Deep Learning? Investigating Student's Perceptions of Educational and Occupational Skills for the Fourth Industrial Revolution

by

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Abstract

The introduction of Artificial Intelligence (AI) is a key factor driving the Fourth Industrial Revolution. Like industrial revolutions of the past, it will have a profound effect on jobs, the kinds of skills needed to fill jobs, and the role of tertiary education in gaining them. Literature suggests that the kinds of skills gained from the Liberal Arts will be important to the future occupational opportunities. This thesis examines students' perceptions of the jobs and skills of the current job and educational context. This is examined through a survey of students (n=1,136) from a research university in Nova Scotia, Canada. Despite the literature's emphasis on the importance of Liberal Arts, my research finds that Arts students do not see the importance of soft skills they have in the future of work as compared to students in other faculties. They also do not see the impact of AI on the labour market and were least likely to feel they are gaining skills needed to be successful in the future labour market. Liberal arts students also expressed that they were not pursuing their degree for a specific line of work and they were least likely to feel they are getting value out of their degree. By contrast, Health students hit many of the aspects that suggests they are best prepared for the coming disruptions. This shows that universities and Deans of Faculties of Arts and Social Sciences can do more to help students prepare for the changing future of work.

List of Abbreviations Used

AI	Artificial Intelligence
DSU	Dalhousie Student Union
O*Net	Occupational Information Network
RBC	Royal Bank of Canada
SBTC	Skill-biased Technical Change
STEM	Science, Technology, Engineering and Mathematics
WEF	World Economic Forum

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Chapter 1. Introduction

The first Industrial Revolution of the 18th century made factories more efficient (Ford 2016) and early mechanization increased people's capability to labour, changing the *nature* of work (Aoun 2017). The change in the nature of work became more apparent at the end of the 19th century with the discovery and domestication of electricity, bringing along the Second Industrial Revolution. The next big change in labour came with the Third Industrial Revolution, which started with the creation of the first digital computer[1] during the Second World War (Brynjolfsson & McAfee 2014). Discussions about the possibility of Artificial Intelligence (AI) were already underway early into this period. In the 2020s the ubiquity of AI, its increasing use in industry, and its potential for disruptions in all spheres of life has led some to conclude we are entering a new era of profound technological change (Brynjolfsson & McAfee 2014; Schwab 2016; Harari 2015; Harari 2018). Some scholars refer to this as the Fourth Industrial Revolution (Schwab 2016), after which the complex 'doing' machines of yesterday will be outmoded by the 'thinking' machines of today and tomorrow.

The Fourth Industrial Revolution is different from previous eras of technological change because of three factors: "velocity, scope, and systems impact" (Schwab 2016). Its pace of evolution is far quicker than previous eras; it is disrupting all industries; and, this will have a profound impact on almost every aspect of people's lives.

[1] While computers as we know them are 'digital' per se, this distinction is made because at the time of the first digital computer, a 'computer' was a job title held by mathematicians to run calculations. The creation of the first digital computer brought about the first job disruptions of the Third Industrial Revolution by replacing human computers.

Automation has already begun to change the role of skills and work, especially in middle skill and, to a slightly lesser extent, low skill jobs (Dahlin 2019; Autor & Salomons 2018; Salomons and Zierahn 2016; Tüzemen and Willis 2013; Autor & Dorn 2013). Such systems are already in place within manufacturing and commercial industries running the kinds of calculations necessary from doing everything from manufacturing cars to sorting tomatoes. And soon, these same technologies will also be driving the cars, harvesting crops and much more. Today, most people interact with AI in some form or another more than they probably realize. As AI becomes increasingly capable of doing tasks once thought to be safe from machines and automation, this raises the question of how long it will be before it takes over the workforce. What will be the breadth of its capabilities, and how exactly will that change 'work'? While many high skill jobs were once considered safe from automation, AI is poised to disrupt many high skill jobs as well (Susskind & Susskind 2015; Ford 2016; Brynjolfsson & McAfee 2014; Aoun 2017). A post-secondary education used to be seen as a path to train young people to enter high skill jobs. With AI, societies now face the issue of training youth for a work that will look very different in the coming years. This means that post-secondary institutions also need to adapt with the changing demands of the labour market.

If this is the case, it is important to know how universities, industries, and individuals will navigate these changes. However, such an analysis would be quite large. Thus, this thesis will engage one portion of these issues by exploring students' perceptions of, and engagement with, the skills needed for the labour market. Some research has looked at how students acquire skills and knowledge from their disciplines and found that most do not acquire the fundamentals that their disciplines try to instil, especially around critical thinking and analytic skills (Arum & Roksa 2011). Other researchers have focused on students’ reasons for going to university, finding that students see it only as a path to get a ‘good job,’ and place little personal value into the education itself, and possibly jeopardizing how students gain important skills and knowledge (Davidson 2017). Thus, there is the need to understand what students know about the kinds of skills that will be effective in the workforce of the Fourth Industrial Revolution, and whether students take technological change into consideration when deciding what to do for a living. For this reason, in this thesis, I ask: What is students' awareness of skills needed for the AI economy? What do students know about the effects of AI on employment, and what do they think about it? And do students see value in their degree?

Chapter 2 will begin investigating these questions by reviewing the literature related to the role of AI in the future labour market. In Chapter 3 will present the methodology used in my thesis and will outline the variables analyzed. Chapter 4 analyzes the data collected, by looking at students’ perceptions on the importance of hard and soft skills, and how their perceptions align with labour market reports on the future of skills. Chapter 5 looks at what students know about the effects of AI on the labour market, and whether students felt they were gaining the necessary skills from their education to be successful in this future labour market. Lastly, chapter 6 looks at the value students place on their degree and the skills they obtain from it, and how this varies between students who were pursuing a specific career or area of work or did not know what they wanted to do for a living.

Chapter 2: Review of Literature

To frame the research questions outlined in the previous chapter, this chapter is broken into three core sections. First, it outlines some of technological trends in the world of work and the place of Artificial Intelligence (AI) within in. Specifically, the analyses the role automation in changing skills needed for work as well as how the introduction of AI is different from traditional forms of automation, affecting the kinds of skills necessary in the future. Second, the chapter engages in a discussion of the role of tertiary education for equipping young people with the necessary skills for 'high' skill jobs. Because of the kinds of skills necessary to succeed in the AI economy, the notion of low, medium and high skill jobs does not translate directly to the Fourth Industrial Revolution, and traditional forms of education are not adequately preparing students for future jobs. Third, I will lay out what these two points mean to this research specifically.

2.1 Skills Needed in the Fourth Industrial Revolution

While there is a body of literature around the effects of technology on work and society, technological change and automation in work and the economy, 'artificial intelligence' as a term in social science and the area of work has largely been absent until relatively recently. This is mainly because 'artificial intelligence' is an evasive term and the concepts of *robotics*, *machines* and *automation* are often used in its place of one another when discussing their effects on work and economy. In this case, *robotics, machines* and *automation* are physical systems and processes created by the adoptions of technologies within the workplace. While these physical systems and processes, are related—and in the case of the AI and the Fourth Industrial Revolution, reliant—on one another, AI is the software that powers such machines. It operates at a metaphysical level and is not easily observable and thus often unrecognized but is just as important as the previous terms as the type of software that powers such machines. John McCarthy—a founding father of AI—saw this early on in AI's creation, and was once quoted as saying "as soon as it works, no one calls it AI anymore" (Vardi 2012, p.5). *Automation* is a far more common term as it is a "much more inclusive" term than *machines* or *robots,* as it includes a wider array of technologies with the same purpose (Dahlin 2019; p.2). While much of the literature may not use the term 'artificial intelligence' per se, many of these aforementioned terms are used interchangeably to mean the same thing: *intelligent, autonomous, disruptive technologies*.

Research on the effects of AI on jobs is largely grouped in two opposing views, with one position predicting that AI *will* take our jobs' and the other predicting that it *will not*. These two positions are referred to as the 'displacement view'—the view that intelligent technologies are 'taking our jobs'—and the complementary view—the view that intelligent technologies complement human labour, provide more value and opportunity for new jobs (Dahlin 2019). However, the two perspectives are not mutually exclusive, and the different conclusions they reach vary based on what job skill-level is in view. Some refer to job skills in terms of unskilled versus skilled work (Goos & Manning 2007; Jäger, Moll & Lerch 2016), manual versus cognitive work (Jaimovich and Siu 2012), or routine versus non-routine work (Autor et al 2003). Manual tasks require physical work such as moving objects or assembling items, while cognitive tasks require mental engagement and forms of abstraction (Dahlin 2019, p.5). Routine tasks are those that have specific sets of procedures, while non-routine require "creativity and flexibility"

(Jaimovich & Siu 2012 in Dahlin 2019). However, these dichotomous views on skills still fail to capture the full picture of jobs skills. An alternative view combines aspects of these previous skills types into the low, medium and high skilled work. Low skilled work fits in as non-routine manual tasks and includes jobs such as retail workers; middle skill can fall on both manual or cognitive routine tasks, and include jobs such as office support staff (routine-cognitive) or manufacturing worker (routine-manual), and; high skill involves non-routine cognitive tasks, and involves jobs such as doctors (Dahlin 2019). While this perspective on skills is better at capturing skills complexity for humans (e.g. amount of time needed to train from low versus high skill jobs, required education, etc.), it does little in exploring replicability of tasks by AI, and thus is a perspective that may not be as relevant to analysis of work in the Fourth Industrial Revolution.

The World Economic Forum (WEF) points out both the benefits and drawbacks of AI and disruptive technologies in the workplace, showing that it creates new jobs while at the same time displacing a greater overall number of jobs. In the WEF's 2016 report, the Forum states that over 5 million jobs across 15 developed nations will disappear by 2020 with the introduction of AI technologies in the workplace. Such disruptions are not distributed across the sexes equally. According to the report, 2.45 million job losses will affect women, while 2.65 million job losses will affect men. While job losses affect more jobs held by men, women are likely to be more affected overall by technological displacement. Men will see one job created for every three jobs that disappear, while women will only see one job created for every six jobs that disappear, suggesting a greater gender gap due to automation (WEF 2016). These job disruptions are expected be to be most concentrated in manufacturing and production, office and administrative occupations, construction and extraction among others, while areas that will see an increase in the number of jobs include business and financial operations, management and, computer and mathematical areas (WEF 2016), or those that require distinctly ‘human’ skills, such as e-commerce and social media experts, customer service workers, sales and marketing professionals, training and development workers, organizational development specialists and innovation managers (WEF 2018, p.8), or sectors involved in building robots and other autonomous technologies (Dahlin 2019). That is, jobs that revolve around human-to-human interaction, or those that will utilize using intelligent machines to conduct their business. That said, data used in the WEF’s *Future of Jobs Report* came from surveys of chief human resource and chief strategy officers of approximately 50 companies throughout the industrial world (WEF 2016). Gender-based data came from those who filled positions within the respective organizations at the time of sampling. Because we do not really know what the future of jobs will hold in terms of the jobs that will be created, their predictions may not actually reflect reality. In fact, many predictions about the future of skills notes the importance of human skills or soft skills as making up much of the labour force, which I discuss in more detail in the next section. Wilson et al (2006) notes that women currently make up a large portion of roles that require human-based skills, such as service, care and sales, and that the number of women in managerial and care positions will grow in the coming years. The fact that women are already clustered in jobs that may utilize soft skills suggests they may be aptly suited for future jobs.

Here is where the two views on whether machines will ‘take our jobs’ begin to overlap. The literature that accompanies the complementary view says that the adoption of AI and other intelligent technologies provides opportunities for new work, however, it focuses on higher-skilled jobs and, to some extent, low skilled jobs (Autor & Salomons 2018; Salomons and Zierahn 2016; Tüzemen and Willis 2013; Autor & Dorn 2013). However, it finds no evidence to counter the displacement view's predictions about the disruption of middle skill jobs. This sides with two contemporary trends. First, the skill-biased technical change (SBTC) view, which sees the adaption of new technologies as complementing high skill jobs, requiring higher levels of education. This is similar to the historical trend in the creation of new jobs requiring more, and higher levels of education (Ford 2016; Dahlin 2019). This perspective sees the acquisition of knowledge as a primary means for entering high skill jobs, and it also includes many of the professions, such as doctors, lawyers and teachers, etc. The second trend is the deskilling of labour, a term popularized by Harry Braverman, which describes the 'dumbing down' of complex jobs into separate small, routine tasks that can be carried out by just about anyone to supplement work for low-skill jobs (Dietz & York 2015; Timmerman 2018; Brougham & Haar 2017). With the introduction of increasingly intelligent technologies that are more capable and less expensive than those in the past, the questions become less about *what* jobs will be affected, and more about *how* AI will affect jobs as it is adopted into jobs across all spectrums of low, medium and high skilled work. As the WEF asserts: "The future of jobs is not singular. It will diverge by industry and sector, influenced by initial starting conditions around the distribution of tasks, different investments in technology adoption, and the skills availability and adaptability of the workforce" (2018, p.15).

One example of this displacement in low skilled jobs is how autonomous vehicles will affect truck drivers. In the US alone, truck driving employs over 3.5 million people

(Day & Hait 2019). It is the second largest occupation in the country besides retail sales (4.5 million people). Ninety percent of truckers are men, and the median age for truck drivers is 46 years-old, five-years older than the mean for all other occupations (Day & Hait 2019). Between 2012 and 2016, trucking was also the fastest growing industry, with a 15.9% growth compared to all other industries which had an 8% growth overall (Day & Hait 2019). The development of autonomous vehicles appears to be on track to displace this workforce, and the adoption of autonomous vehicles is speculated to be widespread by 2025 (Wintersberger, Azmat & Kummer, 2019), affecting a demographic group who cannot easily retrain to enter other sectors. What to do with these people who would become part of an economic 'useless class' is an important discussion to have in discussions about of AI taking over the workforce and how to treat those affected by technological disruption (Harari 2015; Harari 2018). However, this is part of a larger issue for futher research and is not touched on in much detail in this thesis.

Much of the literature has espoused the SBTC view that adopting new technologies has increased the number of jobs and the value of work in high skill jobs (Autor & Salomons 2018; Salomons and Zierahn 2016; Tüzemen and Willis 2013; Autor & Dorn 2013). High skill jobs are referred to as such due to the expertise behind such jobs. They require skills and specific knowledge not easily learned, but rather honed and polished over a period of time, typically during one's education. Here, the specific and specialized knowledge one had was often key for many of these jobs and is the trait that defines specialists within professions (Susskind & Susskind 2015; Aronowitz & DiFazio 2010). In some areas, the body of knowledge is so large that there are even specific experts within fields. This can be seen with doctors, with dermatologists, cardiologists, hematologists, neurologists and the like, all of whom are ‘doctors,’ but each of whom likely know little of one another’s field. This is also similar to lawyers, who deal with criminal law, estate law, malpractice, corporate law, tort law, etc. The large diversity of knowledge is the cause for this wide array of experts with professions and many high skill jobs. It would be unreasonable for any one person to be able to retain so much information. Machines will not just affect many working professions, but also those in the Science, Technology, Engineering and Mathematics (STEM) fields as many of the skills in these areas are more easily replicable by machines than previously thought (Susskind & Susskind 2015; Aoun 2017; Ford 2016; Brynjolfsson & McAfee 2014; Tegmark 2017), despite many jobs that fall within the area of ‘STEM’ as being considered high skill jobs. Besides the example given above about AI changing the role of medical specialists, AI has already begun to change the role of engineers as well, using machine learning[2] algorithms to create modeling simulations to manufacture more durable and more lightweight aircraft parts. Both examples show the depth to which the technology will disrupt high skill jobs.

Currently, the notion of high skill versus low skills jobs is a broad categorization of skills that does not accurately capture the kinds of jobs that may be affected by AI, or the kinds of jobs that may be available in the near future. The literature emphasizes that automation is currently affecting jobs within skill levels, such as the hollowing out of middle skill jobs. However, AI threatens to affect jobs across all skill levels. This poses serious questions about the roles of skills in the workforce, with a need to understand

[2] Machine learning is one method for teaching AI, by providing AI algorithms with large amounts of data which allows them to see patterns and use this data to make decisions based on prior experiences. It is one of the primary methods for teaching AI today.

what *kinds* of skills specifically (rather than skill level) will be affected, and the kinds of skills that young people today should develop to be ready for the workforce of tomorrow.

The changing landscape of skills was addressed in a 2018 report by the Royal Bank of Canada (RBC), which used the Occupational Information Network (O*Net) to assess 35 core skills and how important they were to job roles within North America. In their analysis, the most important skills were all ‘soft’ skills and were primarily identified as “very important” or “important” across all available jobs. The lowest rated skills on this list were ‘hard’ skills, which were mainly considered ”less important” or “not required” (RBC 2018). For example, the skill Critical Thinking was ranked primarily as “important” or “very important,” whereas the skill Equipment Selection was mainly considered “less important” or “not Required” Many of the top-rated soft skills identified by the RBC report were also seen as important by Baker, Smith and Anissa in their 2019 report on the role of AI in education. This suggests that the future of skills will have an emphasis on soft, human-based skills. These will be discussed more in the next section.

2.2. Human Skills and an Education Approach

Engaging in philosophical discussions such as the Trolley Problem—common in discussions around programming autonomous vehicles—is a form of divergent thinking. The notion of divergent thinking comes from the work of psychologist J. P. Guilford (1967, in Aoun 2017) who denoted it as one of two lines of thinking, alongside convergent thinking. Divergent thinking is a broad method of thought and concerns itself with the free flow of ideas and linking of seemingly unrelated, abstract ideas. Convergent thinking on the other hand is narrow, generally binary, and concerns itself with facts or ‘right’ versus ‘wrong’ answers. For example, a convergent thinker would be an engineer thinking about the internal, mechanical workings of a vehicle (Aoun 2017, p.104) while a liberal arts student may engage in wider scope of divergent thinking, such as seeing the social and economic implications of purchasing a car, remembering the history about automobile manufacturing and understanding the effect Fordism and assembly line production had on jobs, understanding the wider effects of fuel emissions caused by vehicles, and seeing the bigger debate between climate change and the political sphere. These tie into contemporary notions of 'hard' and 'soft' skills and have implications for the skills needed to navigate the labour needs of the Fourth Industrial Revolution.

Hard skills are narrow, specific, easily quantifiable skills that are learned, and are teachable such as mathematics, computer programming, engineering principles, and memorizing facts (Acemoglu & Autor 2011; Aoun 2017; Frey & Osborne 2013). Soft skills on the other hand cannot necessarily be taught but are rather acquired by experience. They include the ability to communicate and cooperate with others, combining seemingly unrelated concepts into new ideas, and being innovative/creative (Aoun 2017). These are skills that are generally more flexible, require higher levels of abstraction, and are more translatable into multiple settings. The effects of AI on work emphasizes how machines can replace many of the hard skills currently done in work, whereas soft skills and divergent thinking are seen as safe from machines because they are not easily replicated by machines (Brynjolfsson & McAfee 2014; Ford 2016; Tegmark 2017). Many soft skills are gained through a liberal arts education (Aoun 2017). This is not to say that the liberal arts will solve all of our employment problems in an AI future; some technical knowledge learned in STEM fields will still be required. AI can use convergent thinking to understand logic systems, store vast amounts of data and make accurate predictions, but only a divergent thinker can combine multidisciplinary work needed to engage in abstraction.

The study of *Humanics* is seen as a way of combining the multidisciplinary knowledge needed to stay relevant in the AI economy. *Humanics* as proposed by Aoun (2017), the president of North Eastern University, combines different spheres of learning and knowledge that exist today into what is described as the new literacies and greater awareness of our cognitive capacities. The new literacies come from what people learn, are rooted in data literacy, technological literacy, and human literacy. Data literacy involves new ways in making sense of complex data and having this knowledge as commonplace. Technological literacy involves groundwork so that programming and engineering principles are also commonplace knowledge. Human literacy requires greater awareness for the humanities, social science, communication and artistic design principles. The cognitive capacities are how we learn, and comes from entrepreneurship, systems thinking, critical thinking and cultural agility. Entrepreneurship is where the individual can tie the creative sphere to the economic sphere—this is learning to make money from one's creative endeavors. Systems thinking is the ability to see a system holistically be it enterprise, machine, or conceptual. Critical thinking involves increased discipline, rational analysis and rational judgement or, learning to think for yourself. Cultural agility involves individuals learning to operate in a wider global sphere, such as learning new languages, and an understanding of and appreciation for, other cultures.

In research around students' skills acquisition and academic performance, Arum & Roksa (2011) show that almost half of undergraduate students graduate without retaining much of the knowledge of their discipline, and just over a third do not develop the critical thinking and complex reasoning capabilities they are expected to master during their university education. This suggests that educational credentials that can be used to secure employment are often more valued than what is actually learned. In fact, when asked the primary motive for getting a higher education, students overwhelmingly state it is just to get a good job (Davidson 2017).

There is also a view that graduates of Liberal Arts programs have poorer labour outcomes than those in highly specialized STEM fields. However, evidence to suggest that this is actually the case is mixed at best. Most students do not end up working in their field of study (Davidson 2017) and this might be what leads to such conclusions. Those that do are predominantly STEM graduates, which may explain, in part, the insistence for students to enter the STEM fields over the past several decades (Walters 2004; Axelrod, Anisef & Lin 2001). However, STEM graduates who do go on to work in their field of study after graduation often have narrow, specialized skills that limit job mobility (Axelrod, Anisef & Lin 2001; Walters 2004). While Liberal Arts graduates are the least likely to work directly in their field—and many of them go to work in the service industry after graduation (Axelrod, Anisef & Lin 2001; Walters 2004)—they are often better off in the long-run than their STEM counterparts. The flexibility in their skills and experience, and ability for critical thinking, allow for work in a wider variety of occupations, using a wider variety of skills, which translates into greater job mobility and thus, higher levels of income later in life (Axelrod, Anisef & Lin 2001; Walters 2004). What is primarily examined in the literature is career—and to some small extent, skills—outcomes. What is underexamined is how students perceive and value the skills they get in their education, and how these perceptions align with the necessities of the workforce of the Fourth Industrial Revolution.

2.3. A Summary of Literature on Skills for the Fourth Industrial Revolution

Overall, the literature reviewed in this chapter has shown some of the projected effects of technological change and the role of AI in changing the world of work. It has shown some of the competing views of technological displacement and the role of AI within it. Specifically, that previous conceptions of low, medium and high skilled work do not apply to the Fourth Industrial Revolution. Instead, the model of hard versus soft skills is more applicable to discussions on the kinds of skills that are 'safe' from machines (i.e. soft skills that cannot be replicated by machines), versus those that will increasingly be automated in the coming years (i.e. quantifiable hard skills). This is the kind of work that will help young people 'race *with* machines, not *against* them' (Brynjolfsson & McAfee 2014, p.188). Although, current research onto specific skills acquisition is sparse, especially around skills students acquire from university. Some exceptions to this include a look at research-specific skills in graduate students, and, in particular, PhD students (Ghee, Keels, Collins, Neal-Spence and Baker 2016; Anttila, Lindblom-Ylänne, Lonka and Pyhälto 2015). However, a vast majority of students who enter university as undergraduates do not get a PhD, and research-specific skills paints only a small picture when discussing the future of workplace skills. Some work by Anttila, Lindblom-Ylänne, Lonka and Pyhälto (2015) shows that masters-level students do see more importance of 'general' skills over research skills, especially when compared to PhD students, but they do not explore what these kinds of skills entail. Further there is little research into specific skills themselves, and what are the kinds of skills that are ‘hard’ or ‘soft,’ specifically.

This chapter has also shown that those from different disciplines or industries may or may not succeed based on the kinds of skills they have acquired, and that technological displacement will affect men and women unequally in the industries AI aims to disrupt. As noted by Schwab (2016), the scope and systems impact of AI entering the labour market will be broad and severe on industry and ways of life. Further, the velocity at which it is affecting the labour market is far quicker than past technological changes. With the hindsight of the first, second and third industrial revolutions, it begs the question whether people are aware of the role AI will have—and is having—in the labour market of tomorrow.

The chapter also looked at the issue of how students perceive skills acquisition. While universities can alter and adjust their academic programs to help students better prepare for the AI economy by instilling the important skills of the future, it is also important to that students see the importance of these programs and the value they get from it. The role of a university education has been increasingly seen as a ticket to getting a ‘good job’ (Davidson 2017), despite some research showing that students are getting less of the critical thinking an analytic skills that are aimed to be instilled by their disciplines (Arum & Roksa 2011). It has been hypothesized by Davidson (2017) that this view of universities being a ‘ticket to a good job’ has decreased the intrinsic value of a degree and thus contributed to poorer performance by students. If this is truly the case, the perceived lack of value—and perhaps, importance of—one’s education will equally have to be addressed by the universities to help students continue to be properly engaged if they hope to adequately prepare students for the Fourth Industrial Revolution.

The next chapter will outline the methodology used to explore these issues and the analytical strategy that is used to engage my research questions.

Chapter 3. Methodology

As outlined in the introduction, my thesis looks at three questions related to students' perception of the role of degree types and specific skills needed in the labour market of the AI economy. These questions include: What is students' awareness of skills needed for the AI economy? What do students know about the effects of AI on employment, and what do they think about it? And do students see value in their degree?

3.1 Study Population & Recruitment

In order to answer my research questions, I designed and administered an online survey (Appendix A) to students currently enrolled at Dalhousie University. Students at Dalhousie were chosen as the university is the largest one in the province of Nova Scotia, with a student population of over 19,000 students (Dalhousie 2020). It is also the only U15 (a group of 15 research-intensive Canadian universities) university in the Atlantic provinces and focuses on areas such as big data, clean technology and the environment, food security, healthy people/communities, innovation and entrepreneurships, and sustainable oceans (U15 2020) all of which are seen as important areas of study in an era of rapidly advancing technologies and with a populous whose focus is increasingly toward environmentalism. It was also the university this research project was conducted at and studying my own student population made for ease of access to research subjects.

Participants were recruited through two routes. First, the Dalhousie Student Union (DSU) was asked to email a link to my survey to the student population, as they have access to a university-wide distribution list. However, the DSU sent a different email from the one I requested to be sent that was approved by the Research Ethics Board

(Appendix B) for this project. The email they used (Appendix C)[3] was sent on 10 October 2019. The second means of recruitment supplemented the email blast by asking professors and instructors of 1000- and 2000- lower-level classes across all departments of the university at three of the four campuses for permission to share a flyer (Appendix D) asking for student participation in the survey with entry into a draw for a $100 gift prize incentive for participating. The Agricultural campus of the University was excluded because it is located in Truro, Nova Scotia, another city away from the main campus. This decision was made in order to save time and resources because it is a small campus with less than 1,000 students located over 100 kilometers away from the Halifax campuses, and would not have significantly improved recruitment. I began contacting professors on Wednesday 2 October 2019, with the new recruitment period ending on Friday 22 Nov 2019.

Lower level classes were chosen because they often contain the largest number of students, allowing me to reach more potential research subjects at a given time. They were also chosen because these are common classes for upper-year students to take as elective classes for their degree requirements, allowing me to reach a diverse group of students across years of study. One limitation to note here is that students in their first and second year of study may change academic programs later in their degrees, and thus data around faculty of study may vary based on where the student is in the progress of their degree.

The sampling frame for the second recruitment method was comprised of a total of 235 classes across nine faculties. Five classes were from faculty of Architecture and

[3] The email sent by the DSU was part of a newsletter. Due to its length, only a portion is included, showing an example of the content of the newsletter, and the "Student Classifieds" where my survey was hyperlinked.

Planning, 95 classes were from faculty of Arts and Social Science, 10 were from faculty of Computer Science, six were from faculty of Engineering, five were from faculty of Health, 27 from faculty of Management, three from faculty of Medicine, 82 were from faculty of Science and two were from the college of Sustainability. However, the instructors of only 154 allowed me to recruit from their classes. This included all five classes from faculty of Architecture and Planning, 65 from faculty of Arts and Social Science, five from faculty of Computer Science, all six Engineering classes, four classes from faculty of Health, nine classes from faculty of Management, two classes from faculty of Medicine, 56 classes from faculty of Science, and two from college of Sustainability.

By the end of the recruitment period the survey generated a sample of 1,156 participants. Twenty individuals were removed from the overall analysis because they were not confirmed Dalhousie students, leaving a final analytical sample of 1,136 used in my analysis.

3.2 Variables of Interest

To address my first research question on skills, the survey presented participants with a list of skills, asking to what extent they agree that each skill is important to have. The questions on skill drew upon the Occupational Information Network (O*Net), a database of jobs and skills descriptions for occupations within the United States which is also used by the American Bureau of Labour Statistics for their analytical purposes. These skills variables were also used in the RBC *Humans Wanted* (2018) report on the future of labour skills, as well as the World Economic Forum *Future of Jobs Report* (2018).

The original O*Net skills list included 35 skills. However, since each skill was measured by one question on the questionnaire, to avoid response fatigue I opted to reduce the number of questions asked by narrowing them down to a list of 26 based on RBC's (2018) ranking of all these skills. The 12 most important and 12 least important skills were selected, as well as two within the mid-range. These skills included: Active Listening, Speaking, Critical Thinking, Reading Comprehension, Monitoring, Mathematics, Active Learning, Science, Complex Problem Solving, Time Management, Management of Material Resources, Management of Financial Resources, Social Perceptiveness, Coordination, Service Orientation, Negotiating, Judgement and Decision Making, Operations Analysis, Operation and Control, Technology Design, Programming, Troubleshooting, Equipment Selection, Equipment Maintenance, Repairing and, Installation. I drew from the O*Net definition of each skill in order to form the question used in the survey.

Many of these skills also compliment Aoun's (2017) outline for the study of *Humanics* but missed two key points. Specifically, the importance of *cultural agility* in navigating diverse settings and the importance of incorporating *moral and ethical awareness* in ways of thinking. For this reason, these two were added to the skills variables for this project.

The definitions of each skill were rephrased into a question, asking if each skill was important to have in the workforce. Aoun's (2017) explanation for cultural agility was paraphrased in order to form the definition. Because Aoun (2017) did not explore his ideas of moral or ethical thinking in much detail, I drew on moral psychologists Jonathan Haidt's (2012) definition of morality and ethics in order to form the question used to measure this variable. Haidt’s (2012) definition was also paraphrased in order to form the definition. Aoun (2017) and Haidt’s (2012) definitions are listed in Table 1, along with the O*Net definition of each skill. For each of these skills-based questions, a five-point likert response was used which ranged from ‘strongly disagree’ to ‘strongly agree’. Table 1 provides an overview of the skills variables used to measure students’ awareness of skills for the AI economy outlined in the first question.

Table 1. Labour Market Skills Variables		
Skills Group	*Skill*	*Description*
Basic Skills	Active Listening	Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times.
	Speaking	Talking to others to convey information effectively
	Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems
	Reading Comprehension	Understanding written sentences and paragraphs in work related documents
	Monitoring	Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action
	Mathematics	Using mathematics to solve problems
	Active Learning	Understanding the implications of new information for both current and future problem-solving and decision-making.
	Science	Using scientific rules and methods to solve problems
Complex Problem Solving Skills	Complex Problem Solving	Identifying Complex Problems and reviewing related information to develop and evaluate options and implement solutions
Resource Management Skills	Time Management	Managing one's own time and the time of others.
	Management of Material Resources	Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work.
	Management of Financial Resources	Determining how money will be spent to get the work done, and accounting for these expenditures.
Social Skills	Social Perceptiveness	Being aware of others' reactions and understanding why they react as they do.
	Coordination	Adjusting actions in relation to others' actions.
	Service Orientation	Actively looking for ways to help people.
	Negotiation	Bringing others together and trying to reconcile differences.
Systems Skills	Judgment and Decision Making	Considering the relative costs and benefits of potential actions to choose the most appropriate one.
Technical Skills	Operations Analysis	Analyzing needs and product requirements to create a design.
	Operation and Control	Controlling operations of equipment or systems.
	Technology Design	Generating or adapting equipment and technology to serve user needs.
	Programming	Writing computer programs for various purposes.
	Troubleshooting	Determining causes of operating errors and deciding what to do about it.
	Equipment Selection	Determining the kind of tools and equipment needed to do a job.
	Equipment Maintenance	Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.
	Repairing	Repairing machines or systems using the needed tools.
	Installation	Installing equipment, machines, wiring, or programs to meet specifications.
Humanics Skills	Moral/Ethical Awareness	Recognizing or engaging with phenomena that questions one's idea of right or wrong, or requires them to justify moral judgements.
	Cultural Agility	The ability to build amongst different cultural contexts and norms.

The second research question my thesis aims to explore is what students know about the effects of AI on employment. To capture this, participants were asked what factors would have the biggest impact on the labour market in the next 10 to 15-years (with response options including ”technology,” “environmental change,” “geopolitical conflict,” “artificial intelligence,” “globalization,” “economic inequality,” and “robotics”). These response categories were selected as they are seen as some of the biggest factors that could influence the economy and the labour market (Harari 2015; Harari 2018; Purdy 2015; Aronowitz & DiFazio 2010; Pinker 2018). I also asked students about the effects of AI on employment. Rather than looking at specific opinions, students were asked a dichotomous yes/no question about whether feel they are gaining the skills needed to be successful in the workforce in the next 10- to 15-years.

In order to answer the third question, I draw on previous work that finds a large proportion of post-secondary students do not gain the basic, critical thinking and analytic skills their disciplines aim to instill (Arum & Roksa 2011), and that this lack of performance by students is due, in part, to the fact that students do not value their education itself but rather they attend university only as a means to get a good job (Davidson 2017). The third question looks at how participants see value in their degrees and in degree choices in order to address students’ motivations, and how much they are getting out of their education. Here, I looked at two aspects related to the value of students’ degrees and whether this varied based on if they were in their program to pursue a specific career or area of work. Students were asked “are you in your chosen degree for the purposes of pursuing a specific career or area of work?” Students were also asked if they value their degree and the skills they feel they are obtaining from it (three response options ranging from ‘not at all’ to ‘a lot’).

3.3 Methodological and Analytic Approach

As noted above, the skills examined were selected from O*Net skills ; factors that will affect the future labour market, and whether students are gaining skills to be successful in the future labour market; whether students are in their degree for the purpose of perusing a specific career or area of work, and the value students place on their degree are all examined in relation to students’ faculty of study and their gender.

As outlined in the literature review, although Liberal Arts softs skills are in demand, these students tend to not value the skills they get. STEM students on the other hand value their skills but they tend to be narrow and may be adversely affected by AI. For this reason student’s faculty of study is examined by asking students what their faculty of study is, with response options including Agriculture, Architecture and Planning, Arts and Social Sciences, Computer Science, Dentistry, Engineering, Health, Law, Management, Medicine, Science, Graduate Studies and College of Continuing Education. This is done because much of the literature notes the importance of the liberal arts as compared to many STEM fields in the future of education (Brynjolfsson & McAfee 2014; Aoun 2017), so it would be interesting compare perceptions across these two core groups, as well as how perceptions varied among students not from these two groups (e.g. management students). The analysis also accounts for gender because of the potential disparity in job disruptions between primarily men-centric and women-centric jobs.

As shown in Chapter 2, some predictions, such as the *Future of Jobs Report*, anticipate that women will be disproportionally more effected by job disruptions than men (WEF 2016). However, data used in the WEF (2016) report on the future of jobs came from surveys of chief human resource and chief strategy officers, and thus may not be based on any discernible trends. In contrast, a report by Wilson et al (2006) showed that women make up a large portion of roles that require human skills such as service, care and sales areas, and that the number of women in managerial and care will grow. But as Walby (2007) notes, there is no indication as to whether these will be 'good' jobs. Walby (2007, p.6) also notes that regardless, gender as a dimension is often overlooked in the mainstream analysis of work, creating a 'gender ghetto' that should be overcome.

To explore how field of study and gender are correlated with perceptions of the importance of hard and soft skills, the effects of AI on the labour market, and the value students see in their degrees, the analysis of the data followed two main steps. First, I examine univariate statistics for each variable to show the overall picture in the perceptions of specific skills, the major impacts on the future workforce, and whether students value their degrees. Second I look at bivariate tables between faculty of study and gender, and each of the three factors on skills, the labour market and the value of one's degree

The first research question and the O*Net skills variables are analyzed in terms of soft versus hard skills. However, the original O*Net skills list did not make the distinction to whether the skills were hard or soft skills, thus I made this distinction myself based on the skill descriptions outlined in Table 1. Skills that were described as narrow, specific, fact-based and quantifiable were labeled as hard skills. Skills that were described as being people skills, such as communication, teamwork-based, or required creativity or abstraction were labeled as soft skills.

The chapters that follow in the rest of the thesis are dedicated to each of my research questions, starting with Chapter 4 which looks at students' perceptions on the skills of the future workforce. The skills variables outlined earlier, which are analyzed in Chapter 4 provide an overview of the kinds of skills used in the workforce today. The goal here is to see how important students say each skill is to have. Specifically, whether students' perceptions of skills align with the view that the future of skills rely on soft skills as compared to many of the hard skills today.

Chapter 5 looks at what students perceive would have an effect on the labour market, and what they thought about it in terms of whether they were gaining the kinds of skills necessary to be successful in it. This aims to see whether students are aware of the impact of AI on future work, and if this had an impact on whether they felt they would be successful in the labour market despite the disruptions of AI.

In Chapter 6, I look at what extent students said they valued their degree and the skills they were obtaining from it, as well as whether they were in their degree for the purposes of perusing a specific career or area of work.

Chapter 4. Delving into the Skills of the Future

Despite the projections of rapid and profound change in the labour market and skills needed to enter it, there is relatively little research on students' awareness of the skills they acquire during the course of their degrees. Some exceptions are found around students recognizing research skills acquired in the pursuit of doctoral degrees (Ghee, Keels, Collins, Neal-Spence and Baker 2016; Anttila, Lindblom-Ylänne, Lonka and Pyhälto 2015). Additionally, some research shows that Masters-level students see the importance of ‘general’ skills outside of research-specific skills (Anttila, Lindblom-Ylänne, Lonka and Pyhälto 2015), but little has been done to address what these skills are in specific detail, and little work on perceptions of undergraduate students.

This chapter looks at several key skills that are deemed important to the workforce of the future and students’ perception of hard and soft skills they will need. The chapter analyses students’ overall perception of the importance of each skill across demographic factors, the variations in perception based on the faculty in which the participant belongs, and variations by gender identity. The chapter starts by presenting results on hard skills, followed by the breakdown of some of the notable hard skills by faculty of study and gender. Then it presents the results of the soft skills, which are then broken down by faculty of study and gender of the notable soft skills. Lastly, it discusses what results contribute to the broader understanding of students acquiring the skills for a future workforce.

4.1 Perspectives on the Importance of Hard Skills

Table 2 shows the extent to which students agreed or did not agree with the importance of hard skills. As it is a large list, I will not go through all the skills in extensive detail but will rather discuss the major similarities and differences between students' perceptions in comparison to those demanded by the labour market (RBC 2018). For a more in-depth comparison, see Appendix E. Students' perceptions of the level of importance of a given skill was ranked based on the overall percentage of participants who strongly agreed that each skill was important to have. Of the 14 hard skills listed, the one that was ranked most important by students was Judgement and Decision Making, with many indicating they agree (45.22%) and most indicating they strongly agree (46.7%) that it is an important skill. This coincides with RBC’s (2018) ranking of the importance of skills, as this was ranked the most important of the hard skills in my analysis. Based on the proportion of responses to “Strongly Agree”, the second most important of hard skills to students was Management of Financial Resources, a mid-level skill on the scale of importance according to occupation demands (RBC 2018). Here, participants more likely to agree (45.07%) than strongly agree (39.52%) that it was an important skill to have.

Table 2. Importance of Hard Skills.

Skills	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Judgement and Decision Making	0.34	1.59	6.15	45.22	46.70	878
Management of Financial Resource	0.45	2.49	12.46	45.07	39.52	883
Equipment Selection	0.91	2.05	6.93	50.91	39.20	880
Equipment Maintenance	0.80	4.79	12.44	45.09	36.87	876
Management of Material Resource	0.46	1.60	9.15	52.63	36.16	874
Troubleshooting	0.80	4.00	12.34	48.11	34.74	875
Technology Design	0.69	3.33	13.43	49.48	33.07	871
Repairing	0.92	10.32	21.90	38.76	28.10	872
Operations Analysis	0.80	2.86	17.18	52.46	26.69	873
Operation and Control	0.46	6.37	22.71	47.86	22.60	863
Science	1.14	11.89	27.20	37.49	22.29	875
Installation	1.04	12.44	24.77	39.98	21.77	868
Programming	1.61	16.24	32.03	30.88	19.24	868
Mathematics	1.94	12.34	33.49	35.09	17.14	875

For Management of Material Resources, students were more likely to agree (52.63%) than strongly agree (36.16%) that it was an important skill to have. In terms of Technology and Design, half of respondents indicated they agree with this skill (49.48%), while a third (33.07%) indicated they strongly agree it is an important skill to have.

Another interesting and notable hard skill was Science. While some might argue that 'science' is a method and not a skill, in this instance the skill 'science' is both the knowledge of scientific rules and methods and, knowing *when* and *how* to employ it to solve problems (see Table 1). Science is arguably one of the most notable skills that is instilled on university students—perhaps except for those in the humanities—as one of the most important skills to have today. However, students did not necessarily share this view as it was ranked one of the lowest of the hard skills. The largest portion of respondents indicated that they 'agree' that it is an important skill to have (37.49%), while a large cluster reported they neither agree nor disagreed that it was important (27.2%). Mathematics was the least important skill to students, with much lower proportion of respondents saying they agree (35.09%), or strongly agree (17.14%) that it is an important skill. This said, a bulk of respondents (33.49%) were clustered in the "neither agree nor disagree" category, perhaps indicating that respondents were largely undecided whether mathematics was an important skill to have or not. In contrast, Mathematics was considered to the be most important hard skill according to occupation demands (RBC 2018). Below, Table 3 shows the breakdown by students' faculty of study. Due to the low response numbers for those in the 'other faculty' group, and because it includes a wide variety of different disciplines (medicine, architecture, agriculture) with likely varying perspectives, I cannot make any specific claims about this aggregate group. Responses from participants within the other faculty group may be reported but will primarily be in contrast to the rest of the faculties who will be empathized more.

Table 3 shows that when comparing students across specific faculties, engineering students viewed Judgement and Decision Making as more important, with most indicating they agree (41.58%) or and strongly agree (52.48%) compared to management students who were least likely to see it as important. Interestingly, engineering students were again most likely to see Management of Financial Resources as an important skill to have, with a third (35.64%) reporting they agree and half (55.45%) reporting they strongly agree.

Table 3. Notable Hard Skills by Faculty of Study

Skills	*Group*	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Judgement and Decision Making	Arts & SS	0.52	0.00	7.73	45.36	46.39	194
	Computer Sci	0.00	3.66	4.88	45.12	46.34	82
	Engineering	0.00	0.00	5.94	41.58	52.48	101
	Health	0.00	0.00	5.08	44.07	50.85	59
	Management	0.00	4.76	6.35	46.03	42.86	63
	Science	0.31	1.85	6.46	45.54	45.85	325
	Other Faculty	2.94	2.94	2.94	41.18	50.00	34
Management of Financial Resource	Arts & SS	0.51	3.08	11.79	47.69	36.92	195
	Computer Sci	1.18	4.71	9.41	45.88	38.82	85
	Engineering	0.00	0.00	8.91	35.64	55.45	101
	Health	0.00	0.00	19.67	45.90	34.43	61
	Management	0.00	3.17	11.11	33.33	52.38	63
	Science	0.31	3.09	13.89	46.30	36.42	324
	Other Faculty	2.86	0.00	8.57	54.29	34.29	35
Management of Material Resource	Arts & SS	0.52	2.59	9.84	47.15	39.90	193
	Computer Sci	0.00	3.57	11.90	54.76	29.76	84
	Engineering	0.00	0.00	5.05	47.47	47.47	99
	Health	0.00	0.00	3.23	54.84	41.94	62
	Management	0.00	3.28	8.20	55.74	32.79	61
	Science	0.31	1.24	9.63	56.21	32.61	322
	Other Faculty	2.94	0.00	11.76	47.06	38.24	34
Technology Design	Arts & SS	1.55	4.64	18.56	44.85	30.41	194
	Computer Sci	0.00	3.57	15.48	44.05	36.90	84
	Engineering	0.00	1.98	7.92	46.53	43.56	101
	Health	0.00	3.45	18.97	50.00	27.59	58
	Management	0.00	3.33	11.67	53.33	31.67	60
	Science	0.62	2.79	12.38	53.25	30.96	323
	Other Faculty	3.13	3.13	6.25	50.00	37.50	32
Science	Arts & SS	2.63	17.37	39.47	26.32	14.21	190
	Computer Sci	2.38	10.71	21.43	44.05	21.43	84
	Engineering	0.00	4.95	14.85	42.57	37.62	101
	Health	0.00	8.33	35.00	38.33	18.33	60
	Management	0.00	14.29	22.22	39.68	23.81	63
	Science	0.62	10.15	26.77	39.38	23.08	325
	Other Facul	2.86	17.14	17.14	45.71	17.14	35
Mathematics	Arts & SS	2.59	21.76	44.56	22.28	8.81	193
	Computer Sci	2.41	10.84	21.69	36.14	28.92	83
	Engineering	0.00	6.93	20.79	38.61	33.66	101
	Health	0.00	11.67	38.33	41.67	8.33	60
	Management	3.17	7.94	25.40	38.10	25.40	63
	Science	2.49	9.35	33.64	39.88	14.64	321
	Other Faculty	0.00	14.29	45.71	25.71	14.29	35

In terms of Management of Material Resources, engineering students were also most likely of all faculties to indicate that it was an important skill to have, with an equal number indicating they agree and strongly agree (47.47%). Computer Science students were least likely to strongly agree (29.76%), but had the largest number indicate they neither agree nor disagree (11.9%) and were most likely to disagree out of the faculties that it was an important skill to have (3.57%).

For Technology and Design, engineering students were most likely of the faculties to report that they agree or strongly agree (46.53% and 43.56% respectively). The largest proportion of those who reported they neither agree or disagree were health students (18.97%), while arts and social science students had the largest number of those who disagreed (4.64%) and strongly disagreed (1.55%) it was an important skill to have.

For the skill Science, engineering students were again mostly likely to report that it was an important skill to have, with many reporting they strongly agree (37.62%) and most reporting they agree (42.57%). Arts and social science students were least likely to agree (26.32%) or strongly agree (14.21%), were the most likely of the faculties to report they neither agree nor disagree (39.47%), and were also most likely to report they disagree (17.37%) or strongly disagree (2.63%), with the exception of 'other faculties'.

Mathematics, the least important of the hard skills had almost half (44.56%) of arts and social science students indicate they neither agreed nor disagreed it was an important skill to have. Arts students were also the least likely to agree (22.28%) or strongly agree (8.81%), were most likely to disagree (21.76%), and were second most likely to strongly disagree (2.59%) that it was an important skill. Somewhat unsurprisingly, engineering students were most likely to say it was an important skill to have, where most indicated they agree (38.61%) and were the faculty groups most likely to say they strongly agree (33.66%) that it is an important skill. Management students were most likely to strongly disagree (3.17%).

For these notable hard skills in Table 3, engineering students were most likely to report they agree or strongly agree that these were important skills to have. In contrast, arts and social science students were most likely to report they disagreed or strongly disagreed that these hard skills were important.

Table 4 shows the same notable hard skills indicated in Table 3 but looks at the breakdown of responses by gender identity. Due to the low response rate for those in the 'other gender' category, their responses are shown but not reported. Here, men were more likely to strongly agree (49.76%) that Judgement and Decision Making that this was an important skill compared to women (46.14%), but there was little difference in responses between groups on whether they disagree or strongly disagree.

Table 4. Notable Hard Skills by Gender Identity

Skills	*Group*	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Judgement and Decision Making	Men	0.33	1.99	5.63	42.38	49.67	302
	Women	0.37	1.29	6.43	45.77	46.14	544
	Other Gend	0.00	0.00	12.50	62.50	25.00	8
Management of Financial Resource	Men	0.66	2.64	8.91	46.53	41.25	303
	Women	0.36	2.37	13.84	43.90	39.53	549
	Other Gend	0.00	0.00	37.50	62.50	0.00	8
Management of Material Resource	Men	0.33	1.65	8.91	49.83	39.27	303
	Women	0.37	1.67	8.89	54.44	34.63	540
	Other Gend	0.00	0.00	12.50	37.50	50.00	8
Technology Design	Men	0.66	2.65	11.92	46.36	38.41	302
	Women	0.56	3.72	14.31	51.49	29.93	538
	Other Gend	0.00	0.00	25.00	37.50	37.50	8
Science	Men	0.66	10.53	21.05	39.14	28.62	304
	Women	1.29	12.68	31.07	36.03	18.93	544
	Other Gend	0.00	0.00	33.33	66.67	0.00	6
Mathematics	Men	1.66	10.30	27.91	35.55	24.58	301
	Women	2.21	13.42	36.40	34.19	13.79	544
	Other Gend	0.00	0.00	71.43	28.57	0.00	7

In terms of Management of Financial Resources, men were most likely to report they agree (46.53%) or strongly agree (41.25%). That said, they were also slightly more likely to report that they disagree (2.64%) or strongly disagree (0.66%) compared to women (2.37% and 0.36%, respectively). There was a larger cluster of women that reported they neither agree nor disagreed (13.84%) that this was an important skill to have compared to men (8.91%), suggesting that a larger proportion of women were undecided about its level of importance.

For Management of Material Resources, men were more likely than women to indicate they strongly agree (39.27% and 34.63%, respectively). There was little difference between groups on whether they disagree or strongly disagree. Men were much more likely to indicate they strongly agree (38.41%) with Technology Design compared to women (29.93%), but women were only slightly more likely to indicate that they disagree (3.72%) compared to men (2.65%).

When looking at the skill Science, men were much more likely to agree (39.14%) and strongly agree (28.62%) than women (36.03% and 18.93%, respectively) that it was an important skill to have. Women were more likely to disagree (12.68%) than men (10.53%), and slightly more likely to strongly disagree (1.29%) than men (0.66%). A similar trend was seen with the skill Mathematics. Here men were slightly more likely to agree (35.55%) and much more likely to strongly agree (24.58%) compared to women (34.19% and 13.79%, respectively). Women were also somewhat more likely to disagree (13.42% and strongly disagree (2.21%) compared to men (10.3% and 1.66%, respectively).

4.2 Perspectives on the Importance of Soft Skills

Like the hard skills discussed above, soft skills were ranked by importance to students based on how many responded that they strongly agree with each skill being an important skill to have. Ratings were again consistent across groups for each skill. The list is rather long, containing 14 core soft skills, thus only notable examples will be discussed. For a more in-depth comparison, reference the table in Appendix F with Table 5 below.

Table 5 shows to what extent students reported they agreed or did not agree with the importance of soft skills. Of the 14 soft skills, the top three most important soft skills according to students were also the most important according to occupation demands (RBC 2018). This included Active Listening, Speaking and Critical Thinking. Most respondents felt that Active Listening was an important skill to have, with most indicating they strongly agreed (77.65%) or agreed (19.44%) that it is an important skill to have. The second most important soft skill—Speaking—had three-quarters of respondents indicate they strongly agree or agree (22.48%) that it is an important skill to have. Just over two thirds of respondents (68.5%) indicated they strongly agree that Critical Thinking was an important skill to have, while just over a quarter (28.91%) indicated they agree, the highest amount of the top three skills. The skill of Coordination, which was ranked lowest of the soft skills by students, was a mid-level soft skill according to occupation demands (RBC 2018). According to students, a small portion indicated they strongly agreed (38.08%), while just under a half (48.46%) said they agreed it was an important skill to have.

Table 5. Importance of Soft Skills.

Skills	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Active Listening	1.45	0.34	1.12	19.44	77.65	895
Speaking	1.12	0.22	0.78	22.48	75.39	894
Critical Thinking	0.79	0.34	1.46	28.91	68.50	889
Time Management	0.67	0.90	4.05	29.36	65.02	889
Consideration of Moral or Ethical Issues	0.91	2.28	6.04	26.11	64.65	877
Active Learning	0.57	0.79	3.41	38.25	56.98	881
Reading Comprehension	0.79	1.35	3.37	37.80	56.69	889
Cultural Agility	1.13	3.40	8.95	33.07	53.45	883
Monitoring	0.45	1.01	6.18	44.72	47.64	890
Complex Problem Solving	0.46	1.49	5.38	47.14	45.54	874
Negotiation	0.45	4.86	12.44	38.80	43.44	884
Social Perceptiveness	0.56	3.04	9.00	44.09	43.31	889
Service Orientation	0.90	4.73	13.85	40.43	40.09	888
Coordination	0.57	2.39	10.49	48.46	38.08	877

Two other notable soft skills were Moral/Ethical Awareness and Cultural Agility. These were notable as they were key, 'strictly human' skills mentioned as important in the future of work that were not part of the RBC (2018) list of skills (Aoun 2017). According to students, Moral/Ethical Awareness was the fifth most important soft skill while Cultural Agility was the eighth most important. Consideration of Moral or Ethical Issues was important to a majority of students who indicated they strongly agreed (64.65%). With Cultural Agility, just over half (53.45%) indicated they strongly agree, while a third (33.07%) indicated they agreed it was an important skill to have. However, it also had the largest number of people indicate they strongly disagreed (1.13%), just below Active Listening (1.45%).

While these two skills did not stand out in terms of the overall ranking of skills, there are some interesting patterns between demographic groups on their opinion on these skills, which are explored in Table 6 and Table 7. Table 6 below shows the breakdown by faculty groups. As I mentioned in section 4.1 above, the other faculty group may be reported but will primarily be in contrast and emphasis will be on the rest of the faculties.

Table 6. Notable Soft Skills by Faculty of Study

Skills	*Group*	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Active Listening	Arts & SS	1.02	0.00	0.51	18.37	80.10	196
	Computer Sci	2.33	0.00	1.16	18.60	77.91	86
	Engineering	0.99	0.00	0.99	15.84	82.18	101
	Health	1.61	0.00	0.00	16.13	82.26	62
	Management	0.00	0.00	1.59	15.87	82.54	63
	Science	1.83	0.31	1.83	22.02	74.01	327
	Other Faculty	2.86	2.86	0.00	14.29	80.00	35
Speaking	Arts & SS	0.51	0.51	0.51	23.59	74.87	195
	Computer Sci	1.16	0.00	1.16	29.07	68.60	86
	Engineering	0.99	0.00	0.99	15.84	82.18	101
	Health	0.00	1.61	0.00	12.90	85.48	62
	Management	1.59	0.00	1.59	23.81	73.02	63
	Science	1.53	0.00	0.61	22.63	75.23	327
	Other Faculty	2.86	0.00	0.00	11.43	85.71	35
Critical Thinking	Arts & SS	0.51	0.00	1.53	27.04	70.92	196
	Computer Sci	3.49	0.00	1.16	32.56	62.79	86
	Engineering	0.00	0.00	3.00	19.00	78.00	100
	Health	0.00	1.64	0.00	32.79	65.57	61
	Management	0.00	1.59	3.17	22.22	73.02	63
	Science	0.31	0.31	0.92	31.60	66.87	326
	Other Faculty	2.86	0.00	0.00	28.57	68.57	35
Consideration of Moral or Ethical Issues	Arts & SS	0.51	1.02	7.14	17.35	73.98	196
	Computer Sci	1.19	5.95	4.76	38.10	50.00	84
	Engineering	0.00	3.09	6.19	22.68	68.04	97
	Health	0.00	0.00	3.33	13.33	83.33	60
	Management	1.61	4.84	8.06	24.19	61.29	62
	Science	1.23	2.15	6.46	30.77	59.38	325
	Other Faculty	2.86	0.00	2.86	22.86	71.43	35
Cultural Agility	Arts & SS	1.02	2.04	5.10	29.08	62.76	196
	Computer Sci	3.53	4.71	10.59	42.35	38.82	85
	Engineering	0.00	5.10	14.29	26.53	54.08	98
	Health	0.00	0.00	1.64	26.23	72.13	61
	Management	3.17	1.59	6.35	41.27	47.62	63
	Science	0.61	4.28	11.31	34.56	49.24	327
	Other Faculty	2.86	2.86	5.71	25.71	62.86	35
Coordination	Arts & SS	0.53	0.00	11.05	50.53	37.89	190
	Computer Sci	1.18	5.88	14.12	50.59	28.24	85
	Engineering	0.00	0.99	9.90	47.52	41.58	101
	Health	0.00	0.00	4.92	59.02	36.07	61
	Management	0.00	3.17	11.11	41.27	44.44	63
	Science	0.62	3.41	10.22	47.99	37.77	323
	Other Faculty	3.03	0.00	12.12	24.24	60.61	33

When looking at the skill Active Listening, Table 6 shows that management students were most likely of the faculties to report they strongly agree (82.54%) or agree (15.87%) that it was an important skill to have. Science students were least likely to feel it was important, with the fewest to indicate they strongly agree (74.01%). They were the only group to indicate they disagree (0.31%) besides the other faculty group, and some of the most likely to indicate they strongly disagree (1.81%) besides computer science (2.33%) and the other faculty group (2.86%).

Speaking was the second most important of the soft skills. Here, health students were the most likely to report feeling it was an important skill to have, with the largest percentage to indicate they strongly agree (85.48%) besides the other faculty group (85.71%). However, health students were also the most likely to indicate they disagree (1.61%) and were the only group to disagree besides arts and social science (0.51%). However, none of the health students reported they 'strongly disagreed' as compared to students in every other faculty. Computer science students were the least likely to report they strongly agree (68.6%). The group most likely to indicate they strongly disagree were management students (1.59%) next to the other faculty group (.286%). In fact, management students were most likely to report they neither agree nor disagree (1.59%), indicating that a slightly larger number of management students do not see it as important, or are undecided about its level of importance. This is an interesting find when considering the importance of communication in organizational structures that many management students would be involved in in later occupations.

In terms of Critical Thinking, engineering students were the most likely to report they strongly agree (78%) that it is an important skill to have, while none of them indicated they disagree or strongly disagree with it. Computer science students were the least likely to say they strongly agree (62.79%) and in fact were the group most likely to say they strongly disagree (3.49%) that it is an important skill to have. Interestingly, arts and social science students were third most likely of the faculties to say they strongly agree (70.92%), just behind management students (73.02%).

Consideration of Moral or Ethical Issues was one of the soft skills not originally part of the O*Net list of skills and was borrowed from Aoun (2017). For this added soft skill, health students were much more likely to report they strongly agree (83.33%) that it is an important skill to have compared to students in other faculties. Arts and social science students were second most likely to report they strongly agree (73.98%), while computer science students were least likely to feel it was an important skill, with the smallest proportion of the faculties to indicate they strongly agree (50%). In fact, computer science students were the most likely to indicate they disagree (5.95%) and second most likely to indicate they strongly disagree (1.19%), just below science students (1.23%). Management students were the most likely to report they neither agree nor disagree (8.06%), indicating they were perhaps most unsure about it.

Cultural Agility was another of the soft skills not originally part of the O*Net list of skills. Here, health students were most likely of the faculties to report they strongly agree (72.13%) it is an important skill to have. Arts and Social science students were the second most likely to report they strongly agree (62.76%) beside the other faculty group (62.86%). Computer science students were the least likely to report they strongly agree (38.82%), although were the largest group to indicate they agree (42.35%) indicated they do agree it is an important skill. However they were also some of the most likely of the faculties to disagree (4.71%) or strongly disagree (3.53%) that it was an important skill. Engineering students were most likely to disagree overall (5.1%) or report they neither agree nor disagree (14.29%) that it was an important skill to have.

Coordination was the least important of the soft skills overall. Here, management students were most likely to indicate they strongly agree (44.44%) that it is an important skill to have besides those in the other faculty group (60.61%). Computer science students were the least likely to strongly agree (28.24%), were most likely to indicate they neither agree nor disagree (14.12%), disagree (5.88%) or strongly disagree (1.18%) besides the other faculty group (3.03%). This also indicates that there is some dissensus within computer science students about the importance of this skill.

Table 7 shows the bivariate relationship between the same list of soft skills and participants gender identity, which aims to show how men and women perceive the importance of soft skills. When looking at Active Listening—the most important of the soft skills—women were more likely to report they strongly agree than men (80.83% compared to 74.43%, respectively). In fact, men were most likely to report they strongly disagree (1.97%), disagree (0.33%), or neither agree nor disagree (1.31%) that it is an important skill to have compared to women, suggesting there is some dissensus about its importance to men.

Table 7. Notable Soft Skills by Gender Identity

Skills	*Group*	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Active Listening	Men	1.97	0.33	1.31	21.97	74.43	305
	Women	1.27	0.18	1.08	16.64	80.83	553
	Other Gend	0.00	0.00	0.00	37.50	62.50	8
Speaking	Men	0.66	0.33	0.66	24.26	74.10	305
	Women	1.45	0.18	0.72	20.29	77.36	552
	Other Gend	0.00	0.00	0.00	25.00	75.00	8
Critical Thinking	Men	0.66	0.98	1.31	28.20	68.85	305
	Women	0.73	0.00	1.45	28.36	69.45	550
	Other Gend	0.00	0.00	0.00	50.00	50.00	8
Consideration of Moral or Ethical Issues	Men	1.67	3.34	11.04	28.09	55.85	299
	Women	0.55	1.82	3.28	23.91	70.44	548
	Other Gend	0.00	0.00	12.50	37.50	50.00	8
Cultural Agility	Men	1.98	5.94	17.49	36.30	38.28	303
	Women	0.73	1.45	4.36	30.73	62.73	550
	Other Gend	0.00	12.50	0.00	25.00	62.50	8
Coordination	Men	0.66	2.31	11.88	49.50	35.64	303
	Women	0.55	2.21	9.96	46.68	40.59	542
	Other Gend	0.00	0.00	0.00	100.00	0.00	8

The skill Speaking, women were somewhat more likely to report they strongly agree (77.36%) compared to men (74.1%). However, women were also slightly more likely to indicate they strongly disagree (1.45%) compared to men (0.66%).

Women were slightly more likely to say they strongly agree (69.45%) than men (68.85%) that Critical Thinking is an important skill to have. However, the difference is minimal. In fact, there was less than a full percentage point difference between men and women on every response option for this skill, indicating that both men and women generally agreed with one another on this skills level of importance.

Consideration of Moral or Ethical Issues had a showed a difference between gender identities. Women felt this skill was far more important than men, with the largest proportion saying they strongly agree (70.44%) compared to men (55.85%) that it is an important skill to have. In fact, men were most likely to report they disagree (3.34%) or strongly disagree (1.67%) that it was important.

Cultural agility also had a fairly large difference between genders. Women were also far more inclined to think it was an important skill, with a large majority saying they strongly agree (62.73%) compared to men (38.28%). Men were most likely to neither agree nor disagree (17.49%), disagree (5.94%), or strongly disagree (1.98%) suggesting that not only did they not see it as important, but that there was also disagreement within men about its importance.

Women were a little more likely to see Coordination as an important skill. They were more likely to indicate they strongly agree (40.59%) compared to men (35.64%), where men were more likely to say they neither agree nor disagree (11.88%).

4.3 Perceptions in the Broader Picture

Considering that Active Listening involves "giving full attention…(and) taking time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times" (see Table 1), an important and often utilized skill in the day-to-day classroom related activities to students, it is unsurprising this was rated as the most important soft skill among participants. That said, the amount of overall agreement around soft skills was much higher compared to hard skills. By comparison, Coordination—the lowest ranked soft skill—ranked roughly the same as Judgement and Decision Making—the highest ranked hard skill—in terms of the number of people who say they agree/strongly agree that it is an important skill. Overall, though there was a few exceptions, the perceptions of students in this study about the importance of skills were in line with occupation demands as outlined by RBC (2018), suggesting that students are generally aware of the importance of these skills to the future of work. That is, they overall saw soft skills as more important than hard skills.

Those within the STEM disciplines more often reported that they agree or strongly agree on the importance of hard skills as compared to those in arts and social sciences, which would be expected when hard skills are more prominent in these areas (Susskind and Susskind 2015; Aoun 2017). This is especially true for those in the faculty of engineering, who were most likely of the faculties to strongly agree with all hard skills except for Programming, where they were second only behind students in the faculty of computer science. This aligns with the SBTC view of technological change, where many of these skills may be utilized by engineers in ‘high-skill’ jobs, particularly around the creation and maintenance of robotics (Dahlin 2019), thus explaining their perceived importance by engineers.

Perceptions of the importance of soft skills varied slightly more than for hard skills. The literature suggests that those in arts disciplines would be more adept at the soft skills (Aoun 2017; Axelrod, Anisef & Lin 2001; Walters 2004). This was seen to some extent in two of the added soft skills, Consideration of Moral and Ethical Issues and Cultural Agility, where in both cases arts students were more likely to strongly agree and less likely to disagree or strongly disagree not only compared to engineering students but also computer science students. This aligns with the kind of convergent mindset outlined by Aoun (2017) and the debates around programming self-driving cars, where engineers and computer scientists lag in the ethical considerations important in discussions around creating autonomous machines.

Overall, however, those in the Arts were not more likely over all the faculties to report they strongly agree with any of the soft skills and were only more likely than other faculties to report they agree with three of the 14 soft skills. In fact, those in engineering were more likely to report they strongly agree with soft skills than arts students on 10 of the 14 skills (see Appendix F), suggesting that perhaps they are more prepared for the future labour market as a whole than even Arts students, with the exceptions of the aforementioned ethical thinking skills. This is an important consideration for those in applied STEM fields such as engineering and computer science, as they will require greater levels of ethical consideration in making autonomous systems and machines (Aoun 2017) noted in debates around roboethics (Tzafestas 2018).

Those in the faculty of Health were by far the most likely to report they strongly agree, where they ranked highest in eight of the 14 soft-skills (see Appendix F). This is of particular importance, as many of the programs in the faculty of Health include various areas of nursing, kinesiology, social work, and medical therapy-based programs (Dalhousie Faculty of Health 2020). Many jobs that might stem from these programs could be considered 'fringe' occupations, whereby they are core-science-based (STEM) occupations that rely heavily on the 'human touch' aspect of their workers. These occupations are those that will be seen to be more important in the future (Aoun 2017; Ford 2016; Susskind and Susskind 2015), and my data suggests that their perceptions align with labour market demands and thus are aptly suited for future jobs.

What is worthy to note here is that the largest proportion of responses for soft and hard skills tended to fall within the agree or strongly agree category, with the exception of the hard skill Programming, where the largest proportion indicated they neither agree nor disagree (Table 2). This emphasis on agree/disagree was also seen at the bivariate level of analysis between faculty of study and gender identity, except for the hard skills Science and Mathematics. Here arts and social science students were more likely to say they neither agree nor disagree that they were important skills to have (Table 3). This general trend across all skills suggests that students may also see the importance of skills in terms of amassing as many skills as possible, although the small difference noted above shows that this was more prominent in many of the applied STEM fields. That said, the variation in responses still provides a general overview of who sees certain skills as more or less important compared to others as they relate to labour market demands. It does not show who is gaining these skills, though or how it may relate to labour market performance. This is something touched on in the next chapter, that looks what students know about the effects of AI on the labour market, and whether they feel they are gaining the specific skills necessary to be successful.

Chapter 5. AI, Employment and the Labour Market

In order to understand what students know about the effects of Artificial Intelligence (AI) on employment, I look at their perspectives on aspects of the future labour market. The first is perceptions about the state of the labour market broadly, and this is examined by looking at students' views on major trends that will affect the labour market in the next 10- to 15-years. The second is students' place within this labour market, which is captured by looking at what students feel about their own employability based on the skills they are obtaining from their degree.

5.1 Trends that will Affect the Labour Market

Historically, technological change has had a significant impact on the labour market through creating new forms of employment (Aoun 2017; Susskind & Susskind 2015; Brynjolfsson & McAfee 2014). Today, AI is seen by many as the next major technological trend that will impact the labour market, namely as the medium that carries society into the Fourth Industrial Revolution (Schwab 2016; Brynjolfsson & McAfee 2014). For these reasons, in this chapter I look at how students perceive the potential impacts of AI on the labour market and then their position in that market as a result.

Looking at students' perceptions of what will impact the labour market in the next 10- to 15-years, Table 8 shows that students were most likely to report ‘technology’ (37.76%) as the major factor that will impact the labour market, followed by environmental change (32.61%) in close second. Artificial intelligence was the third highest rated trend to have an impact on the labour market, but by only 1/8th (12.47%) of participants.

Table 8. Factor that will have Biggest Impact on the Labour Market in Next 10-15 Years.	
	Percent
Technology	37.76
Environmental Change	32.61
Artificial Intelligence	12.47
Economic Inequality	5.26
Globalization	3.32
Robotics	4.00
Other	2.40
Geopolitical Conflict	2.17
n=	874

The factor students report as least likely to impact the labour market was 'Geopolitical conflict' (2.17%). To many, the term 'geopolitical conflict' likely elicits notions of war, trade and tariff negotiations or even public/civil conflict such as the recent protests in Hong Kong.

When looking at faculties, Table 9 shows that technology was rated highest by Health students (59.68%), a large margin more than Computer Science students who were second most likely to rate it as the most important factor (44.71%). Science students were less likely to rate technology as having an impact on the labour market (37.73%) than even management students (39.68%), but science students' rating of technology was relatively on par with the impact of environmental change (36.5%). Arts and Social Science students were least likely to rate technology as the most important factor (28.43%) next to the Other Faculty group (22.86%). In fact, Arts and Social Science students were most likely to rate environmental change as the biggest factor to affect the labour market (39.59%) next to the Other Faculty group (51.43%).

Table 9. Factor that will have Biggest Impact on Labour Market by Faculty of Study

	Arts and Social Science	Computer Science	Engineering	Health	Management	Science	Other Faculty	Men	Women	Other Gender
Technology	28.43	44.71	40.59	59.68	39.68	37.73	22.86	40.66	36.59	12.50
Environmental Change	39.59	10.59	31.68	22.58	22.22	36.50	51.43	22.95	37.86	37.50
Geopolitical Conflict	3.55	1.18	1.98	0.00	3.17	2.15	0.00	1.97	2.17	12.50
Artificial Intelligence	3.55	32.94	11.88	4.84	20.63	12.27	14.29	19.02	9.24	0.00
Globalization	6.60	1.18	0.99	1.61	4.76	2.45	2.86	2.62	3.62	0.00
Economic Inequality	8.63	4.71	4.95	6.45	3.17	3.99	2.86	4.26	5.43	25.00
Robotics	2.54	3.53	6.93	3.23	3.17	4.29	5.71	5.57	3.26	0.00
Other	7.11	1.18	0.99	1.61	3.17	0.61	0.00	2.95	1.81	12.50
n=	197	85	101	62	63	326	35	305	552	8

Those who saw AI as having the biggest impact on the labour market were computer science students (32.94%), followed by management students (20.63%). Engineering students were the most likely group to anticipate robotics would have the biggest impact on the labour market, but still also rated technology as the highest (40.59%) and environmental change as second highest (31.68%).

Interestingly, arts and Social Science students were least likely to predict AI (3.55%) or robotics (2.54%) would have an impact on the future labour market, suggesting that arts students are far less concerned about specific technologies or technological change as a whole as compared to social issues or those that would have a direct impact on humans such environmental change or economic inequality, which arts students were the group most likely to report it as a major issue (8.63%).

When gender is examined, men were most likely to report technology as having the biggest impact on the labour market in the next 10- to 15-years (40.66%) compared to women (36.59%), while women were most likely to report environmental change (37.86%) compared to men (22.95%). Men were much more likely to see AI as influencing the labour market (19.02%) compared to women (9.24%), and slightly more likely to see robotics as having an effect (5.57%) compared to women (3.26%).

5.2 Perceptions of Employability from Skills Gained Through Education

Understanding students' perceptions of their likely workforce success is also an important factor to understanding their role in the future labour market. I look at whether students feel they are gaining the skills they believe are necessary for the future workforce.

Overall, Table 10 shows that most students (81%) felt they were gaining the skills necessary to be successful in the labour market in the next 10- to 15-years. Health students were most likely to report gaining the necessary skills (90.57%), except for the other faculty group (93.1%). Engineering students were just slightly behind health students (89.61%), while computer science students fell in the middle of the faculty groups (83.33%).

Table 10. Gaining skills to be successful in workforce in 10 to 15 years?

	No	Yes	n=
Overall	19	81	700
Arts and Social Science	22.08	77.92	154
Computer Science	16.67	83.33	66
Engineering	10.39	89.61	77
Health	9.43	90.57	53
Management	14.29	85.71	56
Science	24.81	75.19	262
Other Faculty	6.90	93.10	29
Men	18.70	81.30	246
Women	19.14	80.86	444
Other Gender	25.00	75.00	4

Those who were least likely to report gaining the skills necessary for the labour market included science students (75.19%), followed by arts and social science students (77.92%). Among genders, there was little difference between groups, with men being only slightly more likely to report gaining necessary skills (81.3%) over women (80.86%).

5.3 Employability in the Labour Market Impact

To revisit my research question, "what do students know about the effects of AI on employment and what do they think about it," it is necessary to look at two sets of issues.

First, what do students know about the effects of AI on employment? Second, what do they think about it? In the case of the latter, I do not look at their specific opinions, but rather whether they feel they are gaining skills they need for future work given what they know about AI and employment.

The data in Table 9 shows that most students do see the impact of technology on society and see it as a means for change. However, most do not see the impact of the fruits of technological change, specifically, the role of AI and robotics as key factors for the Fourth Industrial Revolution.

Taking a deeper look at the data already presented, we can surmise that computer science students are perhaps best capable at understanding the potential impact of AI and engineering students in the impact of robotics. These two groups see the role of these technologies in the 'automation of just about everything' compared to the rest of the faculties. Their awareness most likely stems from messages instilled by their disciplines and faculties, such as computer science students and their awareness of AI as software and engineering students with robotics as hardware. Arts and Social Science students are more aware of the *effects* of technological change, such as 'environmental change' as a byproduct of production and our reliance on fossil fuels, 'globalization' as a product of increased ability to travel, trade and communicate, and 'economic inequality' as a consequence of the unfettered neoliberal capitalism that facilitated modern technological change (Aoun 2017; Ford 2016), which are, again, messages common within liberal arts programs. Arts students are blind to what is impacting the labour market (AI), but are aware there is change and where this change may fester. While the previous chapter suggested that arts and social science students do not perceive the necessary skills of the future as important as compared to students from some other faculties, this suggests they are, to some extent, already engaging in the divergent thinking in one form or another that will aid their success in a future labour market by seeing where the effects take place. However, without understanding the *mechanisms* of change, such as the role of AI specifically, this may not be enough. It is important for students within the arts—especially within the social science and humanities—to see the bigger picture if they hope to enact and change and properly address issues such as economic inequality in an AI economy.

In terms of health students, they are similarly unaware of specific mechanisms (AI), but recognize it will involve technological change that will contribute to economic inequality. Science students were not most likely to report either of the factors, suggesting they are perhaps largely undecided or unaware of specific impacts.

Science students were also most likely to report feeling they are not gaining the skills necessary to be successful in the labour market. Despite there being a greater emphasis by universities to get people in STEM fields (Walters 2004; Axelrod, Anisef & Lin 2001), this suggests that many of these students are feeling unprepared for work. One exception to this is the case of health students, who were the group that feels most prepared. In the previous chapter, not only did our data show they are most aware of the skills necessary for the future workforce, but they also feel they are gaining these skills that will allow them to be successful in the labour market. Again, this may be due to the 'human touch' aspect of jobs that stem from programs such as nursing, health promotion, kinesiology, recreation management and social work, and how important the human-centered soft skills gained from these programs will be to the future labour market

(Brynjolfsson & McAfee 2014; Aoun 2017; Tegmark 2017). Arts and social science students were second least likely to say they are gaining the necessary skills. This is an interesting contrast to the literature that claims the importance of a liberal arts degree (Aoun 2017). While the literature indicates that the skills that are seen as important to the workforce of tomorrow are more likely to be gained through an arts degree (Aoun 2017), arts students are least likely to recognize the importance of these skills (see chapter 4) and feel very unprepared for the labour market, despite seeing the wider effects of technological change. This could be contributed to institutional and cultural influences through increased emphasis on STEM and a decrease in arts (institutional), and the perceived 'uselessness' of an arts degree due to having poorer labour outcomes (Davidson 2017; Walters 2004; Axelrod, Anisef & Lin 2001). This is important to note as, if the future of skills will rely more heavily on arts programs, there needs to be a shift in perspective on the importance of arts degrees itself requiring greater emphasis by universities.

Chapter 6. Motivation and Value Around Degree Path

Arum and Roksa's (2011) research into the general analytic competencies of students graduating university shows that students may have gained some subject- or discipline-specific skills, but almost half of students display "exceedingly small or empirically non-existent" improvements "in critical thinking, complex reasoning and written communication" that is expected of a university education (p.121). In exploring the reasons behind why students took their chosen degree path, Davidson (2017) found that students overwhelmingly reported that their primary reason for pursuing education is to get a good job and this suggests that there is little intrinsic value to the education one receives. Namely, that students see the certificate they earn at their graduation as more important than the skills they are meant to gain during their degree, and thus 'breeze past' without properly gaining many of the skills their disciplines are meant to instill. If this is the case, this could explain why students are not gaining the general skills they are supposed to. In this chapter I will explore the value students place in pursuit of their degree in relation to pursuing a career path.

6.1 Students Pursuing Degree for Work

The first aspect I look at is whether students chose their degree for the purposes of pursuing a specific career path or area of work. Table 11 shows that overall, most students (86.41%) pursued their degree with a specific job or area of work in mind.

Table 11. Are you in your chosen degree for the purposes of pursuing a specific career or area of work?			
	No	Yes	n=
Overall	13.59	86.41	802
Arts and Social Science	29.78	70.22	178
Computer Science	5.00	95.00	80
Engineering	5.49	94.51	91
Health	1.67	98.33	60
Management	7.84	92.16	51
Science	12.87	87.13	303
Other Faculty	5.88	94.12	34
Men	11.59	88.41	276
Women	14.31	85.69	510
Other/Non-Binary	37.50	62.50	8

When looking at specific faculties, health students were most likely to indicate that they were pursuing their degree for the purposes of work (98.33%), followed by computer science (95%) and engineering (94.51%). Interestingly, the two faculty groups least likely to indicate they were pursuing their degree for work were Arts and Social Science and Science students. Science students were second most likely to indicate they were *not* pursuing a specific job (12.87%) and arts and social science students were most likely by a large margin (29.78%).

The position of the faculty of health in this is unsurprising. As mentioned in earlier chapters, the faculty of Health at Dalhousie contains programs such as nursing, kinesiology, pharmacy, health promotion and social work, to name a few. For careers that stem out of these educational pathways, an undergraduate degree can be seen as a form of direct training for specific career paths, through providing a narrow, specific set of skills and hands-on learning within specific areas, common within traditional STEM programs (Aoun 2017; Axelrod, Anisef & Lin 2001). This also helps emphasize the importance of this kind of direct and hands on training for students and suggests such opportunity would help even arts students with potential career prospects, which would help those students in seeing the direct utility of their degree (Aoun 2017). This also supports Davidson's (2017) finding that one of the primary reasons for students to enter their degree program is to pursue a specific job, although this varies on the discipline of study. In contrast to STEM programs, arts programs offer a much broader, flexible range of skills while honing a narrow theoretical base of knowledge that are not often applicable to specific careers outside of the academy (Aoun 2017; Walters 2004; Axelrod, Anisef & Lin 2001). This raises the question whether arts students should be required to take direct training or internships to see where and how the knowledge and skills from their education could be applied. Internships and direct training have shown to be beneficial for students to show how their skills can be applied within industry (Aoun 2017). For many, the experience allows students to get a better idea of what they would like to do for a living and, for some, get an 'in' within the organization that they intern for, later moving to full-time employment with these organizations. A *Humanics* approach would have students across disciplines taking forms of direct training in areas related to their fields of study to hone their craft and knowledgebase only after years of general knowledge training.

Men were slightly more likely to report they were pursuing a specific career (88.41%) compared to women (85.69%). This lines up with the faculty breakdown by gender (see Appendix G). While the highest percentage of those who indicated they were in their chosen degree to pursue a specific career or area of work was from the faculty of Health (98.33%), which is primarily comprised of women, women are also more prevalent in the faculty of Arts and Social Sciences (70.22%) and the faculty of Science (87.13%) which are the two lowest rated faculties. In comparison, Computer Science (95%) and Engineering (94.51%)—other high-ranking faculties for perusing specific careers or areas of work—are comprised of mostly men. One exception to this was Management students, where most (92.16%) indicated they were pursuing a specific career or area of work, and where the percentage of men versus women are equal (49.21% respectively, see Appendix G).

6.2 The Value of a University Education

While the findings of the previous section show that most students pursue their program for the purposes of attaining a specific job or career area, it does not offer direct evidence to test Davidson's (2017) notion that students do not value their degree as much as they ought to. This is explored in Table 12.

Table 12. Do you personally value your degree and the skills you feel you are obtaining from it?

	Not at All	Somewhat	A lot	n=
Overall	1.63	31.51	66.86	857
Arts and Social Science	3.08	30.77	66.15	195
Computer Science	0.00	38.55	61.45	83
Engineering	0.00	28.00	72.00	100
Health	0.00	24.59	75.41	61
Management	1.67	30.00	68.33	60
Science	1.88	34.48	63.64	319
Other Faculty	2.86	17.14	80.00	35
Men	1.67	37.33	61.00	300
Women	1.48	28.60	69.93	542
Other/Non-Binary	0.00	28.57	71.43	7

Overall, Table 12 shows that students indicated they do in fact value their degree and the skills they were obtaining from it. They expressed that they valued their degree 'somewhat' (31.51%) or 'a lot' (66.86%), with only small proportion (1.63%) indicating they did feel they were getting any value out of their degree. This small percentage largely was comprised of management students (1.67%), science students (1.88%) and arts and social science students (3.08%) and those in the other faculty group (2.86%). Arts and science students were some of the least likely to report they value their degree 'a lot' (66.15% and 63.64%, respectively) next to computer science students (61.45%). It should be noted that this variable does not explore what *kind* of value, specifically. As the question asks, "Do you personally value your degree and the skills you feel you are obtaining from it?" this could include both intrinsic (personal) value, or the potential for extrinsic value (skills you feel you are obtaining) as a product of the degree-path.

When gender is examined, we see that women were much more likely to report they value their degree 'a lot' (69.93%) compared to men (61%), but both gender groups were just as likely to report they do not value their degree at all (1.48% and 1.67%, respectively). This is an interesting find, as even many of the faculties comprised primarily of men ranked higher than some faculties comprised primarily of women (with the exception of the faculty of Health). This may suggest that even in men-dominant faculties, the women likely still valued their degree more than men in their cohorts.

The data presented in this chapter and the proceeding two suggests that universities are not adequately translating the importance of liberal arts in the future of education and as key to the future economy (Aoun 2017). In this chapter specifically, it also does not support the claims that students obtain degrees to 'just to get a good job' and thus place little value in the degree itself (Arum & Roksa 2011; Davidson 2017). Rather, value can be found in a multitude of places. For these reasons it is worth probing into the results further.

6.3 Seeking Degree Just to get a Good Job

To analyze the notion that those pursuing their degree only for work may not value their degree as much as they ought to, Table 13 looks at the bivariate relationship between these two variables. Contrary to the notion that students pursue their degree just to get a job instead of valuing the knowledge gained in pursuing a degree on its own, Table 13 shows quite the opposite. As a note, while many students are likely in their education in the hopes of finding decent employment at some point in time, this looks specifically at students who have an idea of what they want to do for a living versus those who do not know what they want to do for a living yet at the time of the survey.

Table 13. Value of Degree cross-tabulation of those pursuing it for work

	Value Degree:	Not at All	Somewhat	A lot	n=
In degree to pursue specific career or area of work:	No	8.26	50.46	41.28	109
	Yes	0.59	27.09	72.33	683

Those who are pursuing a specific job report valuing their degree the most, with the almost all indicating they value their degree somewhat (27.09%) or ‘a lot’ (72.33%). In contrast, those who are not pursuing a specific job were most likely to report they only ‘somewhat’ value their degree (50.46%), but were more likely than those who are pursuing a specific job to report that they do not value their degree at all (8.26%). This shows that those pursuing a specific career or area of work do say they value their degree more. To get a better idea of where this breakdown is coming from, I also look at how the value respondents’ find in their degree differs between those who *are* and those who *are not* pursuing specific careers or areas of work. This is shown in tables 14 and 15, respectively, below.

Table 14. Value of degree for those who *are* pursuing a specific career or area of work by faculty and gender				
	Not at All	Somewhat	A lot	n=
Arts and Social Science	2.40	20.80	76.80	125
Computer Science	0.00	35.14	64.86	74
Engineering	0.00	24.71	75.29	85
Health	0.00	22.41	77.59	58
Management	0.00	21.28	78.72	47
Science	0.39	32.05	67.57	259
Other Faculty	0.00	18.75	81.25	32
Men	0.42	32.92	66.67	240
Women	0.46	24.25	75.29	433
Other/Non-Binary	0.00	25.00	75.00	4

Table 15. Value of degree for those *not* pursuing a specific career or area of work by faculty and gender				
	Not at All	Somewhat	A lot	n=
Arts and Social Science	5.66	47.17	47.17	53
Computer Science	0.00	75.00	25.00	4
Engineering	0.00	40.00	60.00	5
Health	0.00	100.00	0.00	1
Management	0.00	100.00	0.00	4
Science	12.82	48.72	38.46	39
Other Faculty	50.00	0.00	50.00	2
Men	9.38	59.38	31.25	32
Women	8.22	47.95	43.84	73
Other/Non-Binary	0.00	33.33	66.67	3

Table 14 shows the value of one's degree for those who *are* pursuing specific jobs. Here, only arts and science students reported they did not value their degree at all (2.4% and 0.39% respectively). However, there were some glaring differences even within these groups. While arts students who were pursuing a specific career were most likely to report they did not value their degree, they were also some of the most likely to report they valued their degree ‘a lot’ (76.8%), just below health students (77.59%) and management students (78.72). Meanwhile, science students were second least likely to report they valued their degree ‘a lot’ (67.57%), next to computer science students (64.86%).

Table 15 shows the value of one's degree for those who are *not* pursuing a specific career path. However, due to low responses for many of the faculties, I cannot make claims about most of them, and instead only contrast responses for students in the faculty of arts and social science, and faculty of science as they were the bulk of respondents. Here, science students felt the least amount of value towards their degree, with the greatest number of students indicating they do not value their degree at all (12.82%) and were some of the least to report they value their degree ‘a lot’ (38.46%). In contrast, arts students were about half as likely to report they do not value their degree at all (5.66%) but were much more likely to report they value it ‘a lot’ (47.17%).

Table 14 also shows that women pursuing a specific job said they valued their degree ‘a lot’ more than men (75.29% and 66.67%, respectively). Similarly, Table 15 shows that women who were *not* pursuing a specific career or area of work still valued their degree ‘a lot’ (43.84%) compared to men (31.25%), but that the largest proportions of both women and men expressed they ‘somewhat’ valued their degree (47.95% and 59.38%, respectively). Although the two faculties that had any substantial number of participants here—faculty of arts and social science and faculty of science—were two faculties comprised primarily of women, thus the data in Table 15 is unsurprising. Thus, pursuing a specific career or area of work does not decrease the value a person sees in their degree and in fact increases it.

In summary, student who were in more applied programs were more likely to be in their chosen degree path with the intention of perusing a specific job or area of work.

While women generally indicated they valued their degree and the skills earned from it more compared to men, those perusing a specific career often found their education more valuable than those who were unsure of what they wanted to do for a living. With arts students specifically, the data in this chapter indicates that they were most unsure of what they wanted to do for a living and were some of the least likely to indicate they valued their degree or the skills they were obtaining from it. Again, this shows that there is a gap in the perceived value and utility of an arts degree, something to be addressed by deans and curriculum developers, but also suggests that finding a way to implement direct training or forms of internships into arts programs may help students develop some insight around the value of an arts degree in industry.

Chapter 7. Conclusion and Final Remarks

The widespread arrival of Artificial Intelligence (AI) and its introduction into the economy has been said to be a "Fourth Industrial Revolution" (Schwab 2016). Much like past industrial revolutions, it is anticipated to have a profound effect on the social, political and economic spheres of day-to-day life. In the case of work and economy, AI poses to create new forms of automation that could cause wide-scale job disruption and change the charter of jobs of the future.

In the past, job disruption was mitigated because workers gained higher levels of education to meet the high-skilled, high-knowledge demands of a technologically complex labour market. AI poses a new threat to this adaptation strategy because it will affect low, middle, and high skilled work (Aoun 2017; Brynjolfsson & McAfee 2014; Ford 2016). Where tertiary education was once seen as a route to prepare future workers for new, higher skilled jobs, the current model of post-secondary education is based around preparing students for jobs of 'yesterday' and 'today' rather than 'tomorrow.' Thus, we currently face the risk of educating youths for jobs that will be vastly different or may not even exist at all in the next few years.

Previous research on the effects of automation on work has shown how automation has reduced the number of middle and low skill jobs (Dahlin 2019; Autor & Salomons 2018; Gregory, Salomons & Zierahn 2016; Tüzemen & Willis 2013; Autor & Dorn 2013). However, AI poses to disrupt jobs across the low, middle and high skill spectrum because of the kinds of tasks it can replicate (Susskind & Susskind 2015; Ford 2016; Brynjolfsson & McAfee 2014; Aoun 2017). Thus, discussions about the types of jobs that AI will disrupt should migrate away from the low to high skill spectrum and start to discuss skills specifically. It is also important that universities take the discussion of skills specifically in order to stay relevant by ensuring they are properly training youth for the ‘jobs of tomorrow’.

There is also the discussion that tertiary educational development has become ‘stagnant.’ Students are developing less of the skills their programs intend to instill on them (Arum and Roksa 2011). Students are beginning to see the role of post-secondary education as just a path to getting a ‘good job,’ and thus hold less personal, intrinsic value towards their education than in the past (Davidson 2017). This missed potential is something that is problematic for developing the students of tomorrow. Ways to combat this include creating more general degrees that help students focus on building human-centered soft skills alongside the hard skills of their discipline (Aoun 2017), a move away from traditional, formal qualifications and replaced with the recognition of skills capabilities (RBC 2018,p.25), and investment by universities and industry in the constant retraining and reskilling of workers to ensure they are meeting the rapidly changing demands of the workforce (Aoun 2017; RBC 2018). However, the changing landscape of skills is still widely unrecognized by industry and instead often relies on workers already having the necessary skills during the hiring process. To ensure that future workers are gaining the necessary skills for the Fourth Industrial Revolution, it is important that these skills are recognized by industry as necessary for the workforce, and by the individual as necessary to get them into a stable position within the workforce. Thus, my research focused on three aspects of developing the ‘students of tomorrow,’ by first looking at students' awareness of the kinds of skills that will be important in the AI economy, in comparison to labour market reports on the future of skills. It also examined what students know about the effects of AI on the labour market in the next 10- to 15-years, along with whether they feel they are gaining the kinds of skills to be successful in this labour market of 'tomorrow'. Lastly, my thesis analyzed the value students place on their degree and the skills they feel they are getting from it based on whether they are pursuing it for a specific career or area of work.

I have shown that students generally saw the importance of soft skills as compared to hard skills for the workforce of tomorrow. While literature indicates that liberal arts students are adept at gaining the kinds of soft skills that will be important to the workforce of tomorrow as compared to students in STEM fields due to the divergent thinking, critical thinking and engagement as instilled by the liberal arts (Aoun 2017; Ford 2016; Susskind and Susskind 2015; Axelrod, Anisef & Lin 2001; Walters 2004; Brynjolfsson & McAfee 2014), my data shows that arts students are not necessarily aware of the importance of these kinds of skills as compared to other disciplines. Although engineering, for example, is generally described as a STEM field *least* likely to gain or even be aware of the importance of these human-based, soft skills (Aoun 2017), my data suggests that students pursuing these degrees are more aware than liberal arts students of the soft skills that will be needed for the jobs of the future. That is not to say that arts students are not gaining the skills specifically, but rather they do not *see* them being as important as they will be in the next 10- to 15- years. Here there is much work for Deans and professors in the Arts and Social Sciences to inculcate how the skills of the future are developed in their programs.

In terms of the major factors that will affect the labour market, few students saw the impact of AI in changing it. Arts students were the least likely to report it as a major factor. However, other major factors that arts students did report as effecting the labour market involved byproducts of the Fourth Industrial Revolution: namely, the potential for increased economic inequality and the impact of our technology on environmental change (Schwab 2016; Harari 2015; Purdy 2015) in comparison to students in other faculties. Additionally, arts students were some of the least likely to report feeling like they will be successful in the labour market of tomorrow. The data also shows that students are aware of many of Harari's concerns over the coming decades, namely the role of economic inequality and our environmental impact (2015, p.462). However, it also suggests that they are largely unaware of the root of these problems—namely, the role of AI—in the coming decades, especially in the case of arts students who carry the skill the labour market will rely on in the coming years (Aoun 2017; Susskind & Susskind 2015; Ford 2016; Brynjolfsson & McAfee 2014).

Students who were in their chosen degree path for the purposes of pursuing a specific career or area work generally indicated they valued their degree and the skills they were obtaining from it more than those students who did not know what they wanted to do for a living. This runs contrary to Davidson's (2017) notion that for those who are in their education specifically to 'get a good job' do not value their degree, and thus do not put in enough effort to gain the necessary skills their disciplines attempt to instill. However, arts students were the least likely to report they are obtaining their degree in order to pursue a specific line of work and were most likely to indicate they do not personally value their degree or the skills they are getting from it. Similarly, this was also seen for students in the faculty of science, although not as impactful. Again this points to work for Deans and professors of Arts programs to work upon.

Women were also often more equip then men in many of the aspects analyzed in this thesis. In the case of workplace skills (Chapter 4), they were slightly less likely than men to see hard skills as important but were much more likely than men to see the importance of soft skills in the future of work. This coincides with Wilson et al (2006), who notes that women are already clustered in jobs that use human centered, soft skills. While the *Future of Jobs Report* indicates that women may be disproportionally affected as compared to men (WEF 2016), their view on the importance of these skills as compared to men may benefit them in the long run. This was partially reflected in chapter 5, which showed that there was little difference between men and women who felt they were gaining the necessary skills to be successful in the future labour market. When it came to the kinds of factors that would affect the labour market, women were less likely to report seeing the role of technology, robotics and AI specifically, but were somewhat more likely to report to human-centered effects of these, such as economic inequality and environmental change specifically. Lastly, in chapter 6, women were slightly less likely than men to indicate they were taking their education for the purposes of pursuing a specific job or area of work. However, they were much more likely than men to indicate they value their degree and the skills they were obtaining from it. Specifically, women were much more likely than men to report valuing their degree regardless whether they were in their education to pursue a specific career or area of work. This was especially true for those who *were* in their education to pursue work, contrary to Davidson's (2017) notion that pursuing specific jobs decreased the intrinsic value of one's education as it was only viewed as a means to an end.

In sum, if the future of skills lies in the kind of divergent, critical thinking and human-based soft skills gained by arts students, then they are unaware of the importance of their skills. They might be unsure of their place in the labour market, and they feel they are less likely to get valuable skills out of their education as compared to students in STEM disciplines. In a way, universities are letting their arts students down. However, not all students are blind to the importance of these skills as previously thought.

For these reasons, universities need to do more to diversify their academic programs and promote the kinds of skills and modes of thinking that are expected in different disciplines (Aoun 2017). For example, they need to teach future workers to 'race' *with* machines, not *against* them (Brynjolfsson & McAfee 2014). This includes developing a wider scope of disciplinary knowledge within areas of study, and further developing interdisciplinary partnerships. To borrow Aoun's (2017) notion of the *Humanics,* such scope would allow many of the previously narrow STEM fields to improve their human literacy skills, developing the wider, holistic implications of their discipline. This means, for example, engineering students taking classes on the historical implications on previous technological breakthroughs and political discussions on current technological discoveries and debates to see the 'bigger picture' of engineered mediums. Or computer science students taking philosophy classes on ethical decision making in programming autonomous systems such as the current debate with programming self-driving cars. Some institutions have started attempting this through programs that offer an in-depth look at schools of thought. One local example is the Foundation Year Program hosted by the University of King's College in Halifax, loosely part of Dalhousie itself. The program is one year long and is the first step of a four-year undergraduate degree that gives students “a broad understanding of important intellectual developments—in philosophy, history, literature, drama, and the natural and social sciences” (uKings 2020). In this case however, the University of Kings College focuses on the humanities and thus does not reflect as heavily on those within the natural or social sciences. This however means many liberal arts disciplines will have to step outside the ivory towers of their traditional boundaries, develop multidisciplinary partnerships, and begin to rethink the positions their disciplines hold within society if they wish to stay relevant. This also means accepting new ways of making sense of data and developing new data collection methodologies in a new technological paradigm. Last, and arguably most importantly, universities need to ensure their students are developing the critical thinking skills demanded by the wider labour market if they intend on having a competitive advantage in working with the intelligent machines of the Fourth Industrial Revolution.

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Appendix A. Investigating the Educational and Occupational Skills of Students Entering an AI Economy Survey

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Are you currently a student at Dalhousie University?
1Yes
0No
(These parenthesis will be removed in actual survey: If Yes, continue with survey; If No, then participants will see the following message:)

Thank you for participating in the survey. For the purposes of this study, we are currently only surveying Dalhousie students. Thank you for your time.

Perspective on work/educational skills for the future
In this section you will be presented with a series of statements concerning certain job-related skills. You will be asked to what extent you disagree or agree with the following statements.

1. Giving full attention and actively listening to what other people are saying, taking time to understand the points that are being made, asking questions as appropriate and not interrupting at inappropriate times is an important skill to have in the workforce.

    1Strongly disagree
    2Disagree
    3Neither agree nor disagree
    4Agree
    5Strongly agree
    7Refused
    8Don't know

2. Speaking to others to convey information effectively is an important skill to have in the workforce.

    1Strongly disagree
    2Disagree
    3Neither agree nor disagree
    4Agree
    5Strongly agree
    7Refused
    8Don't know

3. Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

4. The ability to comprehensively understand written sentences and paragraphs in work related documents is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

5. Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

6. Being aware of others' reactions and understanding why they react as they do is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused

8Don't know

7. Adjusting actions or coordinating in relation to others' actions is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

8. Managing one's own time and the time of others is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

9. Considering the relative costs and benefits of potential actions to choose the most appropriate one is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

10. Actively learning and understanding the implications of new information for both current and future problem-solving and decision-making is an important skill to have in the workforce.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree

5Strongly agree
7Refused
8Don't know

11. Actively looking for ways to help people is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

12. Identifying Complex Problems and reviewing related information to develop and evaluate options and implement solutions is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

13. Bringing others together to negotiate and try to reconcile differences is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

14. Using mathematics to solve problems is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree

7Refused
8Don't know

15. Analyzing needs and product requirements to create a design is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

16. Controlling operations of equipment or systems is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

17. Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

18. Determining how money will be spent to get the work done, and accounting for these expenditures is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree

7Refused
8Don't know

19. Generating or adapting equipment and technology to serve user needs is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

20. Coding and writing computer programs for various purposes is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

21. Determining causes of operating errors and deciding what to do about it is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

22. Using scientific rules and methods to solve problems is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree

7Refused
8Don't know

23. Determining the kind of tools and equipment needed to do a job is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

24. Performing routine maintenance on equipment and determining when and what kind of maintenance is needed is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

25. Repairing machines or systems using the needed tools is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

26. Installing equipment, machines, wiring, or programs to meet specifications is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree

7Refused
8Don't know

27. Consideration of moral or ethical issues such as the ‘trolley problem’ is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

28. Having a sense of cultural agility such as understanding and appreciating other languages and cultures is an important skill to have in the workforce.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

How you feel about your university degree and the labour market
In this section, we will ask you a little bit about your degree, the skills you are obtaining from it and how you feel it will hold up in the workforce.

29. Do you personally value your degree and the skills you feel you are obtaining from it?
1Not at all
2Somewhat
3A lot
7Refused
8Don't know

30. Are you in your chosen degree for the purposes of pursuing a specific career or area of work?
0No
1Yes

7Refused
8Don’t know

31. Do you feel that you are currently gaining the skills necessary to be successful in the workforce in the next 10 to 15 years?
0No
1Yes
7Refused
8Don’t know

32. Which factor do you think will have the biggest impact on the labour market in the next 10 to 15 years?
1Technology
2Environmental Change
3Geopolitical Conflict
4Artificial Intelligence
5Globalization
6Economic Inequality
7Robotics
97Other: _____(Open Response)

Here you will be presented with a few statements regarding university programs. You will be asked to rate to what extent you disagree or agree with them, as well as how important you think they will become in the following years.

33. The liberal arts are a beneficial discipline today.
1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

34. In the next 10 to 15 years, the liberal arts will become:

1Less Important
2Stay about the same
3More important
7Refused
8Don't know

35. The STEM fields (Science, Technology, Engineering and Mathematics) are a beneficial discipline today.

1Strongly disagree
2Disagree
3Neither agree nor disagree
4Agree
5Strongly agree
7Refused
8Don't know

36. In the next 10 to 15 years, the STEM fields will become:

1Less Important
2Stay about the same
3More important
7Refused
8Don't know

Information (Where they hear about AI)

In this section, we will ask you about your access to news, media and information in relation to where you hear about artificial intelligence (AI), as well what you think about AI.

37. Where do you get your news from?

1Newspaper
2TV
3Radio
4Internet
5Magazines
8Other__(Open Response)___
7Refused
8Don't know

38. How do you think AI is portrayed in the media?

1Negatively
2Neutral
3Positively
7Refused

8Don't know

39. Would you say you are a fan of science fiction?

1Disagree
2Somewhat disagree
3Somewhat agree
4Agree
7Refused
8Don't know

40. Do the promises of AI scare you?

1Yes
0No
8Undecided/Don't know

---

41. What do you think AI will bring in the future? (Open answer)

Demographics

42. What year were you born? ___

43. What is your gender? (Open Response)

44. Which faculty do you belong?

1Agriculture
2Architecture and Planning
3Arts and Social Sciences
4Computer Science
5Dentistry
6Engineering
7Health
8Law
9Management
10Medicine
11Science
12Graduate Studies
99College of Continuing Education

45. Are you currently a…

1Undergraduate Student
2Graduate-level Student
3Other __(Open Field)___

46. If Undergraduate student, what year of study are you in?

1First Year
2Second Year
3Third Year
4Fourth Year
5Fifth+ Year

You have now reached the end of the survey. Thank you again for participating. If you have any comments or anything you would like to add regarding your answers, the survey itself, or the survey process, you can enter it below.

___(Open response)___

If you would like to be entered into the draw to win the $75 pre-paid visa gift card, please follow the link below. You will be taken to an external page where you can enter your email address.

(INSERT LINK HERE)

Appendix B. Recruitment Email Sent to the DSU Approved by Dalhousie REB

Dear Student,

You are invited to participate in a study titled 'Investigating the Educational and Occupational Skills of Students Entering an AI Economy.' The purpose of the project is to look at the kinds of educational and occupational skills that students deem as important to the workforce today, and how relevant these skills will be in a future job market affected by technological disruption.

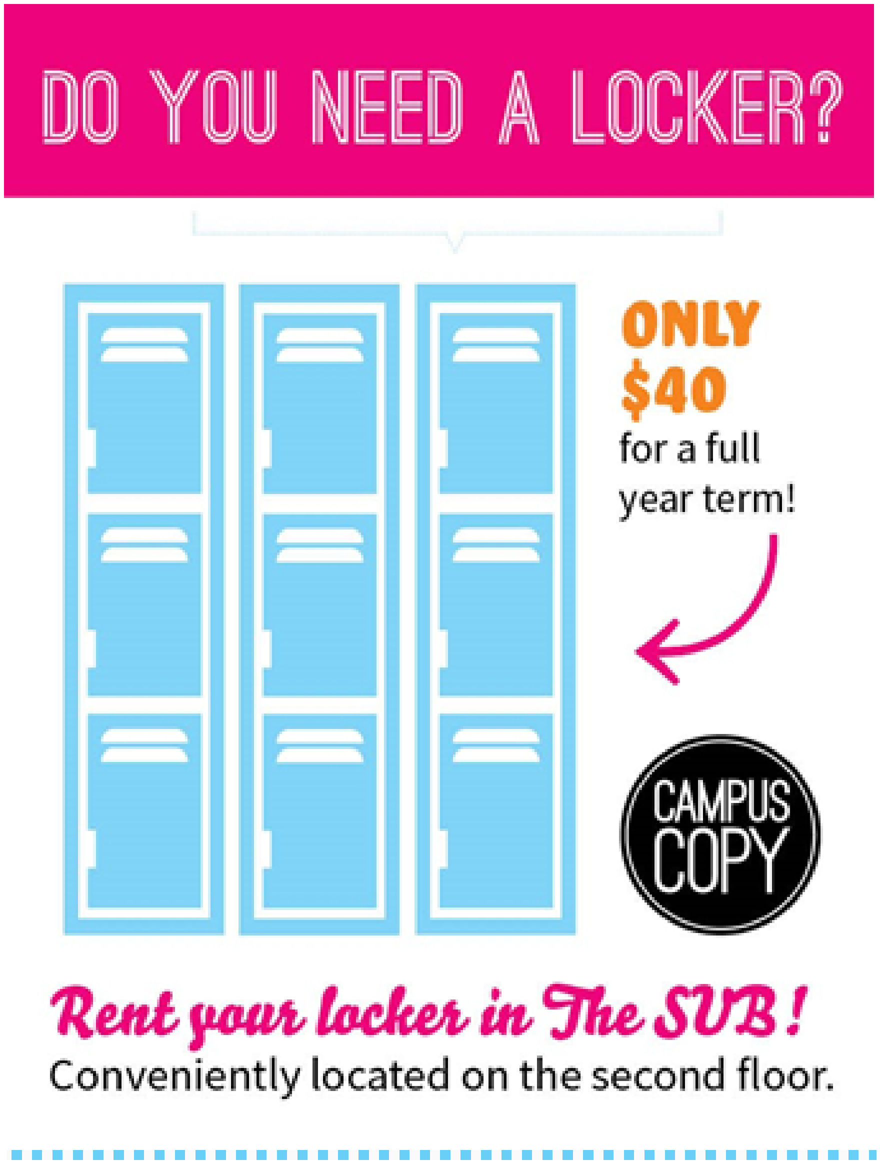
The survey itself is anonymous. You will be asked 46 questions, and should take about 20 minutes of your time and can be done in a place and time of your own convenience. You are not obligated to answer any questions you do not know the answers to, or do not feel comfortable answering. You can also withdraw from the survey at any time. If you wish to discontinue the survey but come back at a later time, you can save the survey by clicking the 'save' button and entering your email address, at which point you will be emailed a link to continue the survey from where you left off.

At the end of the survey, you will prompted to follow a link where you can enter your Dalhousie email address to be entered into a draw for a chance to win a $100 pre-paid visa gift card. The link to the separate page is to ensure anonymity, so that your email address is not directly linked to the data you have entered.

If you have any questions or concerns about the research or the research process, do not hesitate to contact the principal investigator Jo Minx at 902-997-1195 or email jr254200@dal.ca. You can also reach the co-investigator/academic supervisor Dr. Howard Ramos, at the Department of Sociology and Social Anthropology, at 902-494-3130, or email howard.ramos@dal.ca. Or if you have any ethical concerns about your participation in this research, you may contact Catherine Connors, Director, Research Ethics, Dalhousie University at (902) 494-1462, or email ethics@dal.ca and cite REB file #: 2019-4862.

CLICK HERE TO BE TAKEN TO THE SURVEY

Appendix C. Recruitment Email Used by the DSU Not Approved by Dalhousie REB



STUDENT CLASSIFIEDS

CHANCE TO WIN A $100 PREPAID VISA: To enter complete this Dal student's survey titled Investigating the Educational and Occupation Skills of Students Entering an AI Economy here.

WORK AT THE DSU: The Food Bank is hiring a Communications and Events Coordinator, a Scheduling Coordinator, and a Training & Administration Coordinator. Apply!

Appendix D. Recruitment Flyer

Investigating the Educational and Occupational Skills of Students Entering an AI Economy

Survey link: **https://surveys.dal.ca/opinio/s?s=50608**

Contact me: **jr254200@dal.ca**
Subject line**:** "Skills Survey"

Chance for a $100 pre-paid visa!

Appendix E. Ratings of Hard Skills: Students vs. Job Demands Rating

RBC Rating (hard)	*Hard Skills*	*Student Rating*
1	Judgment and Decision Making	1
6	Management of Financial Resources	2
11	Equipment Selection	3
12	Equipment Maintenance	4
5	Management of Material Resources	5
9	Troubleshooting	6
7	Technology Design	7
13	Repairing	8
3	Operations Analysis	9
4	Operation and Control	10
10	Science	11
14	Installation	12
8	Programming	13
2	Mathematics	14

Appendix F. Ratings of Soft Skills: Students vs. Job Demands Rating

RBC Rating (soft)	*Soft Skills*	*Student Rating*
1	Active Listening	1
2	Speaking	2
3	Critical Thinking	3
8	Time Management	4
humanics	Moral/Ethical Awareness	5
9	Active Learning	6
4	Reading Comprehension	7
humanics	Cultural Agility	8
5	Monitoring	9
11	Complex Problem Solving	10
12	Negotiation	11
6	Social Perceptiveness	12
10	Service Orientation	13
7	Coordination	14

Appendix G. Breakdown of Gender Identity by Faculty of Study

	Men	Women	Non-Binary
Arts and Social Science	19.59	78.87	1.55
Computer Science	67.06	30.59	2.35
Engineering	65.00	34.00	1.00
Health	14.52	85.48	0.00
Management	49.21	49.21	1.59
Science	28.83	70.86	0.31
Other	34.29	65.71	0.00
n=	306	551	8

Appendix H. All Hard Skills by Faculty of Study

Skills	Group	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Judgement and Decision Making	Arts & SS	0.52	0	7.73	45.36	46.39	194
	Computer Sci	0	3.66	4.88	45.12	46.34	82
	Engineering	0	0	5.94	41.58	52.48	101
	Health	0	0	5.08	44.07	50.85	59
	Management	0	4.76	6.35	46.03	42.86	63
	Science	0.31	1.85	6.46	45.54	45.85	325
	Other Faculty	2.94	2.94	2.94	41.18	50	34
Equipment Selection	Arts & SS	0.51	2.03	7.61	58.88	30.96	197
	Computer Sci	2.41	3.61	9.64	46.99	37.35	83
	Engineering	0	0	5	40	55	100
	Health	0	1.61	3.23	41.94	53.23	62
	Management	0	3.33	11.67	50	35	60
	Science	0.92	2.15	7.06	50.31	39.57	326
	Other Facul	2.94	0	0	61.76	35.29	34
Management of Material Resource	Arts & SS	0.52	2.59	9.84	47.15	39.9	193
	Computer Sci	0	3.57	11.9	54.76	29.76	84
	Engineering	0	0	5.05	47.47	47.47	99
	Health	0	0	3.23	54.84	41.94	62
	Management	0	3.28	8.2	55.74	32.79	61
	Science	0.31	1.24	9.63	56.21	32.61	322
	Other Faculty	2.94	0	11.76	47.06	38.24	34
Technology Design	Arts & SS	1.55	4.64	18.56	44.85	30.41	194
	Computer Sci	0	3.57	15.48	44.05	36.9	84
	Engineering	0	1.98	7.92	46.53	43.56	101
	Health	0	3.45	18.97	50	27.59	58
	Management	0	3.33	11.67	53.33	31.67	60
	Science	0.62	2.79	12.38	53.25	30.96	323
	Other Faculty	3.13	3.13	6.25	50	37.5	32
Operations Analysis	Arts & SS	1.05	2.62	23.56	54.97	17.8	191
	Computer Sci	2.35	4.71	8.24	48.24	36.47	85
	Engineering	0	0	5	45	50	100
	Health	0	3.28	26.23	50.82	19.67	61
	Management	0	1.61	9.68	54.84	33.87	62
	Science	0.31	3.7	19.75	54.32	21.91	324
	Other Faculty	3.23	0	19.35	38.71	38.71	31
Science	Arts & SS	2.63	17.37	39.47	26.32	14.21	190
	Computer Sci	2.38	10.71	21.43	44.05	21.43	84
	Engineering	0	4.95	14.85	42.57	37.62	101
	Health	0	8.33	35	38.33	18.33	60
	Management	0	14.29	22.22	39.68	23.81	63
	Science	0.62	10.15	26.77	39.38	23.08	325
	Other Facul	2.86	17.14	17.14	45.71	17.14	35
Programming	Arts & SS	3.14	24.61	37.7	24.08	10.47	191
	Computer Sci	1.18	2.35	18.82	37.65	40	85
	Engineering	1	5	17	43	34	100
	Health	0	20	43.33	21.67	15	60
	Management	0	9.84	32.79	34.43	22.95	61
	Science	1.56	18.38	35.2	30.84	14.02	321
	Other Faculty	3.03	24.24	27.27	24.24	21.21	33

Skills	Group	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Management of Financial Resource	Arts & SS	0.51	3.08	11.79	47.69	36.92	195
	Computer Sci	1.18	4.71	9.41	45.88	38.82	85
	Engineering	0	0	8.91	35.64	55.45	101
	Health	0	0	19.67	45.9	34.43	61
	Management	0	3.17	11.11	33.33	52.38	63
	Science	0.31	3.09	13.89	46.3	36.42	324
	Other Faculty	2.86	0	8.57	54.29	34.29	35
Equipment Maintenance	Arts & SS	1.04	5.21	11.46	47.4	34.9	192
	Computer Sci	0	2.38	16.67	48.81	32.14	84
	Engineering	0	0	7.92	34.65	57.43	101
	Health	1.64	6.56	16.39	42.62	32.79	61
	Management	1.64	9.84	16.39	42.62	29.51	61
	Science	0.61	4.6	12.88	47.55	34.36	326
	Other Facul	2.94	5.88	2.94	32.35	55.88	34
Troubleshooting	Arts & SS	0.52	6.19	15.46	53.61	24.23	194
	Computer Sci	1.18	1.18	9.41	36.47	51.76	85
	Engineering	0	0	7.92	32.67	59.41	101
	Health	0	4.84	8.06	62.9	24.19	62
	Management	1.61	4.84	9.68	43.55	40.32	62
	Science	0.31	4.38	14.69	50	30.63	320
	Other Faculty	6.06	3.03	3.03	51.52	36.36	33
Repairing	Arts & SS	1.55	12.44	26.42	37.31	22.28	193
	Computer Sci	1.2	8.43	25.3	38.55	26.51	83
	Engineering	0	3.96	14.85	29.7	51.49	101
	Health	0	13.11	26.23	31.15	29.51	61
	Management	0	11.48	22.95	31.15	34.43	61
	Science	0.62	10.9	20.87	44.55	23.05	321
	Other Facul	2.94	8.82	5.88	47.06	35.29	34
Operation and Control	Arts & SS	0.53	8.42	31.58	41.05	18.42	190
	Computer Sci	0	7.23	24.1	44.58	24.1	83
	Engineering	0	3.03	18.18	38.38	40.4	99
	Health	0	5.17	27.59	48.28	18.97	58
	Management	0	1.61	14.52	54.84	29.03	62
	Science	0.31	6.27	19.44	54.23	19.75	319
	Other Faculty	2.94	11.76	14.71	52.94	17.65	34
Installation	Arts & SS	1.05	20.53	27.37	34.21	16.84	190
	Computer Sci	1.2	13.25	15.66	48.19	21.69	83
	Engineering	0	1.98	15.84	41.58	40.59	101
	Health	0	13.11	29.51	31.15	26.23	61
	Management	0	6.56	31.15	37.7	24.59	61
	Science	1.25	10.94	26.56	43.75	17.5	320
	Other Faculty	2.94	11.76	20.59	35.29	29.41	34
Mathematics	Arts & SS	2.59	21.76	44.56	22.28	8.81	193
	Computer Sci	2.41	10.84	21.69	36.14	28.92	83
	Engineering	0	6.93	20.79	38.61	33.66	101
	Health	0	11.67	38.33	41.67	8.33	60
	Management	3.17	7.94	25.4	38.1	25.4	63
	Science	2.49	9.35	33.64	39.88	14.64	321
	Other Faculty	0	14.29	45.71	25.71	14.29	35

Appendix I. All Hard Skills by Gender

Skills	Group	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Judgement and Decision Making	Men	0.33	1.99	5.63	42.38	49.67	302
	Women	0.37	1.29	6.43	45.77	46.14	544
	Other Gend	0	0	12.5	62.5	25	8
Equipment Selection	Men	1.32	0.99	7.26	45.54	44.88	303
	Women	0.55	2.38	6.76	53.2	37.11	547
	Other Gend	0	0	12.5	62.5	25	8
Management of Material Resource	Men	0.33	1.65	8.91	49.83	39.27	303
	Women	0.37	1.67	8.89	54.44	34.63	540
	Other Gend	0	0	12.5	37.5	50	8
Technology Design	Men	0.66	2.65	11.92	46.36	38.41	302
	Women	0.56	3.72	14.31	51.49	29.93	538
	Other Gend	0	0	25	37.5	37.5	8
Operations Analysis	Men	0.67	1.67	12.37	50.84	34.45	299
	Women	0.74	3.5	19.71	53.22	22.84	543
	Other Gend	0	0	50	25	25	8
Science	Men	0.66	10.53	21.05	39.14	28.62	304
	Women	1.29	12.68	31.07	36.03	18.93	544
	Other Gend	0	0	33.33	66.67	0	6
Programming	Men	2.67	11.33	25	35.33	25.67	300
	Women	0.93	19.07	36.3	28.33	15.37	540
	Other Gend	0	14.29	28.57	28.57	28.57	7

Skills	Group	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Management of Financial Resource	Men	0.66	2.64	8.91	46.53	41.25	303
	Women	0.36	2.37	13.84	43.9	39.53	549
	Other Gend	0	0	37.5	62.5	0	8
Equipment Maintenance	Men	1	1.99	9.3	44.52	43.19	301
	Women	0.55	6.04	14.29	44.69	34.43	546
	Other Gend	0	0	25	50	25	8
Troubleshooting	Men	1.33	2.33	9	46.33	41	300
	Women	0.37	4.59	14.13	48.99	31.93	545
	Other Gend	0	12.5	12.5	50	25	8
Repairing	Men	0.67	8.72	15.77	39.6	35.23	298
	Women	1.1	11.19	25.32	37.8	24.59	545
	Other Gend	0	0	28.57	57.14	14.29	7
Operation and Control	Men	0.33	5.69	16.39	49.16	28.43	299
	Women	0.37	6.93	25.47	47.19	20.04	534
	Other Gend	0	0	50	50	0	8
Installation	Men	1.34	9.06	21.48	39.93	28.19	298
	Women	0.92	13.86	26.62	40.11	18.48	541
	Other Gend	0	0	28.57	28.57	42.86	7
Mathematics	Men	1.66	10.3	27.91	35.55	24.58	301
	Women	2.21	13.42	36.4	34.19	13.79	544
	Other Gend	0	0	71.43	28.57	0	7

Appendix J. All Soft Skills by Faculty of Study

Skills	Group	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Active Listening	Arts & SS	1.02	0	0.51	18.37	80.1	196
	Computer Sci	2.33	0	1.16	18.6	77.91	86
	Engineering	0.99	0	0.99	15.84	82.18	101
	Health	1.61	0	0	16.13	82.26	62
	Management	0	0	1.59	15.87	82.54	63
	Science	1.83	0.31	1.83	22.02	74.01	327
	Other Faculty	2.86	2.86	0	14.29	80	35
Critical Thinking	Arts & SS	0.51	0	1.53	27.04	70.92	196
	Computer Sci	3.49	0	1.16	32.56	62.79	86
	Engineering	0	0	3	19	78	100
	Health	0	1.64	0	32.79	65.57	61
	Management	0	1.59	3.17	22.22	73.02	63
	Science	0.31	0.31	0.92	31.6	66.87	326
	Other Faculty	2.86	0	0	28.57	68.57	35
Consideration of Moral or Ethical Issues	Arts & SS	0.51	1.02	7.14	17.35	73.98	196
	Computer Sci	1.19	5.95	4.76	38.1	50	84
	Engineering	0	3.09	6.19	22.68	68.04	97
	Health	0	0	3.33	13.33	83.33	60
	Management	1.61	4.84	8.06	24.19	61.29	62
	Science	1.23	2.15	6.46	30.77	59.38	325
	Other Faculty	2.86	0	2.86	22.86	71.43	35
Reading Comprehension	Arts & SS	1.02	0.51	2.54	36.55	59.39	197
	Computer Sci	2.38	3.57	7.14	30.95	55.95	84
	Engineering	0	0.99	1.98	31.68	65.35	101
	Health	0	0	3.28	49.18	47.54	61
	Management	0	1.59	3.17	33.33	61.9	63
	Science	0.62	1.54	3.08	39.69	55.08	325
	Other Faculty	2.86	0	8.57	37.14	51.43	35
Monitoring	Arts & SS	0.51	0	8.12	43.15	48.22	197
	Computer Sci	1.16	2.33	10.47	45.35	40.7	86
	Engineering	0	0.99	3.96	45.54	49.5	101
	Health	0	0	1.64	39.34	59.02	61
	Management	0	1.59	9.52	36.51	52.38	63
	Science	0.31	1.53	4.91	47.24	46.01	326
	Other Faculty	2.86	0	8.57	37.14	51.43	35
Negotiation	Arts & SS	0.51	3.57	13.27	39.29	43.37	196
	Computer Sci	1.16	5.81	19.77	40.7	32.56	86
	Engineering	0	2.97	12.87	34.65	49.5	101
	Health	0	0	8.2	26.23	65.57	61
	Management	0	6.45	9.68	38.71	45.16	62
	Science	0.31	7.1	11.42	41.05	40.12	324
	Other Faculty	2.86	2.86	5.71	37.14	51.43	35
Service Orientation	Arts & SS	1.02	3.55	14.72	43.15	37.56	197
	Computer Sci	2.33	8.14	16.28	43.02	30.23	86
	Engineering	0	3.96	17.82	37.62	40.59	101
	Health	0	1.64	6.56	36.07	55.74	61
	Management	0	7.94	19.05	34.92	38.1	63
	Science	0.62	4.92	12.31	41.23	40.92	325
	Other Faculty	2.86	0	11.43	31.43	54.29	35

Skills	Group	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Speaking	Arts & SS	0.51	0.51	0.51	23.59	74.87	195
	Computer Sci	1.16	0	1.16	29.07	68.6	86
	Engineering	0.99	0	0.99	15.84	82.18	101
	Health	0	1.61	0	12.9	85.48	62
	Management	1.59	0	1.59	23.81	73.02	63
	Science	1.53	0	0.61	22.63	75.23	327
	Other Faculty	2.86	0	0	11.43	85.71	35
Time Management	Arts & SS	0.51	1.03	3.08	27.18	68.21	195
	Computer Sci	1.16	1.16	5.81	31.4	60.47	86
	Engineering	0	0.99	6.93	22.77	69.31	101
	Health	0	0	3.23	22.58	74.19	62
	Management	0	0	3.17	28.57	68.25	63
	Science	0.62	0.92	4	32.31	62.15	325
	Other Faculty	2.86	0	2.86	25.71	68.57	35
Active Learning	Arts & SS	0.51	0	3.08	43.08	53.33	195
	Computer Sci	1.18	2.35	3.53	38.82	54.12	85
	Engineering	0	0	4	29	67	100
	Health	0	0	3.23	32.26	64.52	62
	Management	0	0	3.17	38.1	58.73	63
	Science	0.31	1.55	3.42	39.44	55.28	322
	Other Faculty	2.86	0	2.86	28.57	65.71	35
Cultural Agility	Arts & SS	1.02	2.04	5.1	29.08	62.76	196
	Computer Sci	3.53	4.71	10.59	42.35	38.82	85
	Engineering	0	5.1	14.29	26.53	54.08	98
	Health	0	0	1.64	26.23	72.13	61
	Management	3.17	1.59	6.35	41.27	47.62	63
	Science	0.61	4.28	11.31	34.56	49.24	327
	Other Faculty	2.86	2.86	5.71	25.71	62.86	35
Complex Problem Solving	Arts & SS	0.52	2.58	5.15	52.06	39.69	194
	Computer Sci	1.23	2.47	3.7	43.21	49.38	81
	Engineering	0	1	3	40	56	100
	Health	0	0	6.45	43.55	50	62
	Management	0	0	3.23	43.55	53.23	62
	Science	0.31	1.55	6.52	48.76	42.86	322
	Other Faculty	3.03	0	6.06	42.42	48.48	33
Social Perceptiveness	Arts & SS	0.51	2.54	7.11	43.65	46.19	197
	Computer Sci	1.19	5.95	9.52	48.81	34.52	84
	Engineering	0	3.96	5.94	51.49	38.61	101
	Health	0	0	8.2	36.07	55.74	61
	Management	0	3.17	14.29	39.68	42.86	63
	Science	0.61	2.76	10.43	43.25	42.94	326
	Other Faculty	2.86	0	11.43	34.29	51.43	35
Coordination	Arts & SS	0.53	0	11.05	50.53	37.89	190
	Computer Sci	1.18	5.88	14.12	50.59	28.24	85
	Engineering	0	0.99	9.9	47.52	41.58	101
	Health	0	0	4.92	59.02	36.07	61
	Management	0	3.17	11.11	41.27	44.44	63
	Science	0.62	3.41	10.22	47.99	37.77	323
	Other Faculty	3.03	0	12.12	24.24	60.61	33

Appendix K. All Soft Skills by Gender

Skills	*Group*	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Active Listening	Men	1.97	0.33	1.31	21.97	74.43	305
	Women	1.27	0.18	1.08	16.64	80.83	553
	Other Gend	0	0	0	37.5	62.5	8
Critical Thinking	Men	0.66	0.98	1.31	28.2	68.85	305
	Women	0.73	0	1.45	28.36	69.45	550
	Other Gend	0	0	0	50	50	8
Consideration of Moral or Ethical Issues	Men	1.67	3.34	11.04	28.09	55.85	299
	Women	0.55	1.82	3.28	23.91	70.44	548
	Other Gend	0	0	12.5	37.5	50	8
Reading Comprehension	Men	0.66	1.66	4.3	38.08	55.3	302
	Women	0.91	1.09	3.08	36.23	58.7	552
	Other Gend	0	0	0	62.5	37.5	8
Monitoring	Men	0.65	1.31	6.86	46.08	45.1	306
	Women	0.36	0.91	5.81	43.19	49.73	551
	Other Gend	0	0	25	25	50	8
Negotiation	Men	0.33	6.93	11.22	39.93	41.58	303
	Women	0.55	4	12.55	38	44.91	550
	Other Gend	0	0	37.5	25	37.5	8
Service Orientation	Men	0.65	6.86	14.71	41.83	35.95	306
	Women	0.91	3.27	13.27	39.45	43.09	550
	Other Gend	0	12.5	37.5	25	25	8

Skills	*Group*	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n=
Speaking	Men	0.66	0.33	0.66	24.26	74.1	305
	Women	1.45	0.18	0.72	20.29	77.36	552
	Other Gend	0	0	0	25	75	8
Time Management	Men	0.98	0.66	5.25	28.85	64.26	305
	Women	0.36	0.91	3.64	28	67.09	550
	Other Gend	0	0	0	50	50	8
Active Learning	Men	0.66	0.33	3.64	38.41	56.95	302
	Women	0.36	1.09	3.1	37.41	58.03	548
	Other Gend	0	0	12.5	37.5	50	8
Cultural Agility	Men	1.98	5.94	17.49	36.3	38.28	303
	Women	0.73	1.45	4.36	30.73	62.73	550
	Other Gend	0	12.5	0	25	62.5	8
Complex Problem Solving	Men	0.67	1.01	5.72	44.44	48.15	297
	Women	0.37	1.83	4.77	48.26	44.77	545
	Other Gend	0	0	0	37.5	62.5	8
Social Perceptiveness	Men	0.98	3.93	11.48	47.21	36.39	305
	Women	0.36	2.36	8.18	41.64	47.45	550
	Other Gend	0	0	0	75	25	8
Coordination	Men	0.66	2.31	11.88	49.5	35.64	303
	Women	0.55	2.21	9.96	46.68	40.59	542
	Other Gend	0	0	0	100	0	8