Compute Ontario

Interactive
Workshop Series

Toronto • London

February 2020

DEVELOPING & PROMOTING ONTARIO'S HIGHLY QUALIFIED TALENT IN THE TECHNOLOGY SECTOR

EXECUTIVE SUMMARY

Traditionally known as “highly qualified personnel” or “HQP,” this talent pool of individuals is viewed as the **highly skilled technology workforce** who possess foundational skills in computational modelling and technological applications within a specific domain knowledge area. Domain knowledge areas can span from the hard sciences, such as engineering, chemistry, biochemistry and physics, to non-traditional knowledge areas such as the social sciences and humanities.

The purpose of hosting these interactive workshops in Toronto and London was to discover and redefine what this talent pool represents in today’s time by gathering insights from key representatives and experts within academia, industry, public and private sector as well as participants from the talent pool itself. With renowned leaders in the innovation talent development space as keynote speakers, informal and intimate panel conversations, as well as audience participation in group activities, these workshops allowed the opportunity to further Compute Ontario’s efforts in attracting, retaining and developing the highly qualified talent pool within the provincial ecosystem.

Bridging the gap: By identifying the technical skills currently in demand in industry and comparing them to those being developed in undergraduate and postgraduate programs, a gap analysis was performed to identify the areas that need to be addressed in both academia and industry when it comes to skills development.

Redefining the talent pool: Thinking present-day, participants were also asked to revisit the traditional definition of “HQP” and think of key pieces of information or aspects that are missing and should be addressed so that it is more inclusive of other domain knowledge areas, the business or professional skills required and should include the working technology workforce as well.

Enhancing the soft skills: In addition to the technical skills, the importance of soft skills, such as teamwork and communication, was also explored by identifying ways these can be further developed in the classroom and better exercised in the real world when making professional transitions. .

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Background: Compute Ontario's work in developing and supporting high qualified personnel (HQP) in Ontario

Compute Ontario has been a convenor and facilitator for providing access to advanced research computing (ARC) resources to HQP within the province. Managing, storing, analyzing and computing big data and large datasets in the 21st century has become the ultimate goal in a wide variety of research fields. Computational resources have become a necessity to crunch, analyze, simulate and visualize data at a speed that can keep up with the rate at which data is being generated. Attracting and developing the right talent to effectively use ARC resources and seek out the skilled individuals who can further support this talent pool is the main goal for Compute Ontario.

In addition to providing access to ARC resources, Compute Ontario has supported many HQP initiatives across the province, such as annual summer schools on scientific and high performance computing (HPC) as well as provincial-level hackathons. As well, Compute Ontario commissioned two deep-dive studies that further explored HQP skills, occupations and demographics to provide a comprehensive overview of the HQP ecosystem and where it is headed. The following summarizes the report findings.

[1]The Malatest Report
Highly Qualified Personnel Study

- Produced in April 2018, the Malatest report provides a deep-dive into understanding the number of HQP in Ontario as well as their demographics, educational backgrounds and skills gap.
- The study examined challenges in academia and the private sector when it comes to developing and attracting HQP that would directly benefit the economic output for Ontario.
- The study identified six foundational skills for HQP: Computational thinking skills, computing technical skills, domain-specific skills, integration skills, organizational skills, teamwork and communication skills.
- A total of 12 recommendations were provided that would help Compute Ontario support the HQP population in the province.

[1] *Highly Qualified Personnel Study, R. A. Malatest & Associates Ltd., April 2018*

[2]The Brookfield Institute Report
Who are Ontario's Highly Qualified Personnel?

- Produced in August 2019 and building on Compute Ontario's existing efforts in HQP, the Brookfield report explored various aspects of the Canadian tech worker population by zeroing in on the HQP setor as a subset population with very specific technical skills and occupations.

- The report aimed to define HQP with specifics around domain knowledge and digital skills and utilized various occupational databases to classify the definition.

- The study compared HQP to tech workers broadly in terms of education, industry, income, occupation cities as well as the gender pay gap, gender participation and pay for visible minorities.

- Recommendations for Compute Ontario included: focus efforts on expanding the use of ARC in other disciplines; create more traction and increase equity and access to opportunities for underserved groups outside key city centres; and foster greater diversity by highlighting the importance of it in HQP.

[2] *Who are Ontario's Highly Qualified Personnel?, Brookfield Institute for Innovation & Entrepreneurship, August 2019*

The Workshop Series
Toronto & London - February 2020

Two interactive workshops were held in Toronto (February 20, 2020 at the Chestnut Conference Centre, U of T) and London (February 28, 2020 at the Ivey Spencer Leadership Centre, UWO) with representation from academia, industry, public and private sector as well as participants from the talent pool itself. With renowned keynote speakers setting the stage, the audience had the opportunity to engage in informal conversation, raise issues and concerns they have encountered in their field of work as well as interactively participate in group activities where they were able to share and record their thoughts and feelings amongst other peers. Participants were quite excited to share their perspectives and learn more from their peers. The intimate setting allowed for views to be exchanged at a conversational level.

2 WORKSHOPS
SECTORS REPRESENTED

~ 75 PARTICIPANTS

> 8

The Audience Activity Component of the Workshops

The audience activity portion of the workshop was focused on answering some key questions that will help establish a plan of action for attracting, developing and promoting highly qualified talent in the technology workforce in Ontario.

The activity was designed in a way to encourage knowledge translation and networking amongst the participants. Groups of 5-6 individuals gathered at each of the four flipchart stations where specific questions were presented by the facilitator. As the group discussed and shared their thoughts, the facilitator captured their input on the flipchart. After a few minutes, each group moved onto the next flipchart station, where they evaluated the previous group's answers and shared their own perspectives by adding new information to the answer already captured.

The information gathered through the audience activity was then summarized as a key output of the workshop with the findings presented in this report.

TORONTO - Keynote Address

Arvind Gupta; *Professor, Department of Computer Science, University of Toronto*

Arvind Gupta provided a thorough and thought-provoking insight into new and novel university programs that are breaking down barriers between academia and industry. The focus of these programs is to develop and equip tomorrow's technology leaders that take a leap forward in innovation within the Canadian landscape. These programs have students focusing on advanced graduate courses in the latest realms of technology complemented with company-sponsored challenges that result in interactive research projects and academia-industry partnerships. With this curriculum model, the students take on a more interdisciplinary approach in understanding concepts such as advanced systems and cybersecurity. With skill-based integration, such programs attract talent from around the world hence many applications are received from international students as well, considering Canada has the highest per capita immigration rate globally. Lastly, such programs also proactively incorporate business skills (or professional skills) into the curriculum to make the students more relevant to the technology sector thus producing technical people with business skills who can seamlessly transition into the real world.

“72% of net jobs are created by the 5% fastest growing subject matter experts or companies”

~ Arvind Gupta

TORONTO - Interactive Panel Discussion

- **Arvind Gupta;** *Professor, Department of Computer Science, University of Toronto (Panel Moderator)*
- **Edward Shim;** *Managing Director, Studio 1 Labs*
- **Melissa Judd;** *Director, Academic Partnerships, Vector Institute*
- **Ramses van Zon;** *HPC Analyst, SciNet & Lecturer, Department of Physics, University of Toronto*

Based on the interactive panel discussion, panelists identified the following four skills to be vital in today's technology sector:

Team Building Skills / Communication Skills / Presentation Skills / Time Management Skills

➔ Although these skills are difficult to develop and assess in large classroom settings and are still viewed as "nice-to-haves" instead of "must-haves", they are vital to have when it comes to effective knowledge transfer and building relationships across different disciplines and expertise backgrounds.

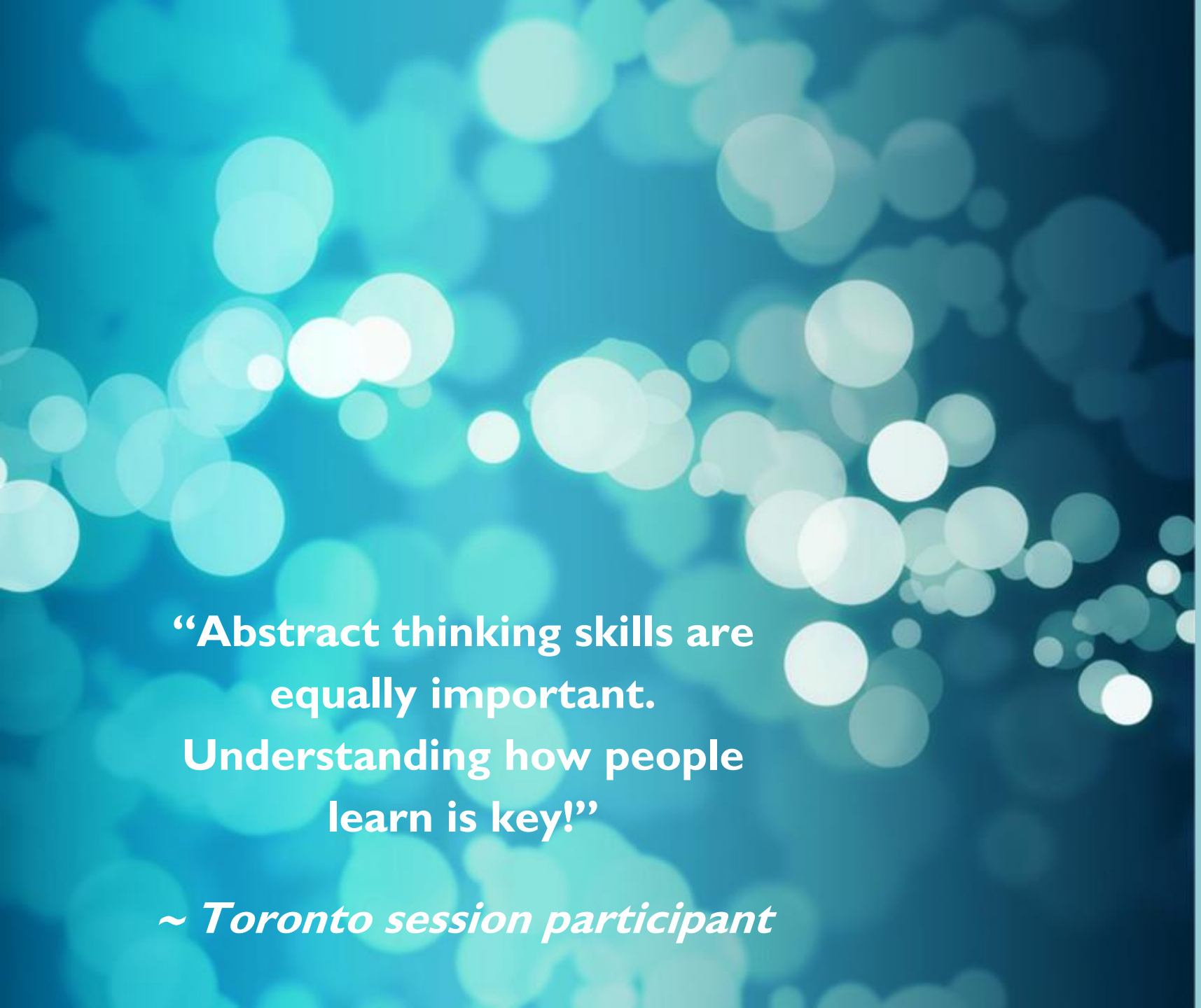
➔ Currently, there is too much focus on knowledge-specific areas in curriculums. There is a strong need and demand for all-inclusive training for students when it comes to developing professional skills in order to facilitate their transition into the real world and refine them to be more eligible job candidates.

➔ The government is also focused on funding the world of computer science and computational modelling however, more of this money should go toward updating and revising current programs with a professional skills component that is more application-based. A shift in culture is definitely required.

➔ With growing concern and interest in ethics and policy when it comes to compute science and AI, having the soft skills would help better understand these sensitivities and issues so that trust and innovation can be balanced and more informed policy decisions can be made.

In addition to identifying the top skills in demand, the Toronto panel also elaborated on the following four key points when it comes funding programs, skills gaps, how the landscape is already changing and adapting and how can the tech workers already in the industry can also be included.

More funding is needed to develop courses and programs that include the development of professional skills We need to better fund the training layer or "data layer" in order to enable better research which can facilitate innovative discoveries and more disruption. There are many well-funded, massive graduate programs that train a select few students but this does not address the problem at large. When developing programs, industry skill development should be incorporated into the curriculum as a real-life application component in the form of co-op opportunities and community-based projects.	**Skills gaps exist in both academia and industry** Institutes need to respond to industry changes more quickly so that the highly qualified talent pool is able to acquire industry skills more quickly. In academia, the skills gap comes from courses that are tailored to the individual discipline since most courses are not designed or structured with an interdisciplinary approach where a wider spectrum of skills can be developed. In industry, the skills gap comes from job profiles focused on years of experience and the "soft skills". There needs to be a more holistic approach from both ends.
What is changing right now? Not all students are in technology-oriented programs - many do come from interdisciplinary programs (e..g culture, communicate and technology) to pursue computer science courses as well. However, instructors are not trained or equipped with the appropriate tools and techniques to teach courses in an all-encompassing way. Hence new delivery mechanisms along with reskilling and upskilling of teaching staff is highly recommended.	**What about the tech workers already working in industry?** We are seeing an increase in AI talent as more and more universities are incorporating AI into their graduate curriculum. New AI opportunities are emerging quickly and companies are still trying to figure out what to do with them or even keep up with them. As well, more professional development opportunities must be created for the tech workforce in order to keep them relevant, competitive and encourage them to further their knowledge base. Larger companies that are beginning to partner with smaller companies, such as start-ups, are providing greater exposure to novel technologies, different markets, agile processes and more diverse cultures.



"Abstract thinking skills are equally important. Understanding how people learn is key!"

~ Toronto session participant

"Abstraction that generates creativity is what helps build something that is agile"

~ Toronto session panelist

TORONTO - Audience Participation & Feedback

The audience was asked to answer the following questions to help further the conversation on how to address the skills gap between academia and industry, incorporate and enhance the soft skills as well as redefine the talent pool in a way that is more all-encompassing with respect to skills, expertise and real-world applications.

- **A multidisciplinary explanation** is needed in terms of domain knowledge areas and application of technical skills in various sectors so that the definition is more inclusive and integrative
- **Some keywords** that should be included: digital fluency, innovation and reinvention with less focus on advanced research computing (ARC)
- **Soft (and transferrable) skills** that should be included: Communication, leadership, adaptability, agility and nimbleness

What do you think is the ideal definition of highly qualified talent? What key piece of information or aspect should be captured?

- **Lack of funding and support:** For developing programs that ensure skills being taught are relevant and in demand; incorporating industry research; funding and support from the government
- **Tech workforce:** Emphasis on upskilling and reskilling/retraining is missing; low risk tolerance when it comes to developing and applying new skills in the workforce
- **Demographic-related limitations:** Gaps in access to opportunities for underrepresented and marginalized groups; cost and standard of living when moving to metropolitan areas for jobs; geographical limitations in attracting talent and creating opportunities in rural regions

In your opinion, what is the biggest strategic obstacle facing the highly qualified talent pool in Ontario?

TORONTO - Audience Participation & Feedback

- **Analytical and architecture skills:** Programming language, quantum physics & computing, machine learning, data science & analytics, cybersecurity and statistics
- **Translational skills:** Ability to understand the technology landscape, changing requirements, need for commercialization; understand "differential technology need" versus the "problem and finding solutions"
- **Presentation / communication skills:** Ability to simplify complex concepts and present them to various stakeholders

What are the most popular technical skills in demand right now for the technology workforce?

In the classroom:

- Academic staff need to focus on how a successful transition can be made to industry
- Lack of communication when it comes to advertising, highlighting or promoting industry advancements and activities
- Difficult implementing new outreach programs without management support and funding

In job profiles:

- Requirements and terminology are continuously changing
- Tech sector job descriptions have too many specific requirements that students cannot identify with
- Need to describe the role and work in a way that students can decompose, understand and identify with

What is missing in the classroom when it comes to real world job skills? What is missing in job profiles and descriptions?

LONDON - Keynote Address

Hanan Lutfiyya; *Professor & Chair, Department of Computer Science, University of Western Ontario (UWO)*

Hanan Lutfiyya shared various insights and perspectives into educating computer science students in other disciplines as well as supporting students in digital humanities, engineering and medical health informatics. Many of the fourth year courses provide opportunities to collaborate with other departments, thus allowing for interdisciplinary learnings. Many new jobs nowadays focus more on an interdisciplinary approach, as opposed to a hard science background. Such jobs include digital marketing and social media, video content editing and search engine optimization, multimedia communications, all with respect to demographics and social biases. In the last 10 years, the number and types of opportunities have exploded with increasing amount of data. However, there is insufficient talent that can effectively work with new and emerging technologies (such as data protection methods, cloud computing and architecture, etc.) hence universities need to develop and implement newer delivery mechanisms to create more awareness on this front. Computer science now includes data management and storage, open-source analytical software tools, and AI and machine learning to analyze and understand big datasets. Many of these techniques have become mainstream in the last 2-5 years. The highly qualified talent pool needs to stay relevant with these techniques hence it is vital to develop courses at the integrative graduate level. Nowadays, many continuing education courses and professional programs allow obtaining "micro-credentials" which recognize the core competencies needed for understanding such novel techniques.

“Technology evolves very quickly so maintaining and upgrading skills to stay relevant and applicable is very important”

~ Hanan Lutfiyya

LONDON - Interactive Panel Discussion

- **Baolai Ge;** *HPC Consultant and HPC Summer School Lead, SHARCNET*
- **Hanan Lutfiyya;** *Professor & Chair, Department of Computer Science, UWO*
- **Jennifer Maclean;** *Director, Collaboration, NGen Canada*
- **Kimberley Adamek;** *Ph.D. candidate, Department of Civil & Environmental Engineering, UWO*
- **Nizar Ladak;** *President & CEO, Compute Ontario (Panel Moderator)*
- **Warren Helland;** *Vice President, DataFix*

Promoting more women in the highly qualified talent pool Traditionally, due to cultural norms, women have had to focus on raising families while focusing on career development at the same time. The highly qualified talent pool saw a 5% increase in men participation compared as opposed to only 3% in women. Hence creating a more equitable workforce (i.e. gender balance) has become human capital goals for many organizations. Certain aspects such as better access to childcare and post-maternity work engagement has become more attached to the company culture nowadays. Many organizations are incorporating these aspects into their employee retention policies.	**How can we tap into resources in underserviced areas such as rural communities in Ontario?** There is a whole resource pool outside of the Southern Ontario corridor. Hiring individuals closer to their local colleges and universities, for example, would help retain talent and enable community advancement. The government needs to encourage industry to tap into this resource pool as well. Industry can also encourage and engage such talent by enabling virtual team environments where remote access and networking is readily available. For example, SHARCNET in the London area has adopted the model of creating smaller centres of work in different areas to tap into isolated resource pockets.
The millennial generation does not have enough incentives to take on internships - how can we change this? Need to have more cross-functional communication in an interdisciplinary environment. This approach is necessary at the classroom level so students are able to adapt quickly and respond to their work environment when then first enter the real world. Young students understand social media but not the underlying technology on how these platforms operate when it comes to analytics, architecture and cybersecurity.	**Can virtual communication limit developing the soft skills?** Key soft skills, such as teamwork, collaboration and communication, can still be developed through a virtual environment. It seems to work effectively with the younger workforce as they are already pretty tech savvy. As well, team members are able to reach out to the broader team to make more informed decisions with real-time input and address issues and concerns as they arise. Virtual teams has become a mainstream form of communication for many organizations nowadays and will continue grow with time.

“Understanding how people from different disciplines interpret information is really exciting and frustrating at the same time”

~ London session panelist

LONDON - Audience Participation & Feedback

The audience was asked to answer the following questions to help further the conversation on how to address the skills gap between academia and industry, incorporate and enhance the soft skills as well as redefine the talent pool in a way that is more all-encompassing with respect to skills, expertise and real-world applications.

- **Technical aspects:** Requirements around fundamental training, technical knowledge, digital thinking, data analysis, advanced research computing and computational understanding
- **Real-life application and adaptability** when it comes to: market globalization, data society, data security and understanding the cyber landscape
- **Soft skills that are essential:** Communication, adaptability, sense and recognition of changing environments, digital understanding and technology translation

What do you think is the ideal definition of highly qualified talent? What key piece of information or aspect should be captured?

- **Lack of alignment between industry and academia** when it comes to: Transitioning students; co-op and internship opportunities in the tech sector in general; no economic incentive for students or most industry partners to enable co-op opportunities that help establish successful academia-industry partnerships
- **Lack of funding and support** from the government since provincial funding is based on placement instead of enrollment
- **Lack of interdisciplinary learning** since current classroom techniques do not expose students to branch out and think of ideas outside of the box

In your opinion, what is the biggest strategic obstacle facing the highly qualified talent pool in Ontario?

LONDON - Audience Participation & Feedback

- **Computational:** Programming, modelling, AI, machine learning, data/code hygiene, statistical expertise, analyzing big data
- **Data:** Cybersecurity, data privacy and blockchain, systems awareness, real-time data streaming and management, digital ethics, scientific/technical writing
- **Cloud-based:** Cloud computing, working with commercial cloud products, database management, data analytics, IoT and embedded technology, workflow automation

What are the most popular technical skills in demand right now for the technology workforce?

In the classroom:

- No awareness of public policy and role of tech in society, ethics and equity
- Not enough academia-industry partnerships allowing for mentorship/internship programs
- Need to focus on techniques that develop critical thinking, problem solving and other key soft skills

In job profiles:

- Need more interactive onboarding processes
- Job descriptions should be more realistic in terms of describing the work, application of skills, leadership opportunities, communication channels, virtual team environments, etc.
- Encourage candidates outside of STEM to apply to positions

What is missing in the classroom when it comes to real world job skills? What is missing in job profiles and descriptions?

The "Take-Home" Message
What we Learned

These workshops provided an open and intimate platform to identify and discuss the key hurdles in advancing the highly qualified talent pool as well as discover ways in which these hurdles can be overcome with respect to current trends and changing economic landscapes. The key "takeaways" include:

- In order to bridge the gap between industry and academia, an interdisciplinary approach must be taken to foster more academia-industry partnerships, endorse cross-functional communication and adopt a skill-based methodology in the classroom
- More funding and support is needed to enable skill-based training and teaching diversity in universities and colleges so that the teaching staff can be trained with new delivery mechanisms
- More professional development opportunities and resources need to be created and provided to the current tech workforce so that they stay relevant and competitive in the market through reskilling and upskilling
- Need to implement and promote virtual team environments and remote networking so that there is more outreach and attraction to tech talent in rural and underrepresented areas in Ontario

Next Steps

This report will be shared with the Ontario Ministry of Colleges and Universities (MCU) directly to highlight the findings and insights as well as advocate the various suggestions gathered from participants. The key message will emphasize the need for more funding and support to:

- Enable and promote skills-based training for both staff and students
- Create more professional development opportunities and resources for reskilling and upskilling the current technology workforce
- Promote more academia-industry partnerships
- Include and attract tech talent in rural and underrepresented areas in Ontario

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