



GENDER AND DIVERSITY IN IGEN PARTICIPATION

A 10-YEAR LONG LONGITUDINAL STUDY ON THE
JOURNEY OF STUDENT IGEN PARTICIPANTS





IGEM DIVERSITY

The International Genetically Engineered Machines (iGEM) competition is an international student based competition in the field of synthetic biology. **Synthetic biology** uses engineering tools to modify living organisms and produce new innovations that can help our lives. Such innovations can be used to better produce insulin using bioreactors, generate new fabric materials, build biological sensors that tell us about harmful contaminants in the world and many more applications. iGEM has been around since 2006 and boasts hundreds of teams a year that compete on a global stage for the teams around the world. Alberta first engaged in the competition in 2008 and since then has had teams that yearly compete in the competition at the high school and collegiate levels.

Often considered the “science olympics” of youth synthetic biology, iGEM is an incredibly unique opportunity for students to engage in the cutting edge field of synthetic biology at a young age. Students go through a collaborative science based development project that is focused on team youth led innovation, and often identify novel types of products and solutions, some of which have led to the formation of start-up companies, new patents, and significant publications throughout the field.

In the last decade iGEM has looked at the impacts of participation based on gender and various diversity metrics and has shown leadership in creating pathways for conversation and growth in equity, inclusion and gender diversity. While female representation is under parity in iGEM there have been numerous studies and actions taken to understand how to increase involvement throughout the world. Alberta teams have been a contributor towards these efforts and have been showcased as an example of excellence when it comes to project work in Diversity and Inclusion (Canmore 2018 team).

Diversity and Inclusion leads to economic and social impacts this has been shown through various lenses from a competition perspective to the impacts we generate in real-life. Creating open and welcoming communities, bringing opportunities to all individuals drives better performance long term for society.

There have been many gender led programs and initiatives to help support female engagement in STEM This study aimed to identify the diversity of the iGEM participants through a longitudinal lens - where were students able to incorporate their work into iGEM and where did they end up going.

Data Taken From: 2020.igem.org/Diversity

HIGHER DIVERSITY DRIVES YOUTH RESULTS IN COMPETITION AND INNOVATION

Overall, 757 students were identified as being part of 76 Alberta-based iGEM projects from 2007-2022 of which 440 individuals were surveyed and 162 responses, or 21%, were collected. Critically important is that each of the 76 biotechnology projects were represented by team members who participated in the full survey. Participants ranged from a wide background and all Alberta iGEM teams were represented. The survey probed into attributes of the iGEM experience, and the respondent's journey from student to professional, and critically, determining the impact that iGEM and geekStarter (Tech Futures Challenge) had on the participants post-secondary, career and/or innovation journey. Respondents were asked questions about their experiences in Alberta's innovation ecosystem, the competition and provided information on diversity and inclusion. This is what we learned:



40% OF RESPONDENTS CONTINUE TO USE THEIR BIOLOGY SKILLS IN THEIR JOBS TODAY



1-IN-5 RESPONDENTS (20%) HAVE STARTED A COMPANY

AND

1-IN-3 (36%) OF RESPONDENTS HAVE COMMERCIALIZED A TECHNOLOGY



45% FEMALE, 14% LGBTQIA+, AND 40% IDENTIFIED AS A RACIAL MINORITY



96% OF RESPONDENTS AGREED OR STRONGLY AGREED THAT IGEM MADE A POSITIVE IMPACT ON THEIR CAREER



AFTER RESPONDENTS' IGEM EXPERIENCE, 91% REMAINED IN THE CANADIAN ECONOMY, WITH 79% STAYING IN ALBERTA

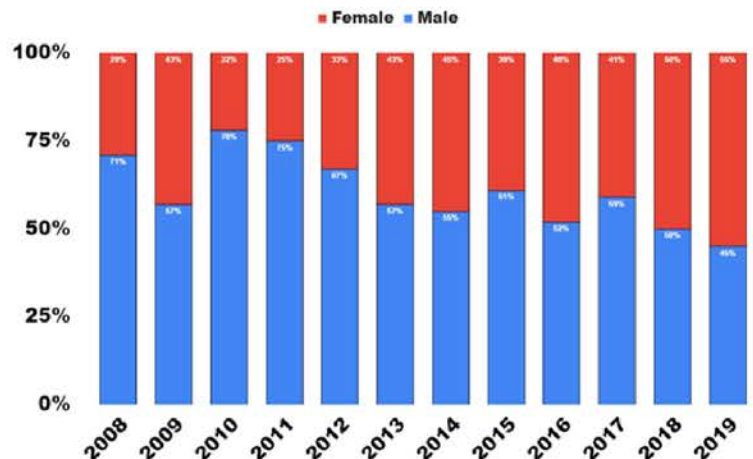
WHO ARE THE PARTICIPANTS?

WHO

Respondents are a diverse group. 40% of respondents identified with a racial identity outside of "Caucasian". LGBTQIA+ representation included 14% of respondents and the male/female ratio was 51:45%, respectively. All respondents were part of iGEM teams and received programming, funding, mentorship and skill support from geekStarter (Tech Futures Challenge) MindFuel programs. **This diversity is significantly higher compared to the national average in particular for female innovators.**

Female team involvement has grown substantially since 2008.

Using our respondents as an average participation over time there was a marked increase in female participation in iGEM teams from 2009 - 2019 in fact 2019 had a higher number of female participants than male on the iGEM team (55%). Female participation increased in Alberta based teams likely do to separate initiatives that drive participation



WHAT HELPED FEMALE STUDENTS ACHIEVE SUCCESS

31% OF FEMALE RESPONDENTS AGREED MENTORSHIP WAS KEY

Male and Female groups showed a significant difference in their iGEM experience based on the responses. While most saw the iGEM experience as a powerful motivator and experience in their career's trajectory there were differences in what motivated the groups. **When asked how important mentorship was with judges during their iGEM experience 31% of female respondents identified this as impactful or strongly impactful while only 19% of male respondents chose the same.** This trend was also true for mentorship from advisors where 78% of female respondents felt this was impactful or strongly impact while only 67% selected the same. This may suggest that mentorship has a more dramatic impact on female participants in the iGEM competition.

AFTER IGEM - COMMERCIALIZATION PARTICIPATION



APPROXIMATELY 1-IN-3 OF THOSE WHO COMMERCIALIZE TECHNOLOGY ARE FEMALE, MUCH HIGHER THAN FEMALE INNOVATORS IDENTIFIED BY THE CANADIAN INTELLECTUAL PROPERTY OFFICE AND SIMILAR TO DATA FROM WIPO.

We found that **22% of all female respondents (representing a third of all responses)** have been involved in commercializing a technology compared to 48% of those who are male. As a guiding benchmark, nationally, 17% of women have started a company, although this is only a guideline and not direct comparison. While female rates of commercialization are higher in Alberta than the national average, there still exists a significant gender gap.

GENDER SCHOLASTICS AND CAREER



23% of Female Respondents entered Education and 9% entered the Technology space



60% of female respondents received 4+ scholarships versus 47% of male respondents.

When the careers of male versus female students were compared most industries were represented in equal proportion. Two particular industries stood out for differences. Male respondents were largely represented in technology while female respondents were largely represented in education.

48% of female and 35% of male participants entered graduate school (MSc / PhD) and either transitioned into higher studies, professional schools or a career. Female respondents received a high number of scholarships and noted a slightly higher agreement that Mindfuel helped them in receiving these scholarships

LETS PUT IT IN CONTEXT

The inaugural State of Youth Report (2021) undertaken by Canada reveals significant areas of opportunity, both self-identified by youth and through expert recommendation, including highlighting Innovation, Skills and Learning as a priority area for youth investment and policy. Notable, are the recommendations for investment in entrepreneurship and innovation fellowships, work integrated learning opportunities, and in the development of a skills building strategy.

Moreover, the pandemic has accelerated a shift to digital technologies, platforms, and learning environments that are unlikely to be reversed. Equipping young people with the tools of innovation and skills in this new and emerging environment will give them the foundation they need to succeed, whether as entrepreneurs, innovators, or professionals. Investment in these critical areas lays the foundation for youth across Canada to build an innovation mindset, acquire new skills, and even translate this into economic growth from a young age. The partners in this study believe, based on over 10 years of youth innovation programming, that these investments are critical to building a diversified pipeline of innovation talent. This, as we've demonstrated through impact assessments, results in two critical outcomes:

1. increased interest in STEM innovation post-secondary pathways, and
2. entrepreneurship in STEM

This study focuses primarily on youth talent development in Alberta over the last 10+ years, however, based on successful programming expansion to Yukon, British Columbia and Ontario, it is clear that this validated youth innovation model adapts to other geographies within Canada. Through continued academic, public agency and private investments, Canada will become a place for innovators to generate growth opportunities. However, we must continue to invest in early-stage development of innovators through programming with various attributes such as youth programs that focus on engaging diversified talent, critical skills training, building mentorship networks, and having access to project funding.

MindFuel, formerly Science Alberta Foundation, a national organization dedicated to youth innovation, has set a critical goal of enabling innovators across Canada to achieve such outputs and recognizes the imperative nature of preparing our youth innovation talent pipeline for the future. Public agencies and not-for-profits, such as MindFuel and Genome Alberta have been running programming which has made significant investments towards this end. And, for over a decade, the program has invested into high school and post-graduate youth interested in building novel biotechnology products and ideas, taking them to large international audiences through the International Genetically Engineered Machines (iGEM) competition and providing one-of-a-kind training support to setup these youth for success. To date, prior to this study, no longitudinal analysis has focused on gathering comprehensive insights connecting youth skills training, mentor network support, project funding support, under the lens of economic outputs and social progress.

This study will aim to create a thesis for why continued and increased investment in programming such as the Technology Future Challenge and strategic youth innovation supports will be critical to ensuring Alberta, and Canada, continue to increase its innovation capital, bringing economic advantage into the future.

WE LEARNED....

- Female participation amongst iGEM teams has increased in the last decade likely due to the diversity of programs available for STEM youth.
- Female participants in iGEM showed the strong impact to mentorship in the program compared to male respondents
- Female participants did not enter commercialization or innovation ecosystems to the same degree to their male counterparts however, more female representation than average is reported.
- Scholastic achievement was high amongst female participants
- There is fair and equitable representation and program participation among female/male/non-binary; LBGTQ+; and racialized minorities. These economic and social progress results positively impact Alberta and Canada's innovation goals with tangible outcomes.

**WHEN WE MAKE INVESTMENTS INTO
CANADIAN YOUTH INNOVATION PROGRAMS
WE SEE KEY **INNOVATORS LEAD THE CHARGE**
IN BUILDING OUR INNOVATION ECOSYSTEM.**

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