

"Fostering strong partnerships between Canada's colleges and industry partners leads to new, innovative ideas and transforms the results of R&D into new products that will benefit all Canadians."

— Kirsty Duncan, Minister of Science and Sport [9]

A Refreshing Glass of Humber River

Project: MICROSA Water Purification Device

Partner: Mikroen Solutions

Principal Investigator: Dhimitri Gusho

Co-investigator: Hassan Hassan

Funder: Cultivate Fund

Students: Michael Curi, Zizheng Gao, Jonathan MacAulay and Anxhelo Mecollari

Water Comparison Before and After Treatment

Often taken for granted, access to safe drinking water is a worldwide problem, particularly in less-developed countries. The World Health Organization estimates that waterborne diseases are directly responsible for over two million human deaths annually.[10] Residents of developed countries can usually count on safe and reliable water supplies when they're at home, but this isn't always the case when travelling abroad.

A result of a one-year partnership between Humber College and Mikroen Solutions, MICROSA Water Purification Device can deliver a steady supply of pure, distilled water of up to ten litres per day. The distillation process employed by MICROSA reliably delivers pure water by removing dangerous pathogens, toxins and salts from even the most polluted of water sources, including saline waters. The new device operates on solar power, a feature made possible by the fact that its power consumption is only a small fraction of the energy normally needed for similar conventional devices.

Faculty Member Dhimitri Gusho and Students

“This applied research project gave me a great hands-on experience and helped me to learn more about the importance of developing tools like this water purification device. I’d be happy to take part in other projects in the future. ”

— Anxhelo Mecollari, Student, Mechanical Engineering Technology

Humber students assisted with developing the mechanics behind the system and learned about the impact that this product can make around the world, especially in remote areas where access to fresh drinking water is scarce.

The team’s next goal is to further develop the device to increase its output of distilled water from one to four litres per hour. This next step in the development process will assist with bringing the product to market and ensuring that even more people benefit from its capabilities.

Optimizing Water Filtration

Project title: Biofiltration versus Conventional Filtration in Drinking Water

Partners: City of Ottawa

University Collaborator: Carleton University

Principal Investigator: Shawn Cleary

Co-investigator: Onita Basu, Carleton University

Funder: Natural Sciences and Engineering Research Council (NSERC) College-University Idea to Innovation

Students: Cezzanata Andrade, Ashley Piche, and Karly Treleaven

Research Team

This drinking water treatment project involved a pilot scale comparison between conventional and biological filtration to assess each processes' performance in removing organic matter, the pre-cursor to disinfection byproducts. The filters operated under a range of temperature and backwashing conditions to assess the effect of these factors on performance.

It was a joint research project between Humber College, Carleton University, and the City of Ottawa (Brittania Water Treatment Plant), which involved students from both academic institutions collecting data and drawing conclusions from the findings that are relevant to the operation of municipal water treatment plants.

"It has been an incredible experience to work with Carleton University and the City of Ottawa on this applied research project. Dynamic partnerships provide educational institutions with the capacity to do the research we are passionate about. I look forward to continuing to grow these existing partnerships and have a positive impact on drinking water safety and environmental sustainability in Canada."

— Shawn Cleary, Professor, School of Applied Technology

Thus far, the biofilters have performed significantly better ($p<0.05$) in terms of disinfection by-product reduction, where TTHM and HAA9 concentrations were lower than the conventional filters by 40% and 46%, respectively. Also, the biological filters have proved to be less vulnerable to turbidity spikes following backwashing. However, the biofilters have exhibited greater headloss development, as expected, which was mitigated when applying air scour and ETSW techniques during backwashing.

These findings are valuable to the water industry. Continued research in this area will help municipalities optimize their water filtration processes to ensure maximum treatment efficiency with minimal disinfection by-products.

Section 3

Innovation Ecosystem

- Centres of Innovation
- Overview of Centres
- Spotlight on the Barrett CTI
- Spotlight on Centre for Entrepreneurship
- Research Ethics Board
- Applied Research Ambassadors

Centres of Innovation

Humber's interdisciplinary Centres of Innovation (COIs) leverage resources, students, faculty, and staff to help businesses and communities succeed and grow.

Our COIs are innovation catalysts, solving real-world problems, accelerating new concepts, developing new applications, and preparing our graduates to drive progress and performance in an era of unprecedented change. Humber's COI network brings together talented people with the insight, imagination, and skills to put ideas into action.

We are collaborating in exciting new ways, bringing unique perspectives to challenges and opportunities. Our COI teams examine problems from many different angles, leveraging their diverse backgrounds and industry expertise to disrupt traditional thinking and design creative, user-centred solutions.

Overview of Centres

Humber's COI network focuses on five areas of proven strength and industry sector growth: technology, creative business, health and wellness, entrepreneurship and social innovation.

Barrett Centre for Technology Innovation:

The Barrett Centre for Technology Innovation (Barrett CTI) opened in April 2019 and has already demonstrated the power of the COI model. The facility includes flexible and collaborative space, as well as unique mixed reality, advanced manufacturing and digital media equipment which creates opportunities for interdisciplinary projects and enhanced creativity.

The Barrett CTI is home to Humber's Advanced Manufacturing Skills Consortium; a set of partnerships with industry leaders focusing on applied research projects, collaboration between partners, and training and development solutions for students and workers.

The heart of Humber's thriving skills varsity program is located within the Barrett CTI. Humber students have competed and medaled in baking, digital game art, photography and mechatronics at Skills Canada. Humber's mechatronics competitors have placed in the top five during the last two consecutive WorldSkills competitions.

Barrett CTI (April 2019)

Centre for Entrepreneurship:

The Centre for Entrepreneurship (CfE) is a student-focused, on-campus destination which promotes entrepreneurial and interdisciplinary thinking. The CfE recognizes that ideas can come from within and provides opportunities and space to collaborate and create.

> ***"The [COI network] will provide graduates with the knowledge and training that are in high demand by employers. We need a labour force of this caliber to stay competitive in our global economy."***
>
> ***— Iris Tupholme, HarperCollins Publishers Ltd., Humber College Partner[11]***

Centre of Innovation in Health and Wellness: The Centre of Innovation in Health and Wellness will address prevailing community health issues by supporting the design, implementation and evaluation of new models of teaching and health services delivery to benefit students and the broader community.

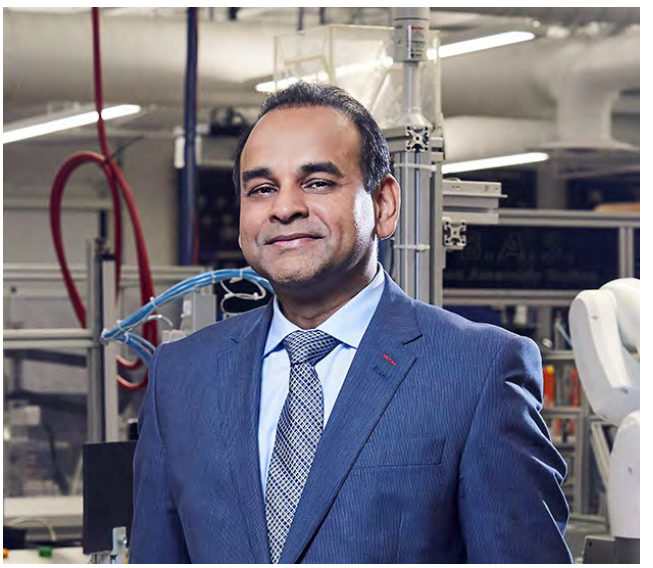
Centre for Creative Business Innovation: The Centre for Creative Business Innovation will enable businesses and communities to reap the benefits of creativity-driven innovation. It will serve as a valuable resource for local partners to develop new revenue streams and test cutting-edge technology within creative industries.

Centre for Social Innovation : Humber's strength in social innovation focuses on community development and addressing community issues at the local, national and global level. The Centre for Social Innovation will provide leadership in cross-college social innovation activities in collaboration with partners.

Humber's COI network is preparing graduates to be the innovation leaders of the future and is helping partners bridge the gap between ideas and results.

Spotlight on the Barrett CTI

Meet Neal Mohammed, the Director of Barrett CTI



A champion of applied research, Neal Mohammed is dedicated to ensuring Humber students receive an immersive hands-on education that will ensure success in their respective careers.

Since joining Humber in 1993, Mohammed has been responsible for the design, development, and delivery of over twenty courses for customized training, certification, and diploma programs. He's held the roles of both Program Coordinator and a full-time faculty member in the Electromechanical Engineering Technology program. Along with his in-class leadership, Mohammed's had a tremendous impact outside of the classrom. He has mentored dynamic mechatronics teams and helped them clinch the podium at Skills Ontario, Skills Canada National, and WorldSkills.

In May 2017, Mohammed stepped into the role of Barrett Centre for Technology Innovation (CTI) Director. He has worked with a dynamic team comprised of architecture firm Perkins & Will, contractor BIRD, Barrett CTI founding partners, and Humber faculty, staff and administration, to bring the Barrett CTI vision to life.

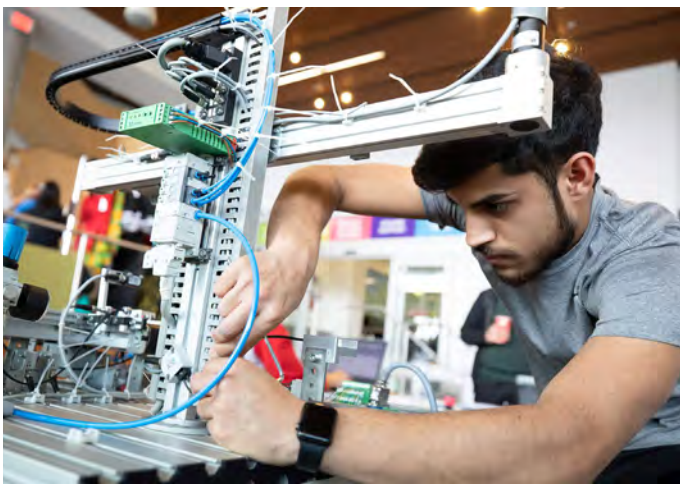
"We make [skills qualifying] a fun environment. We engage the students and it complements their class work throughout their terms, leading to excelled final capstone outcomes."

— Neal Mohammed, Director, Barrett CTI [12]

Neal Mohammed (Second from Left) Receiving the 2018 Robert A. Gordon Leadership Award

As a Humber leader, Mohammed is a true inspiration. Due to his many contributions to Humber faculty, staff, and industry/community partners, Mohammed was awarded the Robert A. Gordon Leadership Award at the President's Breakfast in August 2018. This award is designed to recognize a Humber full time employee who has demonstrated high levels of leadership which enhance the reputation of Humber, both internally and externally, in accordance with its mission, values and goals.

Neal Mohammed (Right) with WorldSkills Abu Dhabi Winner Theo Willert (Left)



Humber Student Suhail Mohammed at 2019 Qualifying Competition

Advanced Manufacturing Skills Consortium: Inaugural Meeting

Humber's Advanced Manufacturing Skills Consortium is comprised of industry partners working with the college to train students and employees of Canadian companies within the Barrett CTI. The consortium will integrate new learning pathways and opportunities for students, faculty, and industry experts to work together on the latest technology.

On October 25, 2018, as a lead-up to the Barrett CTI grand opening, Humber gathered more than 100 stakeholders, including industry partners and educators, for its first consortium event to discuss the future of Industry 4.0 for students, technology and industry leaders.

Partners including Cimetrix, Cisco, DMG MORI Canada Inc., Festo Didactic, KUKA Canada Inc., Rockwell Automation, SEW-EURODRIVE, and SICK Sensor Intelligence joined Humber to discuss their partnership role and work towards addressing the skills gap by bringing industry and education together.

Humber Administration with Barrett CTI Founding Partners

Through these partnerships, Humber is developing education towards employment pathways and recruitment opportunities for students and graduates. These initiatives include STEAM outreach activities, robotic equipment, audio-visual systems and more to support the vision of the Barrett CTI.

Chris Whitaker, Humber College president and CEO, says the leadership and investment from the Barrett CTI partners helps to create a technology hub that positions students far ahead of the curve. The partnerships support students through awards, scholarships, and experiential opportunities.

Guest speaker Paul Preston*, and Jayson Myers, CEO of Next Generation Manufacturing Canada led a discussion on the Advanced Manufacturing Supercluster, which was followed by a global cafe where Humber faculty, and industry and government partners brainstormed solutions to issues facing an Industry 4.0 business.

Global Cafe Discussions

Paul Preston discusses the Advanced Manufactoring Supercluster.

* On October 25, 2018, Paul Preston was Director of Science, Technology and Innovation Policy for The Conference Board of Canada. Since then he has assumed a new role as the CEO of the Newfoundland and Labrador Association of Technology Industries (NATI).

Consortium Members

Humber and Cimetrix Solutions, a division of Javelin Technologies, have entered into a five-year partnership agreement designed to give students a strong understanding of the latest applications of additive manufacturing (advanced industrial 3D printing). Cimetrix will make a significant contribution towards student preparedness with a donation of $50,000 - $10,000 to be awarded each year for five years to a student demonstrating a proven understanding of advanced manufacturing and automation applications related to Industry 4.0 practices.

Cisco Canada has partnered with Humber to launch an initiative to engage students, faculty and companies in maximizing the opportunities presented by cyber, network communication, and collaborative digital technologies. Cisco will provide more than $4-million of equipment and infrastructure to help build and support Humber's applied research network and activities. Collaborative audio-visual systems using Cisco Webex Teams technology will be installed throughout the Barrett CTI.

Humber and DMG MORI Canada Inc. have partnered to address skills needs for advanced manufacturing tooling processes and engage in applied research.The collaboration will focus initially on Industry 4.0 enabled 5 axis CNC technology (vital to automotive and aerospace manufacturing), and broaden to support outreach initiatives related to education in science, technology, engineering, and mathematics (STEM) over the course of the agreement.

In January 2018, Humber and Festo Didactic, Inc. entered a partnership designed to address the skills gap between industry needs and educational programming.The partnership includes the installation of the first Cyber Physical Factory in English Canada. The factory, to be housed in the Barrett CTI, is a comprehensive and expandable model enabling companies to research and engage in industrial simulations using cutting-edge technology to support production, logistics and quality assurance.

Humber and KUKA Canada Inc. have formed a partnership focused on bringing the latest robotics technology to Humber and working together on robotics systems integration applications. KUKA Canada Inc. will make significant investments in robotic equipment, advanced software, and contribute to curriculum development for Humber, with financial contributions each year for five years.

Rockwell Automation has partnered twice with Humber to address the skills gaps in the advanced manufacturing sector and equip students for the science, technology, engineering, and mathematics (STEM) careers of the future. The partnership will expand applied research in advanced manufacturing related to power line communication (PLC) technology and connectivity in the digital factory environment. Rockwell Automation and Humber will assist applied research partners in better integrating control systems into advanced manufacturing processes.

In July 2018, Humber and SEW Eurodrive entered into a five-year agreement designed to narrow the skills gap between industry and education. Ontario students and employees will benefit from this partnership by receiving hands-on training on autonomous guided vehicles (AGVs). As part of the agreement, SEW will showcase their Industry 4.0 living laboratory for the first time in North America in the Barrett CTI at Humber.

Humber College and SICK, a leading sensor manufacturer, have partnered to build awareness of new industry automation sensor solutions and Industry 4.0 ready sensor technologies. SICK will provide sensor technologies and services worth $765,000, training opportunities for Humber students and scholarships called the SICK Canada Leadership & Vision Awards.

Spotlight on the Centre for Entrepreneurship

The Centre for Entrepreneurship (CfE)'s reach goes beyond the G-Building at Lakeshore Campus; it extends across all Humber's campuses and faculties. The CfE is an on-campus destination for everyone who wants to explore the world of entrepreneurship and intrapreneurship. The CfE provides a space for like-minded individuals to meet, collaborate, and create.

CfE Insights

Emergence Symposium

Event Spotlights

Global Forum on Entrepreneurship and Innovation: This two-day forum brought together Humber's global partners with the aim of showcasing approaches to entrepreneurship education and innovation. Institutions from Denmark, Austria, New Zealand, The Netherlands, Indonesia, and Finland participated as workshop/panel presenters. The CfE manager led a panel on women in entrepreneurship.

Emergence Symposium: Over 150 community-engaged arts practitioners, policymakers and community leaders met for reciprocal knowledge exchange, leadership development, creative self-reflection, mentorship and cross-sectoral collaborations and critical discussions surrounding the theme of arts and equity. This large-scale symposium builds on the equity dialogue which Neighbourhood Arts Network has explored since its foundation in 2010.

LinkedIn Locals: A collaborative effort with Ignite, LinkedInLocal is a worldwide LinkedIn community-driven phenomenon organized by everyday regular people, interested in connecting with fellow humans behind their LinkedIn profiles, titles, business cards, and company names. The first LinkedIn Local was titled "Digitalizing Entrepreneurship" and was held at the Centre for Entrepreneurship. The second LinkedIn Local was titled "The Future of Leadership: Diversity & Authenticity" and was held at North Campus.

DoughTO at CfE Launch Party

Entrepreneurship Spotlight

In the 2018-2019 fisal year, there were twenty-one Launch Me applicants of which six were selected as finalists, with two picked to win $10,000 in prizes, to launch their business venture.

The six finalists had a chance to pitch their business idea in front of the CfE internal review panel and an external review panel, comprised of four experts from the CfE partnership network (Ontario Centres of Excellence, Futurpreneur, Entrepreneurship Point and Regional Innovation Centre).

Winners:

Hunter Gears ($6000) – Devon Hunter owns Hunter Gears. He developed a travel case that can be adapted to function also as a stroller·

Makeup Mate ($4000) - Makeup Mate is a digital beauty subscription service for women of colour owned by Roxanne Miller and Casey Hannivan.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Research Ethics Board

Mandate

The Humber Research Ethics Board (REB) exists for one reason: to ensure all research carried out by Humber faculty, staff and/or students involving human participants, no matter where the research takes place, is conducted ethically – adhering to the standards set by the federally mandated Tri-Council Policy Statement (TCPS 2): Ethical Conduct for Research Involving Humans.

Assessing Applications

When assessing applications for ethical considerations, the REB focuses on the following:

- benefits of the research relative to risks;
- types of risks (such as psychological, financial, reputational);
- methodology (e.g. are there deceptive practices or incentives);
- the language used to communicate the study purpose and parameters;
- fairness and equity in participant selection and treatment;
- privacy and confidentiality;
- conflicts of interest between the researcher(s) and study sponsors [or between the researcher(s) and participants];
- power relations between the researcher(s) and participants;
- data handling and disposal; and
- dissemination of results

"Having served the REB for four years prior to my appointment as Chair in September 2018, I understand the importance of a strong REB working cohesively with a view of the Humber community as a partner in the research process, to ensure research is conducted ethically without undue deterrents, in a collaborative college-wide environment."

— Dr. Lydia Boyko, Chair, REB

Review Process

Comprised of 10 Humber faculty and external community members and the REB coordinator, the REB meets monthly to review applications for research deemed to have higher-than-minimal risk (research with vulnerable populations and/or on sensitive subjects such as sexual orientation, illegal behaviour, and religious/cultural beliefs/practices). Delegated reviews for research deemed to have minimal risk are conducted by two REB members individually with a 10-day turnaround to the applicant from the day a submission is received.

2018/2019 Statistics

90+	61	24
Applications Processed	Active Applications	Active Course Designations

Additional Roles

We also provide guidance to researchers within and outside Humber on questions about the REB process and ethical aspects of their projects, aiming to move their work forward expeditiously.

The Humber REB is a member of the Canadian Association of Research Ethics Boards (CAREB) and the Heads of Applied Research (HAR) in Ontario, and communicates regularly with the Secretariat on Responsible Conduct of Research in Ottawa for clarification of specific provisions and for TCPS materials.

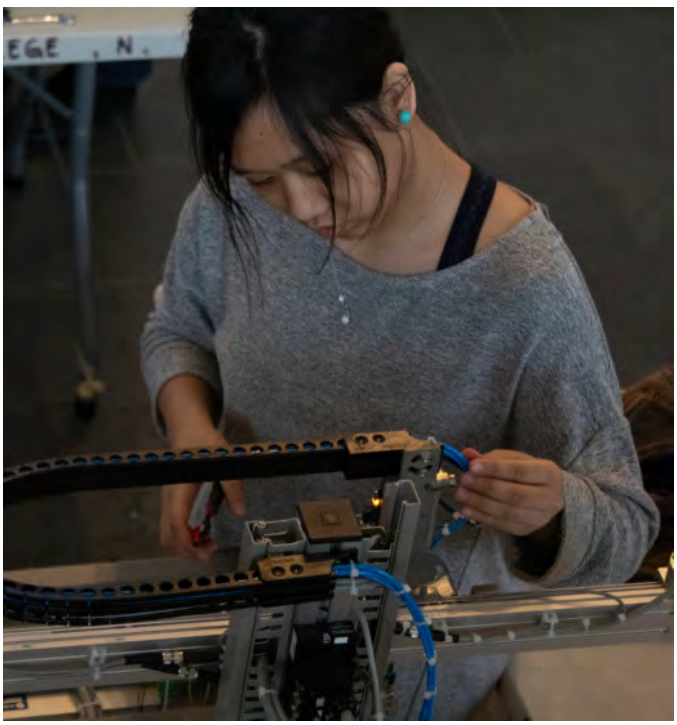
Future Goals

Looking ahead, the REB is gearing up for substantive revisions to the TCPS (3) expected mid-2019, which will require all researchers and course professors to complete the new certificate. We are also planning a wide-ranging series of “awareness-building” initiatives for 2019-2021, including regular tips in communique.

Applied Research Ambassadors

Applied Research & Innovation is dedicated to increasing awareness to the broader community about Humber and its programs and intiatives. These activities support Humber's strategy to lead, transform, and differentiate the educational experience. The students, faculty, staff, and volunteers who take part in these activities are ambassadors for applied research and innovation at Humber.

Brampton Tech Fair 2018



Skills Qualifying 2019

College Day at Queen's Park 2018

CICan Symposium 2018

Funders & Partners

Ontario

Ontario Centres of Excellence

NSERC CRSNG

SSHRC CRSH

Toronto Arts Foundation

Neighbourhood Arts Network

"Ministry of Advanced Education and Skills Development"

A Balanced Life

Access Employment

Achieve

Among Friends

ArtsPond

B+H Architects

Bishop's University

Black Owned Unity

Brampton Entrepreneur Centre

Brock University

Caledon Business Innovation Zone

Canadian Students for Sensible Drug Policy

Carleton University

CCARI (BLINQ Networks) CCR Certified

Centennial College

Centre of Excellence for Youth Engagement

Child and Youth Care Alliance for Racial Equity Cimetrix Solutions

Cisco

Chumbuggy Inc.

Clean Oil International Inc

College of Massage Therpist of Ontario

Crosslinks Health Consulting Inc

Crystal Fountains

Dilon Consulting

Dough T.O

DMG Mori

Dufferin Board of Trade

Enactus

Etobicoke Philharmonic Orchestra

Festo

Gap Wireless Inc

Heart to Mind Leadership

Holland Bloorview Kids Rehabilitation Hospital

Hunter Gears

iApotheca

ICUBE UTM

Kuka

Legalswipe Inc.

Makeup Mate

Masterplan Magnetics Inc

My Dreams Work Inc.

Nulink Media

Peter and Paul's

Prairie Merchant

Purple Stage Door Productions

Rachel Manno Developments

Regeneration Community Services

Regenesis Personalized Fitness

Rexdale Community

Rockwell Automation

Ryerson University

Serverus Management Consulting

SEW-Eurodrive

Shepherd Thermoforming & Packaging Inc.

Sheridan EDGE

Sick Sensor Intelligence

Sokkia Corporation

Songbird Marketing Communications

Speakers University

SWISSCAN

The City of Brampton

The City of Mississauga

The Hospice of Windsor Essex County Inc

The Story Architect

Toastmasters International

Toronto and Region Conservation Authority

Toronto Dominion (TD)

Toronto Police Service

Toronto Region and Conservation Authority

Unique Sand Castings Ltd.

Universitas De La Salle

Universitas Hasanuddin

Universitas Klabat

Universitas Muhammadiyah

Universitas Negeri Manado

Universitas Sam Ratulangi

University of Windsor

Work in Culture

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Notes

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