Digital Journeys:

A Path Towards Digital Economic Empowerment for Indigenous Youths in Canada

Graham Dobbs, Viet Vu | June 2023

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Foreword

In today's rapidly evolving technological landscape, the need for a diverse and inclusive workforce has never been more critical. As we stand at the precipice of a new era of innovation, progress and reconciliation, we must ensure that the voices and talents of all communities are represented and valued. It is with great pride and enthusiasm that we, Alejandro Mayoral Baños, Executive Director, and Shane Young, President of the Board of the Indigenous Friends Association, present this foreword on the importance of Indigenous tech workers in shaping the future of our global society.

The Indigenous community has long been a source of immense knowledge, wisdom, and innovation. From the earliest days of human civilization, Indigenous Peoples have demonstrated an innate ability to adapt and thrive in the face of adversity. Today, as we navigate the complexities of the digital age, it is essential that we recognize and harness the unique skills and perspectives that Indigenous tech workers bring to the table. Indigenous tech workers possess a wealth of knowledge and experience that can greatly benefit the technology industry. With a deep understanding of the land, its resources, and the interconnectedness of all living things, Indigenous Peoples have the potential to drive sustainable and responsible innovation in digital tech. Furthermore, their holistic approach to problem-solving and decision-making can provide valuable insights into the development of new technologies and systems that prioritize the well-being of both people and the planet.

As the technology sector continues to grow and evolve, it is crucial that we create opportunities for Indigenous tech workers to contribute their expertise and perspectives. This means not only providing access to education and training but also fostering an inclusive and supportive work environment that values diversity and encourages collaboration. By doing so, we can ensure that the technology industry remains at the forefront of innovation while also promoting social and environmental responsibility.

In our roles as Executive Director and President of the Board of the Indigenous Friends Association, we have had the privilege of witnessing firsthand the incredible potential of Indigenous tech talent. Through our various initiatives and programs, we have seen these talented individuals excel in a wide range of roles, from software development and data analysis to project management and digital marketing. Their success serves as a testament to the immense value that Indigenous tech workers can bring to the technology industry and the broader global community.

As we look to the future, it is our hope that this foreword will serve as a call to action for all stakeholders within the technology sector. We must work together to break down the barriers that have historically excluded Indigenous Peoples from participating in the tech industry and create pathways for their full and meaningful inclusion. This will require ongoing collaboration and commitment from all parties, including government, industry, educational institutions, and non-profit organizations.

Together, we can build a more equitable and inclusive technology sector that not only drives innovation and economic growth but also honours and respects the unique contributions of Indigenous communities. By doing so, we will not only be investing in the future success of the technology industry but also in the well-being and prosperity of Indigenous communities and the world as a whole.

Sincerely,

Alejandro Mayoral Baños
Executive Director & Founder,
Indigenous Friends Association

Shane Young
President of the Board,
Indigenous Friends Association

1

Executive Summary

Access to digital literacy, skills, and employment leaves Indigenous youth behind in an evolving talent landscape in Canada. This executive summary provides an overview of the intersection of Indigenous youth engagement in technology-related employment, and the efforts in providing opportunities and pathways for Indigenous youth in digital and tech-related careers. This work, supported by the Indigenous Friends Association (IFA), aims to support program providers in improving its current offerings. This paper explores technical and digital labour market trends, identifies occupations, skills, and program opportunities, and provides actionable insights on barriers to entry, employment, and skill development in the Indigenous tech labour market.

The report highlights the challenges faced by Indigenous communities in accessing and participating in the technology economy, including physical, social, and economic barriers. It emphasizes the importance of including Indigenous youth in tech-related labour as they constitute Canada's significant and growing population. Indigenous youth face various barriers, including limited access to broadband internet, digital devices, and mentoring, further widening the socioeconomic gaps in Indigenous communities and regions.

The report recommends addressing these challenges and promoting digital inclusion among Indigenous youth.

1. Indigenous youth are employed at half the rate of non-Indigenous youth in professional, scientific, and technical industries relative to all other service sectors. The COVID-19 pandemic exacerbated this gap to rates seen at the end of the Great Recession.

2. Highly specialized digital skills such as coding and programming improve labour equity for Indigenous Peoples, particularly Indigenous women.

3. The need for labour market information (LMI) for Indigenous youth, on-reserve Indigenous communities, and 2SLGBTQIA+ communities continue to exclude adequate support and funding for better access to tech skills, employment opportunities, and professional development.

4. The need for investment in infrastructure and supports systems to support Indigenous youth in technology-related pathways effectively. The recommendations include providing discounted internet packages for Indigenous communities, low-cost digital devices, and supporting local technology service businesses.

5. The report recommends incorporating Indigenous voices and self-determination by funding digital literacy programs that empower Indigenous communities. It highlights the use of a two-eyed seeing approach and critical project-based learning to operationalize this approach.

The report also discusses the in-demand skills and occupations relevant to the IFA programming participants, highlighting the INDIGital and IndigiTECH programs' potential in teaching foundational and relevant skill sets. It recommends a further emphasis on crucial concepts in computer engineering, specialization in specific areas of focus, and formalized wraparound support for program participants.

The authors of this report emphasize the urgent need to address Indigenous youth's barriers to accessing technology-related education and employment opportunities. It calls for a multi-faceted policy approach that improves physical access, provides demand-driven training, and indigenizes training initiatives. By investing in Indigenous youth's tech education and entrepreneurship, Canada can tap into their potential as a valuable source of innovation and contribute to a more inclusive and prosperous future.

2

Introduction

Navigating the digital divide remains a challenging landscape for Indigenous Peoples of Canada[1]. They are often left disconnected from the technology economy by physical, social, and economic barriers. The divide can be deeper for Indigenous youth, relying on public education and family support to bridge this gap. Technology-related skills remain in-demand in a post-pandemic labour market, particularly in modern technology development. These technology-related skills give their holders autonomy and flexibility in deciding what, who, and how they want to work more than in any other occupation. These skills require access to digital devices, web connectivity, and training, and also require strong critical thinking skills, cognitive aptitude, and abstract thinking.

Tech-related tools, skills, and competencies are learned in online, metropolitan, and post-secondary education institutions. Restricted access to broadband internet, computing hardware, and mentoring remains the crux of tech participation among Indigenous youth in Canada. Indigenous youth are among the fastest-growing populations in Canada. Exclusion from tech-related training and career opportunities further widens Indigenous communities' socioeconomic gaps. Supporting the livelihood of Indigenous youth is a critical responsibility of a national equitable growth strategy that cannot be overlooked.

Exclusion from tech-related training and career opportunities further widens Indigenous communities' socioeconomic gaps. Supporting the livelihood of Indigenous youth is a critical responsibility of a national equitable growth strategy that cannot be overlooked.

The intersection of Indigenous youth engagement and technology-related employment is a developing research area in an increasingly digital world of work. In this context, the Indigenous Friends Association (IFA) provides avenues and opportunities for youth to gain a foothold in an expanding world of digital and tech-related careers. The IFA creates pathways for youth previously inaccessible or unattainable in breaking into technology-related work. As mentioned in the foreword, the Indigenous Friends Association (IFA) offers three youth-centred programming courses focused on incorporating Indigenous knowledge, history, and culture into digital media. Alongside their educational programming are digital community-building opportunities, workshops with Indigenous Elders, and mentorships alongside established developers for digital media applications and projects. The Dais at TMU have partnered with the IFA to bring our research experience to explore technical and digital labour market trends in identifying occupations, skills and program opportunities to improve its current offerings.

We also look to provide sound and actionable insights on the status of the Indigenous tech labour market,[2] particularly with regards to barriers to entry, employment, and skills development. This report seeks to support the IFA initiative in providing better avenues in imparting the knowledge, history, and values they possess in creating more equitable outcomes in the digital and technology-intensive labour market. The IFA's two main objectives are to:

1. Develop and deploy safer and better digital and non-digital spaces for Indigenous youth to reconnect with their culture.

2. Develop several skill sets of Indigenous Peoples to become creators of digital technologies.

This report details the trends of Indigenous communities in the technology sector. We define the technology sector as participation in tech-related occupations or industries. This document addresses three major themes:

Barriers: Existing barriers to skills development and career pathing among Indigenous Peoples in Canada.

Outcomes: Current labour market information around Indigenous communities' employment, wages, and skill differentials.

Skills: In-demand skills and occupations that are on the rise in Canada are relevant to the participants of the IFA programming.

Data Sources

The data examined in this report include individuals who self-report their Indigenous identity, live off-reserve and live in a non-institutional setting. It does not offer insight into Indigenous communities living on-reserve lands, living in institutional settings, or those who do not wish to report their identity to public sources. Similarly, the lack of 2SLGBTQIA+ labour market information in Canada poses similar barriers to insight with respect to digital literacy and employment.

It is paramount that data for Indigenous Peoples in Canada requires engagement and establishing principles of data sovereignty. Historically, research and data collection conducted by non-Indigenous stakeholders occurred without consultation, results, or benefits to the communities it states to report on.

Indigenous-led organizations are addressing the issue. Organizations like the First Nations Information Governance Centre (FNIGC) provide training, education, and processes for collecting and disseminating research. The Ownership, Control, Access, and Possession (OCAP) principles also define how information needs to belong within Indigenous communities.

The FNIGC has been collecting data in First Nations communities for over 20 years, built on the data sovereignty principle provided by OCAP principles. This approach is at the core of their data collection and is considered the premier source for communities living on-reserve and remotely across Canada. The First Nations Regional Early Childhood, Education and Employment Survey began in 2013 and was designed under OCAP principles and employs these in its data design and methodology.

There are three primary public sources for labour market data about Indigenous Peoples in Canada, all from Statistics Canada: the Labour Force Survey (LFS), the Indigenous Peoples Survey (IPS), and the Canadian Census of Population.

The LFS and IPS only collect data on those living off-reserve, which means less than half of all Indigenous Peoples participating in the survey frame. The census is the only public source of on-reserve labour market information (LMI) for Indigenous Peoples.

3 Barriers: Existing works on barriers to skill development and career pathing

Overview of Indigenous Peoples in Canada

In 2021, approximately 5 percent (1.8mn) of those in Canada identified as Indigenous (Statistics Canada, 2022)[3]. Just under half (45 percent, 801,045) of Indigenous Peoples live in large urban centres (100,000+ residents). Similarly, close to half live on reserves across Canada. Indigenous communities have been growing at nearly twice the pace of non-Indigenous (9.4 percent versus 4.8 percent) over the last five years. The growth rate has slowed considerably compared to 2011 to 2016, which saw the pace of growth at 18.9 percent. Overall, the pace of population growth from 2006 to 2021 is nearly four times faster than the non-Indigenous population. This population growth reflects the younger proportion of Indigenous Peoples, who have a better opportunity to engage in an increasingly digitalized labour market. It is important that Indigenous Peoples are included in tech-related labour as the population continues to grow, particularly in its youngest demographic.

Indigenous youth account for almost half of the total number of Indigenous Peoples in Canada

Indigenous youth, ages 15-24, account for close to a fifth (307,230) of the total number of Indigenous Peoples in Canada (Statistics Canada, 2021)[4]. Another quarter (459,210) of Indigenous Peoples in Canada is under fourteen years old, making the total Indigenous population almost a decade (8.2 years) younger than the rest of the population in Canada. Additionally, Indigenous youth, ages 15 to 24, were more likely to identify as transgender or non-binary than non-Indigenous youth (1.3 percent versus 0.8 percent). Despite significant generational trauma and historical genocide of Indigenous culture, more than half of Indigenous youth made efforts to understand more about their identity, language, and culture. While it is good to see promising growth and cultural beliefs in Indigenous youth, they face far more barriers than non-Indigenous communities. The 2021 Census of Population shows Indigenous youth are sixteen times more likely to be in foster care, and close to a quarter live in low-income households. Assisting and supporting Indigenous youth appropriately is urgent as they account for a significant portion of Indigenous Peoples in Canada. The next section explores the geographical impediments to access technology and digital training, education, and career opportunities.

Physical barriers to access remain a crucial issue in rural and remote areas

The Canadian Radio-television and Telecommunications Commission (CRTC) has promised that all homes and businesses will have broadband access by 2030, but it still needs to address the priority for access among remote communities. On the contrary, access to high-speed broadband internet is unavailable to most Indigenous Peoples and remains the primary inhibitor to digital education and resources.

Moreover, the COVID-19 pandemic exacerbated the vulnerability of remote Indigenous communities that lack broadband internet access. It hinders work and learning opportunities, creates isolation, and highlights insufficient policy addressing digital inequalities among these communities (Koch, 2022)[5]. Koch (2022)[6] finds that a third of First Nations reserves had access to high-speed broadband service in 2019. Internet access is available at lower bandwidth for many reserves, which would inhibit the ability to use most content and services requiring high-speed connections. For example, broadband access is unavailable for all Inuit communities and reserves in the territorial lands in Canada. Similarly, less than half of rural areas have high-speed access, and no high-speed access exists for the territorial regions in Canada. Without the foundational connection to digital resources, literacy, and education for tech skills, engaging in tech employment remains an outlier for many Indigenous Peoples in Canada.

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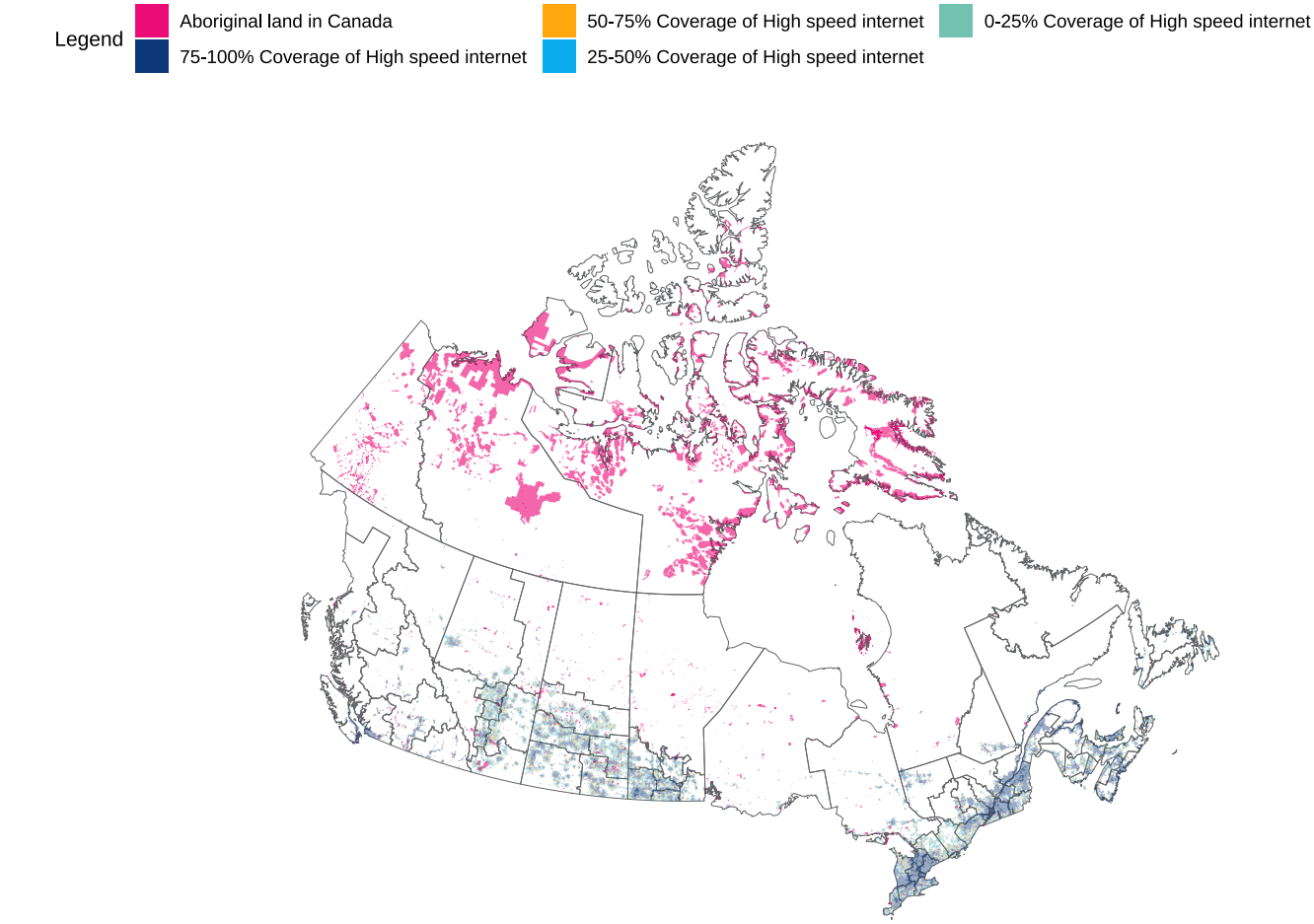
Figure 1 visualizes broadband access coverage in green—defined as 50/10 Megabits per second (Mbps) download/upload speeds—and the Indigenous land[7] claims, in pink, across Canada in 2021. The spatial divide speaks to the lower tech participation and opportunity for Indigenous communities in Canada. Bridging this divide remains the largest barrier to digital participation for rural and on-reserve Indigenous communities.

Figure 1

Broadband Coverage in Canada



Source: CRTC

Defining the Digital Divide

The digital divide in Canada is categorized in three parts, starting with the first divide of "material access" to information-communication technology (ICT). The CRTC policy provision is considered a first-level access policy required to address physical barriers, whereas digital literacy education is an example of a deeper layer within the divide. The second level of divide refers to the "ability to use ICT" among businesses and homes as technological innovations progress. The third level refers to internet usage skills and enlisting digital resources to achieve specific objectives effectively. These divides align with the socioeconomic and educational inequalities but are more pressing, particularly for non-urban Indigenous residents.

Koch (2022)[8] reports that CRTC coverage overestimates the number of households with access, as an area is covered if at least one household is within a 25-kilometre hexagonal radius. This measure assumes that the remaining households are covered, leaving this area ineligible for applying to public funding initiatives. More recently, the CRTC committed $155 million for broadband and satellite access to the most northern communities in 2021. Further research finds that digital divides are a complex issue requiring all levels of government to address the inequalities in high-speed broadband internet (Bacic & Zheng, 2022)[9]. The overall federal strategy to address the digital divide has focused solely on access, leading to limited public support for addressing Indigenous communities' digital education and literacy needs, leaving the deepest layers of digital divides unaddressed.

In the United States of America, socioeconomic factors have a critical role to play for internet access and Indigenous lands. Gregg, Bauer & Feir (2021)[10] find that while population density and terrain account for the most significant barriers to access, Indigenous lands still experience significant differences in access speeds. To put this into perspective, Indigenous lands had 21 percent less access than neighbouring non-Indigenous lands. Controlling for regional factors to access, this suggests that gaps in access and home connection to the internet remained for Indigenous lands. In the same study, they find income differences are strong predictors of access but do not affect connection speeds.

Youth barriers to internet connectivity and digital device use

Formal education remains a critical barrier to digital literacy among Indigenous children. The differences were most significant by Indigenous identity and income level. Using tax records linked to standardized test scores from 2012 to 2015 in British Columbia, for example, economists show that the lowest- and highest-income Indigenous families have the most significant difference in test scores compared to all other families. The test score differences between the highest and lowest-income families increased as students progressed (Bacic & Zheng, 2022). This finding suggests that socioeconomic status plays a prominent role in educational achievement among Indigenous youth.

A 2021 report from RBC, Building Bandwidth: Preparing Indigenous Youth for a Digital Future, highlights the divide between access and education. Based on survey data from 2019 to 2021, Indigenous youth (ages 15-29) frequently use digital devices and are confident in their communication skills but need more confidence in their digital skills. They also report that Indigenous youth are less likely to complete high school. Only half of the Indigenous Peoples aged 24 to 35 have a post-secondary education relative to three-quarters of non-Indigenous peoples, further widening skills and employment opportunities during critical career-building years. Recommendations in the report state the need for teaching digital skills in big data, artificial intelligence (AI), and cybersecurity. The 2021 RBC report also highlights several Indigenous tech role models. Some examples of these Indigenous role models include:

1. digital learning coordinators in educational programs among Indigenous communities;

2. software developers for real-time weather and animal behaviour applications for safer hunting in the Arctic; and

3. web developers and administrators selling physical products online that showcase Indigenous entrepreneurship nationwide.

Costs and impact of broadband access for Indigenous communities

Spicer, Goodman & Olmstead (2021)[11] find broadband access costs three to five times more in remote areas in Canada. Despite efforts around community purchasing and sharing, access is still more costly than urban internet service provider solutions. As necessary services become more digitized, remote communities' connection to health services and government assistance remains inaccessible. Moreover, the returns to developing broadband capacity require talent and resources that municipalities can only sustain with public grants and support.

Another challenge is that broadband access does not provide the same scale or spillover effects in rural areas that are experienced in large metropolitans. The lack of broadband access exacerbates the barriers to entry for small rural businesses looking to scale or reach larger networks. Entrepreneurship is limited unless public subsidies exist for digital ventures. In the example of a remote city like Iqaluit, digital divides are not a question of remaining competitive in the digital economy, but surviving alongside it.

4

Outcomes: Current labour market information around Indigenous communities' employment, wages, and skill differentials

Indigenous Tech Workers in Canada

Indigenous Peoples in Canada engage in tech-related employment and industry at half the rate of non-Indigenous communities (Statistics Canada, 2022).[12] Gaps in employment, wages, and participation in technologically-intensive labour remain for Indigenous Peoples in Canada. In a 2019 report, *Who are Canada's Tech Workers?* Vu, Zafar and Lamb (2019)[13] find the participation rate of Indigenous Peoples in tech occupations is half that of non-Indigenous Peoples (2.2 percent versus 5.2 percent). Indigenous Peoples are also generally paid less than non-Indigenous communities according to data from the 2016 Census. The pay gap for tech work also extends to a gendered divide, as Indigenous women are paid less than their male counterparts (a $13,000 gap for those with a First Nations identity).

Another report, *An Indigenous Future and Present of Work*, emphasizes the barriers to career entry and progression, and conversations on the Future of Work, fail to include Indigenous knowledge and worldviews. Wiebe (2020)[14] discusses the systemic and labour barriers imposed on Indigenous communities and its effect on the unrealized potential for Indigenous-led innovation. The report recommends that Indigenous-led solutions, training, and employment initiatives are the most effective ways to address these barriers.

Vu (2022)[15] explores the relationship between tech participation and Indigenous identity in the report Further and Further Away: Canada's Unrealized Digital Potential. The report finds that Indigenous identity is associated with a lower probability of being employed in tech, relative to non-Indigenous communities in Canada from 2001 to 2016. Indigenous women also experience a lower opportunity of engaging in tech work than non-Indigenous men and women across the same period.

Wage differences are driven by credentialism and occupational realities.

Other evidence suggests wage gaps among Indigenous and non-Indigenous workers engaging in tech work are smaller than anticipated. Goldmann & Racine (2021)[16] examine the relationship between employment earnings, occupation, and education among Indigenous and non-Indigenous communities in Canada using findings of the 2011 National Household Survey participants. Interestingly, the report estimates that off-reserve First Nations professionals in natural and applied science occupations earn almost twice as much as compared to First Nations professionals in other occupations. Additionally, a university degree increases income similarly among Indigenous and non-Indigenous communities. While promising, the report did not consider comparisons of income at different levels of formal education within occupations. The intersection can be a crucial indicator of whether education and tech employment could provide better insight into whether technology workers with higher formal credentials earn more among Indigenous communities.

Labour Force Participation in Tech improves earnings for Indigenous Women.[17]

Indigenous employment and labour force participation tend to be lower than in non-Indigenous communities. Even when controlling for education, disparities in labour force outcomes remain. Employment and labour force participation for Indigenous women is lower than for Indigenous men. Overqualification for labour was more likely among Indigenous communities than non-Indigenous communities (Park, 2019).[18] When controlling for demographic factors such as age, occupation, education, and regional factors in the 2017 Indigenous Peoples Survey, Haan Chuatico & Cornetet (2020)[19] shows that women make 25 percent more than Indigenous men. Similarly, the differences in earnings among Indigenous women and men in professional, technical, and scientific services were not significantly different with non-Indigenous men and women (Haan, Chuatico & Cornetet, 2020)[20].

Surprisingly, education level had no significant impact on earnings potential when controlling for these factors using the same data source among Indigenous communities (Haan, Chuatico & Cornetet, 2020).[21]

Historical Trends of Indigenous Youth Tech Employment

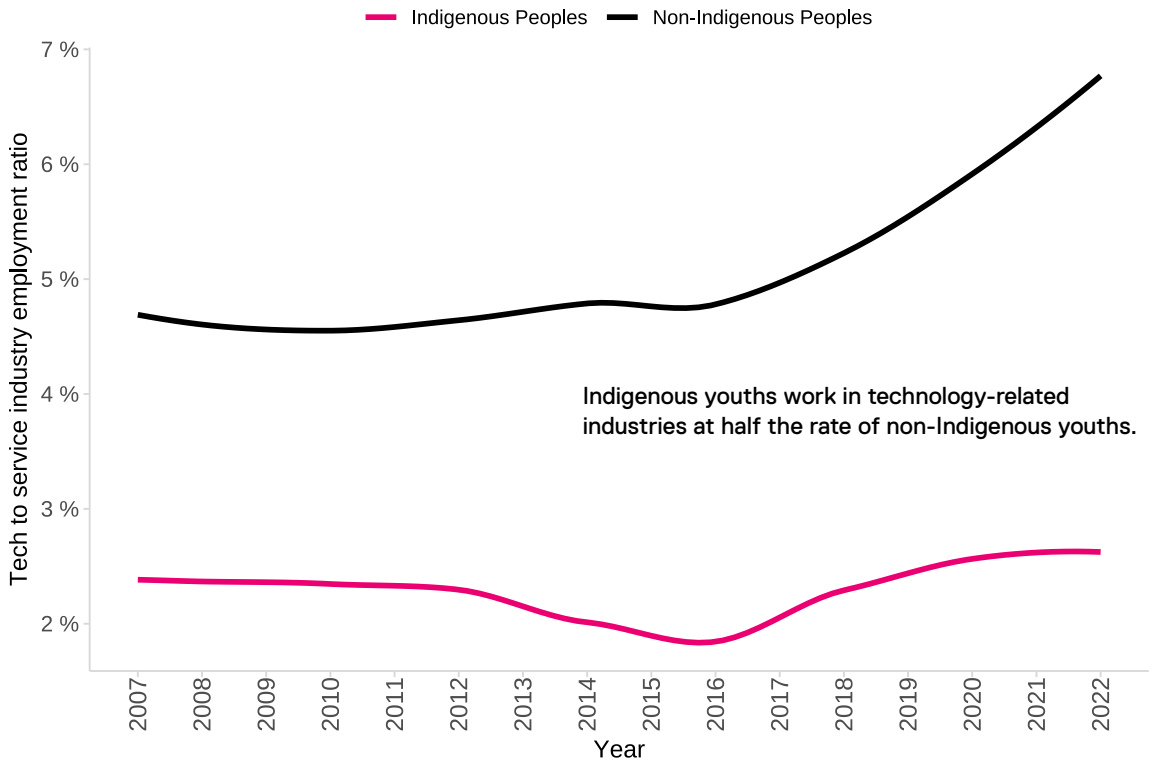
We examine the historical trends of tech-related employment of Indigenous youth in Canada, ages 15 to 24. This historical collection of labour market information began in 2007 for Indigenous Peoples in the Labour Force Survey, Canada's primary and most responsive source for the labour market. Please note that the data collected only accounts for off-reserve Indigenous Peoples residing in non-institutional settings.

Another interesting finding is that employment in tech-related sectors for non-Indigenous workers increased relative to all other service industries during the 2020 pandemic and decreased for Indigenous communities.

Figure 2 compares the percentage of youth employed in tech-related industries as a proportion of service industries between Indigenous and non-Indigenous communities. We define technology-related employment as being employed in professional, scientific, and technical services. Indigenous youth employment in tech industries is generally lower than non-Indigenous communities relative to all other service industries, and the gap has widened in the last five years. The increase in the share of non-Indigenous workers in tech and a relatively flat trend for non-Indigenous workers widened the gap, particularly from 2016 to 2019. This period of infancy for advanced digital skills like Artificial Intelligence (AI), data science and machine learning, is often taught in more formal educational and professional settings. This gap could be a function of increased opportunities for employment in tech among the non-Indigenous population, or that non-Indigenous communities are looking at tech more than other service industries. Another interesting finding is that employment in tech-related sectors for non-Indigenous workers increased relative to all other service industries during the 2020 pandemic and decreased for Indigenous communities. As economic headwinds in tech continue to permeate the United States and Canada, hiring capacity and employability remain challenging for Indigenous youth. As Indigenous Peoples were left behind in the growth period of advanced digital skills pre-pandemic, the scarring effects could have serious negative implications for Indigenous youth moving forward, given the cooling technology job market.

Figure 2

Youth employed in Professional, scientific and technical services as a share of all services industries, ages 15-24

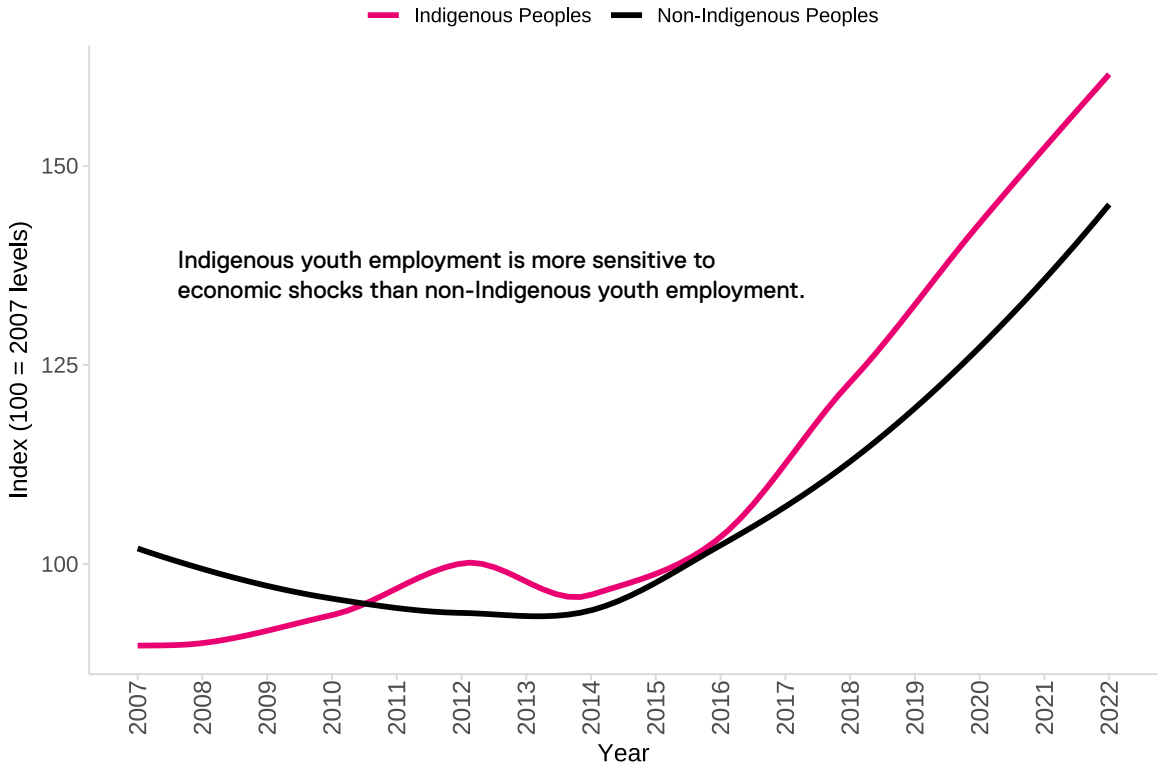


Labour Force Survey, CANSIM 1410036601, line fitted using LOESS

Figure 3 depicts the growth of youth employment, indexed to 2007 employment levels. Youth employment has grown over 50 percent and these levels are higher among Indigenous youth as compared to non-Indigenous youth. In the last fifteen years, Indigenous youth employment in natural and applied sciences occupations has seen decreases in the 2008 Great Recession and 2014 Alberta oil price shocks. This has caused relative decreases in the growth rate of Indigenous youth employment as compared to the growth in employment among non-Indigenous peers since 2007. The impact of the 2020 recession did not impact the rate of employment growth for Indigenous youth and continue to increase more than their non-Indigenous peers in natural and applied science occupations

Figure 3

Youth employed in natural and applied sciences and related occupations (indexed to 2007 levels), ages 15-24



Labour Force Survey, CANSIM 1410010401, line fitted using LOESS

Computer Skills and Indigenous Peoples' Employment

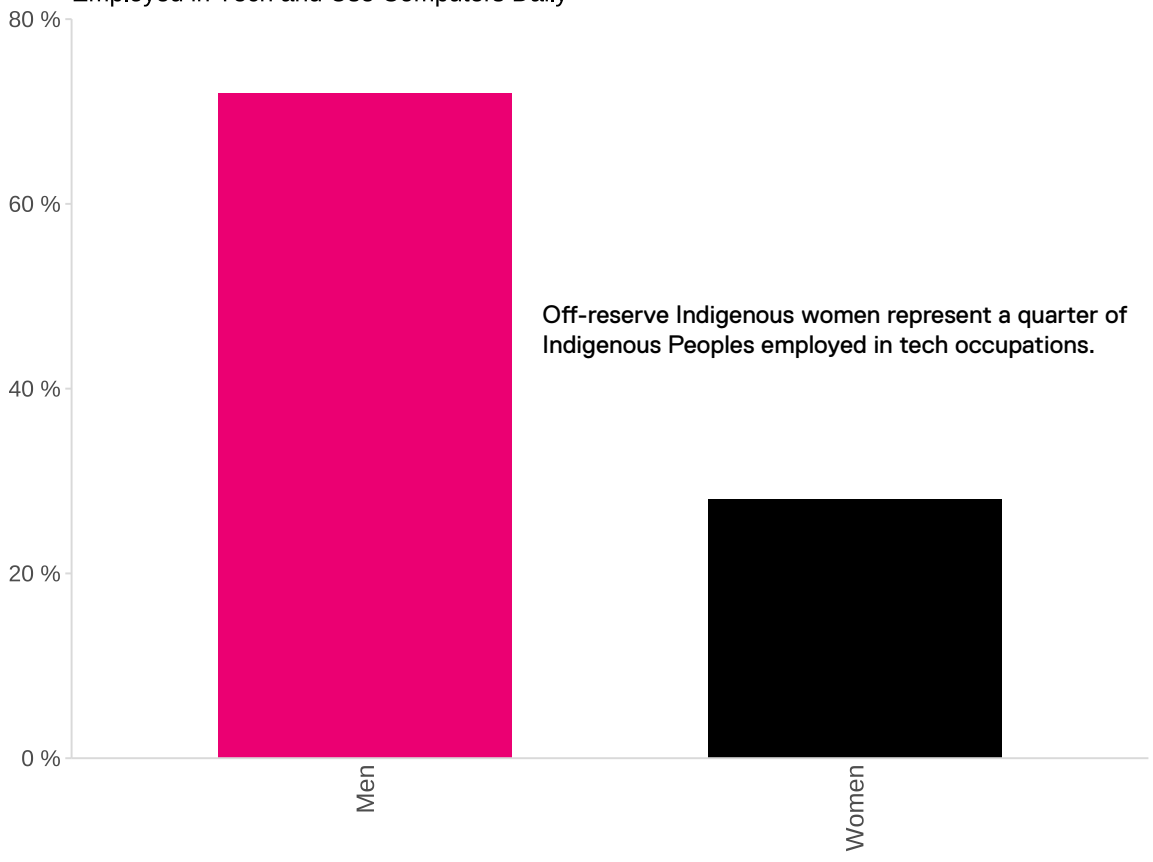
We define the next section with individuals employed in tech-related occupations who engage in a specific digital skill, namely daily computer use or engaging in coding or programming[22] whilst being employed in a natural or applied sciences occupation.

Overall, the rate at which Indigenous Peoples are employed in tech occupations and industries (compared to non-tech) is half that of non-Indigenous peoples in the 2021 Census.

Overall, the rate at which Indigenous Peoples are employed in tech occupations and industries (compared to non-tech) is half that of non-Indigenous peoples in the 2021 Census. According to the 2017 Indigenous Peoples Survey, Indigenous women who live off-reserve represent a quarter of Indigenous tech workers in Canada (**Figure 4**). The gender employment gap remains in 2021, with a similar proportion of non-Indigenous women in tech.

Figure 4

Proportion of Indigenous Men & Women, Off-reserve, Employed in Tech and Use Computers Daily

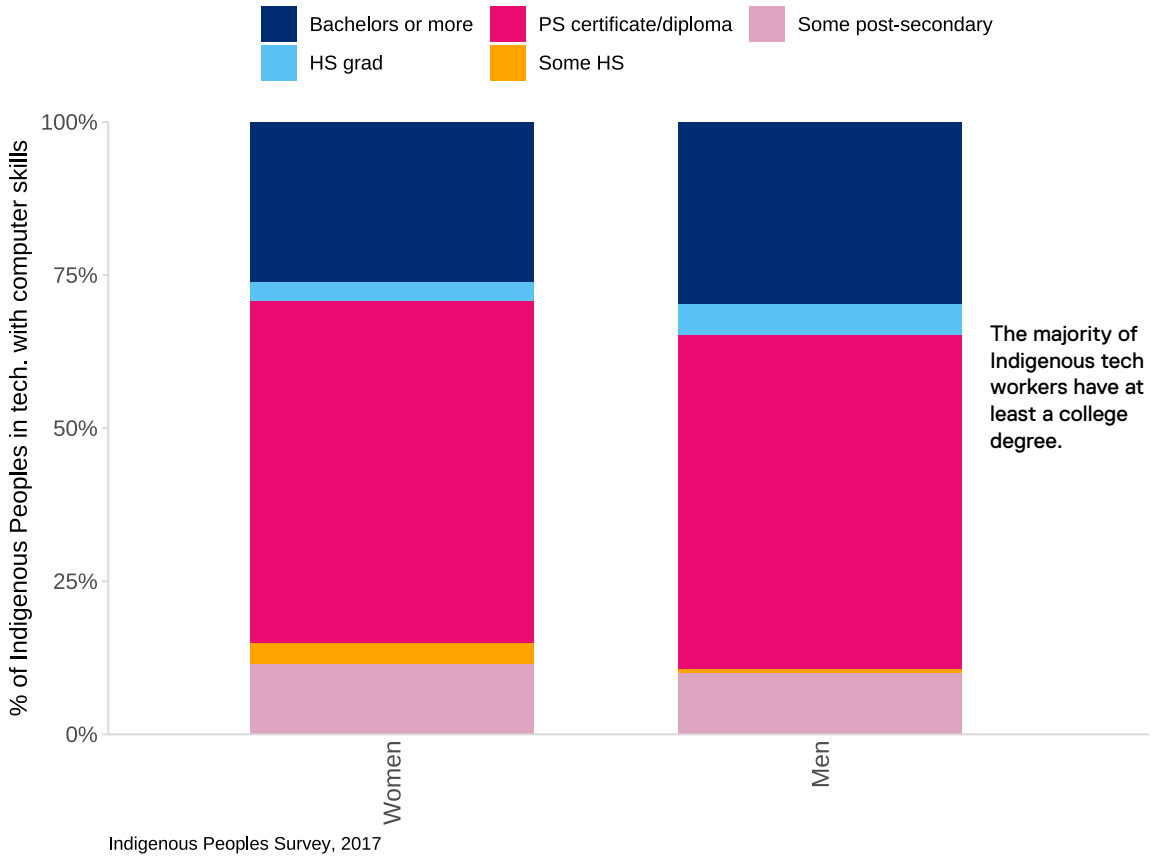


Indigenous Peoples Survey, 2017, line fitted using LOESS

Figure 5 depicts educational attainment among those who work in natural and applied science and use computers daily in their work tasks. Indigenous communities' educational attainment in tech occupations was relatively equal across men and women in 2017. Most Indigenous tech workers have at least a college diploma or certificate. This relationship suggests that educational attainment in tech-related work may not be a driving force for earnings growth. Vu (2022)[23] finds the economic return for having a bachelor's degree in tech has been growing since 2000. The lower share of Indigenous women with bachelor's degrees may drive income inequality among those who engage in computer-related tech work.

Figure 5

Indigenous Peoples, Off-reserve, Employed in Tech and Use Computers Daily

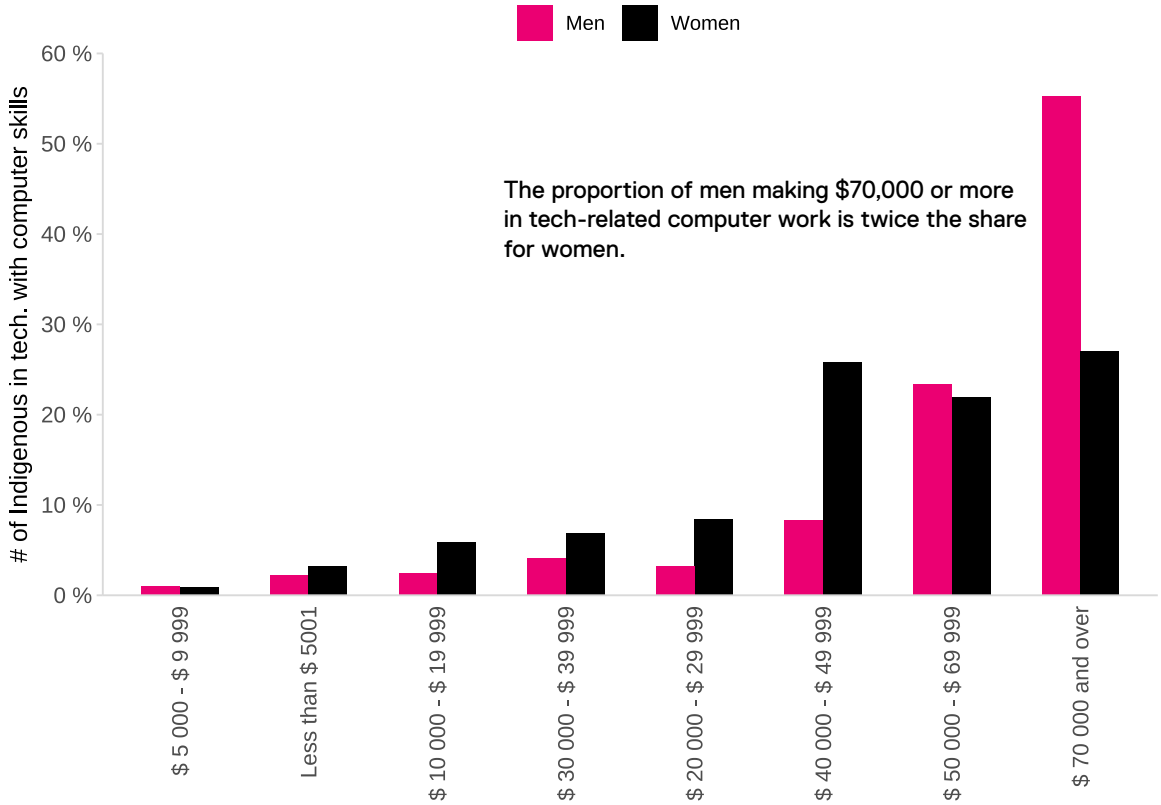


Indigenous Peoples Survey, 2017

Figure 6 demonstrates the earnings of Indigenous Peoples in tech occupations who use computers daily. Over half of the people who use computers daily in tech-related occupations earn $40,000 annually. Among those making $70,000 or more, there are significantly more men than women as a proportion of their communities (66 percent versus 39 percent).

Figure 6

Indigenous Peoples, Off-reserve, Employed in Tech and Use Computers Daily

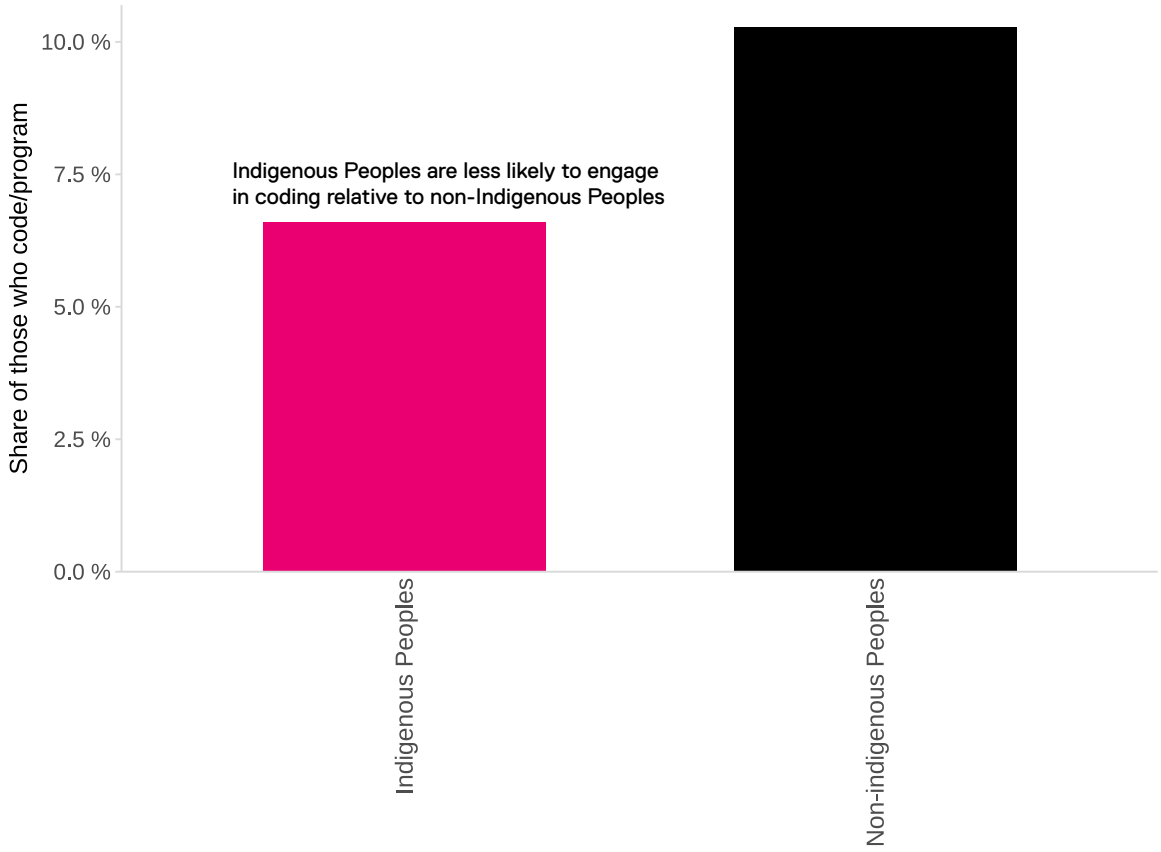


Indigenous Peoples Survey, 2017

We focus on Canadians who are employed and code in Canada. To understand differences in skills among tech workers, we identified individuals who code or program and work in the 2018 and 2020 Canadian Internet Use Survey. The survey includes information on Indigenous identity, demographic and employment information. Among those in Canada who code, 10 percent are non-Indigenous, and 7.5 percent are Indigenous, as shown in **Figure 7**.

Figure 7

Share of Indigenous and Non-Indigenous Peoples who Code in a Programming Language

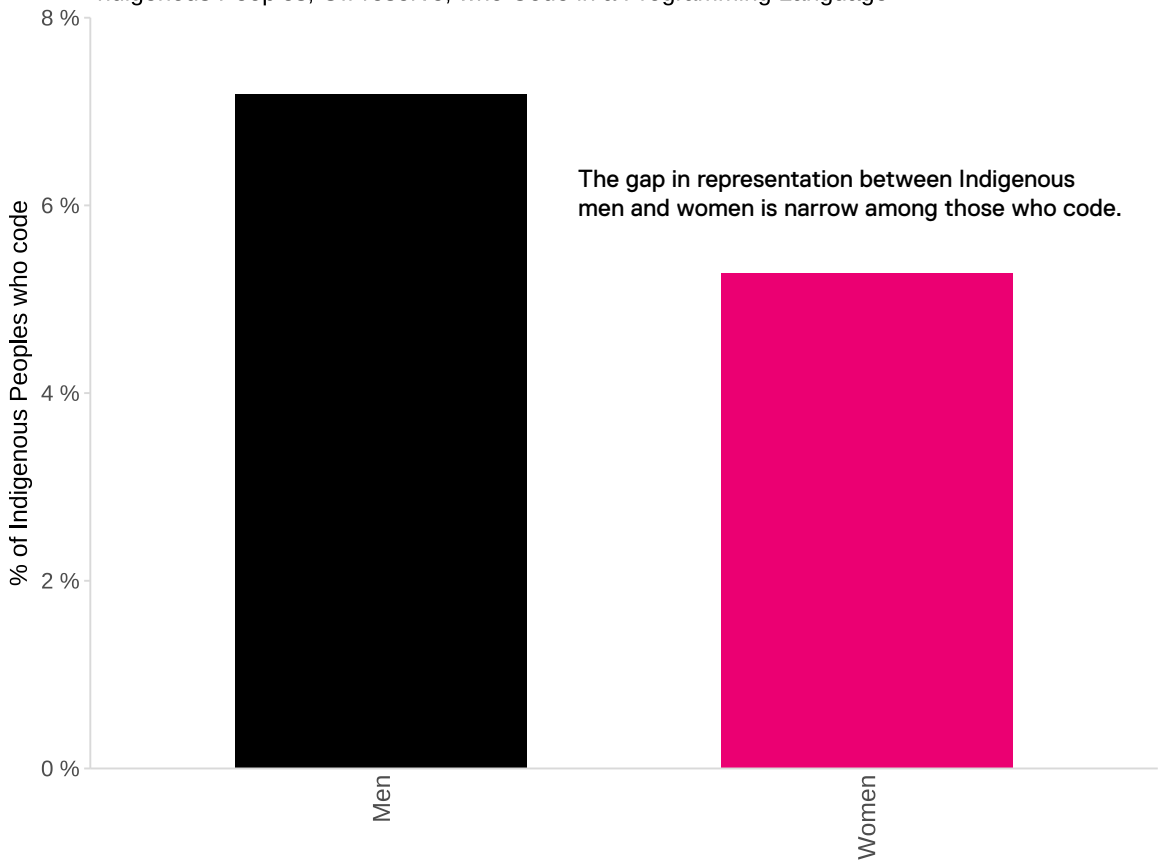


Canadian Internet Use Survey, 2018 & 2020

Figure 8. shows that among Indigenous Peoples who do code, the proportion of men is far closer to women as a proportion of the total gendered population (7 percent versus 5 percent). This statistic suggests that among the most specialized skills tech workers, disparities in gender representation narrow relative to the broader category of tech-related employment.

Figure 8

Indigenous Peoples, Off-reserve, who Code in a Programming Language

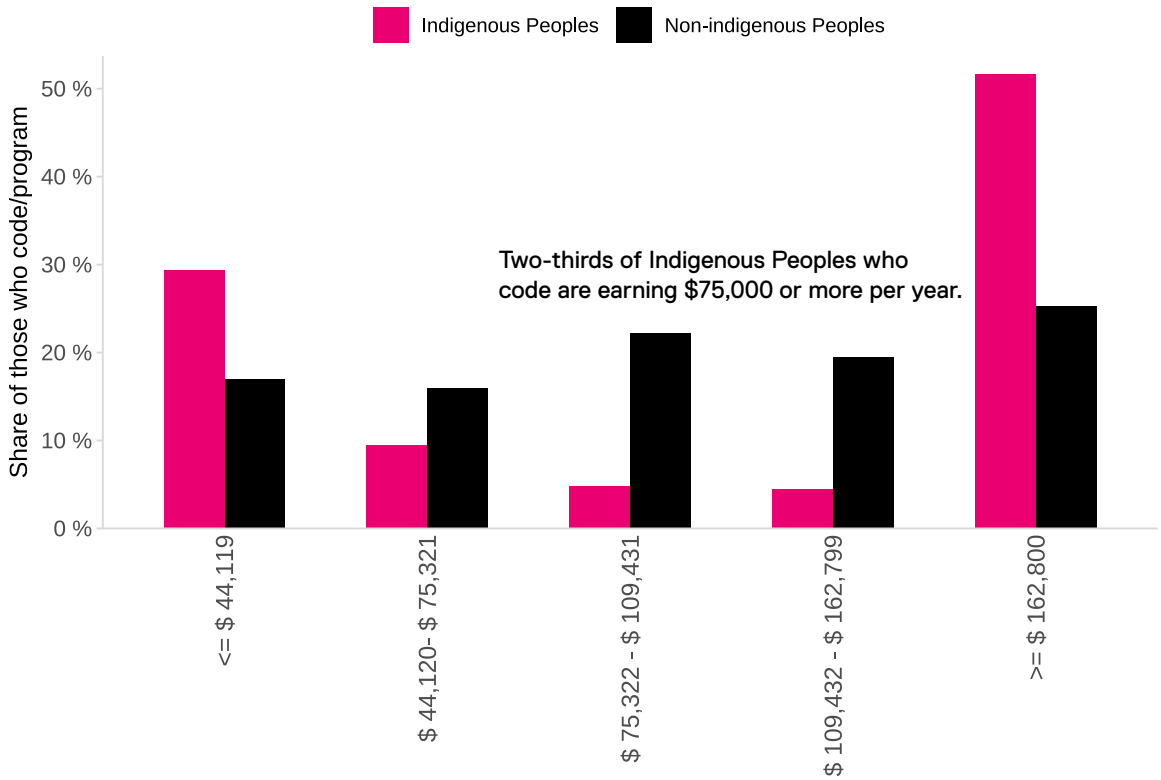


Canadian Internet Use Survey, 2018 & 2020

Figure 9. shows income earnings among those who code in Canada. Almost two-thirds of Indigenous Peoples who code earn more than $75,000 per year, which is in line with non-Indigenous communities. Additionally, under half of the Indigenous Peoples who code earn at least $150,000 or more, considerably more than the proportion of non-Indigenous communities (52 percent versus 26 percent).

Figure 9

Share of Indigenous and Non-Indigenous Peoples who Code in a Programming Language, By Income



Canadian Internet Use Survey, 2020

Figure 10. shows that, among Indigenous Peoples, the educational relationship does not hold for those who code or program. This relationship is contrasted by non-Indigenous communities, which align with coding skills traditionally acquired in private sector and post-secondary institutions.

Figure 10

Share of Indigenous and Non-Indigenous Peoples who Code in a Programming Language, By Education

Canadian Internet Use Survey, 2018 & 2020

Findings of Primary Data Analysis

Indigenous youth are particularly vulnerable to economic shocks when trying to break into tech-related industries and employment. Similarly, the barriers to engaging in tech work are proxied by the lower employment in tech-related industries relative to all other service industries. The findings also show Indigenous women are underrepresented in tech-related work. Those with more specialized skills, like coding in tech work, tend to earn more and are represented more equitably. Similarly, educational achievement among Indigenous tech workers is high and is similar across genders.

The findings also show Indigenous women are underrepresented in tech-related work. Those with more specialized skills, like coding in tech work, tend to earn more and are represented more equitably.

5

Skills: In-demand skills and occupations that are on the rise in Canada are relevant to the participants of the IFA programming

This section examines digital skills and their related occupations to inform program design for skills training programs for Indigenous early-career workers. Leveraging the analysis from I, Human: The Digital and Soft Skills Driving Canada's Labour Market (Vu, Lamb & Willoughby, 2019),[24] highlight a series of skills profiles for tech jobs in Canada. In particular, we disaggregate digital skills into five main clusters, as shown in Table 1.

Table 1: Digital Skills Cluster definition (reproduced from Vu, Lamb, Willoughby 2019)

Digital Skill Cluster	Definition
Workforce Digital Skills	The skills range from those associated with general office tasks to those associated with specific professions, such as the use of architectural and engineering-based software to augment existing job tasks and business processes. Some prominent skills in this cluster include Microsoft Excel, Word, PowerPoint, and Office. This cluster also includes skills associated with some general-use design software, such as Adobe Photoshop, as well as general data analysis skills and use of tools such as SAS.
Data Skills	This skill cluster consists of unique skills focussed primarily on data gathering and analysis, especially in large-scale enterprise analytics. Some prominent skills in this cluster include "data modeling", "big data", and "business intelligence", as well as skills associated with specific data analytics tools, such as Apache Hadoop, Tableau and R.
System Infrastructure Skills	This skill cluster consists of unique skills that pertain to digital infrastructure management, ranging from setting up and managing cloud computing services to more general IT support. Some prominent skills in this group include proficiency with specific platforms such as VMware or Windows Server and general support skills such as "system administration" and "hardware and software installation".
Software/Product Development Skills	This skill cluster consists of skills that pertain to the generation of new digital products, both web- and software-based. Some prominent skills in this group include proficiency in specific programming languages, such as Java and Python, and general skills, such as "software development", "software engineering", and "web development". Some technical design skills pertaining specifically to web development are also a part of this cluster. On average, skills in this cluster are the most digitally intensive.

We also focused on occupations for which there are existing Indigenous professionals, especially those without formal credentials that are at the bachelor's degree levels, or other credentials that require a bachelor's degree as a prerequisite. We used the 2016 census data to identify these occupations. We noted that information systems analysts and consultants, as well as computer programmers and interactive media developers, were two occupational groups with the highest number of Indigenous employment (with over 3,000 Indigenous workers across these two occupations in 2016). "Java programmer" and "website programmer" were among job titles within the Computer Programmers and Interactive Media Developers occupational groups. Another notable occupation was web designers and developers. In 2016, 420 Indigenous professionals worked in this occupation, of which more than half did so without a bachelor's degree. In the following discussion, we will focus on particular job titles (that are part of a broad occupational group) in understanding skills demand.

Job Title Business Analyst		
Job Posting # between January 2021 and January 2023: 17,647		**Occupational-group:** Information Analysts and Consultants **# of Indigenous Workers:** 2,040 **# of Indigenous Workers without a Bachelor's degree:** 1,475
Skills Cluster	**Job Make-up**	**Top skills**
Workforce Digital Skills	16.5%	Microsoft Excel Microsoft Office Business Systems Information Systems Data Analysis
Software Digital Skills	15.1%	SQL System Analysis Oracle Java
Systems Digital Skills	13.8%	Information Security Technical Support UNIX Linux
Data Digital Skills	1.2%	Data Science Big Data
Non-digital skills	53.4%	Communication Skills Problem Solving Teamwork/Collaboration Planning Business Analysis Project Management

Job Title JavaScript Programmer		
Job Posting # between January 2021 and January 2023: 21,700		**Occupational-group:** Computer Programmer and Interactive Media Designers **# of Indigenous Workers:** 1,140 **# of Indigenous Workers without a Bachelor's degree:** 395
Skills Cluster	**Job Make-up**	**Top skills**
Workforce Digital Skills	10.7%	Microsoft Excel Microsoft Office Business Systems Information Systems Microsoft SharePoint
Software Digital Skills	40%	SQL Java Software Development JavaScript
Systems Digital Skills	7.78%	UNIX Linux Technical Support
Data Digital Skills	0.4%	Big Data Artificial Intelligence
Non-digital skills	41.1%	Communication Skills Problem Solving Teamwork/Collaboration Planning Writing Project Management

Job Title Web Designer		
Job Posting # between January 2021 and January 2023: 3,176		**Occupational-group:** Web Designers and Developers **# of Indigenous Workers:** 420 **# of Indigenous Workers without a Bachelor's degree:** 245
Skills Cluster	**Job Make-up**	**Top skills**
Workforce Digital Skills	13.8%	Adobe Photoshop Adobe Illustrator Adobe InDesign UX Wireframe
Software Digital Skills	48.8%	JavaScript Web Development jQuery HTML5 CSS
Systems Digital Skills	4.27%	Linux UNIX Perl scripting language
Data Digital Skills	0.3%	Big Data Scala
Non-digital skills	32.8%	Communication Skills Teamwork/Collaboration Creativity Problem solving Writing Detail-oriented

Related skills and job postings trends for tech training and employment

To identify in-demand skills, we use a variety of sources that rely on public forecasting and job vacancy data that describes the tasks, skills, and tools required. To identify relevant occupations, we ranked occupations by the skills taught in the Indigenous Friends Association INDIGital and IndigiTECH programs, namely:

1. CSS
2. jQuery
3. Ruby
4. JavaScript
5. User interface design
6. Web development

We identify the occupations that most closely match the skills listed above, from greatest to least number of postings, since December 2021:

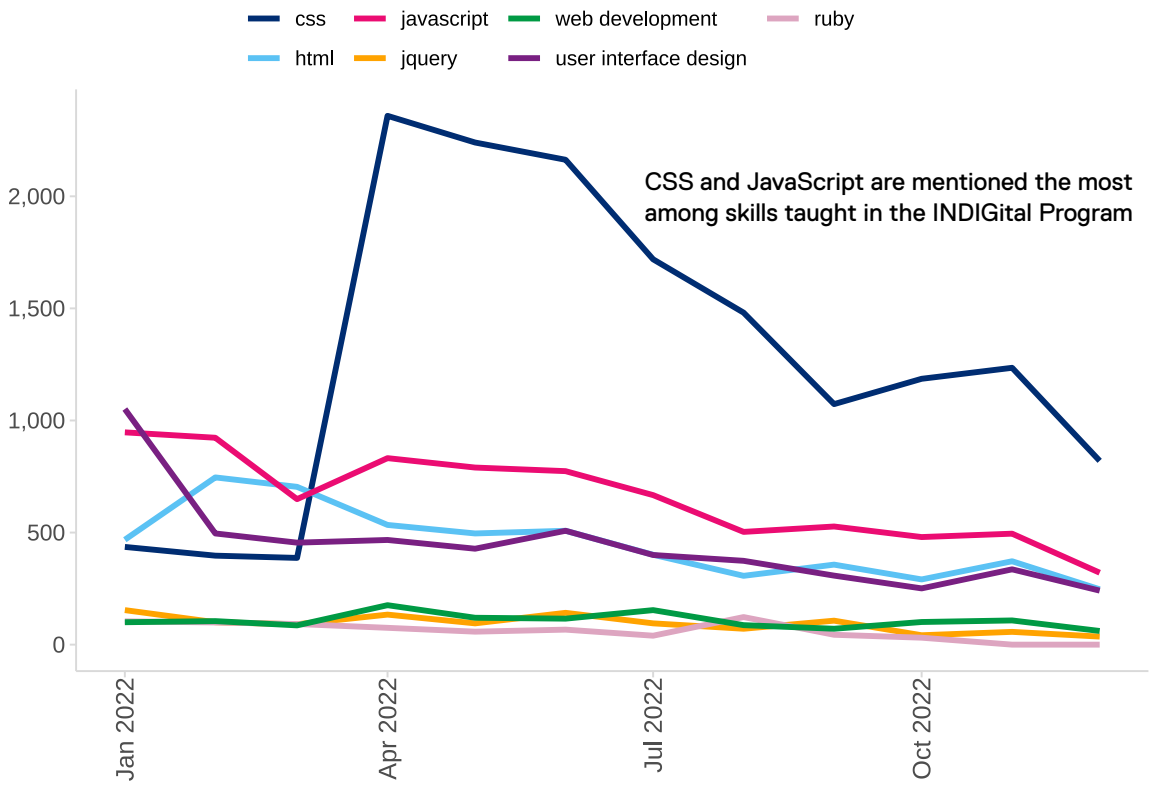
1. Computer programmers and interactive media developers
2. Software engineers and designers
3. Information systems analysts and consultants
4. Web designers and developers
5. Database analysts and data administrators

This section will look at the demand for skills taught in the INDIGital and IndigiTECH programs and offer guidance on skills closely aligned with occupations employers across Canada seek. Job vacancies, more commonly known as job postings, are scraped from online job boards across Canada to understand the nature of job and skill needs as recorded in job descriptions.

Figure 11 details the number of times a skill or occupation appears in job postings from January 2022 to December 2022. “CSS” has appeared in more than a thousand monthly postings since May 2022. jQuery, web development, and JavaScript were mentioned the least among skill requirements in job postings.

Figure 11

Skill Mentions in Job Posting in 2022

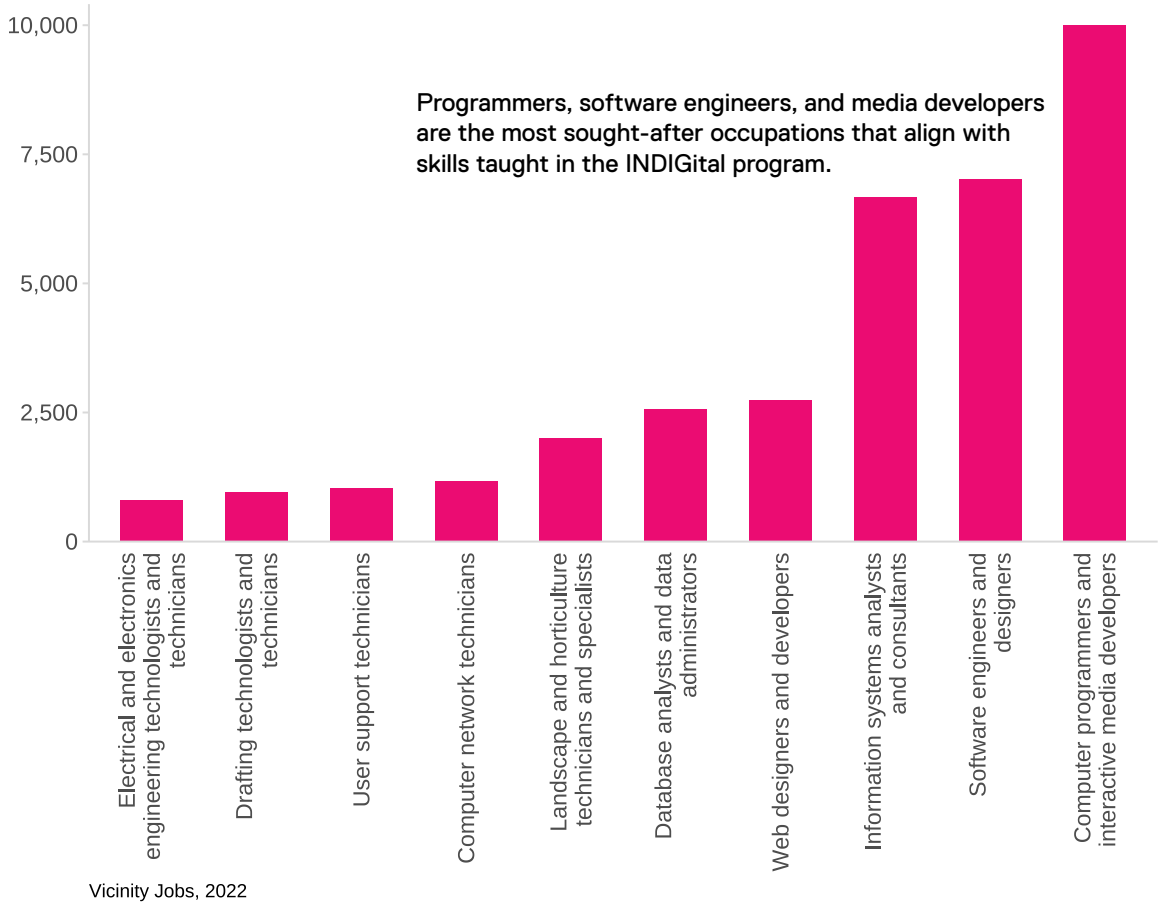


Vicinity Jobs, 2022

To determine which occupations aligned with these skills, we looked at all occupations that required them in their descriptions over the 12 months. **Figure 12** shows that computer programmers and interactive media developers, Software engineers and designers, information systems analysts and consultants were the most common job postings requiring skills taught in the IFA program.

Figure 12

Total Job Postings by IFA Skills



Vicinity Jobs, 2022

The Canadian Job Bank Trends Analysis tool provides information on these occupations' wages, outlooks, and education. The top three occupations noted above earn between $25 and $61 per hour on average, typically require a university education, and all have good ratings for employment outlooks across the provinces.

6

Recommendations

There is a clear disconnect between opportunities for digital inclusion and policy. The level of investment and infrastructure to effectively support Indigenous youth in pathways to technology-related employment remains lacklustre. While a number of programs provide discounted internet packages for low-income households, people with disabilities, and older/younger populations, none cater to Indigenous communities who face higher than average internet costs. In addition, providing Indigenous youth with low-cost digital devices could also narrow the technological skill gap that many rural communities face. Concurrently supporting local technology service businesses will assist sustainability of these programs and devices in the long run.

This lack of support is evident in STEM post-secondary education enrolment, technical labour market participation, and access to digital technologies and literacy among the majority of Indigenous communities in Canada. Similarly, the need for more support targeting Indigenous youth, on-reserve Indigenous communities, and Indigenous-led digital literacy highlights the inaction of policy to critically address challenges of Indigenous participation in the future of work. Several institutional and program level recommendations will be detailed in this section to better serve the needs of Indigenous youth tech literacy, education, and labour force participation.

There is a clear disconnect between opportunities for digital inclusion and policy. The level of investment and infrastructure to effectively support Indigenous youth in pathways to technology-related employment remains lacklustre.

Incorporating the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) in Canada's legislative framework is vital in centralizing the creation of Indigenous-led, culturally relevant and inclusive digital literacy programming. Recognizing Indigenous Peoples as innovators and key decision-makers in developing education and training opportunities may address communities' unique challenges when accessing safer digital spaces. This also includes recognizing Indigenous Peoples rights toward sovereign control over their information, resources and technologies. The federal government can take a meaningful step toward truth and reconciliation by reviewing and updating its policies that advance diversity and inclusion initiatives that enable Indigenous Peoples to fully participate and thrive in a digital economy."

Program design for digital skills and education

Winter & Boudreau (2022)[25] find that prioritizing Indigenous voices, self-determination, and sovereignty will orient Indigenous youth in creating and innovating content through digital technologies. By showcasing several initiatives online, they highlight that content and projects should emphasize future imagery of Indigenous life and community. Operationalizing Indigenous futures with online initiatives, video games, apps, and virtual reality development will teach Indigenous values and in-demand skills. The concept of makerspaces as a framework to bridge this theory into practice is an avenue of future research. Makerspaces serve as a gathering point for tools, projects, mentors, and expertise to give rural communities access to technology and practice that is otherwise unavailable and provide ample opportunities for youth to engage with innovation in a meaningful way.

Indigenous skill gaps are exacerbated physically and by cost of entry

Indigenous skills and education training evaluation is sparse. Feir, Foley & Jones (2022)[26] find that Indigenous women in high-intensity training programs participants earn significantly more than participants in low-intensity training. Providing physical access through devices, subscription access to broadband, and training resources provides foundational digital skills development for Indigenous youth (Spicer, 2021).[27] Moeke-Pickering (2020)[28] finds that embracing education around social media content creation and sharing can empower Indigenous teachings and culture. Social media can communicate, strengthen cultural networks, and seek connections that empower Indigenous communities and education. Harnessing its ability to make connections can provide a network for sovereign knowledge transfer and cultural exchange. Moeke-Pickering (2020)[29] asserts social media drives activism and disrupts dominant colonial and patriarchal worldviews. Advocacy disseminates quickly in social media and these platforms provide a vital role in bringing awareness framed in an indigenizing worldview.

Promoting digital solutions for addressing Indigenous community needs

Applying digital skills in addressing Indigenous communities is a promising space for expansion. Bhawra et al. (2022)[30] investigate strategies to tackle climate change among Indigenous communities using citizen digital data collection. Smartphones and digital literacy offer unparalleled research opportunities within Indigenous communities, leading to ethical and equitable impacts between researchers and communities. A program in Île-à-la-Crosse, Saskatchewan, provided a Métis community with cellular towers, cellphones, and data plan to communicate environmental changes for early detection of climate change impacts on food sovereignty and security. The platform provides access to real-time data and communities' ability to facilitate timely climate change mitigation decision-making. The authors highlight how using a two-eyed seeing approach and how digital citizen science can assist in preparing for climate change preparedness and adaptation.

The INDIGital and IndigiTECH program curricula teach foundational and relevant skill sets that can apply to various in-demand occupations post-pandemic. We expect these skills and occupations to grow outside of technical and digital sectors as employers will need these skill sets in-house. Similarly, the skills and devices used in the IFA programs address the issues experienced by Indigenous youth in the technology and digital career journey.

Additional recommendations to the Indigenous-led digital literacy programs

Across Canada, Indigenous-led digital literacy programs are just starting to receive the investment that they rightfully deserve. Yet, these programs have already achieved early successes in applying existing body of knowledge on educational and programming effectiveness. The solid foundation of the program can be built upon in several ways, emphasizing the longer-term goals of improving Indigenous youth outcomes in highly technical occupations. For example, the use of high-intensity programming, a 'two-eyed seeing' approach, and critical project-based development to engage and indigenize the learning process identified in our literature review.

What can be added or better supported in digital literacy programs is formalized wraparound support for those entering and leaving high-intensity programs. The authors of this report spoke to the Founder & CEO of Culture Foundry Studios, Chad Quinn, a digital development studio focussed on Indigenous language revitalization, to capture experiential advice on the topic of digital literacy program development. While we did not conduct a full analysis of such wraparound support, his comments are left here to spur additional research and discussion on how to design a digital literacy program for Indigenous youth that continues beyond the classroom.

“As the CEO of an education technology company focused on language revitalization, I have witnessed firsthand the incredible potential Indigenous youth bring to the table in technical occupations. Indigenous youth bring to companies specialized skills and a holistic worldview that promotes health and long-term thinking. However, I have also seen the many barriers Indigenous youth face accessing these fields, including proximity to program locations, difficulty finding available programs, and a lack of tailored programs that address their unique life circumstances. While the root causes for many of the barriers run deep, some things can be acted upon now.

The findings in this report have spurred significant thought and discussion within my team. One critical aspect of supporting Indigenous students in pursuing technical occupations is providing wraparound support for individuals entering and leaving high-intensity programs. We have anecdotally learned that the lack of connection between programs are where too many students get lost. Either life circumstances change, or the demands of the more advanced program can present challenges without additional guidance. Support should not end within programs. Support should continue after graduation in some form to give individuals a sense of ongoing community where they can share knowledge, struggles, and other learnings. Employers should also have a space to connect with the program and fellow employers to share knowledge and collaborate.

The INDIGital and IndigiTECH programs capture many key educational and program effectiveness recommendations. The solid structure of the program can be built upon in several ways, emphasizing the longer-term goals of improving Indigenous youth outcomes in highly technical occupations. Program expansion could include bridges to post-secondary schools enabling students to attain full degrees, mentorship programs to support graduates well into their careers, and a consolidated place for students and employers to find available programs.

This report highlights the importance of investing in Indigenous youth and their digital futures. By providing access to the necessary tools and education and breaking down the barriers that prevent Indigenous students from participating fully in the digital economy, Indigenous communities will have access to talent to innovate and create, leading to a better future for all.”

7

Conclusion

Indigenous youth will inevitably face challenges developing the credentials, skills, and social networks to enter a digitally intense labour market. Economic shocks, access to broadband internet, and technological tools outside educational programs remain critical barriers to adopting and developing these skill sets and career opportunities. Similarly, participation remains lower in tech-related occupations and industries than non-Indigenous communities. In contrast, among Indigenous professionals participating in technical and digitally intensive work, earnings are exceptionally high for women who program or code. Moreover, educational level is not a significant barrier to employment in coding and programming work. There were also no significant gender differences in the graduation rates of Indigenous Peoples in Canada. Increasing participation will require a multi-faceted policy that improves physical access, provides training based on skill demand, and indigenized training initiatives emphasizing Indigenous worldviews alongside programming for in-demand, specialized digital skills and competency.

Discussion

The intersection of Indigenous youth and tech work is an area that is often considered secondary research in Canada. Most research focuses on barriers to physical access and educational gaps among youth. With a burgeoning population share and steadfast population growth rate, youth employment pathways and training initiatives in tech cannot be ignored or underestimated. A dearth of physically accessible technology, tailored to Indigenous youth's unique life circumstances remains a troubling yet surmountable barrier that can be acted upon in the present.

As aligned with the IFA programming and Indigenous education literature, Indigenous tech education uses digital modalities to engage and interact with Indigenous knowledge, history, and language. While the traversal of real-life barriers to tech work remains a critical point of failure for engaging youth, some solutions require long-term investment in youth educational infrastructure, particularly in northern regions. Unified efforts for curriculum-wide adoption of tech education and resources like makerspaces can be deployed without broadband connection and facilitated through on-site storage. Tangible, permanent, and modern training can engage students to expand their skill boundaries while integrating Indigenous values and knowledge.

The consequences of stagnating Indigenous tech participation will leave Canada further behind in tech talent and the pool of innovation from which it can draw. Indigenous values placed on environmental justice and conservation align with the global demand for carbon-neutral technologies and communities. Providing the avenues and tools for Indigenous communities to reclaim their values and knowledge through technological entrepreneurship and education is an engine for innovation that is unrealized in many aspects of the Canadian economy. The future of work is synonymous with its workforce, in which Indigenous youth are becoming an effervescent force that needs more than a village but a nation to raise them to their true potential.

The consequences of stagnating Indigenous tech participation will leave Canada further behind in tech talent and the pool of innovation from which it can draw. Indigenous values placed on environmental justice and conservation align with the global demand for carbon-neutral technologies and communities.

End Notes

[1] We define Indigenous Peoples as those who identify as First Nations (North American Indian), Métis and/or Inuk (Inuit), and/or those who report being Registered or Treaty Indians (that is, registered under the Indian Act of Canada), and/or those who have membership in a First Nation or Indian band.

[2] We define the tech labour market at those employed in broad NOC and NAICS groups of Natural and Applied Sciences Occupations and Professional, Scientific, and Technical Services Industries.

[3] Government of Canada, Statistics Canada. 2022. "The Daily — Indigenous Population Continues to Grow and is much Younger than the Non-Indigenous Population, although the Pace of Growth has Slowed." September 21, 2022. https://www150.statcan.gc.ca/n1/daily-quotidien/220921/dq220921a-eng.htm.

[4] Government of Canada, Statistics Canada. 2021. "Portrait of Youth in Canada: Indigenous Peoples." December 1, 2021. https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2021085-eng.htm.

[5] Koch, Katharina. 2022. "The Territorial and Socio-Economic Characteristics of the Digital Divide in Canada." Canadian Journal of Regional Science 45 (2): 89–98. https://doi.org/10.7202/1092248ar.

[6] Ibid.

[7] Indigenous lands of Canada is a legal concept and, in many instances, does not correspond to an understanding of historic, cultural, or transitional Indigenous lands. A reserve, as specified in the Indian Act, is a ''tract of land, the legal title to which is vested in Her Majesty, which has been set apart by Her Majesty for the use and benefit of a band'' (Canada 1985). A band, often in the Canadian context, may also be known as a First Nation. Reserves are not confused with land-claim areas, which are much larger territories than a reserve (Feir & Hancock, 2015).

[8] Koch, Katharina. 2022. "The Territorial and Socio-Economic Characteristics of the Digital Divide in Canada." Canadian Journal of Regional Science 45 (2): 89–98. https://doi.org/10.7202/1092248ar.

[9] Bacic, R., & Zheng, A. (2022). Income-Achievement Gaps in Canada (SSRN Scholarly Paper No. 4087027). https://doi.org/10.2139/ssrn.4087027.

[10] Gregg, M. T., Bauer, A., & Feir, D. (2022). The Tribal Digital Divide: Extent and Explanations (SSRN Scholarly Paper No. 3948233). https://doi.org/10.2139/ssrn.3948233.

[11] Spicer, Zachary, Nicole Goodman, and Nathan Olmstead. 2021. "The Frontier of Digital Opportunity: Smart City Implementation in Small, Rural and Remote Communities in Canada." Urban Studies 58 (3): 535–58. https://doi.org/10.1177/0042098019863666.

[12] Government of Canada, Statistics Canada. 2022. "The Daily — Indigenous Population Continues to Grow and is much Younger than the Non-Indigenous Population, although the Pace of Growth has Slowed." September 21, 2022. https://www150.statcan.gc.ca/n1/daily-quotidien/220921/dq220921a-eng.htm.

[13] Vu, Viet, Asher Zafar, and Creig Lamb. 2019. "Who Are Canada's Tech Workers?" Brookfield Institute for Innovation and Entrepreneurship. https://brookfieldinstitute.ca/who-are-canadas-tech-workers/.

[14] Wiebe, Justin. 2020. "An Indigenous Future and Present of Work." Brookfield Institute for Innovation and Entrepreneurship (blog). April 30, 2020. https://brookfieldinstitute.ca/an-Indigenous-future-and-present-of-work/.

[15] Vu, Viet, 2022. "Further and Further Away: Canada's Unrealized Digital Potential."- Brookfield Institute for Innovation and Entrepreneurship. https://brookfieldinstitute.ca/further-and-further-away/.

[16] Goldmann, Gustave, and Audrey Racine. 2021. "'Show Me the Money': The Returns to Education for Indigenous Canadians." Canadian Studies in Population 48 (2): 293–313. https://doi.org/10.1007/s42650-021-00049-9.

[17] Statistical categories of sex often capture biological sex assigned at birth, but we broadly use women in the text of this report. We acknowledge it may not be representing non-binary and non-cis-gendered individuals accurately.

[18] Park, Jungwee. 2018. "Overqualification Among Aboriginal Workers in Canada." International Indigenous Policy Journal 9 (1). https://doi.org/10.18584/iipj.2018.9.1.2.

[19] Haan, Michael, Georgina Chuatico, and Jules Cornetet. 2020. "Aboriginal Earnings in Canada: The Importance of Gender, Education, and Industry." Canadian Ethnic Studies 52 (2): 1–27. https://doi.org/10.1353/ces.2020.0011.

[20] Ibid.

[21] Ibid.

[22] These concepts are captured with the Indigenous Peoples Survey "Used a computer at work daily in the last 12 months" and the Canadian Internet Use Survey "Engaged in coding or programming in the last 12 months".

[23] Vu, Viet, 2022. "Further and Further Away: Canada's Unrealized Digital Potential."- Brookfield Institute for Innovation and Entrepreneurship. https://brookfieldinstitute.ca/further-and-further-away/.

[24] Vu, Viet, Creig Lamb, and Rob Willoughby. 2019. "I, Human: Digital and Soft Skills Driving Canada's Labour Market." Brookfield Institute for Innovation and Entrepreneurship. https://brookfieldinstitute.ca/i-human-the-digital-and-soft-skills-driving-canadas-labour-market/.

[25] Winter, Jasmin, and Justine Boudreau. 2018. "Supporting Self-Determined Indigenous Innovations: Rethinking the Digital Divide in Canada." Technology Innovation Management Review 8 (2): 38–48. doi:10.22215/timreview/1138.

[26] Feir, Donna, Kelly Foley, Maggie E.C. Jones . "The Distributional Impacts of Active Labor Market Programs for Indigenous Populations" AEA Papers and Proceedings 111 (May 2021):216-20 ." https://www.aeaweb.org/articles?id=10.1257/pandp.20211013.

[27] Spicer, Zachary, Nicole Goodman, and Nathan Olmstead. 2021. "The Frontier of Digital Opportunity: Smart City Implementation in Small, Rural and Remote Communities in Canada." Urban Studies 58 (3): 535–58. https://doi.org/10.1177/0042098019863666.

[28] Moeke-Pickering, D. T. (2020). Decolonizing and Indigenizing Education in Canada, Chapter 15. Canadian Scholars' Press.

[29] Ibid.

[30] Bhawra, Jasmin, M. Claire Buchan, Brenda Green, Kelly Skinner, and Tarun Reddy Katapally. 2022. "A Guiding Framework for Needs Assessment Evaluations to Embed Digital Platforms in Partnership with Indigenous Communities." PloS One 17 (12): e0279282. https://doi.org/10.1371/journal.pone.0279282.