



ENGINEERING

MacChangers:  
A proposal to establish a  
Grand Challenges Scholars Program  
at  
McMaster University

Submitted on behalf of

[Faculty of Engineering, McMaster University](#)

By

Ishwar K. Puri, Dean

Arlene Dosen, Director of Outreach and Student Engagement & GCSP Director

with

Kenneth Coley, Associate Dean (Academic)

John S. Preston, Associate Dean (Research & External Relations)

Maria White, Assistant Dean (Academic)

&

Beth Levinson, Community Programs Developer, [Paul R. MacPherson Institute](#)

[deaneng@mcmaster.ca](mailto:deaneng@mcmaster.ca)

[www.eng.mcmaster.ca](http://www.eng.mcmaster.ca)

[www.eng.mcmaster.ca/co-op-career/macchangers](http://www.eng.mcmaster.ca/co-op-career/macchangers)

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## Preamble: About McMaster Engineering

McMaster Engineering has a long history of excellence in industry-driven research and student-focused education. The Faculty of Engineering at McMaster University endeavours to be known internationally as a leader in research and education supporting the development of engineering practices for a sustainable world.

In 1956, McMaster named its first Director of Engineering Studies – Dr. John W. Hodgins, a Chemical Engineering professor from the Royal Military College – to develop a full engineering program for the university. The program was approved by the McMaster University Senate in February, 1958. The engineering building, now (John Hodgins Engineering Building) officially opened a few months later. The first class of 25 students graduated in 1961.

Five departments were established in the first two years – Chemical, Civil, Electrical, Mechanical and Metallurgical Engineering—and, later, Engineering Physics joined them. The first engineering degrees from McMaster were Master of Engineering (M.Eng.) degrees, with the first ones awarded in 1959. The first doctoral degrees (Ph.D.) were awarded in 1965.

The undergraduate programs grew in step, and by 1972, over 100 engineers received their (Bachelor of Engineering) B.Eng. degrees, with the annual total passing 200 by 1980, and in 2014 this number equalled 588. The year 1971 marked the start of the Engineering and Management program and later that decade, the Engineering and Society program began. In the early 1980s, the Electrical Engineering started its unique Computer Engineering program, and Mechanical Engineering began its program in Manufacturing Engineering.

The Faculty of Engineering began joint faculty appointments, research associates and collaborative research activities with McMaster's Faculty of Health Sciences. Courses in Biomedical-Engineering were offered as electives in all engineering programs.

Our various engineering programs now enrol 3800 undergraduate students and 1,000 graduate students, of whom 400 are doctoral students.

In 2018, ShanghaiRanking rated 16 McMaster Engineering academic disciplines among the best in the world. The Faculty climbed in global rankings with the civil engineering program securing the 30th spot, metallurgical jumping to 45th, and transportation science and technology landing 49th. Computer science & engineering was rated within the top 51-75 and water resources, telecommunications and electrical & electronic engineering made the top 101-150. Also, a

number of McMaster Engineering programs appeared on the list for the first time that year including biomedical engineering, which was among the top 201-300. The ranking is a reflection of the creativity of McMaster Engineering faculty members and the impact of their research, the support provided by our staff, and our thriving culture of engaged students who translate ideas into innovations. We make this possible through robust partnerships with industry and startups. Consequently, the research intensity of the Faculty is among the highest in Canada.

## Introduction

The [Faculty of Engineering](#) at [McMaster University](#) shares the same objective with the NAE Grand Challenges Scholars Program (GCSP), i.e., to educate future leaders who will address grand challenges that can be solved by engineers in collaboration with graduates of other disciplines. McMaster Engineering has a proven history of educating students through experiential learning. Here, we explain how we have created an integrated curricular, co-curricular, and extra-curricular program for students to develop the attributes and competencies that are also required by the GCSP, namely,

1. Research/creative: Mentored research or project experience related to a Grand Challenge to enhance technical competence and creativity.
2. Multidisciplinary: Understanding gained through experience of the multidisciplinary character of implementable and viable grand challenge solutions.
3. Business/entrepreneurship: Understanding gained through experience that viable business models are necessary for the successful implementation of grand challenge solutions
4. Multi-cultural: Understanding gained through experience that serious consideration of cultural issues is mandatory for successful implementation of grand challenge solutions
5. Social consciousness: Deepen social consciousness and motivation to address societal problems, often gained through service learning, because serving people is the vision served by the grand challenges

McMaster Engineering already offers extensive opportunities for students to pursue each of the required GCSP elements. This proposal describes how we will integrate those opportunities. A formalized and integrated McMaster GCSP will provide our students with an even broader education, reinforcing the global perspectives that students require to address grand challenges.

## Background

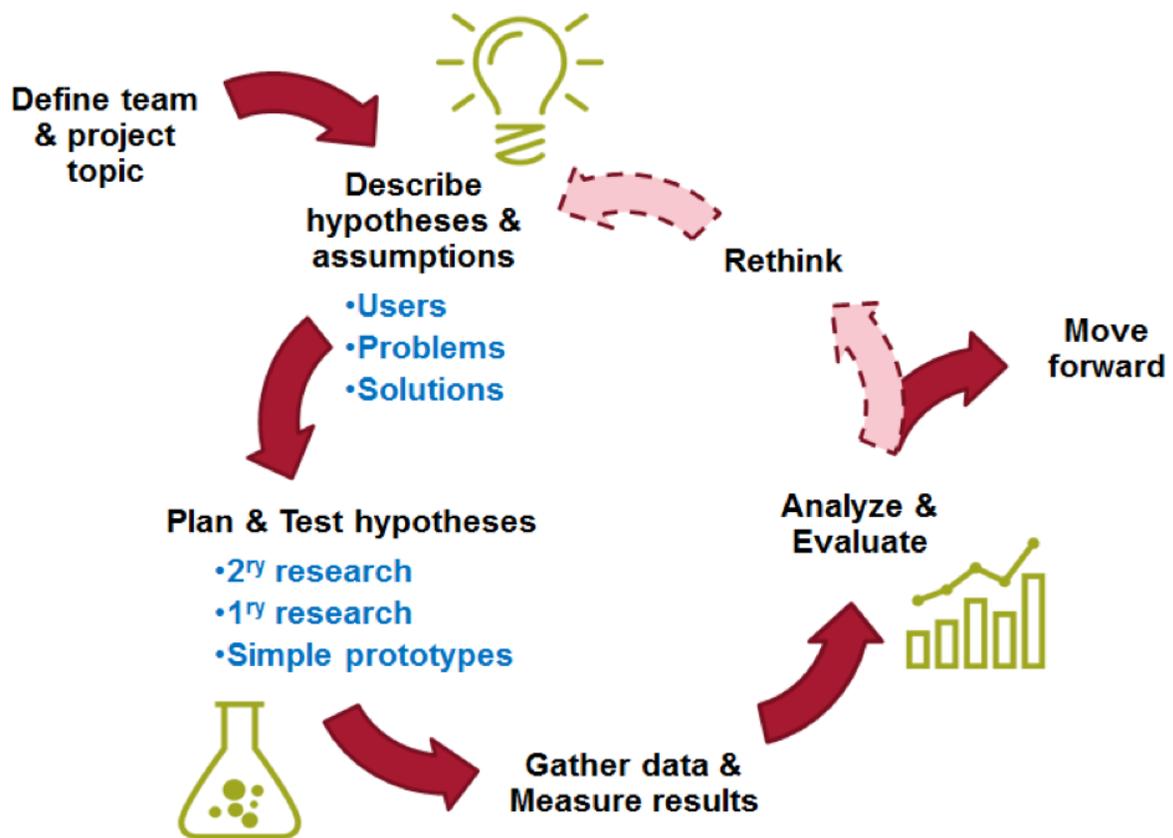
In February 2018, Doug Ruth, President of the Canadian Academy of Engineering (CAE) confirmed the interest of the CAE in opening discussions with members of the National Council of Deans of Engineering and Applied Science (NCDEAS) on how universities might collaborate on a pan-Canadian student engagement concept for Canadian Engineering Grand Challenges. He charged the NCDEAS chair with leading this discussion and also authorized him to discuss the Canadian context for a Grand Challenge program with the NAE, please see Appendix 1. At the Spring 2018 NCDEAS meeting, hosted by University of Prince Edward Island in Charlottetown, PE, a number of deans, as well as the President of the Canadian Federation of Engineering Students (CFES) expressed an interest in exploring this concept further.

Further discussion ensued at the Fall 2018 meeting of NCDEAS hosted by University of Calgary in Calgary, AB, where Dean Yannis Yortsos of University of Southern California, representing GCSP and NAE, presented the GCSP concept. The discussion revealed strong consensus within NCDEAS to address Grand Challenges within the Canadian landscape, allowing university participants with flexibility and latitude to develop their own Canada-oriented programs to address local contexts. To do so, the group expressed strong alignment with the [UN Sustainable Development Goals \(SDGs\)](#) and the vision that the engineering profession to work purposefully to advance the well-being of humanity. The thematic areas that have engaged the group include water sustainability, particularly in Indigenous communities, sustainable transportation and infrastructure, and the challenges posed at the nexus of climate change and sustainable development.

## Our GCSP Vision

The McMaster GCSP will support the commitment made by the Faculty of Engineering to inspire engaged citizen scholars who are educated to transform our world. We will utilize the program to broaden our students' education through experiential, problem based and service learning, immerse them within innovative research, and provide them with training to address grand challenges. The McMaster GCSP will be a Canadian exemplar for educating future engineering leaders, innovators, and entrepreneurs who are imbued with global perspectives and social awareness.

Our students will focus on understanding and developing solutions for the [UN sustainable development goals \(SDGs\)](#) according to one of [four GCSP themes](#), namely, sustainability, health, security and joy of living.



The [MacChangers](#) methodology is based on [Design Thinking](#), [The Lean Startup](#), [The Design Sprint](#), [Project Management](#), and [Systems Thinking](#).

### *Alignment with Canada's Vision*

In September 2015, Canada along with 192 other UN member states adopted the 2030 Agenda for Sustainable Development. The 2030 Agenda is a 15-year global framework centred on an ambitious set of 17 Sustainable Development Goals (SDGs), 169 targets and over 230 indicators. The 2030 Agenda envisions a secure world free of poverty and hunger, with full and productive employment, access to quality education and universal health coverage, the achievement of gender equality and the empowerment of all women and girls, and an end to environmental degradation.

Many of the Government of Canada's priorities and programs, both domestically and internationally, are well aligned with the 2030 Agenda. Through its focus on women and girls, Canada's Feminist International Assistance Policy supports the main principle of the 2030 Agenda for Sustainable Development, which is to ensure that no one is left behind in the achievement of

the SDGs. By prioritizing gender equality and the empowerment of all women and girls, Canada supports SDG 5 (gender equality), as well as the achievement of all other SDGs. Consistent with the Government of Canada's commitment to advance the work of reconciliation, renewing Canada's relationship with, and outcomes for, Indigenous peoples supports multiple SDGs, including SDG 1 (no poverty), SDG 3 (good health and well-being), SDG 4 (quality education), SDG 6 (clean water and sanitation) and SDG 16 (peace, justice and strong institutions). Canada's 2016 to 2019 Federal Sustainable Development Strategy, which sets out Canada's sustainable development priorities, is linked to many SDGs, including SDG 7 (affordable and clean energy), SDG 13 (climate action), SDG 14 (life below water) and SDG 15 (life on land). Finally, Canada's support for the Pan-Canadian Framework on Clean Growth and Climate Change, investments in clean economic growth and investments in international climate finance all contribute to SDG 7 (affordable and clean energy), SDG 11 (sustainable cities and communities), SDG 12 (responsible consumption and production) and SDG 13 (climate action).

In Budget 2018, the Government of Canada announced that it would provide \$49.4 million over 13 years to establish an SDG unit and fund monitoring and reporting activities by Statistics Canada. This is expected to enable better coordination among government, civil society organizations and the private sector on Canada's efforts on the 2030 Agenda for Sustainable Development

### *Prioritizing the SDGs*

From an engineering and technology perspective, we place priority on:

SDG 3: Ensure healthy lives and promote well-being for all at all ages.

SDG 5: Achieve gender equality and empower all women and girls.

SDG 6: Ensure availability and sustainable management of water and sanitation for all.

SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all.

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable.

Goal 12: Ensure sustainable consumption and production patterns.

Goal 13: Take urgent action to combat climate change and its impacts.

## Implementation

At the core of the McMaster GCSP lies [MacChangers](#), which is an intensive integrated extracurricular community engagement, innovation, inquiry, experiential and problem-based learning program that has been recognized by the Province of Ontario, receiving funding from it. The program begins with mandatory equity, diversity and inclusion training in the context of community engaged learning that also emphasizes the multicultural values enshrined in the Canadian constitution.

A student may replace participation in MacChangers by developing a learning portfolio which includes similar learning activities that lead to similar intended learning outcomes. Such a substitute portfolio must be able to show the same learning experience for equity, diversity and inclusion in the context of community engaged learning that is available for MacChangers students.

Besides their integrated experiential learning through MacChangers, which emphasizes inquiry through a hands on project or research experience involving service learning, or a similar independently pursued project, students will also take courses, cumulatively equal to at least 18 units (or six one-term courses). Representative courses are listed below and marked as RC (research/creative), MD (multidisciplinary), BE (Business/entrepreneurship), MC (multicultural), and SC (social consciousness). For successful completion of the program, McMaster GCSP students will take courses that fulfill all five competencies.

Below, we discuss how the five GCSP components are being met through MacChangers, the unique aspects of the McMaster GCSP and how future GC scholars will be recruited, mentored and assessed. We explain the roles and responsibilities of the McMaster GCSP Steering Committee and how funding and support for the program has been obtained and will continue.

### *Integrating All Competencies: MacChangers*

Students will participate in a subset of a comprehensive list of activities for at least two years. Successful completion of these activities will be noted on their curricular and co-curricular records based on which students will be able to obtain academic credit. For this, we have developed standards and means of activity assessment that ensure consistency and rigour.



Our signature GCSP experiential learning program will be MacChangers, an existing extracurricular program at McMaster that covers all five GCSP competencies and has been actively promoted at McMaster University (see Appendix 2). Its intended learning outcomes include interdisciplinary inquiry (or research), design thinking and creativity in multicultural teams that often provide results leading to entrepreneurship or social innovation.

The program begins with mandatory equity, diversity and inclusion training in the context of community engaged learning for all participants. MacChangers staff provide resources, coaching and support to interdisciplinary teams of students who propose and develop an innovative solution to issues that impact society both locally and globally. While tackling a grand challenge, students also take advantage of the opportunity to develop their professional skills and network.

Over the academic year, beginning in the September Fall term, MacChangers teams develop a project on their topic of choice through full-group coaching sessions, workshops with guest speakers, panel discussions with subject matter experts and consultations with MacChangers faculty and staff members. At the conclusion of the Winter term in April, each MacChangers team presents its project results to a panel of McMaster students, faculty and staff members, and community stakeholders and leaders. Through this experience, MacChangers students develop skills, build connections and make a difference. They also use creative methods to bring about positive change to our community.

To date, MacChangers has focused on the GCSP themes of sustainability and joy of living, where students have reflected on the objectives of SDG 9 and SDG 11.

## *Professionalism: Durable Skills*

Participation in the MacChangers program allows students to cultivate many of the professional skills that employers seek. They work in teams, develop leadership skills, learn how to identify the right problem, and how to design and implement a creative solution. MacChangers students benefit by applying their prior and acquired knowledge to tackle real-world problems for real world clients, first by building empathy with the client, then defining and ideating a possible solution through design thinking and pivoting, and finally building a prototype solution and testing it along with the teams' community partners.

Under the McMaster GCSP, students will be required to participate in MacChangers over two academic years running from September through April, or four academic terms.

### *Leadership Reflection*

McMaster Engineering aspires to educate citizen scholars who will transform our world. Our aspiration requires that students develop strong leadership and team building skills. Learning about these skills is inherently embedded in MacChangers, or a MacChangers-type, experience. Consequently, students develop leadership skills beyond a simple instinctual leader like response. We ask students to reflect on their “try and fail” leadership and team building experience so that the consequent learning allows them to understand that there are a diversity of leadership and team development styles, which vary depending upon circumstance. This allows students to become more self aware, moving them beyond their inherent instinctual styles towards a deeper understanding of leadership.

## **Intended Learning Outcomes**

Through integrated inquiry and research, experiential and problem based learning, and its focus on entrepreneurship and social innovation, MacChangers covers all five GCSP competencies. Upon successful conclusion of the program, learn how to:

1. Apply the Design Thinking approach to effectively identify and define a real-world problem and provide a real-world solution.
2. Develop and demonstrate qualitative research methodology skills.
3. Propose innovative solutions based on inquiry and research that can result in positive change in a local community.

4. Explore how to develop these multidisciplinary solutions with community partners or with The Forge, which is McMaster University's campus linked accelerator dedicated to developing start-ups and entrepreneurial culture.
5. For the problems on which students focus, apply McMaster University's principles of Community Engagement to build valuable connections with Hamilton residents, and with subject matter experts from McMaster and Hamilton community organizations, as well as globally recognized content experts.
6. Develop professional skills in research, teamwork, project management, entrepreneurship, presentation delivery and communication.
7. Work in teams with students from different Faculties at McMaster, i.e., Business, Health Sciences, Humanities, Science and Social Sciences, as well as students from different academic levels and cultures. (Nearly 25% of Level 1 Engineering students at McMaster are international students. Besides, many of our domestic students are either immigrants or first-generation Canadians.)

### *Example Projects: SDG 9, Resilient Infrastructure*

These examples related to SDG 9 fall under the broad GCSP themes of sustainability and joy of living, and specifically address the NAE grand challenge that requires engineers to [restore and improve urban infrastructure](#).

Transportation and Social Inequalities: Through an examination of two case studies, one with the Toronto Transit Commission and the other with the Edmonton Transit System, a MacChangers group conducted a feasibility analysis of the implementation of no cost fares for children aged 12 years and under who access public transportation in the City of Hamilton. The purpose of the project was to develop a solution that mitigated social inequality through transportation, removed stigma in accessing public transportation, and increased ridership and inclusivity.

Transportation Alternatives: Informed by McMaster University student survey results and interviews addressing user experience of the City of Hamilton Bike Share Program ([SoBI Hamilton](#)), another group developed a proposal to strategically address issues of access for McMaster University students by developing a complementary 'MacBike' Program. The proposal outlined the development of a student-led sustainable transportation action committee that will work in close partnership with City of Hamilton Sustainable Mobility Programs Office to develop

an integrated bike share program. The objective is to increase access, convenience, and user satisfaction with this transportation alternative.

Additional details about the MacChangers activities are provided through the representative schedule in Appendix 3.

### **Additional Requirements to Meet the Competencies**

Besides their integrated experiential learning through MacChangers or a similar independent project, students will also take courses, cumulatively equal to at least 18 units (or six one-term courses). Representative courses are listed below and marked as RC (research/creative), MD (multidisciplinary), BE (Business/entrepreneurship), MC (multicultural), and SC (social consciousness). For successful completion of the program, McMaster GCSP students will take courses that fulfill all five competencies.

### **Representative Courses**

- CMTYENGA 2A03 Foundations of Community Engagement, 3 units. This course provides you an understanding of how communities function, the politics and processes involved in community participation and leadership. It focuses on developing the beginning skills for effective and ethical community engagement. MD, MC, SC
- COMP SCI 4EN3 Software Entrepreneurship, 3 units. This course covers the technical, financial, legal and operational issues encountered by software startups. Small groups of students take an idea and turn it into a prototype, a business plan, and a sales pitch. Lectures cover issues from team formation to appropriate software development processes to patent protection to venture capital. MD, BE
- ECON 1B03 Introductory Microeconomics, 3 units. Introduction to the method and theory of microeconomics, and their application to the analysis of contemporary economic problems. BE
- ENGINEER 1P03 Engineering Profession and Practice, 3 units. Introduction to professional engineering including ethics, health and safety, roles and responsibilities to society, sustainability, engineering communication; design skills; team design projects. RC, MD.
- ENGINEER 4A03 Sustainability and Ethics in Engineering, 3 units. The impact of triple bottom line thinking on the engineering profession, including economic, environmental, and social responsibility. The ethical and legal responsibilities of engineers. The role of the engineering profession in the social control of technological change. SC.

- ENGINEER 4EX3A/B Experiential Engineering Design, 3/6 units. Students have the opportunity for formal recognition of the design-based experiential learning conducted within the atmosphere of technically-oriented McMaster Engineering teams. RC, BE, MD.
- ENGINEER 4CX3 Immersive Experiential Learning in Communities, 3/6 units. Students have the opportunity for formal recognition of their community-based experiential learning conducted through various McMaster Engineering programs or Clubs. RC, BE, MD, SC.
- ENGINEER 4ID3 Addressing Social Problems Through Business, Engineering and the Social Science, 3 units. Students work in interdisciplinary teams on an experiential project that incorporates business, engineering and social sciences elements. RC, MD, SC.
- ENGNMGT 4A03 Innovation Driven Project Development and Management, 3 units. What is innovation and how is it managed? Team-based creativity skills are developed with a focus on delivering innovation. Participants develop teamwork skills while using project management tools to develop a project. RC, MD, BE.
- ENGNMGT 5E03 Entrepreneurial Processes and Skills, 3 units. Students develop an awareness of, and skills in, innovation and entrepreneurial behaviour. Emphasis is placed on becoming a more effective team player, becoming more aware of one's own learning style and entrepreneurial orientation, and understanding the processes of business idea generation, development and evaluation. RC, MD, BE.
- ENGNMGT 5EL3 Leading Innovation, 3 units. This course explores leadership in an innovation context and provides a conceptual understanding of role model leadership. A personal leadership capacity development approach is explored. (Also, cross-listed as SEP 4EL3.) MC, MD, BE, SC.
- ENGPHY 3ES3 Introduction to Energy Systems, 3 units. A survey course on energy systems with emphasis on the analytic tools needed to evaluate them in terms of performance, resources and environmental sustainability, costs, and other relevant factors over their life cycles. MD, SC
- E&S 2Y03 Case Studies in the History of Technology, 3 units. History and philosophy of technology with emphasis on cultural aspects. MC, SC.
- E&S 3Y03 The Culture of Technology, 3 units. Nature and structure of technology, nature of culture, role of groups in culture dominated by technology. MC, SC.
- HISTORY 2EE3 Science and Technology in World History, 3 units. An introduction to the manner in which science and technology influence society and how society influences science and technology, paying particular attention to the transfer of knowledge and machines over time and between cultures. MC, MD, SC

HISTORY 3CH3	Catastrophic History: Natural & Technological Disasters, 3 units. An examination of how natural and technological disasters have shaped past societies and how catastrophe features as an important method of understanding the human condition. MC, MD, SC
HISTORY 3UA3	The History of the Future, 3 units. This course examines how technology has historically shaped social ideas about the future and how these social ideas about the future shaped subsequent technology. MC, MD, SC
INNOVATE 1X03	The World of Entrepreneurship, 3 units. Fundamentals of entrepreneurship by prominent entrepreneurs. Case studies to analyse strategies and methods for growing a scalable business. MD, BE
INNOVATE 2X03	Lean Startup, 3 units. Introduction to lean methodologies of building a successful start-up business, including market validation, analysing market potential for start-up ideas, establishing a business model and “failing fast”. Students will learn how to test business ideas and hypotheses with customers and stakeholders. MD, BE
INNOVATE 2Z03	Sprint Methodologies, 3 units. Rapid prototyping, testing and iteration of ideas with customers using design sprint methodologies. Students also learn about agile development and pathways from idea to market. MD, BE
INNOVATE 3EX3	Experiential Learning in Innovation, 3 units. Students have an opportunity to gain direct experience working at an existing start-up company and must maintain a comprehensive learning portfolio of their experience. MC, MD, BE
INNOVATE 4EX6	Founders Startup, 6 units. Working with The Forge, McMaster’s startup accelerator, students form teams to develop a new startup venture. Through the application of lean startup and design sprint methodologies, students rapidly test and iterate product-market fit with customers and refine their business models. At the end of the course, students pitch their validated business models and evidence for product-market fit to a panel of Forge entrepreneurs, advisers, and mentors for possible entry into The Forge’s Stage II program. RC, MC, MD, BE
MATLS 4I03	Sustainable Manufacturing Processes, 3 units. Sustainable development, ingenuity gap, materials cycles, Eco-Efficiency, Environmental Impact parameters, introduction and computational structure of life cycle analysis, waste treatment and recycling technologies, impact of sustainable practice, Vision 2050. MD, SC
MECHENG 4O04	Sustainable Energy Systems, 4 units. Assessment of current and future energy systems, covering resources, extraction, conversion with emphasis on meeting regional and global energy needs in a sustainable manner. Different renewable and conventional energy technologies and their attributes. Evaluation and analysis of energy technology systems in the context of political, social, economic and environmental goals. MD, SC

POLSCI 2I03	Global Politics, 3 units. A study of institutions and processes of the international political system. MC, MD.
POLSCI 2J03	Global Political Economy, 3 units. A study of institutions and processes of the international political economy. MC, MD.
SUSTAIN 1S03	Introduction to Sustainability, 3 units. An introduction to sustainability from an interdisciplinary perspective which examines the historical and societal lenses through which sustainability is viewed. Students learn terminology, theories and concepts to effectively communicate across disciplines and on various topics of sustainability. MD, SC
SUSTAIN 2S03	Evaluating Problems & Sustainable Solutions, 3 units, Students learn how to identify problems and evaluate sustainable solutions to societal problems from an interdisciplinary perspective. The course involves active experiential learning which emphasizes actions on local projects. MD, SC
SUSTAIN 3S03	Implementing Sustainable Change, 3 units. Exploring agency, leadership, and strategy effectiveness within the context of sustainability. The course includes interdisciplinary perspectives, experiential learning and community engagement projects. MC, MD, SC

Readers who are more familiar with engineering education in a global context will recognize that McMaster University is a pioneer in problem based learning. As De Graaff and Kolmos write, “Problem-based learning (PBL) is widely regarded as a successful and innovative method for engineering education. Since the development of the PBL model at McMaster University in Canada in the late 1960s, many different varieties have emerged.”\* Further, in Canada, engineering programs are accredited on the basis that they are able to adequately prepare all graduates to become licensed professional engineers. A cornerstone of this preparation is that all engineering graduates must have developed an [understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest](#). For those unfamiliar with McMaster Engineering and Canadian engineering education, descriptions of some sample courses follow.

The content of ENGINEER 1 P03 includes a strong emphasis on design thinking, which provided students with a research/creative project experience. For evidence, please see the *Globe and Mail*<sup>†</sup> article, [McMaster engineering students help make life easier at nursing home](#). The award

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\* De Graaf, E. and Kolmos, A., 2003. Characteristics of problem-based learning. *International Journal of Engineering Education*, 19(5), pp.657-662.

† The *Globe and Mail*, founded in 1844, is [Canada's foremost news media company and a part of Canada's fabric](#).

winning instructor for the course works with students [to emphasize empathy, creative problem-solving and listening skills](#) – exactly the skills that are needed to solve complex, real-life problems. See also the CBC<sup>‡</sup> story, [Engineering with a heart: Students impress by helping wheelchair users do laundry](#). Students in this course receive active experiences and experiential learning, as exemplified in the *Globe and Mail* and CBC stories.

The learning objectives of Engineer 4A03, which teaches social consciousness, include that upon completion students will (1) identify and analyze the essential characteristics of a complex problem from a sustainability perspective, including its ethical dimensions, risks, and uncertainties; (2) feel and explain a sense of respect for diversity, the environment, and past, present, and future generations in all engineering decisions; (3) identify professional ethical dilemmas and competing stakeholder interests and develop conscientious, well-reasoned, professional responses; (4) identify and quantify short and long-term impacts of engineering on a scale ranging from the local to the global; (5) detect patterns, connections, and relevant data, and then apply that knowledge to synthesize original thoughts and solutions; (6) devise creative solutions to overcome opposing needs by collaborating with designers and experts of all disciplines to incorporate a variety of social, economic, and environmental perspectives; (7) develop communication skills for effective teamwork, influence, and effectiveness; and (8) thoughtfully consider personal and professional choices and career contributions.

The Engineering & Society program, which provides courses under the E&Y rubric, is a 5-year degree that educates students about how their engineering practices will influence society and teaches them to be proactive in a sustainable manner. In all E&Y courses, such as in E&Y 2Y03, case studies involving real world problems are examined against the three pillars of sustainability, i.e., economic, environmental and societal, in inquiry-based courses as well as interactive courses within the local community. Students must complete a minor, where popular minors include sustainability, business, and innovation, along with astronomy, economics, geography, philosophy, and statistics. The inquiry-based E&S courses ask students to undertake a search for understanding through a process of asking questions and seeking answers through research. Here, inquiry, as conducted in E&Y 2Y03, is a question-driven search by students that requires considerable research for them to discover and reflect on an answer.

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<sup>‡</sup> The Canadian Broadcasting Corporation, CBC, serves as the national public broadcaster for both radio and television.

## ***Course substitutions***

Students are required to complete six courses, or eight units, and MacChangers. However, three or six units can be replaced if students complete the experiential learning ENGINEER 4EX3A/B, or ENGINEER 4CX3 courses, which recognize the excellent technical or community engagement work already occurring in extracurricular engineering competitive teams, or the work that our students do within our communities and in turn educate themselves about society.

One of the first of its kind in Canada, ENGINEER 4EX3 provides third and fourth year engineering students with an opportunity to receive [formal recognition of experiential learning conducted within technically oriented McMaster Engineering teams](#), such as Solar Car, Chem-E-Car, Concrete Toboggan, Baja SAE, EcoCar3, Formula Electric, and Rocketry.

Following the success of ENGINEER 4EX3A, we will offer ENGINEER 4CX3 from Fall 2019. With this course, Immersive Experiential Learning in Communities for 3/6 units, students have the opportunity for formal recognition of their community-based experiential learning conducted through various McMaster Engineering programs or clubs.

Students who are active participants in a team may seek their team faculty advisor's permission to enrol in either course. These pass-fail courses are used as a 3 credit technical elective towards a student's degree. Students learn how to build a portfolio showcasing their extracurricular work, which is also an asset when applying for a job or co-op.

With nearly 275 undergraduate students undergoing a four month research experience in a mentor's laboratory, primarily during summer, McMaster Engineering runs one of the largest undergraduate research programs in North America. Each year, about seven percent of our undergraduate student population conducts research in our professors' laboratories for which students receive co-op recognition. We will encourage students to use up to two of these four month experiences, assuming each to be equivalent to a three credit course, to satisfy the RC and MD competencies for the McMaster GCSP.

Likewise, students who participate in international exchange programs will be able to receive 3 MC credits for each four month global experience for a maximum of six credits in this category.

## ***Recruitment, Cohort Size, Mentoring and Assessment***

The McMaster GCSP and MacChangers information will be integrated into the promotional activities and materials offered by all Faculty of Engineering Level I (i.e., Year 1 or freshman)

programs to prospective students. These materials and activities include the [McMaster University Viewbook](#), [Faculty of Engineering Program Guide](#), the on-campus tour program and the online 'Virtual Tour of Engineering', [McMaster Engineering website](#), and display booth information at University-wide Fall and Spring open house events. We will also utilize youth outreach programs at partner high schools throughout the Province of Ontario, within key [K-12 McMaster Engineering programs on-campus, i.e., Venture and LEAP](#), and [K-12 outreach programs](#) within the broader community that cumulatively reach over 30,000 students.

We will also leverage our strong partnership with the McMaster Residence Life Office. In particular, we will utilize the infrastructure of the Engineering student-focused [Innovation & Society Living Learning Community \(LLC\)](#) in residence to actively promote the McMaster GCSP and MacChangers among all McMaster University first-year students in residence. First-year, or Level 1, Faculty of Engineering students in the Innovation & Society LLC already have access to programming aimed at building critical thinking, creativity, and communication skills. Annually, over 150 Faculty of Engineering students live and participate in this specialized Living Learning Community, but the program is offered to all of the nearly 800 Engineering students in the McMaster University Residence Community who live on campus.

We will actively promote the McMaster GCSP and MacChangers through Associate Deans who oversee undergraduate programs across all Faculties at McMaster University. Using their connections, we will host Fall and Winter term 'Lunch and Learn' sessions with academic advisors across Faculties where these advisors will meet current McMaster GCSP (and MacChangers) students.

The McMaster GCSP will also be represented at the Level I (i.e., Year 1 or Freshman) to Level II (Year 2 or sophomore) Program Fairs in each of the six Faculties at McMaster. These Program Fairs provide information for students transitioning into their second baccalaureate year at McMaster, since students typically have a common discipline-based curriculum at McMaster before selecting a major. A strong emphasis will be placed on representation at programs that feature interdisciplinarity, such as [Engineering and Society](#), [Engineering and Management](#), [Innovation Minor](#), and [Sustainability Minor](#).

Students will formally enter the GCSP program when they participate in MacChangers or provide evidence of having completed a MacChangers-type experience. They will be able to do so at any time during their academic journey through McMaster University.

Presently, any McMaster student can apply to be part of the MacChangers program. A fifth of the current MacChangers cohort, or ten out of fifty students, is enrolled outside the Faculty of Engineering, primarily in the DeGroot School of Business and the Faculty of Social Sciences. We do not anticipate that these students will take and complete courses listed under the ENGINEER, ENGNMGT, ENGPYHS E&Y, MATLS and MECHENG rubrics. However, a pathway towards a GCSP credential exists for these students if they take courses under other rubrics and also complete MacChangers or a MacChangers-type experience. Our focus will remain on recruiting a one hundred member cohort for MacChangers in future, comprising of both engineering and other students.

### ***Blockchain Credential***

We will begin offering a credential indicating successful completion of MacChangers in April 2019 based on the blockchain-based BlockCerts app. [Blockcerts is an open standard for creating, issuing, viewing, and verifying blockchain-based certificates](#). These digital records are registered on a blockchain, cryptographically signed, tamper-proof, and shareable. Thus, in future, McMaster GCSP graduates will be awarded and possess their own official records, which they can then share as they deem appropriate.

Upon completion of MacChangers, or a MacChangers-type independent study, students will be required to submit a portfolio describing how they have met the requirements of the McMaster GCSP. Review of this will reveal the requisite coursework, including course substitutions, as well as [BlockCerts certification](#) of their satisfactory completion of MacChangers. Evidence of completion of an independently pursued MacChangers type program can be provided through credit for ENGINEER 4CX3 and, in some cases, ENGINEER 4EX3. These credentials will be reviewed by the GCSP coordinator.

### **Cohort Size**

We intend to leverage our MacChangers experience and extend it to the GCSP program. MacChangers provides community engagement and learning experiences to roughly thirty students, about three quarters of whom are engineering students. Our initial GCSP pilot will target a fifty-student cohort, with about forty of these engineering students. Our aspiration is to gradually increase the cohort size to roughly 125 students by 2025. This would make the GCSP program comparable to some of the larger extracurricular programs offered through McMaster Engineering.

## Mentors

The MacChangers program benefits through the McMaster University [Student Partners Program](#) offered through the Paul R. MacPherson Institute for Excellence in Teaching and Learning. The student partners program is designed for undergraduate and graduate students interested in pedagogical research and innovation. Each year, two student partners, who serve as student mentors for the entire academic year, contribute to the learning objectives of MacChangers. Mentoring is also provided by MacChangers dedicated staff.

## Administration

The McMaster GCSP will be administered by an academic steering committee that will have five major responsibilities, as follows.

1. Documentation: Maintain documentation regarding the requirements of the program
2. Infrastructure: Ensure that a digital infrastructure for archiving and collaboration is operational for participation at all times
3. Quality assurance: Responsibility to organize the approval process for participant work towards the distinction to be awarded of McMaster University Grand Challenges Scholar, according to the criteria set forth in program documentation
4. Governance: Responsibility to approve the creation and dissolution of Challenge Groups, and the appointment of their leaders. The board is also responsible for reviewing student-mentor pairings annually
5. Outreach: Responsibility to continuously strengthen communication and collaboration between GCSP schools and be responsible for championing the program through the Canadian Academy of Engineering (CAE) and the Canadian National Council of Deans of Engineering and Applied Science (NCDEAS).

## Steering Committee and GCSP Director

The proposal names the McMaster Engineering Director of Outreach and Student Engagement as the GCSP Director. The McMaster GCSP Director will be a member of the steering committee and will also report to it. Ultimate authority for the GCSP resides in the Dean of Engineering who will rely on the advice of the Associate Dean (Academic) and Associate Dean (Research and External Relations). The steering committee will monitor how students meet learning outcomes and develop graduate attributes, obtain resources to maintain and expand the McMaster GCSP through

philanthropy, and ensure that the program is adequately staffed. The program coordinator will report to the GCSP Director.

The McMaster GCSP Steering Committee consists of the Dean of Engineering, Director of Outreach and Student Engagement, Associate Dean (Academic), Associate Dean (Research & External Relations) and Assistant Dean (Studies) of the Faculty of Engineering who are joined by the Community Engagement Developer for the Paul R. MacPherson Institute for Leadership, Innovation & Excellence in Teaching. Brief profiles of the Steering Committee members are included below.

**Ishwar K. Puri** has served as Dean of the Faculty of Engineering since 2013. He is chair of the Canadian National Council of Deans of Engineering and Applied Science and has served on the executive Committee of the Global Engineering Deans Council. As a Fellow of the Canadian Academy of Engineering, Dr. Puri has been charged by the Academy's President to explore how a Canada-wide grand challenge program can be established through Canadian universities, see Appendix 1.

**Arlene Dosen** has served as Director of Outreach and Student Engagement since 2017 and will serve as Director of the McMaster GCSP. She oversees student engagement, community engagement, youth outreach to the community, co-op and career services, recruitment, alumni relations, communications, and advancement for the Faculty of Engineering. She has worked with the McMaster Paul R. MacPherson Institute for Leadership, Innovation & Excellence in Teaching to enhance and more fully implement the cross-Faculty MacChangers Program.

**Ken Coley** has served as Associate Dean, Academic since 2008. His strategies have improved Year 1 to Year 2 student retention in the Faculty of Engineering programs from 75% to 95%. He is leading curricular innovations that will integrate all four years of the B.Eng. curriculum to include year-long problem solving and experiential learning, or learning by doing, courses moving it away from separated 3 or 4 unit lecture or laboratory-based courses.

**John Preston** has served as Associate Dean, Research and External Relations since 2014. His efforts have transformed the Engineering undergraduate research program. Now, each year, about 500 undergraduate students undertake a research experience, typically at least one semester long, in the laboratories and groups headed by faculty members. He is also facilitating a new approach to design thinking within the Faculty that integrates research with education and training.

**Maria White** has served as Assistant Dean, Studies since 2006 and provides support to the Associate Dean, Academic. She has been responsible for implementing a proactive academic advising model and developing intervention strategies for students in distress that have facilitated the Year 1 to Year 2 Engineering B.Eng. student retention of 95%. She was a primary member of teams that developed the Integrated Biomedical Engineering and Health Sciences (iBioMed) Program and the joint Engineering and Business Innovation Minor and has helped facilitate several engineering program accreditation reviews by the Canadian Engineering Accreditation Board.

**Beth Levinson** is Community Developer in the McMaster Paul R. MacPherson Institute for Leadership, Innovation & Excellence in Teaching. She works primarily on two student engagement programs: McMaster Child and Youth University (MCYU) in the City and MacChangers. MCYU in the City is a community engaged education program that invites undergraduate and graduate students to collaborate on developing a workshop to present to Hamilton's youth. MacChangers invites undergraduates from all McMaster Faculties to provide sustainable grand challenge solutions for Hamilton. Both programs are extracurricular and open to all students on campus.

### **Annual Budget and Resource Allocation**

The McMaster Grand Challenges Scholarship Program will use a full-time staff lead, the Student Experiential Learning and Community Engagement Program Coordinator who will work under the direction of the Steering Committee. The responsibilities of the Coordinator, who has been recruited for MacChangers, include responsibility for operational outcomes as follows.

1. Oversee operational management of MacChangers, including program planning, ongoing community engaged curriculum development and delivery, and strategically leverage its infrastructure to strengthen the foundations of the McMaster GCSP.
2. Generate a comprehensive list of activities considered suitable to be placed on the co-curricular record.
3. Work with the Steering Committee to determine those activities that can be credited with academic approval for learners' participation in the McMaster GCSP.
4. Assist the Steering Committee in the development of standards and means of activity assessment that ensure consistency and rigour.
5. Help identify learning outcomes associated with each activity, connecting these clearly with the education and professional development of the whole engineer.

6. Identify suitable validators, i.e., McMaster University faculty and staff mentors, who will assess student activity and determine the appropriate credit. These validators will be carefully selected by the Steering Committee and trained to ensure credibility.
7. Configure the Outcome Experiential Learning Management software platform to host the student co-curricular record, enable appropriate tagging for activities associated with the McMaster GCSP and populate the system with student competency and skill development information.
8. Record faculty, industry and community partner involvement with curricular and co-curricular experiential learning programs and activities.
9. Develop a communications strategy to inform students, clubs, teams and other groups to suggest validators.
10. Oversee implementation, and determine maintenance protocols and ways to scale up the McMaster GCSP.

The Faculty of Engineering has made an initial annual budget allocation of \$150,000 as follows.

***McMaster Grand Challenges Scholars Program Initial Annual Budget***

Salary - Staff Lead	68,000
Fringe benefits - Staff Lead	22,500
Educational tools, software and resources	20,000
Supplies and operations, including marketing and promotion	10,000
Project funding for students	20,000
Local travel and training	10,000
<b>Total</b>	<b>\$150,000</b>

**Summary**

The McMaster Grand Challenge Scholars Program will be a Canadian exemplar that satisfies all five GCSP competencies through an intensive extracurricular community engagement, innovation, inquiry and experiential learning program, MacChangers or a close substitute that can be assessed based on a detailed learning portfolio. A substitute learning portfolio must show the same learning experience for equity, diversity and inclusion in the context of community engaged learning that is offered to MacChangers students. If a student is to obtain formal McMaster GCSP recognition, this integrated extracurricular program must be coupled with a suite of at least six courses, or 18 units, from a list that covers the five competencies, RC (research/creative), MD

(multidisciplinary), BE (Business/entrepreneurship), MC (multicultural), and SC (social consciousness). Upon completion of the McMaster GCSP, students must be able to: propose innovative solutions that can result in positive change in Hamilton; explore how to develop these multidisciplinary solutions with community partners or with The Forge, McMaster University's campus linked accelerator; prove their ability to build connections with subject matter experts from McMaster and Hamilton community organizations, as well as globally recognized content experts; develop professional skills in research, teamwork, project management, entrepreneurship and communication; and work in teams with students from different McMaster disciplines. Our objective through the McMaster GCSP is to educate engaged citizen scholars who will transform our world.

## Appendix 1: Charge letter from Canadian Academy of Engineering



12 February 2018

Dean Ishwar Puri, FCAE  
McMaster University  
John Hodgins Engineering Building  
1280 Main St. W.  
Ancaster, ON L8S 4L7

Dear Ishwar,

It was great to talk with you this morning and to explore our mutual interests in the "Engineering Grand Challenges" concept. This is a concept that holds a lot of promise for cooperation between the Canadian Academy of Engineering (CAE) and the National Council of Deans of Engineering and Applied Science (NCDEAS). With this letter, I confirm the interest of the CAE in opening discussion on how we might implement a Canadian version of an Engineering Grand Challenges conference.

In order to further explore this idea, I empower you to act on behalf of the CAE to open discussion with the NCDEAS on the possibility of having a Canadian Engineering Grand Challenges event in the fall of 2019. Should you require the participation of the Board of the CAE, this can be arranged through Kevin Goheen.

Yours sincerely,

Douglas Ruth, PhD, FCAE, FEC  
President

For additional information, please contact:

Kevin Goheen, P.Eng., Ph.D.  
Executive Director  
The Canadian Academy of Engineering  
300 – 55 Metcalfe Street  
Ottawa, ON K1P 6L5  
Tel.: (613) 235-9056  
Fax: (613) 432-6840  
E-mail: kgoheen@cae-acg.ca

## Appendix 2: McMaster Daily News Story on MacChangers

### [Students solve transportation challenges and develop professional skills through MacChangers](#)



The aim of MacChangers, a joint venture between the Faculty of Engineering and the MacPherson Institute at McMaster University, is to support interdisciplinary teams of students as they develop research projects and propose innovative solutions to issues that impact society.

**SEPTEMBER 12, 2017**

Gaining real-world experiences before entering the world. This is what attracted Jordan Sullivan to [MacChangers](#).

The aim of MacChangers, a joint venture of the Faculty of Engineering and the MacPherson Institute, is to support interdisciplinary teams of students as they develop research projects and propose innovative solutions to issues that impact society both locally and globally. The extracurricular activity is open to all McMaster undergraduate students.

Sullivan, a Chemical Engineering & Society student, joined MacChangers in 2016 after hearing about it through a friend. His team project focused on creating solutions to social inequalities found in Hamilton's transportation system.

"I was attracted to MacChangers because it gave me an opportunity to take on a project related to what I wanted to do after graduation," said Sullivan. "I thought if this is going to be my life one day, why not get involved?"

This year's program continues to focus on improving transportation, one of 14 grand challenges identified by the [National Academy of Engineering](#).

“We chose transportation this year because Hamilton is now in the process of developing a good transportation plan, while keeping issues of social equality and user-friendly aspects in mind,” said Beth Levinson, Community Programs Developer, MacPherson Institute. “Students will be able to reimagine how technology might be used and different ways of moving people.”

The collaborative nature of the program also helps students develop their professional skills.

“MacChangers gives engineering students an appropriate vehicle to interact with students from other disciplines and get a jumpstart on what they are going to do after graduation,” said Ishwar K. Puri, McMaster’s Dean of Engineering. “One day, students will work in partnership with diverse groups from different backgrounds. This program gives students diversity of thought and opinion.”

The freedom to think of innovative solutions outside of the classroom is another aspect of MacChangers that Sullivan enjoys.

“You have this big safety net and support from your peers and supervisors and you can do whatever you want and try to figure out a problem that’s way beyond you.” Sullivan said.

Learn more about MacChangers by attending an information session on one of the following dates:

**Thursday, September 21, 2017**

2:30 p.m. – 3:30 p.m. MDCL 3023

5:30 p.m. – 6:30 p.m. MDCL 3023

**Monday, September 25, 2017**

1:30 p.m. – 2:30 p.m. MDCL 3022

5:30 p.m. – 6:30 p.m. MDCL 2232

## Appendix 3: MacChangers Activities and Representative Schedule

MacChangers emphasizes inquiry through a hands on project or research experience involving service learning. Below, we describe the MacChangers program in greater detail. MacChangers must commit to:

1. Attending full group coaching sessions as per the schedule provided during the start of the Fall term.
2. Managing their own team’s work schedule, which includes research, project management, information sharing and presentation development.
3. Communicating with their teams.

Select MacChangers activities are presented in the following schedule for the 2018-19 academic term. MacChangers must commit to twelve full group meetings, culminating with teams presenting their work at Hamilton City Hall on April 10, 2019.

### Fall Term: Problem Definition (From Sep 22 to Nov 20)

<b>Saturday, Sept 22</b> <b>10:00 am -3:30 pm</b>	<b>Full Group Meeting #1 - <u>Launch</u></b> <b>3 hours</b>	<b>Location</b> <b>JHE 326H</b>
<b>10:00-10:30</b> 30 min	<p><b>Welcome &amp; Kick-off</b> <b>Write on Board- Imagine A World Where.... Related to Transportation/ Mobility</b></p> <p><b>10:00-10:15</b> <b>Dean Ishwar Puri: “Why Change?”</b></p> <p><b>10:15-10-30</b></p> <ul style="list-style-type: none"> <li>● <i>MacChangers Staff Introductions</i></li> <li>● <i>MacChangers introductions - Names/Faculties/Why did you join MacChangers?</i></li> </ul> <p><b>Reflections-</b> <i>Goal Setting for MacChangers - Academic, Personal, Professional</i> <b>Goal Statement-</b> <i>On Avenue to Learn (See Assessment tab)</i></p> <p><b>Linkedin</b> - <i>Remind students that they should have a profile. If they do not, they can book an appointment by email (<a href="mailto:piconed@mcmaster.ca">piconed@mcmaster.ca</a>.)</i></p>	

<b>10:30 - 11:45</b>	<b>Guest Speaker: Transportation Update</b> Steve Molloy - Manager, Transportation Planning, City of Hamilton <ul style="list-style-type: none"> <li>• Transportation Master Plan (TMP)</li> <li>• Planning Economic Development</li> <li>• New Initiatives</li> <li>• Budget and Challenges</li> </ul>
<b>11:45- 12:15</b>	<b>Guest Speaker: Existing Projects</b> Beatrice Ekoko - Environment Hamilton/Friendly Streets <ul style="list-style-type: none"> <li>• Existing Initiatives for collaboration</li> </ul>
<b>12:15 – 12:45</b> 30 min	<b>Project Development - Part 1– Imagine a World...</b> Introduce yourselves Can work collaborate
<b>12:45 – 1:15</b> 30 min	<b>Lunch Break</b> Fill worksheet “WS 2 - Team Contact Sheet “
<b>1:15 - 1:45</b> 30 min	<b>Project Development - Part 2</b> Continue filling “WS 1 – Imagine a world” - Part 2
<b>1:50-2:20</b> 30 mins	Discussion
<b>2:20-2:30</b>	<b>Break</b> <i>-coffee and dessert</i>
<b>2:30 - 3:20</b>	<b>Training: Community Engagement &amp; Professional Communication</b> <b>Sheila Sammons - Director, Office of Community Engagement</b>  <i>Focus on Principles- Building Relationships and Reciprocity (Professional communications and conduct)</i>
<b>3:20-3:30</b>	<b>Wrap Up</b>

<b>Tuesday, Oct 2</b> <b>5:30 – 8:00 pm</b>	<b>Full Group Meeting #2 Design Thinking</b> <b>2.5 hours</b>	<b>Location</b> <b>ETB 535</b>
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<p><b>5:30 – 7:30</b> 2 hours</p>	<p><b>Training: Design Thinking</b> <b>Robert Fleisig – Associate Professor, W Booth School of Engineering Practice and Technology</b> <i>Design Thinking - Intro -15 mins</i> <i>Set Culture - - 45 mins</i></p> <ul style="list-style-type: none"> <li>● Empathy for users/learning from others</li> <li>● Observation</li> <li>● Storytelling/art of listening</li> <li>● Creativity and Discovery</li> </ul> <p><i>Interview - The Art of Listening-1 hour</i></p> <ul style="list-style-type: none"> <li>● Demo</li> <li>● Practice</li> </ul>
<p><b>7:30 - 7:55</b> 25 min</p>	<p><b>Project Development - <b>Part 3: What you know &amp; don't know</b></b> Fill worksheet "WS 3 – Know &amp; Don't know"</p>
<p><b>7:55 – 8:00</b> 5 min</p>	<p><b>Closure &amp; Next Steps</b> Fill worksheet Ten Questions to develop broad research question and "<b>WS 4 – Research Questions</b>" to drive research and interview questions <b>Teams prepare interview questions based on research questions</b></p>

<p><b>Week of Oct 15</b></p>	<p>Teams meet with MacChangers coaches to discuss and finalize topics. We will send out available times to team contacts</p>
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<p><b>Tuesday, Oct 23</b> <b>5:30 – 8:00 pm</b></p>	<p><b>Full Group Meeting #3 <u>Research Methodology</u></b> <b>2.5 hours</b></p>	<p><b>Location</b> <b>BSB 117</b></p>
<p><b>5:30 – 6:30</b></p>	<p><b>Cisco Team Presentation-</b> Daniel (10 mins) <b>Ethics protocols and link to design thinking</b> - Beth (10 mins)</p> <p><b>Primary Research Methodology</b> <b>Dr. Michael Agnew</b> Interviewing Skills- -Rewrite prepared interview questions -Tips for conducting effective interviews- asking follow-up questions (40 mins)</p>	

<b>6:30-7:30</b>	<p><b>Secondary Research Methodology</b>  <b>Dr. James McKinlay – Senior Lead Programs, McMaster Health Forum</b></p> <ul style="list-style-type: none"> <li>● using credible sources</li> <li>● useful resources to share with MacChangers</li> </ul> <p><i>(60 mins)</i>  Follow up: Read at least two articles from the sources James shares with you related to your topic</p>
<b>7:30-8:00</b>	<p><b>Group Brainstorming, practice what learned from speakers</b></p> <p><b>Closure &amp; Next Steps</b>  Problem Statement  Research Questions- Some will be answered through interviews, others will be answered by reading secondary resources.</p>

<b>Tuesday, Nov 6 5:30 – 8:00 pm</b>	<b>Full Group Meeting #4 <u>Speed Interview Session</u> 2.5 hours</b>	<b>Location BSB 117</b>
<b>5:30 -7:55 2 hours</b>	<b>Speed interviewing with subject matter experts</b>	
<b>7:55 – 8:00 5 min</b>	<b>Closure &amp; Next Steps</b> Refine Problem Statement- Understanding the user Bring Data from Interviews to Next Session	

<b>Tuesday, Nov 13 5:30 – 8:00 pm</b>	<b>Full Group Meeting #5 <u>Using Research</u> 2.5 hours</b>	<b>Location BSB 117</b>
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<b>530-6:00</b>	<p><b>Mid Point Presentation Format</b></p> <p>Describe the User. What does the problem look and feel like for the user?          What is the problem? Why we should care?          Fill worksheet “<b>WS 5 – Problem Statement</b>”</p>
<b>6:00 – 7:30</b>	<p><b>Qualitative Data Analysis Workshop</b> Dr. Michael Agnew,          MacPherson Institute Researcher</p> <ul style="list-style-type: none"> <li>- How to code and analyze data collected from interviews</li> </ul> <p>6-6:30 Michael Instruction          6:30-6:45 Teams practice on one paragraph          6:45-7:00 Teams report on their coding</p>
<b>7:00 - 7:30</b>	<p>Work time!</p>
<b>7:30-8-00</b>	<p><b>Teams work together to develop their Mid Point presentations</b></p>

<b>Tuesday, Nov 27th, 5:30 – 8:00 pm</b>	<b>Full Group Meeting #6 - <u>Mid point Presentations</u> 2.5 hours</b>	<b>Location BSB 117</b>
5:30-7:30s	<p><b>Presentation on Users &amp; Problem (5 min Pitch)</b></p> <p>Describe the User. What is the problem? Why we should care?</p> <p><b>Feedback:</b> Each team will receive feedback on their presentation in the form of questions (post-it notes) that MacChangers colleagues pose as a way to develop a strong proposal. No discussions or answering the questions. Teams just listen to the questions posed</p> <p><b>Cisco Teams</b></p>	
<b>7:30 – 8:00 5 min</b>	<b>CityLab Visit</b>	

Winter Term: Solution Validation Phase (From Jan 15 to April 10)

<b>Tuesday, Jan 15 5:30 – 7:00 pm</b>	<b>Full Group Meeting #7 2.5 hours</b>	<b>Location BSB 117</b>
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5:30 pm - 6:30 pm 1 hour	<b>Adding MacChangers to Your Resume LinkedIn and Reflections on Goal Statement</b>
6:30 –6:50pm 30 mins	<b>Logistics:</b> <b>Teams that didn't have one- give us a problem statement</b> <b>Names of people they need to interviews</b> How can we help? Stress that they should be interviewing subject experts

<b>Tuesday, Jan 29</b> 5:30 – 7:00 pm	<b>Full Group Meeting #8</b> 1.5 hours	<b>Location</b> BSB 117
5:30 - 6:30 pm 1 hour	<b>Project Development - Part 5: Brainstorm Solutions</b> Fill worksheet "WS 6 – Brainstorm solutions"  <b>Training: Prototyping</b> <i>MacChangers Staff</i> <i>Activity: Building your own prototype</i>	
6:30 – 6:55 25 min	<b>Project Development – Part7: Understanding Your Solution Ideas</b> <i>Fill worksheet "WS 8 – Understand solution ideas"</i> <i>Prepare questions for mentorship session.</i>	
6:55 – 7:00 5 min	<b>Closure &amp; Next Steps</b>	

<b>Tuesday, Feb 12</b> 5:30 – 7:00 pm	<b>Full Group Meeting #9 - Speed Interviewing Night</b> 1.5 hours	<b>Location</b> BSB 117
5:30 -7 pm 1.5 hours	<b>Speed interviewing night</b>	

<b>Tuesday, Feb 26</b> 5:30 – 7:00 pm	<b>Full Group Meeting #10 - Mid point Presentations</b> 1.5 hours	<b>Location</b> BSB 117
5:30 – 6:30 1 hour	<b>Project Development - Part 8</b> <i>What did you learn from the mentor discussions</i> <i>Fill worksheet "WS 9 – Lessons learned"</i>	

<b>6:30 -7:00</b> 1.5 hours	<b>Presentation on Solution (5 min Pitch) - Groups Present to MacChangers staff in small room off of BSB 117</b>  What is your solution for change? Why?  <b>Feedback:</b> Each team will receive feedback on their presentation in the form of questions (post-it notes) that MacChangers colleagues pose as a way to develop a strong proposal. <b>No discussions or answering the questions. Teams just listen to the questions posed</b>
<b>7:55 – 8:00</b> 5 min	<b>Closure &amp; Next Steps</b>

<b>Tuesday, Mar 5</b> <b>5:30 – 7:00 pm</b>	<b>Full Group Meeting #11</b> <b>1.5 hours</b>	<b>Location</b> <b>BSB 117</b>
<b>5:30 – 6 pm</b> 30 mins	<b>Presentation Skills</b> (on PPT from last school year) <i>Prepare for final PPT &amp; get feedback about program</i> PowerPoint on Drive	
<b>6 pm - 6:30 pm</b> 30 mins	<b>Provide Template and Guidelines for Final Presentation - Standardize all slides</b>  Present ideas and structure of presentation to the MacChangers Coaches. 5 mins per team. - Scott and Rachael will make the schedule	
6:30-6:50 20 mins	<b>Anna Magnota- Final Reflection on Goal Statement and additions to LinkedIn and Resume</b>	

<b>Tuesday, Mar 19</b> <b>5:30 – 7:00 pm</b>	<b>Full Group Meeting #12</b> <b>Pre-Presentation</b>	<b>Location</b> <b>BSB 117</b>
<b>5:30 – 7 pm</b> 1.5 hours	<b>Teams present a rough outline of their presentation:</b> <ul style="list-style-type: none"> <li>● <b>Problem</b></li> <li>● <b>Solution</b></li> <li>● <b>Challenges/Moving Forward</b></li> </ul>	

<b><u>Projects Showcase</u></b>  <b>April 10th, 2019   10:30am-3:00pm   Hamilton City Hall</b>
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