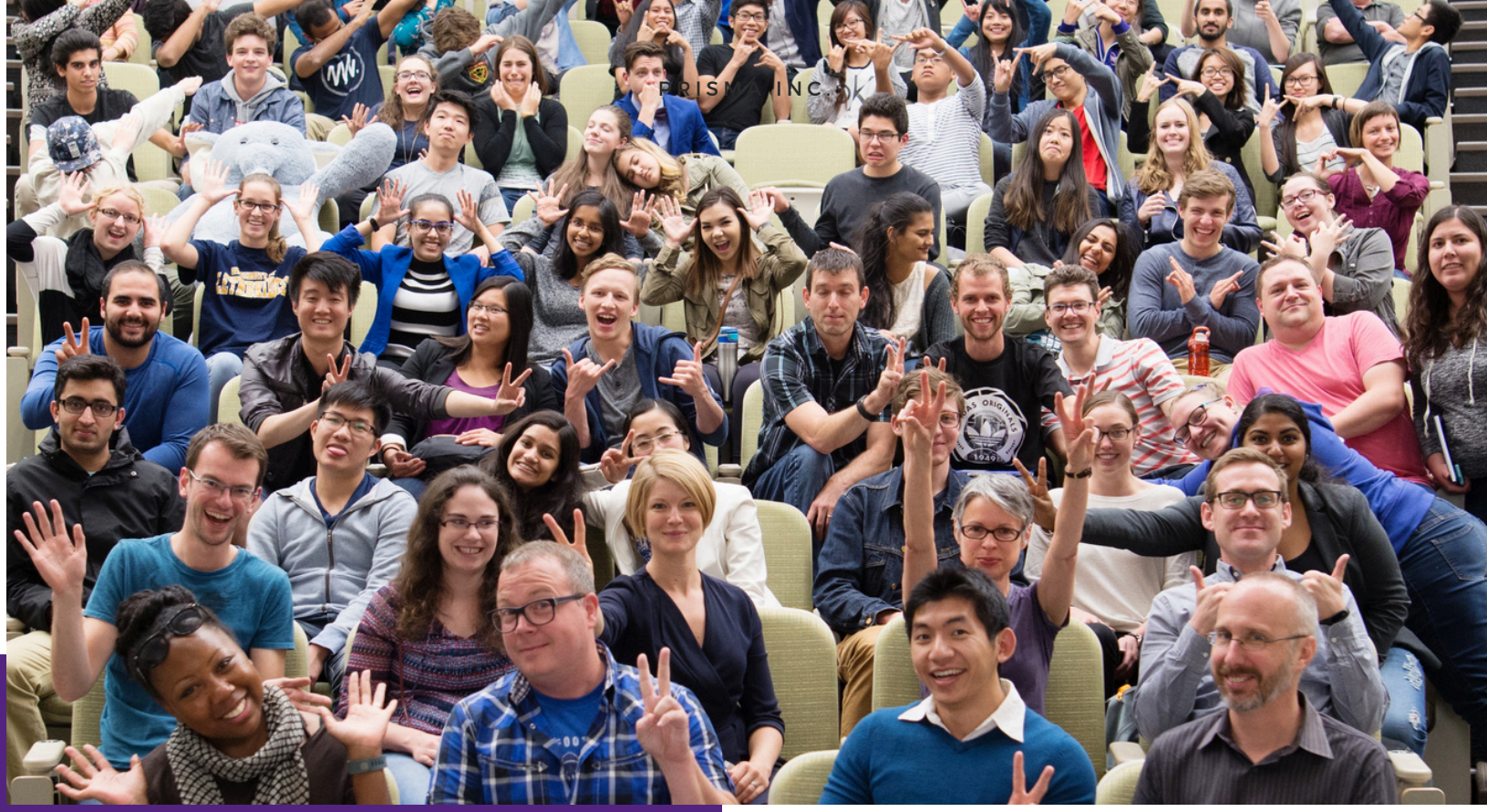
INSIGHTS INTO KEY ELEMENTS OF YOUTH SUCCESS

TRACKING A DECADE LONG ENGAGEMENT IN THE INTERNATIONAL GENETICALLY ENGINEERED MACHINES (IGEM) COMPETITION TEAM IN THE ALBERTA ECOSYSTEM

Mindfuel

Publication Date: May 2024



WHAT IS IGEM?

The International Genetically Engineered Machines (iGEM) competition is a student based international 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 use collaborative science based development to develop 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.

The competition highly focuses on science based communication and marketing where student teams need to produce posters, a website, and presentation to a wide variety of professionals across the field of biotechnology. This makes iGEM a unique offering to students engaging in innovation training and science based academic pursuits.

WHY THIS STUDY?

Alberta has always "punched" above its weight in the iGEM arena. For instance, in 2012 there were over 350 teams that competed across the globe including youth from major Ivey League institutions, and Alberta secured more awards than any other geography. These iGEM Alberta youth have gone on to engage highly in Alberta and Canada's innovation ecosystem demonstrating that iGEM can be a critical link to building an innovation ecosystem.

With these impressive outcomes this study aimed to understand what impact the iGEM experience had on youth innovators. There has never been a formal study to identify the impacts the competition has had on youth.

Organizations such as MindFuel have made significant investments through programs such as geekStarter and Tech Futures Challenge to supply high school and collegiate students with financial tools, advisory services and support mechanisms to build competencies and compete on the international stage of deep technology competitions. Why and how did iGEM make an impact and why can continued investments into this type of programming dramatically impact Alberta youth?

INVESTING IN ALBERTA SCIENCE-BASED COMPETITIONS LEADS TO REAL RESULTS

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 and through this we learned:

76 UNIQUE PROJECTS HAVE BEEN ENTERED INTO THE IGEM COMPETITION FROM VARIOUS ALBERTA INSTITUTIONS

OVER 750 ALBERTA STUDENTS HAVE COMPETED IN THE IGEM COMPETITION

46% OF ALL PROJECTS RECEIVED A GOLD METAL ACCMODATION AND >80% RECEIVED AT LEAST ONE AWARD

ALBERTA IGEM TEAMS AND THEIR PROJECTS HAVE BEEN A GRAND FINALIST OR WINNER OF TEH COMPETITION 7 TIMES AND THESE PROEJCTS HAVE GONE ON TO CREATE BUSINESSES IN OUR ECONOMY

86% OF RESPONDENTS AGREED THAT IGEM PARTICIPATION SUPPORTED TEHIR FUTURE CAREERS

THE RESULTS

76 ***Real-world High Impact Projects***
have been produced by iGEM teams

757 **Alberta Students**
(High School & Post-Secondary)
have competed in the competition

We identified all Alberta-based iGEM projects from 2007 - 2022 and found an impress 76 real-world projects were submitted to the competition and over 750 students were registered on Alberta based teams coming from various institutions.

Alberta iGEM Teams Have Won Many MEDALS

46%

18%

22%

84% OF IGEM TEAMS HAVE RECEIVED MEDALS, THE HIGHEST OF WHICH HAVE RANKED GOLD

iGEM uses medals to rank the "completeness" of an iGEM project by requiring projects to adhere to particular criteria. The more complete a project team the higher their ranking

Alberta iGEM Teams Received Numerous AWARDS

61 TRACKS

- *Medical*
- *Environmental*
- *Food*

ALBERTA IGEM TEAMS HAVE BEEN NOMINATED OR WON 61 AWARDS IN THE TRACKS AND CATEGORY SECTIONS

iGEM tracks and categories determine the overall ranking of a set of projects in the particular category. These range from industrial themes such as "Medical" and "Environmental" to elements of a project such as "Best Foundational Advance" or "Presentation"

Alberta iGEM Teams Have Won It ALL

7X

Seven iGEM teams have been ranked top 6 projects of the competition *on an average of ~300 teams per year winning out against schools from various institutions including Ivey League Schools such as Harvard, Stanford and others.*

WHY DOES PARTICIPATION MATTER?

79% OF RESPONDENTS AGREED THAT BEING PART OF AN IGEM TEAM HELPED THEM PREPARE FOR THEIR PROFESSION

- **Skill Building** - Opportunities to learn new skills translated into their career whether technical or other. Many spoke about the skills in team building, networking and presentation as invaluable.
- **Inspiring a Career** - Several respondents talked about how their time at iGEM inspired their future direction in synthetic biology or research. Some talked about using their iGEM experience as a springboard to start a company.
- **Career Change** - Even some who saw iGEM as a less than ideal career opportunity talked about how the experience helped them to better understand a new career path in a different area.

86% OF RESPONDENTS TALKED ABOUT HOW IGEM PARTICIPATION SUPPORTED THEIR FUTURE CAREERS.

- **Respondents agreed** these specific areas of support made a difference: Their Team (85%), the iGEM Competition (80%) and Mentorship from Advisors (78%)
- **Project Funding Support** - was critical in achieving this success with **74% of respondents** agreeing that project funding was a major part of what allowed for their achieved success in iGEM.
- **geekStarter/Tech Futures Challenge** - **73% of respondents** agreed that support programs like geekStarter/TFC were critical in achieving the outcomes.

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

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.

www.mindfuel.ca

ACKNOWLEDGEMENTS

- Program alumni dataset provided by: **The MindFuel Foundation**
- With thanks to Longitudinal Impact Study Partner: **Genome Alberta**
- With special thanks - Study made possible through funding provided by **ATB Financial**
- White Paper Development and Drafting - **DCL Consulting**

MindFuel