Digital Literacy in a Digital Age

A Discussion Paper

brookfield institute
for innovation + entrepreneurship

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INTRODUCTION

The Brookfield Institute for Innovation + Entrepreneurship (BII+E) is launching a program of research that will explore digital literacy: what it is, why it is important in a workplace context, and what the current opportunities and gaps are in the landscape of digital skills and education across the country. We believe that it is important to engage users, experts, and other stakeholders in our work early to test our assumptions and link our work to the work of others. This discussion paper is being released to encourage conversation, solicit feedback, and refine our thinking.

WHY INVESTIGATE THE STATE OF DIGITAL LITERACY IN CANADA?

As digital technologies become more pervasive, the nature of work is changing and skills development is high on government agendas for building the workforce of the future. Technology has a long history of disrupting the labour market; however, the pace of these changes has accelerated.[1] The World Economic Forum has identified this period as a "Fourth Industrial Revolution".[2]

A recent BII+E report estimated that 42 percent of the Canadian labour force is at risk of being affected by automation over the next 10 to 20 years.[3] Certain skills are likely to become less relevant as technology is applied to a wider range of job tasks, while demand for skills that are complementary to emerging technologies is likely to grow.[4] The continued shift toward digitization is making digital literacy essential for today's workforce and the workforce of the future. This applies to current workers whose jobs may change or become obsolete, and to people who will be entering the workforce soon. Equipping Canadians with a range of digital skills will be critical both to ensure a robust talent pipeline for employers, and to support the development of an inclusive economy.

This has been recognized by Canada's federal government, which invested over $50 million in digital learning at the K–12 level and over $29 million in nonprofit initiatives aimed at teaching basic digital skills to vulnerable groups in its March 2017 budget.[5] This is also being prioritized at the level of provinces and territories: for example, Ontario has made budget commitments to advance digital literacy and inclusion, and Nova Scotia recently devoted $1 million to support existing investments in K–12 coding and computer skills.[6]

This agenda is complicated by the pace of technological change, socioeconomic barriers to participation in the digital economy, and a fragmented digital literacy policy and education landscape. In other words, who you are and where you live will have significant impacts on your exposure to and ability to develop digital literacy skills and competencies.

As such, there is a need for more clarity on what digital literacy comprises and the options that Canadian policymakers can pursue to develop a digitally literate workforce at scale.

PROJECT OVERVIEW

This discussion paper summarizes the key issues and questions that crop up in debates about digital literacy, and sets out our initial thinking on the need for digital knowledge and skills, what digital literacy comprises, and a framework for understanding digital skills.

To inform this discussion paper, BII+E conducted an in-depth literature review and jurisdictional scan. We also spoke to policymakers, program delivery experts, and industry experts across the country about the importance of digital skills, trends in education and training, and the challenges associated with equipping the present and future workforce with the skills to participate in an increasingly digital economy.

BII+E published a literature review in April 2017 as a first step in the Institute's research on the state of digital literacy in Canada. The literature review focuses on digital literacy as it pertains to the changing nature of work and draws upon Canadian and international research and best practices in order to summarize existing thinking on what digital literacy is, the skills it comprises, and its importance.

Concurrent to this work, BII+E is leading the development of a Digital Literacy + Coding Pilot. The Pilot is focused on developing a scalable model for bridging the gap between youth underrepresented in science, technology, engineering and math (STEM), and the digital skills and competencies that are critical to full economic participation in the labour force. As the Pilot advances, the aim is to incorporate emergent insights from its participatory research approach into this work, and vice versa.

This discussion paper will be used to test our definition of digital literacy and our framework for understanding digital skills from across sectors. It will also inform consultations with experts on the next steps in our research agenda.

In future phases of work, we will more closely examine data related to digital skills supply and demand across Canadian occupations and industries; map current digital literacy-focused programs and policies in Canada; and develop actionable recommendations to address existing barriers and take hold of opportunities to equitably develop digital literacy in Canada.

KEY ISSUES

HOW HAS DIGITAL LITERACY BEEN DEFINED BY OTHERS?

Despite a vast amount of literature and numerous frameworks, there is neither a standardized definition of digital literacy nor a universal lexicon of the skills and competencies it comprises. Several existing digital literacy and digital skill definitions are captured in Figure 1.

Figure 1: Definitions of digital literacy and digital skills

Organizations	Definitions
MediaSmarts[7] (2016)	According to MediaSmarts, a Canadian digital and media literacy nonprofit, digital literacy includes a number of elements that range from basic interaction with digital tools to more complex creative and critical digital literacies. MediaSmarts has identified three levels of *digital literacy*: **Use:** Baseline skills needed to engage with digital tools. **Understand:** Skills needed to understand and process information. **Create:** Skills needed to produce digital content.
OECD PIAAC Survey[8] (2012)	The Programme for the International Assessment of Adult Competencies (PIAAC) measures literacy, numeracy and *problem solving in technology-rich environments* (PS-TRE). PS-TRE is defined as "using digital technology, communication tools, and networks to acquire and evaluate information, communicate with others, and perform practical tasks." The OECD assesses PS-TRE along four levels of proficiency: **Below level 1:** Tasks with clear goals, few steps, and performed in familiar environments that can be completed using basic computer functions such as using a mouse. **Level 1:** Tasks in which the goals are explicitly stated and for which a small number of operations are performed in a single familiar environment, including email usage or finding information in spreadsheets. **Level 2:** Tasks with explicit criteria for success, a small number of applications, several steps, and occasional unexpected outcomes. **Level 3:** Tasks that involve multiple applications, a large number of steps, occasional impasses and the discovery and use of ad hoc commands in a novel environment.[9]
European Commission[10]	The European Digital Competence Framework for Citizens focuses on *digital competence*, which is defined as "the confident and critical use of information technology for work, leisure, learning and communication. It is underpinned by basic skills in ICT [information and communication technologies]. This includes the use of computers to retrieve, access, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the internet."

	Digital competence is separated into five competence areas: information and data literacy; communication and collaboration; digital content creation; safety; and problem solving.
e-Skills Forum[11] **(2004)**	The European e-Skills Forum defines *e-skills* as falling generally under three categories: **ICT practitioner skills:** The skills required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems. **ICT user skills:** The skills required for the effective application of ICT systems and devices, including the use of common software and specialized tools supporting business functions within industry. This category includes the skills required for the confident and critical use of ICT for work, leisure, learning and communication. **e-Business skills:** The skills required to use and understand the limitations of software and information systems to increase the efficiency of organizations, and to quickly assess new capabilities in conducting business.
WDM Consultants[12] **(2011)**	Placing a focus on *digital skills* for Canadian workers, this framework names four clusters of skills: **Foundational skills:** The gateway basic literacy and numeracy skills that reflect the proficiency level required to engage with digital technology and demonstrate or develop more precise digital information processing skills. **Transversal skills:** Broadly transferable, non-technical skills that contribute to the optimization of human performance at work when combined with specific occupational or technical skills. **Digital technical skills:** The skills involved in the use of digital systems, tools, and software applications. **Digital information processing skills:** The skills required for using digital technology to access, manage, integrate and evaluate information, construct new knowledge, and communicate with others.
American Library Association[13]	The American Library Association (ALA) defines *digital literacy* as "the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills." Among a number of capabilities related to understanding and using technology, the ALA also notes that a digitally literate person can use digital skills to "actively participate in civic society and contribute to a vibrant, informed, and engaged community."

Users to sensemakers[14] to creators

Most of these definitions refer to a spectrum of digital skills or competencies that coincide with different types of tasks, and that move from using to sensemaking and creating.

These skills and competencies include understanding the basis of how digital information is created and how digital tools operate, and can include the ability to create digital tools. The capacity to critically understand digital tools is different from the ability to simply use them and, in our view, marks the distinction between digital literacy and digital skills.

There is general agreement that the capacity to navigate and adapt to rapidly changing digital environments is critical to digital literacy.[15] Just as traditional literacy is understood as a deep competency that goes beyond simply reading and writing, digital literacy implies a deeper understanding than simply using technological tools.

This means that "digital natives"—members of the generations that have grown up with technology and have inherent digital skills—are not necessarily digitally literate.[16] On its own, early exposure to technology does not generate an understanding of the underlying technology, nor does the ability to use it; education has a crucial role to play in developing this deeper understanding.[17]

WHO IS ADDRESSING THE NEED FOR DIGITAL LITERACY?

Digital literacy education in Canada is shared between formal education infrastructure and extra-curricular education offerings from non-profit and private sector program delivery organizations, both in-person and online. To some extent, employers are also playing a role in digital skill training. A high-level overview of this landscape is shown in Figure 2.

A number of provincial governments have recognized a need to more systematically incorporate the development of digital skills and competencies into K-12 education curricula.[18] For example, British Columbia's #BCTech Strategy aims to ensure that "every student will have the opportunity to learn coding by the end of Grade 9."[19]

The reach and scale of the formal education system, which encompasses K-12 and post-secondary education, means that it plays a critical role in equipping students from across geographies and socioeconomic groups with the right mix of skills for the future of work. The formal education system also provides access to digital technology hardware. However, the relatively slow pace of curriculum change presents difficulties given how quickly the relevant platforms and languages are changing. To date, K-12 digital literacy education has not been consistent across schools, and is largely dependent on school board initiatives or individual teachers (interview, March 21, 2017).

Extra-curricular programs, which are better placed to keep pace with technological change, may have an advantage in teaching some elements of digital literacy, such as coding.[20] Recent federal commitments have focused on supporting digital literacy initiatives that fall outside of

the formal education system.[21] The range of programs available is growing, with some large providers, such as Ladies Learning Code, Actua, and Kids Code Jeunesse offering coding workshops and boot camps for youth and adults in communities across the country; however, cost and location remain a barrier for many.

There are a number of Canadian and international platforms that enable do-it-yourself online learning, such as Code.org and Codecademy. Community organizations such as public libraries also play a growing role in broadening access by offering resources such as peer support, hardware, and digital learning spaces.[22] [23] Workforce training on the part of employers, while limited, is another part of this landscape, taking the form of in-house training programs for existing employees or work-integrated learning opportunities for students.

Developments within and outside of the country's formal education systems have been advancing in a piecemeal fashion, which concentrates access in certain geographies and populations. This is further complicated by Canada's federal system, which places education and workforce development programming under provincial jurisdiction and national economic and labour strategies under federal jurisdiction. Significant activity is also taking place at the local level. Ultimately, Canada may benefit from a national digital literacy strategy, to knit together the efforts of the different stakeholders engaged in designing digital literacy policies and programs.

In a subsequent phase of this research, BII+E will map digital literacy-focused policies and programs in Canada and develop best-practice case studies.

Figure 2: An overview of digital literacy program offerings in Canada
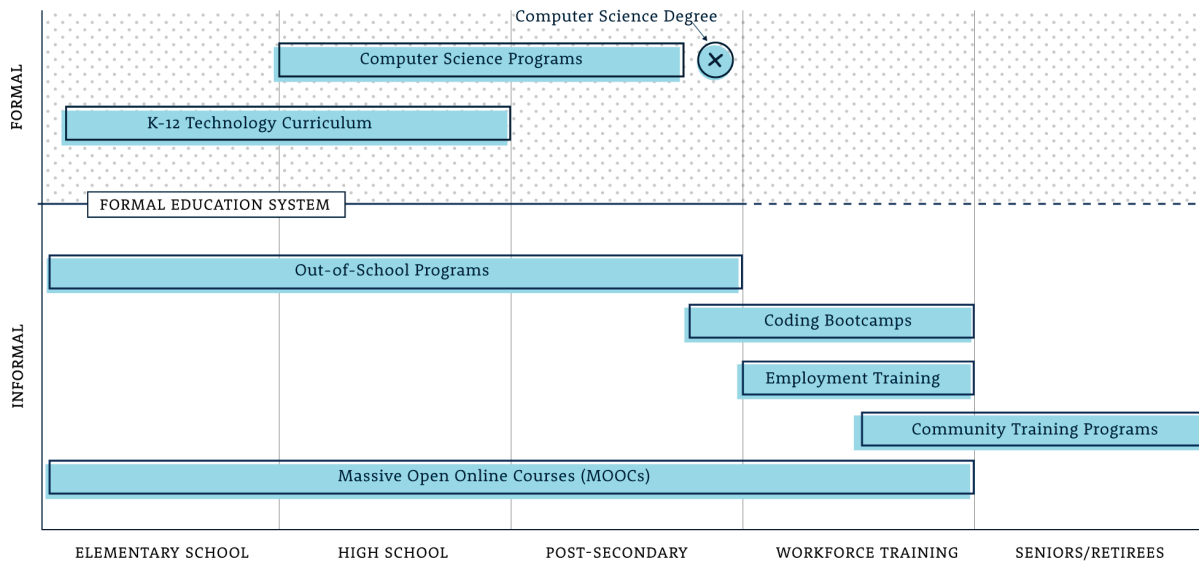
New technologies are enabling more job tasks to be automated. While some jobs could become obsolete as a result, it is expected that others will be created and that many more will change to include a greater degree of interaction with digital technologies. It is expected that a basic level of digital skill will be crucial for the vast majority of the labour force, and that demand for higher levels of digital skill will increase.[24] In an evolving digital economy—the new economic paradigm marked by increasing reliance on digital technologies—digital literacy has been identified as an economic necessity.[25]

Available data suggests that the demand for digitally literate talent is growing. For example, the Information and Communications Technology Council (ICTC) estimates the need to hire an additional 216,000 information and communications technology (ICT) workers in Canada by 2021.[26]

Beyond the ICT sector, ICT-related digital skills are also increasingly relevant. From 2011 to 2016, employment growth for ICT-oriented roles was reported as highest in the professional, scientific and technical services, manufacturing, and information and cultural industries respectively.[27]

A 2016 employer survey reports that 84 percent of Canadian companies consider the use of a computer and basic technical competencies to be essential to their operations, while Essential Skills Ontario reports that even low-skilled jobs increasingly require a basic level of digital literacy.[28] [29]

This is also reflected in comparable jurisdictions like the US, where 78 percent of middle-skill job opportunities—defined by Burning Glass Technologies as occupations where less than 80 percent of job postings require a bachelor's degree, and offer a median hourly wage above the national living wage—now require digital skills in the form of spreadsheet and word processing.[30] Similarly, 77 percent of jobs amongst small and medium-sized businesses in the UK require the use of basic digital skills.[31]

The extent to which Canada is positioned to respond to growing demand for digital skills is unclear. A 2013 Statistics Canada study using data from the Programme for the International Assessment of Adult Competencies (PIAAC) found that Canadians were above the Organisation for Economic Co-operation and Development (OECD) average in technology use and problem solving skills.[32] Canada was second amongst participating countries in the proportion of the population scoring at the highest level of proficiency in technological problem solving, at 37 percent. However, there is significant in-country variation, with Alberta having the highest share of people scoring high in problem solving in technology-rich environments (PS-TRE) at 39.5 percent compared to Nunavut at only 10.9 percent.[33] While PIAAC's measurement of problem solving in technologically-rich environments is not a perfect analog for digital literacy, it does shed some light on the digital skills of Canadians.

Currently available data does not enable us to create a comprehensive picture of how the supply and demand for specific digital skills, at different levels of proficiency, is changing. It

does, however, indicate growing demand for digital skills, and while Canada as a whole appears to be well positioned to meet this demand relative to other countries, there is a risk that demand could outstrip supply as technology continues to reshape jobs across the economy. Moreover, some parts of the Canadian population are getting left behind. To help fill some of the gaps in this picture, BII+E plans to further explore existing and new sources of data in future work.

WHAT DO WE KNOW ABOUT CANADA'S DIGITAL DIVIDES?

Alongside a potential undersupply of digital skills, available data suggests an inequitable distribution of these skills. Certain demographics are less likely to have digital skills, or to be represented in technology-intensive jobs.[34][35] To augment economic and social inclusion, as well as to build a more robust talent pipeline that engages all available talent, it will be critical to create new opportunities for digital skills development for Canadians from across geographies, ages, income levels, genders, racial and ethnic groups, and other types of divides.

A large number of structural barriers exist to achieving digital equity. For instance, access to technology—most notably, access to a quality internet connection—is a persistent challenge. In Canada, one of the most significant divides in terms of internet access is along urban/rural lines.[36] Statistics Canada's Internet Use survey found that 83 percent of Canadian households had internet access in 2012.[37] About 85 percent of households in census metropolitan areas and 80 percent in census agglomerations had home internet access, as compared to only 75 percent of households outside these areas. Even more striking, among households with incomes of $30,000 or less, only 58 percent had home internet access, as compared to 98 percent of households in the top income quartile.[38]

Income is also a barrier to participation in digital skills education and training opportunities. Pressure on workers to upskill in order to stay relevant to the labour market largely places responsibility on the individuals.[39] However, the costs of private courses, which are prohibitive for some, and limited on-the-job training pose barriers to workers who need digital skills to survive and thrive in the labour market.

Gender is another dividing line for digital skills and participation. While PIAAC data suggests that men and women in Canada are generally at the same levels of proficiency with respect to problem solving in technology-rich environments, women remain underrepresented in STEM and ICT professions. Women make up 23 to 25 percent of people in ICT professions, which is lower than in EU countries and the US.[40] In addition, according to the most recent Census data, women account for only 39 percent of university graduates aged 25 to 34 with a STEM degree, but represent 66 percent of non-STEM graduates.[41] Research suggests that the causes of lower STEM participation among women tend to be embedded in culture.[42] Factors such as socioeconomic background and measured proficiency have a relatively small impact on women choosing to study computer science compared to social encouragement; this includes encouragement from family and peers, self-perceived proficiency, academic exposure to computer science courses, and perception of future career success.[43]

In Canada, Indigenous communities face specific barriers to digital access and literacy. While roughly 4 percent of Canada's population identifies as Indigenous, as of 2016 there were an estimated 10,300 Indigenous ICT professionals employed in Canada, representing only 1.2 percent of all ICT professionals nationally. These Indigenous ICT professionals make seven percent less on average than their non-Indigenous peers.[44] Furthermore, among Canadians aged 25 to 54 with a STEM degree, less than one percent identified as Indigenous in the last National Household Survey.[45] This is likely influenced by lower literacy levels, a lack of pedagogical strategies that account for Indigenous knowledge, and a range of other socioeconomic challenges.[46]

As technology continues to advance, so do forms of digital exclusion influenced by factors such as geography, income, gender, race, ethnicity, and age. While new technologies close some gaps by, for example, making information more widely accessible or lowering the cost of assistive technologies, other gaps widen.[47] In particular, technological advancements are changing skill requirements in the workforce, privileging people who have had the means and encouragement to develop in-demand skills.

This is by no means a comprehensive assessment of digital divides among Canadians. BII+E plans to investigate these divides in more detail in subsequent work.

WHAT IS DIGITAL LITERACY?

Our working definition of digital literacy: The ability to use technological tools to solve problems, underpinned by the ability to critically understand digital content and tools. This can include the more advanced ability to create new technological tools, products, and services.

OUR CURRENT THINKING

Based on our initial investigation into the nature of digital literacy and skills, we have developed a notional definition of digital literacy and a framework for understanding digital skills. Our intention is to use this paper to test our current thinking with experts from across sectors, with a view to informing future research.

DIGITAL SKILLS

Digital skills exist on a spectrum, as do the levels of understanding and critical thinking that accompany them. Our initial thinking on a framework for understanding digital skills is outlined in Figure 3.

Figure 3: A potential framework for understanding digital skills
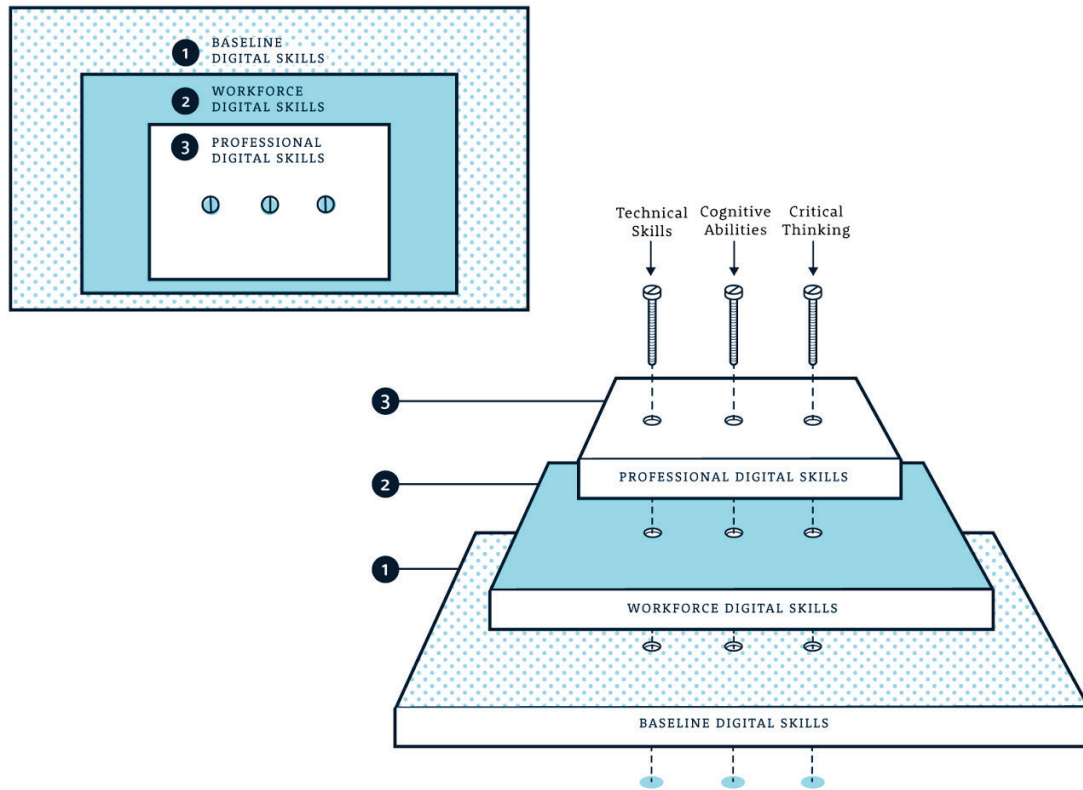
Baseline digital skills: The skills needed by everyone to participate in an increasingly digital economy. This includes being able to confidently use and interact with technology—such as understanding how to find information, conducting a search on an online search engine, communicating with others, and using existing software.

These baseline digital skills are built on a foundation of traditional literacy skills: reading, writing, and numeracy. Ideally, they are founded in some degree of digital literacy that enables users to understand the capabilities and limitations of digital information and tools, and to transfer knowledge of how to use one tool to another.

Workforce digital skills: The occupation-specific skills needed by a rapidly growing proportion of the workforce. These skills can include performing tasks using spreadsheet, data entry, graphic design, or customer relationship management (CRM) software.

Professional digital skills: The skills needed to develop new digital technologies, products, and services. This includes, for example, skills needed by software developers, machine learning engineers and data scientists.

While these skills are presented on a series of levels, the separation between levels is permeable. Understanding how to deploy certain digital tools, knowing the algorithms on

which tools are based, or creating entirely new platforms involve very different digital skills, which people may possess at varying levels of proficiency and in different combinations.

Our focus is on the digital skills that are most relevant to workforce participation, rather than social interaction or civic participation, although we recognize that there is significant overlap.

Does everyone need to learn to code?

In Canada, mainstream conversations around digital literacy have called for education curricula and rapid upskilling programs to include coding. Coding is defined as the ability to use a computer program by writing instructions in languages that computers can understand, such as JavaScript, HTML, Python, C++, and Ruby, among many others.[48]

Demand for coding skills is growing across industries and occupations. While the ICT sector, which is the traditional home of coders, is growing, the market for coding has expanded far beyond this domain. For instance, in the US, roughly half of all job openings requiring coding skills are in healthcare, manufacturing, finance, and other sectors outside of ICT.[49]

In this context, developing coding skills can be considered one helpful way to "future-proof" workers.[50] The opportunities associated with coding skills have clearly been recognized—there has been a proliferation of offerings, both off and online, to help people develop these skills, from private bootcamps to massive open online courses (MOOCs) for professional upskilling.

However, while coding skills are unquestionably important, the emphasis on coding can obscure the wider spectrum of digital literacy and training that underpins a strong and diverse workforce. Digital literacy extends beyond coding to encompass a broader and more foundational set of skills, including logical thinking and problem solving—integral elements of "computational thinking" (described in more detail in the next section)—which transcend individual coding languages and are applicable across disciplines. Part of the value of coding, particularly in certain languages, is that it offers an avenue to develop this broader skillset.[51]

Computational thinking

The pace of technological change means that developing skills that will be relevant throughout a career is much less about attaining specific knowledge, and more about encouraging people to become resilient lifelong learners.

To prepare for the tasks of the future—which are as yet largely unknown—workers will need to be equipped with a broad suite of foundational technical and soft skills that are expected to be relevant across a wide range of jobs.[52] Digital literacy is an important part of this skill set, alongside communication, problem solving, critical thinking, teamwork, and other skills that are complementary to technology.[53]

Among the multifaceted skills and competencies that make up digital literacy, computational thinking is perhaps the most important.

Computational thinking draws on concepts present in computer science, but is increasingly attracting attention as a cross-disciplinary problem solving approach. It is defined by Jeannette Wing—current Corporate Vice President of Microsoft Research and former professor of computer science at Carnegie Mellon University—as "an approach to solving problems, designing systems and understanding human behaviour that draws on concepts fundamental to computing."[54]

According to the International Society for Technology in Education (ISTE) and the Computer Science Teachers Association (CSTA), computational thinking includes, but is not limited to:

1. Formulating problems in a way that enables us to use a computer and other tools to help solve them

2. Logically organizing and analyzing data

3. Representing data through abstractions such as models and simulations

4. Automating solutions through algorithmic thinking

5. Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources

6. Generalizing and transferring this problem solving process to a wide variety of problems[55]

Rather than training everyone to become a computer scientist, the aim is to train people to understand how computers think when faced with problems—to think at multiple levels of abstraction. The ability to think computationally shifts people from using to understanding technology.[56] It can also be helpful for understanding non-computational systems and concepts. Coding is one way to teach and learn computational thinking—in many pedagogical approaches, certain coding languages are used as an entry point to understanding and demonstrating the cognitive tasks involved in computing processes.

Computational thinking is not a precondition for digital skills. A lack of computational thinking will not affect the experience of someone who only needs digital skills to use technological tools at a basic level. However, computational thinking is central to the creation of new digital tools and to deeper understanding.[57] Without an underlying computational thinking ability, knowledge of how to use one tool may not be as easily transferred to another as technology changes. In other words, computational thinking plays a key role in digital literacy.

Against rising concerns about automation, some experts are calling for workers to be trained to create digital tools and use existing tools to problem solve, rather than be displaced by what is being created (interview, April 13, 2017). While the reality may not be as dichotomous, undergirding digital skills with computational thinking will foster creativity and problem solving in digital environments, building a greater capacity for lifelong learning and adaptability.[58]

While computational thinking emerged from STEM disciplines, the concepts that it involves extend across disciplines and are not entirely inaccessible to non-coders.[59] Knitting is one example of applying algorithmic thinking and modelling without the use of a computer.[60]

Unplugged activities that model computational thinking concepts through non-computer-centered exercises like games and puzzles—for example, those developed by CS Unplugged—are a popular approach to teach computational thinking concepts. These activities can avoid barriers like limited access to digital devices or lack of fluency in a coding language. They also help to make the abstract concepts of computational thinking visible and tangible.[61]

To teach computational thinking, unplugged activities cannot replace a deeper understanding of computing, but they can narrow knowledge gaps, cultivate interest, and build confidence with computational concepts.

QUESTIONS + HYPOTHESES

In conducting this initial phase of research, a number of insights have emerged around how digital literacy is understood in the Canadian context. These insights are presented here as hypotheses, with accompanying research questions that will help to refine a definition of digital literacy and a taxonomy of digital skills, and will guide subsequent work aimed at: assessing the supply and demand for these skills in the Canadian labour market, better understanding digital divides, exploring the roles that different actors are best placed to play in fostering a digitally literate workforce, and drawing lessons from existing digital literacy policies and programs.

Hypothesis #1: There is a baseline level of digital skills and awareness that everyone (or nearly everyone) will need to participate in Canada's future economy, regardless of occupation and industry.

+ Is digital literacy a critical 21st-Century skill?

+ What comprises a baseline level of digital skills? What specific digital skills and competencies are (or will be) required across the economy?

+ What level of digital skills should all students have developed on entering the workforce?

+ What should be considered when building a taxonomy of digital skills that is reflective of labour market needs?

Hypothesis #2: Emerging technologies such as artificial intelligence, blockchain and augmented/virtual reality will intensify the need for digital talent across sectors.

+ What impact will emerging technologies have with respect to digital skill needs across different occupations and industries?

+ Given the pace of technological change, can we anticipate the skills that will be needed in the future?

Hypothesis #3: The supply of digital skills in the Canadian labour market is insufficient to meet employer demand, and this gap could grow if digital literacy policy and program solutions are not adopted at scale.

+ What data sources (e.g., PIAAC, the US O*Net crosswalked with Canadian National Occupational Classifications, LinkedIn, Burning Glass Technologies, Magnet) could help to shed light on the supply of and demand for specific digital skills in the Canadian labour market?

+ What are the gaps in this data, and what steps could be taken to fill these gaps?

Hypothesis #4: Canada is faced with a number of "digital divides," which, if not addressed, will lead to widening economic and social inequalities as technology continues to reshape the nature of work, and will contribute to critical talent gaps in Canada's labour market.

+ To what extent do digital divides exist in Canada's population? What factors are contributing to these divides?

+ What impact could reducing these divides have on talent gaps?

+ What research/data is needed to understand the size, causes, and implications of these divides?

Hypothesis #5: Canada will need the public, private, and nonprofit sectors to collaborate on a digital literacy agenda for Canada in order to extend access to digital literacy education and training to all parts of the population, and to ensure that education and training keep pace with the changing nature of work.

+ What are the current roles of employers, nonprofit organizations, educational institutions, governments, and other actors in providing digital literacy education and training? In assessing digital skills? What roles should these actors play?

+ What best practices (for both policies and programs) currently exist in Canada or internationally, and how can they be replicated or scaled?

+ How should Canada's different orders of government work together to build a digitally literate workforce?

+ What role should the federal government's proposed new organization, which is intended to support new approaches to skills development and measurement, play?

BII+E will seek to test these hypotheses and explore answers to these questions in collaboration with partners, over the course of the next year.

CONCLUSION

There is broad recognition that digital technologies are increasingly woven into the fabric of work and daily life, and that this has implications for the skills that Canadians need to participate in the workforce, both today and into the future. This preliminary research offers insights into the state of digital literacy in Canada and how its constituent parts can be understood.

In following phases of this research, BII+E plans to focus on:

+ Further research to map digital literacy-focused programs and policies that currently exist in Canada, alongside Canadian and international case study research to extract lessons for inclusive digital talent development.

+ A closer examination of data related to the supply of and demand for digital skills across different Canadian occupations and industries. This could include research aimed at quantifying existing digital divides in the labour market. This research will be based on existing data sources and potentially on new survey data.

+ Developing actionable recommendations for government as well as private and nonprofit actors to address existing gaps and barriers to digital literacy in Canada.

BII+E will continue to develop and seek advice on the concepts in this discussion paper, and welcomes all comments and feedback. To get in touch, please email andrew.do@ryerson.ca and annalise.huynh@ryerson.ca.

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