

Skill savvy

Professional skills needs for
Canada's electricity sector

A research paper by
Electricity Human Resources Canada

About Electricity Human Resources Canada

Electricity Human Resources Canada (EHRC) is Canada's most trusted source for objective human resource and market information, with the tools to guide business planning and development for the Canadian electricity industry. We provide a platform for current industry needs, identify ways to make Canadian businesses "best in class," and forecast industry trends and issues. Our work enables the industry to map workforce supply to demand and to foster growth and innovation in employers and employees. This improves the quality of service industry provides and improves the confidence Canadians have in the industry.

Further information on EHRC is available at electricityhr.ca.

Ce rapport est également disponible en français sous le titre: Savoir-Faire : Les compétences professionnelles requises pour le secteur canadien de l'électricité. This report also available in French.

The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.



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Technical skills: just the beginning

Studies show that when students or new graduates struggle in the workplace, it's usually not for a lack of technical skills: it's because they're missing key *non-technical* skills needed to perform their roles effectively. At Electricity Human Resources Canada (EHRC), we have been aware of this fact since our inception in 2005. It's a priority issue we're determined to address because our sector needs next-generation talent who are equipped in every way to succeed.

But what exactly are the non-technical skills students and new graduates require most? How are these skills related to the changes underway in Canada's workplaces resulting from digitalization, innovation and the aging of the workforce? Where should students be learning these skills? And what, even, should those skills be called?

Those are some of the questions that drove us to undertake this research. We sought to identify the most essential non-technical skills for the electricity sector, then determine if there are gaps in how those skills are currently being taught and developed in the post-secondary education (PSE) programs our sector draws on for talent.

It should be noted that there is debate about who is responsible for helping students acquire these skills: educators or employers. Our position is it is not one or the other but rather *both together*. We also believe work-integrated learning (WIL) is an excellent mechanism for employer–educator collaboration on skills development.

Evidence shows that the kind of experiential learning afforded by WIL is a highly effective way to produce graduates who are ready for the workplace. Based on that evidence, Employment and Social Development Canada (ESDC) has invested in WIL programs across the country, including EHRC’s *Empowering Futures* wage subsidy program for electricity organizations that hire students for WIL positions.ⁱ

This particular research focuses only on PSE’s role in professional skills development. We looked at course outlines and the accreditation requirements PSE engineering and technician/technologist programs are designed to meet and, through that analysis, identified potential skills gaps for students and new grads that may need be addressed in future programming.

What are employers looking for?

Today’s workers need to be versatile, adaptable and collaborative. They also need to be fast learners who thrive amidst constant change. Canada’s electricity sector is by no means alone in needing this kind of talent. In 2016, 92% of executives surveyed by the *Wall Street Journal* said communication, curiosity, critical thinking and other non-technical capabilities matter just as much as candidates’ technical skills.¹

In its oft-cited *Humans Wanted* report, RBC presented a list of the 10 most wanted skills for future jobs:²

- | | |
|-------------------------|-------------------------|
| ▶ Active listening | ▶ Social perceptiveness |
| ▶ Speaking | ▶ Collaboration |
| ▶ Critical thinking | ▶ Time management |
| ▶ Reading comprehension | ▶ Decision-making |
| ▶ Monitoring | ▶ Active learning |

Google identified many of the same skills in its efforts to define the characteristics of great managers (and subsequently, productive teams), with technical skills ranking low on both lists.^{3,4} Business leaders have also told LinkedIn that leadership, communication, collaboration and time management are all especially valuable.⁵

These needs are changing the ways companies do their hiring. Multinationals like Google, Apple and IBM are putting less emphasis on degrees and credentials alone. As reported by *Canadian Business*:⁶



Companies now recognize that a degree doesn’t always signal talent. Often the most unique, creative, outside-the-box thinkers skip the conventional route meaning educational requirements remove some of the best candidates from the talent pool.

“When we started, a lot of companies were adamant that their hires needed degrees,” says Jeremy Shaki, CEO of Lighthouse Labs, which runs coding bootcamps. But in an industry with rapid growth, companies are now willing to consider these students with unconventional backgrounds. Shaki’s company has produced over 1,000 developers in the past five years. Thirty percent of students had zero coding experience.

“They started to come back for more and more of these people,” explains Shaki.

i For more on WIL and its potential for the electricity sector, read our thought paper, *Empowering the next-generation workforce*, at <https://electricityhr.ca/resources/empowering-the-next-generation-workforce/>

What are “non-technical” skills called?

There’s little agreement when it comes to deciding what to call these coveted non-technical skills. The term “soft skills” seems to be used quite often, but it doesn’t include everything employers are looking for because it tends to focus more on “people skills”—which exclude things like time management, self-monitoring and other aspects of professional discipline.⁷ (The Oxford dictionary defines “soft skills” as “personal attributes that enable someone to interact effectively and harmoniously with other people.”⁸)

The RBC *Humans Wanted* report⁹ uses the terms “basic” and “cross-functional” skills.¹⁰ Other publications talk about “transferrable” skills¹¹ and “foundational” skills.¹²

One term gaining traction in the literature is “+skills.”¹³ This is usually applied to skills beyond core technical competencies that add to jobseekers’ value in the eyes of employers.¹⁴ In an article on the future of work, HR services firm Randstad said that for students and new grads, “...in the face of a wealth of technical skills, skills like communication, teamwork, problem-solving and attention to detail suddenly become valuable once again as a way of setting yourself apart from other candidates.”¹⁵

Yet the *plus* aspect of “+skills” seems more appropriate to fields such as engineering, where technical and non-technical abilities are clearly differentiated, than to

sociology for example, where “+skills” are actually core competencies developed through post-secondary programs. That said, “+skills” is gaining ground in Canada because of our generally high level of education and the competitiveness of the job market, with many reports and articles having adopted the label.¹⁶

All this competing terminology has led to confusion not only about what to call non-technical skills but also about what, precisely, employers want or need. That makes it difficult to assess whether or not candidates actually have the prerequisite non-technical skills—and for colleges, universities and other PSEs to adequately prepare their students for the world of work.

While what’s really needed is a pan-Canadian conversation to settle on an appropriate term, we have tried to further the discussion by asking employers and PSE institutions about their preferences among a set of potential terms.

“Professional skills” ranked first with 22% of respondents favouring it. “Soft skills” and “social skills” came a close second and third at 20% and 18%, respectively, though some felt “soft skills” devalued the importance of the skills required. Given the small margins between the top three terms, more discussion is needed—although for the purposes of this study and other communications related to the *Empowering Futures* wage subsidy program, we at EHRC have chosen to use “**professional skills**”, with validation from a steering committee composed of post-secondary educators and electricity sector employers.

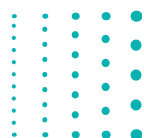


Figure 1: Preferred terminology for non-technical skills needed in the workplace

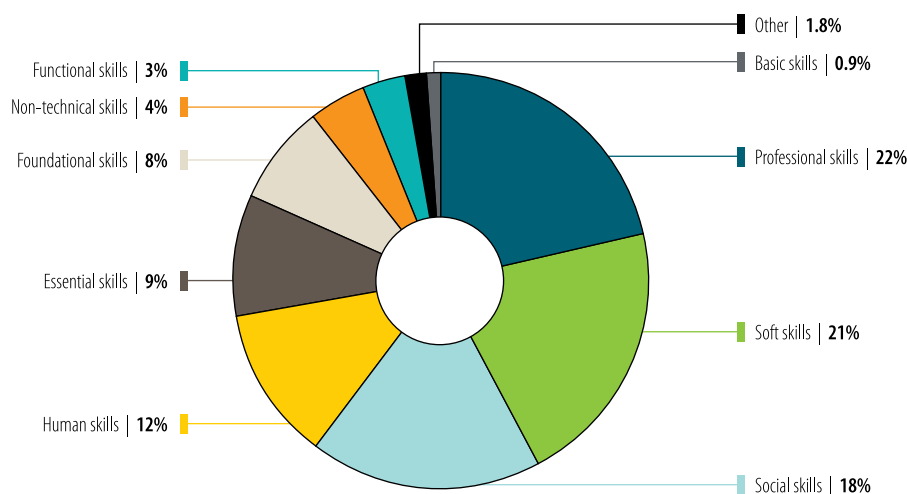
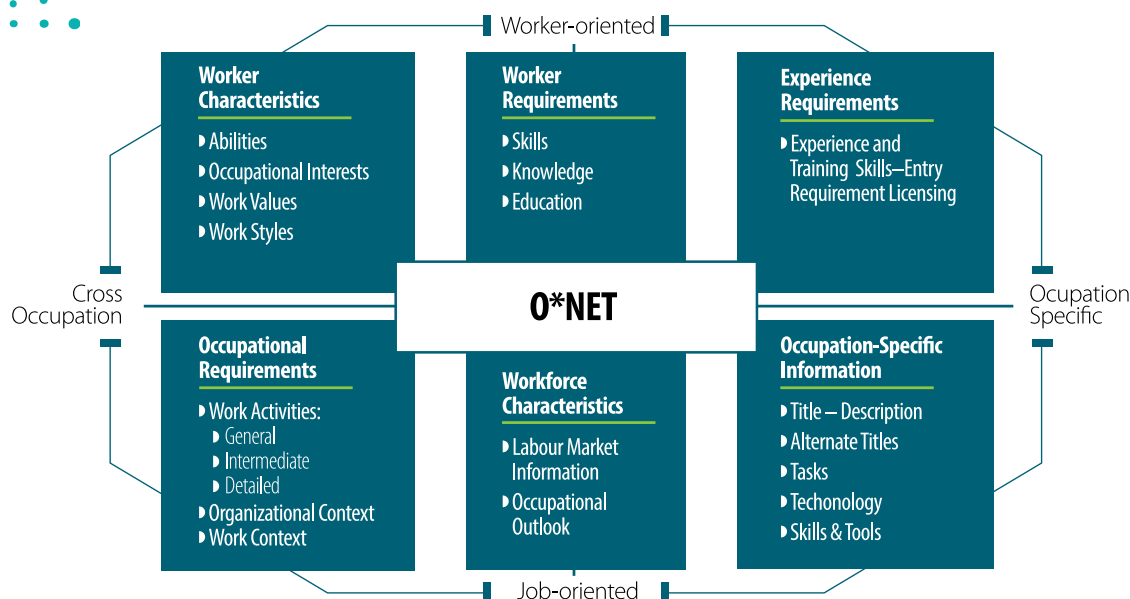




Figure 2: Overview of the O*NET content modelⁱⁱ



Defining professional skills

Many models and frameworks have been developed in recent years to define key professional skills and competencies. The Ontario Ministry of Advanced Education and Skills Development (now the Ministry of Training, Colleges and Universities) developed the **Essential Employability Skills (EES)**: a set of 11 skills (and associated learning outcomes) across six categories that college students must be able to reliably demonstrate before they can graduate.¹⁷

The EES skill categories are:

- ▶ Communication (e.g., reading, writing, speaking)
- ▶ Numeracy (e.g., understanding and applying mathematical concepts)
- ▶ Critical thinking and problem-solving (e.g., decision-making)
- ▶ Information management (e.g., gathering and analyzing data)
- ▶ Interpersonal skills (e.g., teamwork, conflict resolution)
- ▶ Personal skills (e.g., time management, personal responsibility)

While most Ontario colleges have based their curricula on the skills outlined in the EES framework, there are still debates about how effectively EES describes what employers are really looking for when it comes to new graduates' personal competencies.¹⁸ For this reason, we at EHRC prefer the **O*NET content model**, which is sponsored by the U.S. Department of Labor's Employment & Training Administration.^{19, 20}

As shown in Figure 2, the O*NET model is organized into six major domains that are used to specify the key attributes of both workers and occupations. The worker-oriented descriptors have three elements: *characteristics* (e.g., interests, values), *experience* (e.g., training, licensing) and *requirements*, which refer to the work-related skills and attributes acquired or developed through experience and education.²¹

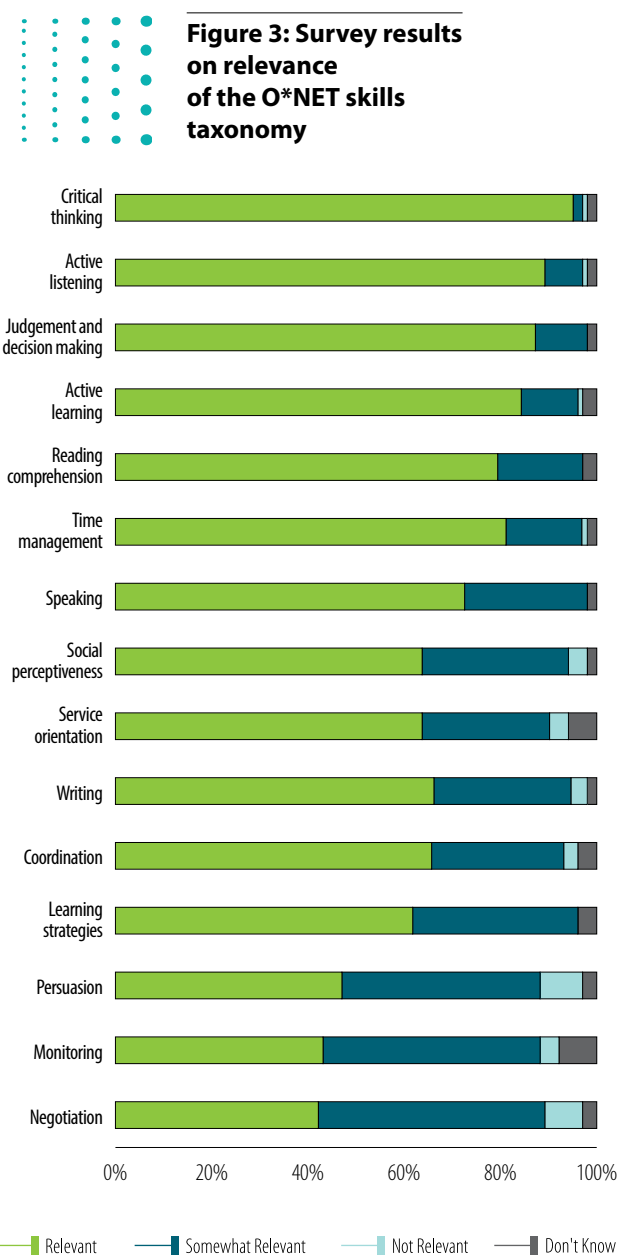
Of these, the workers' requirements intersect most directly with the kinds of non-technical skills that are the focus of this study. They include:

- ▶ **Basic skills** that facilitate learning or the rapid acquisition of knowledge (e.g., writing, reading comprehension)
- ▶ **Cross-functional skills** that facilitate the accomplishment of activities across jobs/roles (e.g., problem-solving, social perceptiveness)
- ▶ **Knowledge** (e.g., principles and facts applied in general domains)
- ▶ **Education** (e.g., prior educational experience required to perform the job)

ii This page includes information from O*NET Resource Center (www.onetcenter.org) by the U.S. Department of Labor, Employment and Training Administration (USDOL/ETA). Used under the CC BY 4.0 (www.creativecommons.org/licenses/by/4.0/) license. O*NET® is a trademark of USDOL/ETA. EHRC has modified all or some of this information. USDOL/ETA has not approved, endorsed, or tested these modifications.

Creating the electricity sector's list of professional skills

By breaking skills down to their most fundamental definitions, the O*NET content model presumably makes them very easy for employers and educators to understand. To test that assumption, we extracted the model's basic and cross-functional skills and asked our industry and PSE stakeholders about their relevance. As Figure 3 shows, much of the language used in the O*NET model is very relevant to our sector's current conversation about professional skills.



Based on this feedback, we used the definitions of the basic and cross-functional skills described in the O*NET content model to build on the 10 most-wanted skills mentioned in the *RBC Humans Wanted* report, resulting in EHRC's own list of the professional skills that matter most to the electricity sector:

- ▶ **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
- ▶ **Self-awarenessⁱⁱⁱ:** monitoring and assessing one's own performance to make improvements or take corrective action
- ▶ **Social perceptiveness:** being aware of others' reactions and understanding why they react as they do
- ▶ **Collaboration^{iv}:** adjusting actions in relation to others' actions
- ▶ **Time management:** managing one's own time and the time of others
- ▶ **Judgment and decision-making:** considering the relative costs and benefits of potential actions to choose the most appropriate one
- ▶ **Active learning:** understanding the implications of new information for both current and future problem-solving and decision-making

These 10 skills are not the only ones students and new graduates will need in the electricity sector workplaces of today and tomorrow—but they are the skills most desired by employers.

iii The O*NET model uses the labels "monitoring" instead of "self-awareness" and "coordination" instead of "collaboration". We renamed these two skills based on feedback from our steering committee, focus group and survey respondents.

iv The O*NET model uses the labels "monitoring" instead of "self-awareness" and "coordination" instead of "collaboration". We renamed these two skills based on feedback from our steering committee, focus group and survey respondents.



Basic skills versus composite skills

Feedback we received during our research (and especially during the focus group we held to validate our findings) suggested we might be overlooking skills such as leadership, professionalism, ethics and information management. These are not in our final list because they are what we call “composite skills”, which incorporate elements of several basic and cross-functional skills. Professionalism, for example, involves a combination of time management, social perceptiveness, self-awareness and collaboration.

Because composite skills are more difficult to define, trace and measure, we found it is easier and more efficient to evaluate the electricity sector’s skills gaps using only the most foundational professional skills. In addition, students and new grads can be expected to build on these foundational skills, developing composite skills over a longer period of time as they integrate more fully into the workplace.





Where are students learning professional skills?

Professional skills will be critical to the success of Canada's next-generation electricity workforce. But where and how are students and new graduates acquiring these skills? While both industry and academia have important roles to play in this area, we focused our investigation on the ways colleges and universities are teaching and developing professional skills—and where the gaps might be that need to be addressed to better serve the electricity sector going forward.

While we recognize that industry has a role to play in skills development, students do spend a majority of their post-secondary education time in the classroom, so it makes sense to focus our inquiry there. Through quantitative research, surveys and focus groups, we reviewed the current state of professional skills development from two angles:

1. Accreditation requirements for PSE programs
2. Activities undertaken by students in those programs, as indicated in course outlines

(See Appendix A for more details about our research methodology.)

A closer look at accreditation requirements

The electricity sector heavily relies on engineers, technologists and technicians who receive their training in university and college programs, which have to meet certain standards established by accreditation bodies. Looking at how those standards are reflected in program curricula provides some insight into the kinds of professional skills students are acquiring from these institutions.

University engineering programs are accredited by the **Canadian Engineering Accreditation Board (CEAB)**, which has defined 12 attributes that it uses to grant or deny

accreditation. In colleges, the technician and technologist programs relevant to the electricity sector are accredited by **Technology Accreditation Canada (TAC)** using the Canadian Technology Accreditation Criteria (CTAC), which is made up of eight program learning outcomes.

We analyzed the CEAB attributes and TAC learning outcomes against our list of professional skills, looking at whether or not each skill is needed for a given attribute or outcome.

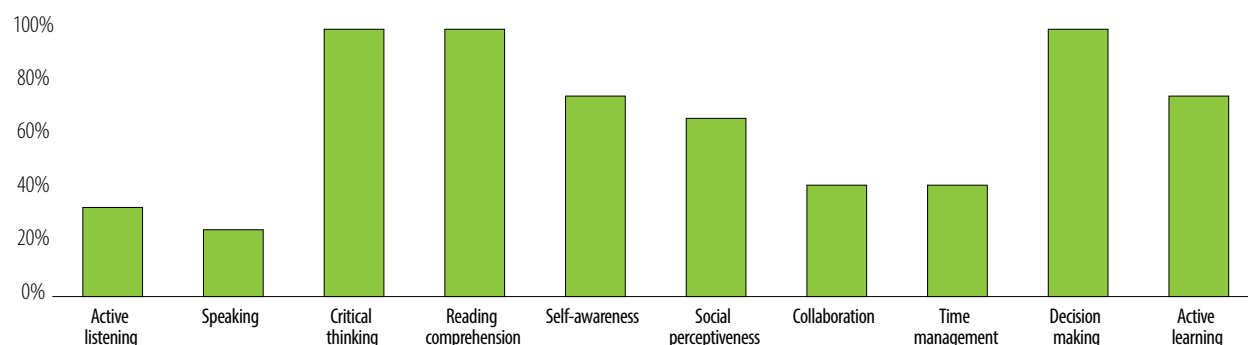
What we found

In general, college-trained technologists and university-trained engineers are the most well-rounded when it comes to professional skills, with their programs contributing to the strong development of all but speaking and active listening. College-trained technicians appear to be the least well-rounded when it comes to professional skills.

That said, there are gaps across the board in the teaching of professional skills.

At the university level, when we looked at the 12 attributes used by the CEAB to grant or deny program accreditation, the following professional skills were not well represented: active listening, speaking, self-awareness, social perceptiveness, collaboration, time management and active learning. As shown in Figure 4, the skills gaps in CEAB-accredited programs are particularly pronounced for active listening, speaking, collaboration and time management.

Figure 4: Skills gaps in CEAB accreditation process for university engineering programs



Y axis represents the extent to which a given skill is called upon in the accreditation requirements.

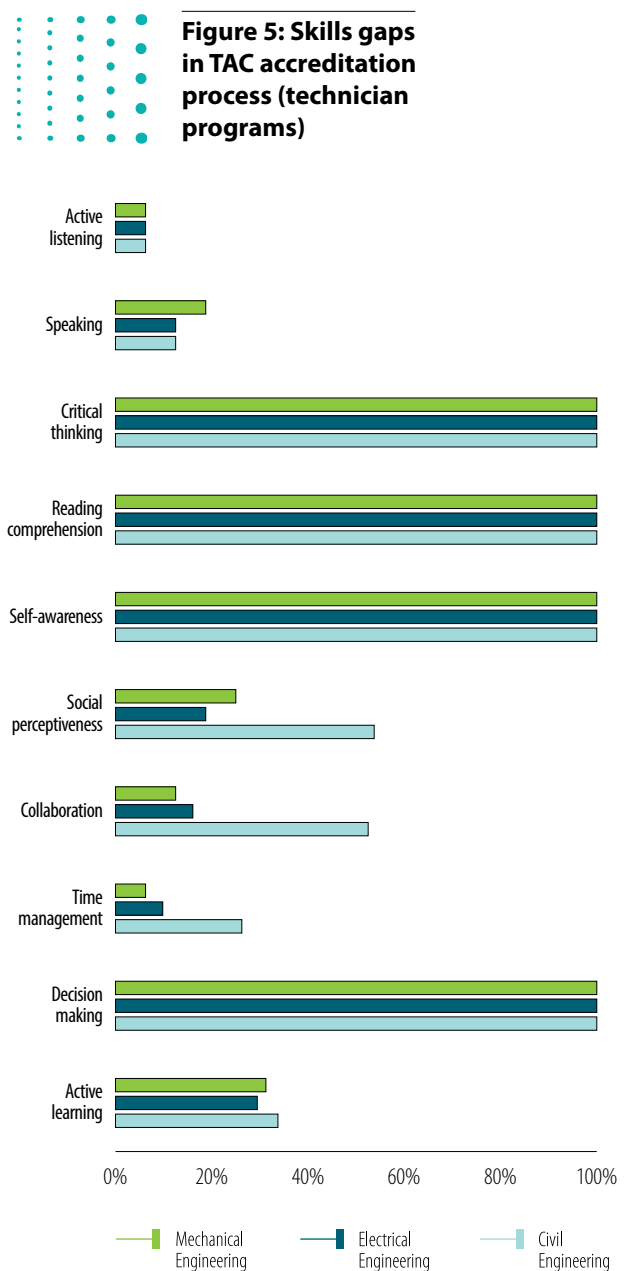
Our review of the TAC accreditation process for college mechanical, civil and electrical engineering technician and technologist programs revealed a similar picture of professional skills development, with the exception that the self-awareness skill is much more strongly represented in the college-level TAC learning outcomes when compared to the CEAB attributes.

This may be due partly to colleges' more "hands-on" pedagogical approach and partly to the language of the TAC accreditation process, which emphasizes the monitoring of one's own performance in a way the CEAB process does not. There may be an assumption that university students are more mature, so monitoring requirements are less prescriptive.

Looking specifically at technician training, we found civil engineering technician programs have the fewest professional skills gaps, while electrical engineering technician programs seem to have the most skills gaps.

The opposite is true for technologists: electrical engineering technologist programs have the fewest professional skills gaps, while civil engineering technologist programs have the most. Broadly, though, technologist programs in all three areas of engineering have fewer skills gaps than technician programs.

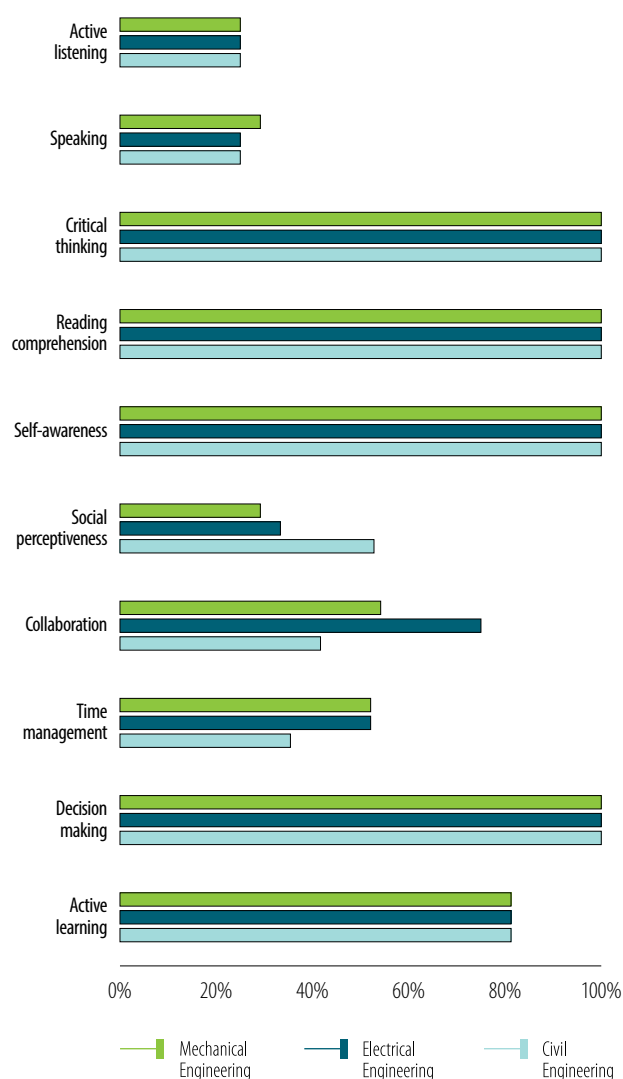
Clearly professional skills are and can be reflected in accreditation requirements (which ideally should be expressions of what industry needs and reflect the full spectrum of professional capabilities), and so filling the gaps where they exist could help improve the teaching of professional skills at both universities and colleges.



X axis represents the extent to which a given skill is called upon in the accreditation requirements.



Figure 6: Skills gaps in TAC accreditation process (technologist programs)



X axis represents the extent to which a given skill is called upon in the accreditation requirements.

Professional skills reflected in course outlines

Students acquire skills through the activities they complete during their courses, with different kinds of activities—lectures, tutorials, exams, group laboratories and so on—helping to build or reinforce different kinds of professional skills.

By reviewing the activities described in a course's outline, we can identify the professional skills students would develop by meeting that course's objectives. We took an "optimal outcomes" stance during our analysis, assuming students take part in all mandatory/graded activities and achieve full marks in the associated evaluations.

We recognize this approach can provide only a generalized notion of students' professional skills development. Short of breaking down the most granular content of every course activity or observing individual students as they take part in those activities, it is essentially impossible to gauge the development of skills such as active listening, reading comprehension, self-awareness and active learning.

However, based on the way the pedagogy is conceived and because we considered the best possible outcomes for every course, for the purpose of this study, we can assume these skills are being acquired by every successful student.

Certain activities affect skills development

We then made a few further assumptions about the activities described in the course outlines. As it relates to the **types of learning experiences**, we assumed:

- ▶ Lectures help students develop active listening skills.
- ▶ Exams help students acquire active learning, reading comprehension and self-awareness skills.
- ▶ Written tests, assignments and all other individual activities help students develop active learning, time management, self-awareness, reading comprehension, active listening, critical thinking, and judgment and decision-making skills.
- ▶ Group laboratory work helps students acquire speaking, social perceptiveness and collaboration skills, in addition to all the skills gained through exams and individual assignments.

- Skills like speaking, social perceptiveness and collaboration are developed by interacting with others. If a course outline clearly indicates such interactivity, we can assume those skills are being acquired.

Regarding **activity time and significance**, we assumed:

- The more time students spend performing an activity, the more they build the skills associated with that activity. That means a 25-hour course has more impact on skills development than a 15-hour course, generally speaking. We took this into consideration for outlines that clearly defined time spent on activities.
- An activity that counts for a smaller proportion of the students' overall grade (e.g., 5%) is not as important to skills development as an assignment that counts for a larger proportion (e.g., 20%).

Based on feedback raised early on by our focus group participants, we determined that our assumptions were not aligning with stakeholders' real-world experiences for two skills in particular: time management and critical thinking. After taking a second look at our assumptions, we revised our framework of analysis for these two skills, as reflected in the approaches below.

Time management

A student's success in any course depends on how they plan and manage their time to complete tasks and achieve goals. This needs to be considered when determining students' acquisition of time management skills.

Generally, three levels of time management need to be considered:²²

- Short-range planning** – Here, the educator sets a larger goal (e.g., the final grade) and a series of small tasks (e.g., weekly quizzes or assignments) to achieve it. Students have to manage their time week-to-week to accomplish the tasks and, in turn, the larger goal.
- Medium-range planning** – Instead of weekly quizzes or assignments, tests or assignments are given once a month. Students have to plan accordingly how they will use their time.
- Long-range planning** – The educator evaluates students just twice a year. With only midterms and finals contributing to their grade, students must set their own goals and tasks to succeed.

In other words, the degree and depth of time management skills students acquire depends significantly on course design.²³ Extrapolating from that, we set a simple formula for assessing courses, presuming those requiring short-range planning would impart roughly a third of the time management skills needed by students, those with medium-range planning requirements would impart about two-thirds and those requiring long-term planning would impart the full skill.

Critical thinking

Critical thinking is the process of actively synthesizing, analyzing, conceptualizing and applying information.²⁴ It is key to effectively evaluating arguments, making inferences and solving problems.²⁵

In STEM fields like engineering, the scientific method is an essential part of the curriculum. When solving any given problem or testing a hypothesis, STEM students must apply some degree of critical thinking when deciding what algorithms, methods, models or frameworks to apply during each step of the scientific method (e.g., observation, measurement, experimentation, analysis).²⁶

However, it would not be accurate to say that every successful STEM student will have developed robust critical thinking skills. In many cases, STEM students are taught to follow and apply standardized thought patterns that are often misconstrued as critical thinking. Real critical thinking goes beyond reproducing standardized thought patterns: it involves an element of creativity, with students taught how to come up with their own methods for solving problems and how to translate the methods they have already learned to solve problems in entirely different contexts.

In this context, we considered four levels of critical thinking during our analysis:²⁷

- Level 1:** Students attend lectures and complete assignments and exams.
- Level 2:** In addition to lectures, assignments and exams, students take part in tutorial sessions that offer a greater level of interactivity. Prior to each session, students analyze information to come up with a solution most suitable to a given problem, with the tutorial becoming a discussion on how the students reached that solution.

- Level 3:** In addition to tutorial sessions, students participate in activities where they get to analyze and develop practical solutions to problems related to the theory learned in lectures—for example, through group laboratory work or presentations. This a higher level of critical thinking because it requires a greater degree of conceptualization, analysis and evaluation.
- Level 4:** Along with all of the above, students have the opportunity to conduct some independent research and then present their findings to teachers and classmates for feedback.

Because judgment and decision-making are the end products of critical thinking, we assume any course with a positive critical thinking score will also rank well on judgment and decision-making.

What we found

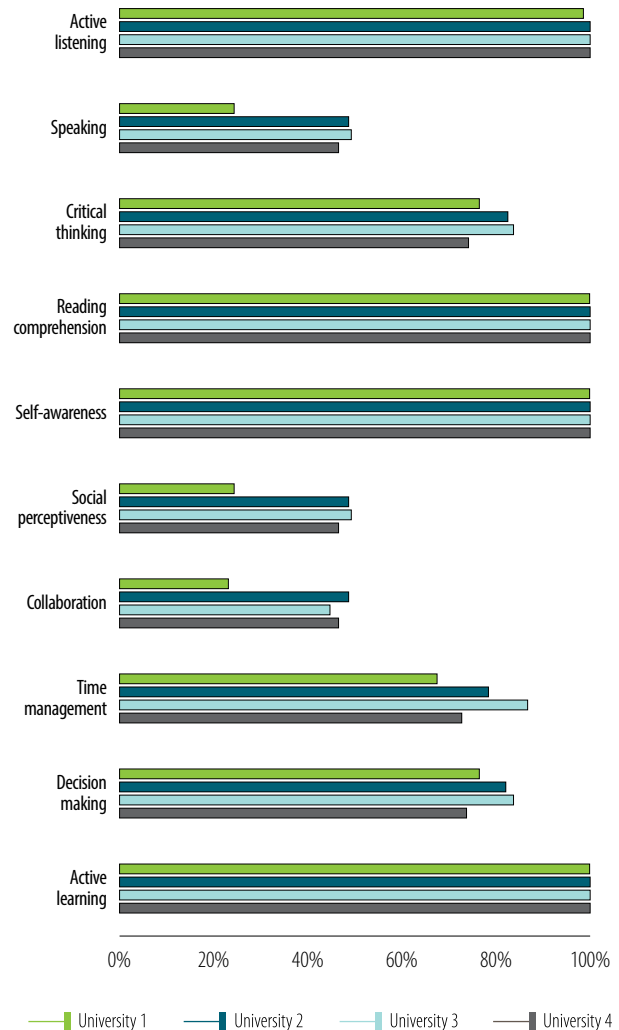
University curricula influence skills development

We reviewed the course outlines of four Canadian university electrical engineering programs and found similar skills gaps in each, particularly related to speaking, social perceptiveness and collaboration. There were also non-negligible gaps related to critical thinking, time management, and judgment and decision-making.

While we couldn't compare the schools directly because each program was structured differently (e.g., some involve mandatory co-op placements while others do not, different numbers of credits are required to graduate), looking at the courses themselves did allow for an assessment of where and how professional skills are likely being developed.

While all the universities we reviewed have skills gaps in the same areas, some are performing better than others. University 3 was ahead of all the others, likely due to the fact that it offers courses in professional development (i.e., courses whose content is designed specifically to coach students in many of the professional skills we have identified through our research).

Figure 7: Skills gaps based on course outlines of four university electrical engineering programs



This axis represents the extent to which a given skill will be developed by a perfect student in a given program if the course outline was faithfully executed.

The offering of co-op learning opportunities also seems to have an impact. As shown in Figure 8, a program that offers *both* co-op opportunities and professional development courses appears to produce more well-rounded graduates than those that have just co-op or no co-op at all.

Figure 8: Impact of co-op and professional development courses on skills development

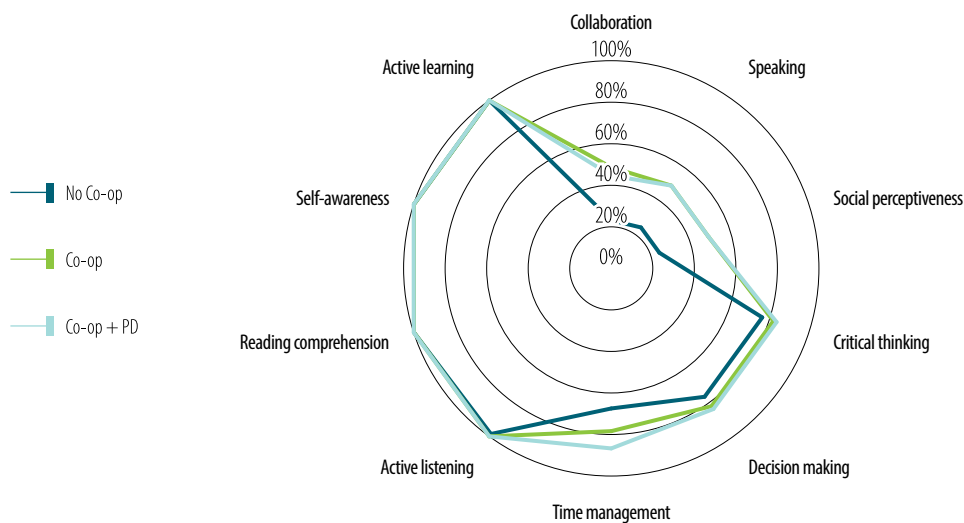


Table 1: Ontario Essential Employability Skills with corresponding EHRC terminology

ONTARIO EES	EHRC
Communication	Speaking
Communication: Respond	Active listening
Numeracy	Critical thinking
Problem-solving	Judgment and decision-making
Information management: Locate	Active learning
Information management: Analyze	Reading comprehension
Interpersonal: Show respect	Social perceptiveness
Interpersonal: Interact with others	Collaboration
Personal: Use of time and resources	Time management
Personal: Take responsibility	Self-awareness

College curricula influence skills development

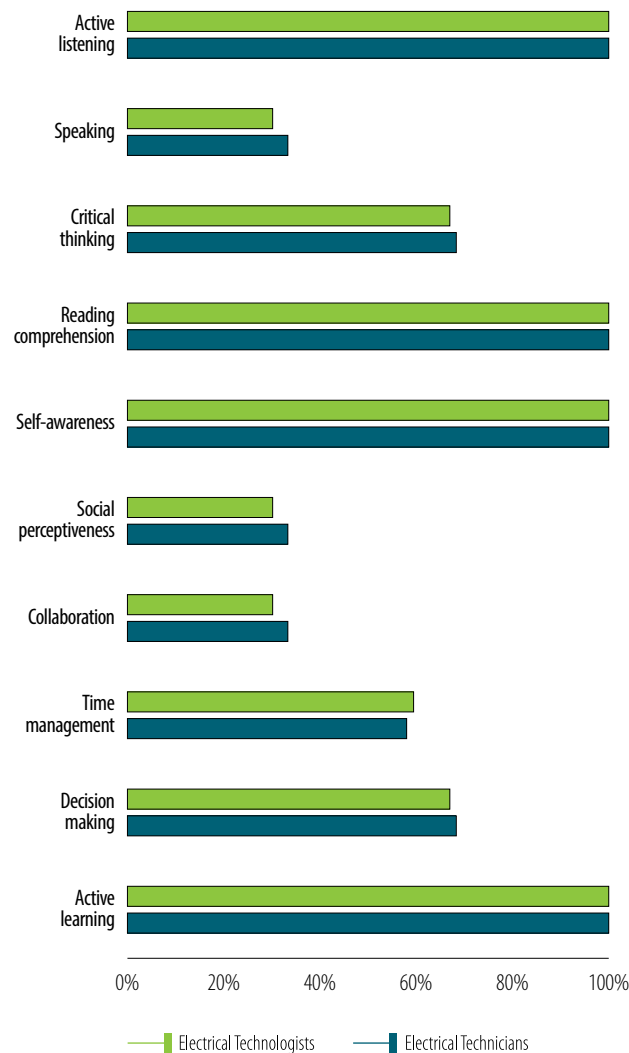
In some Ontario colleges, course outlines must define the Essential Employability Skills (EES) students will have learned by the end of the course.²⁸ Fortunately, there's a fairly direct match between these skills and those in our list of professional skills needed in the electricity sector, greatly simplifying our analysis for courses where the EES are directly mentioned.

We gathered course outlines for engineering technician and technologist programs from two colleges: one in Ontario (where the EES are mentioned in course outlines) and the other in British Columbia (which mentions the CEAB attributes in its course outlines).

As shown in Figure 9, there were very few differences in the skills gaps between the technician and technologist programs.

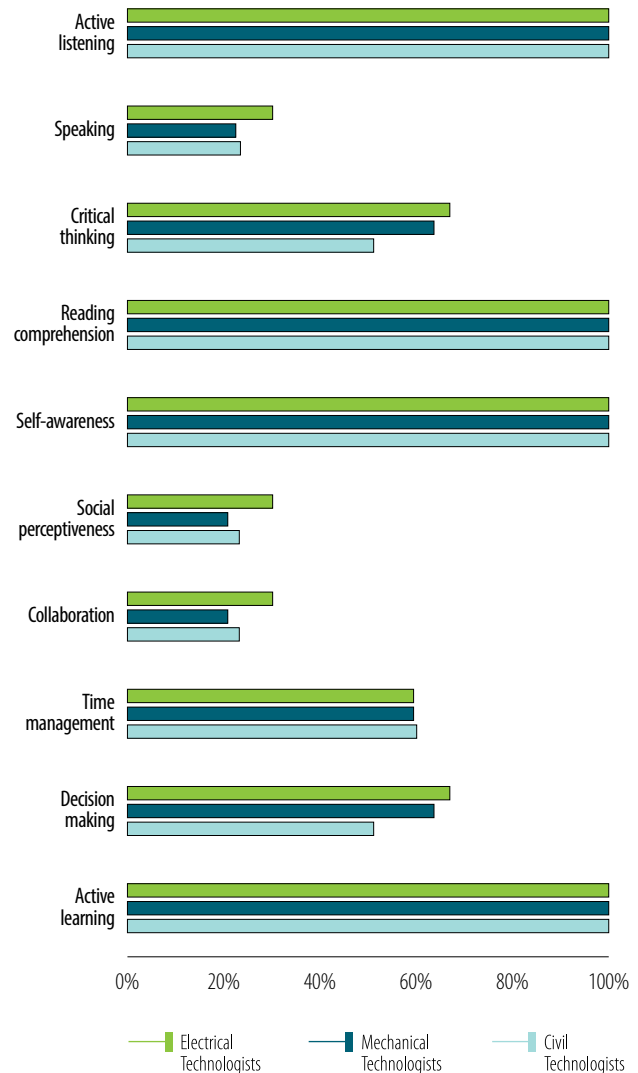
Compared to mechanical and civil engineering technologist programs, electrical engineering technologist programs seem to show fewer skills gaps.

Figure 9: Skills gaps based on course outlines for electrical engineering technicians and technologists



This axis represents the extent to which a given skill will be developed by a perfect student in a given program if the course outline was faithfully executed.

Figure 10: Skills gaps based on course outlines for engineering technologists



This axis represents the extent to which a given skill will be developed by a perfect student in a given program if the course outline was faithfully executed.

As shown in Figure 11, electrical engineering technologists appear to have a more well-rounded skills profile compared to the other students.

There was very little difference between the EES-based college program and the CEAB-based program in skills gaps, with the exception of time management skills. As seen in Figure 12, it appears students in CEAB-based programs develop stronger time management skills than those in EES-based programs.

Figure 11: Skills profiles of electrical, mechanical and civil engineering technologists

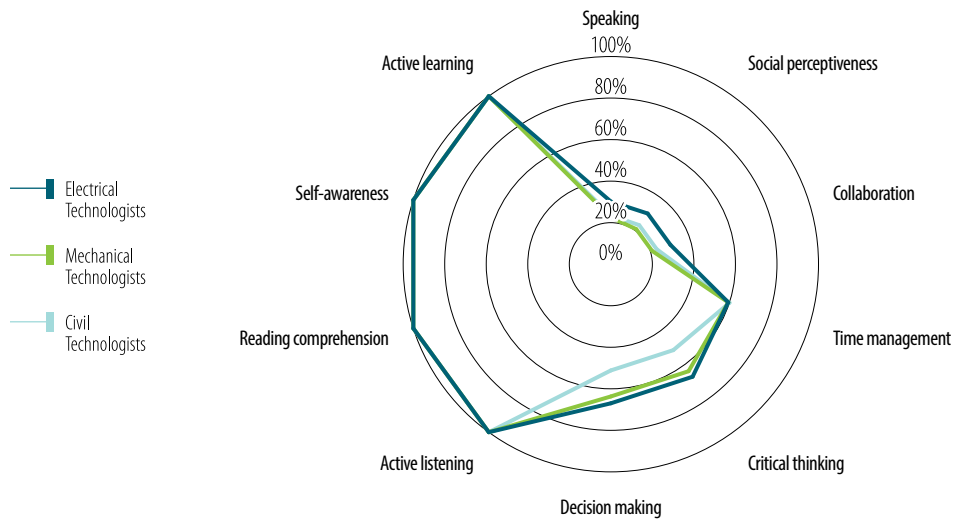
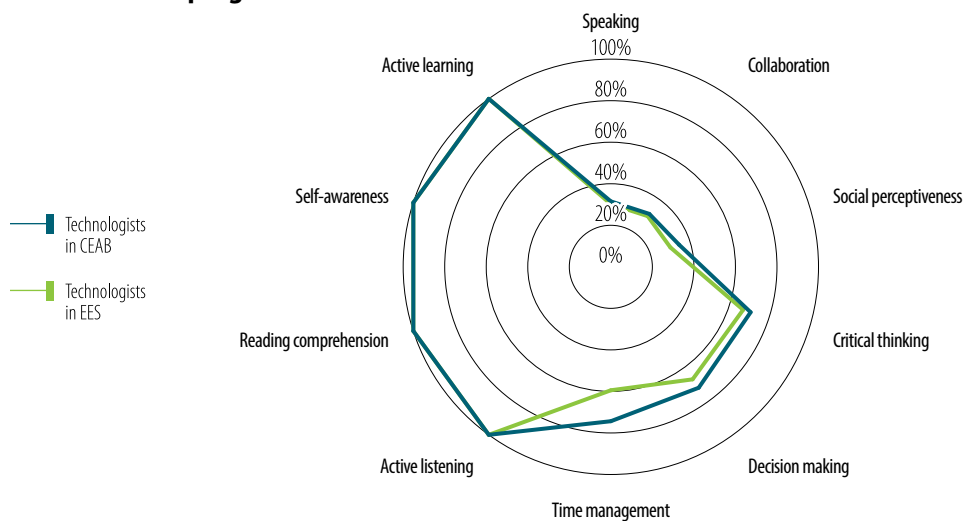


Figure 12: Skills profiles of electrical engineering technologists in EES vs. CEAB programs



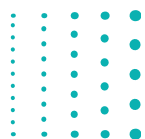
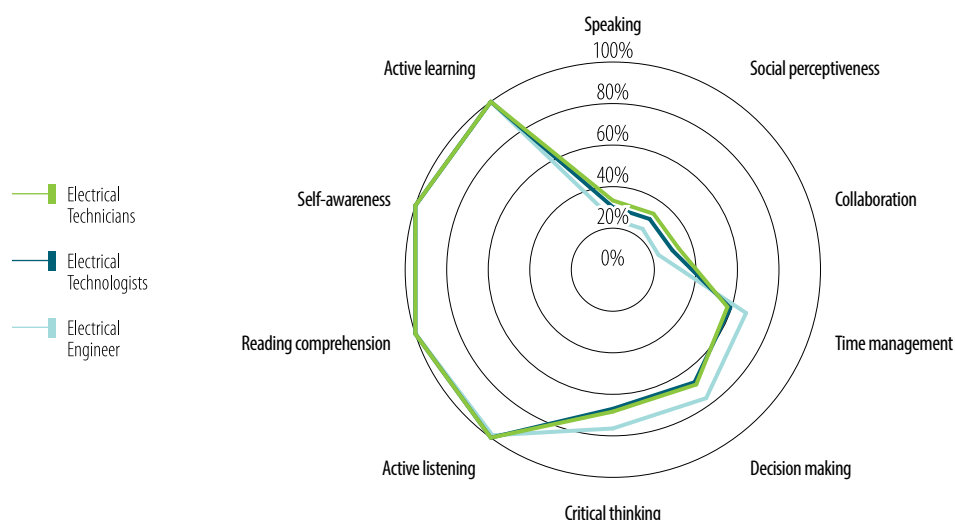


Figure 13: Skills profiles of electrical engineers, technicians and technologists (EES-based)



Skills are also developed when transitioning from college to university

Students can take many paths to become an engineer. Some, for example, start out as electrical engineering technicians, advance into electrical engineering technologist roles, then register in university engineering programs. We wanted to get a sense of students' skills profiles as they move along this path.

As shown in Figure 13, the growth in skills acquired when students transition from an EES-based program to university was not what we were expecting. Students improved their decision-making, critical thinking and time management—but their speaking, social perceptiveness and collaboration skills *decreased*. That said, the university engineering program we analyzed for this did not have mandatory co-op work terms: any student who moves from college to a university with both mandatory co-op and professional development courses should see a drastic improvement in their professional skills profile (as seen earlier in Figure 8).

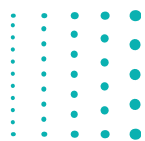
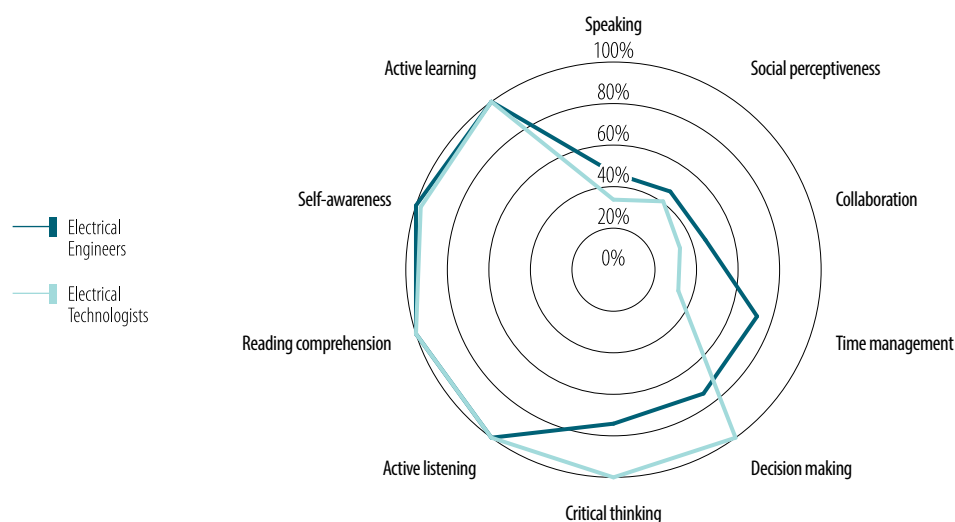


Figure 14: Skills profiles of electrical engineers and technologists (CEAB-based)



College programs based on CEAB requirements appear to better prepare technologists to enter university engineering programs than those based on the Ontario EES. Figure 14 shows improvement in areas such as time management, social perceptiveness, collaboration and speaking as they advance from technologist to engineer. (The college and university engineering programs in this particular analysis were both from British Columbia and had mandatory co-ops.)

Validating our findings

We tested our preliminary assumptions about professional skills with a small focus group of educators and WIL professionals. To validate the results of our more thorough quantitative research, however, we needed to survey a much larger group of employers, educators and students. We asked them about the relevance of our professional skills terminology, the most important skills for the electricity sector, and the skills gaps exhibited by students or new graduates entering the workforce.

(See Appendix B for a detailed breakdown of this survey's demographics.)

We found that more than 70 percent of respondents felt students or new graduates had some or significant gaps in the following professional skills:

- ▀ Judgment and decision-making
- ▀ Critical thinking
- ▀ Active listening
- ▀ Time management
- ▀ Speaking

Four of these five skills—judgment and decision-making, critical thinking, time management and speaking—are also the top four skills found lacking in our course outline analysis, indicating strong alignment between our quantitative research and stakeholders' perceptions.

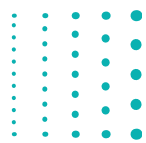
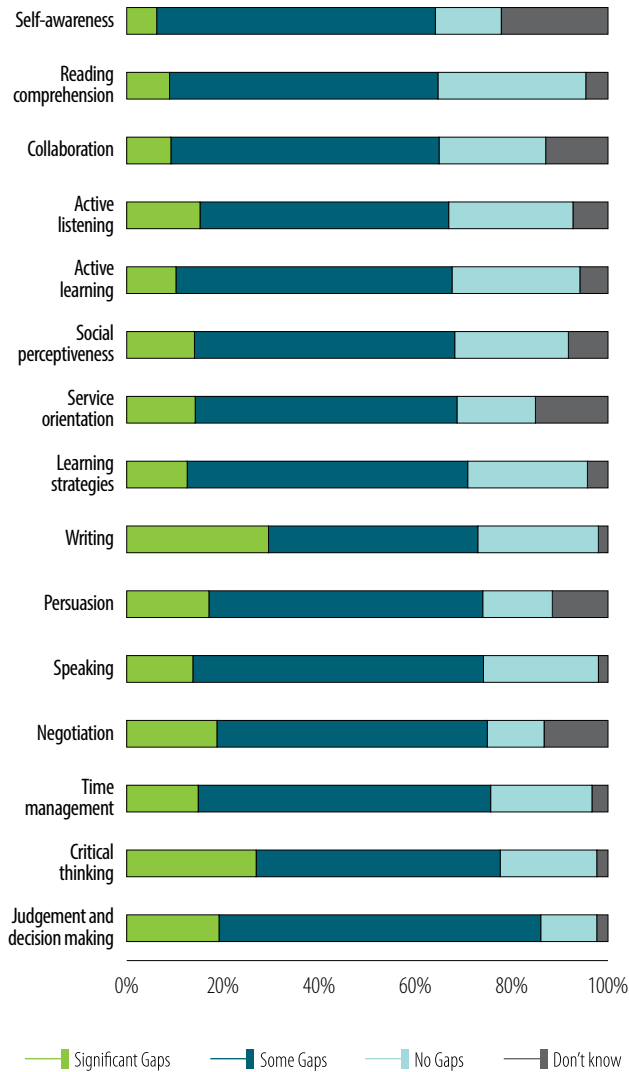


Figure 15:
Perception of skills
gaps across all
survey respondents



Student and employer perceptions

One of the aims of our survey was to get students' perspective on the skills gaps they're seeing and experiencing in the classroom and in the workplace. More than two-thirds of the students surveyed said there were gaps in their judgment and decision-making skills and their self-awareness skills. In addition, at least half of the students reported gaps in their speaking, active listening and collaboration skills.

Among electricity sector employers, more than half think students or new graduates entering the workforce have some or significant gaps in *all* professional skills. Of the skills mentioned by more than 60 percent of employers, four—judgment and decision-making, critical thinking, time management and collaboration—are among the top six skills gaps revealed through our research.

Figure 16:
Students'
perception
of skills gaps

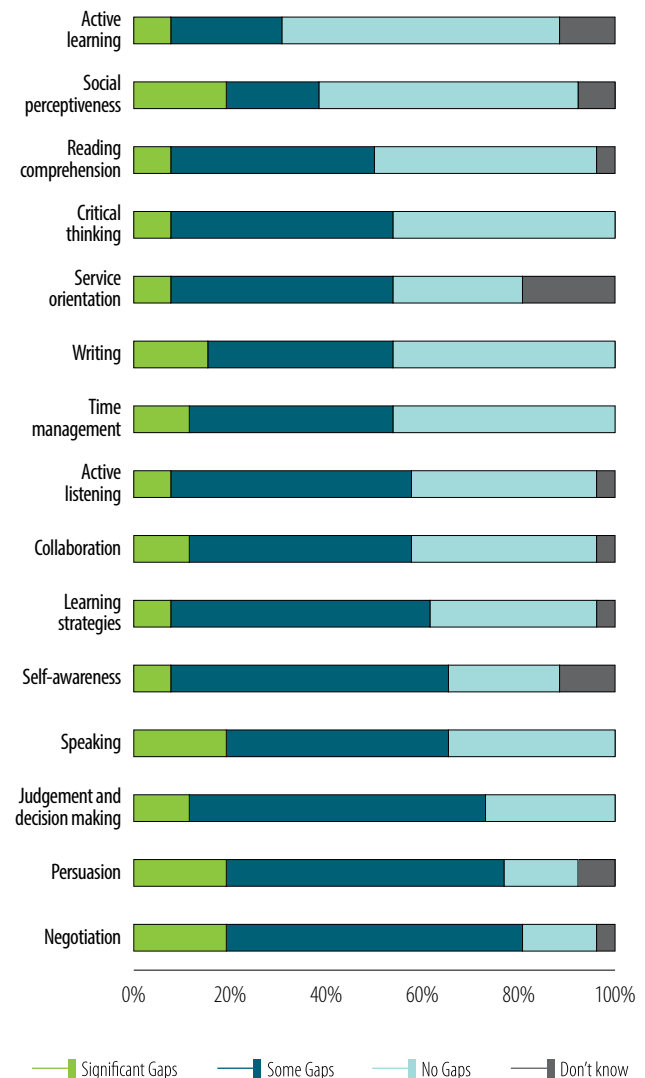
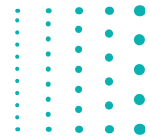
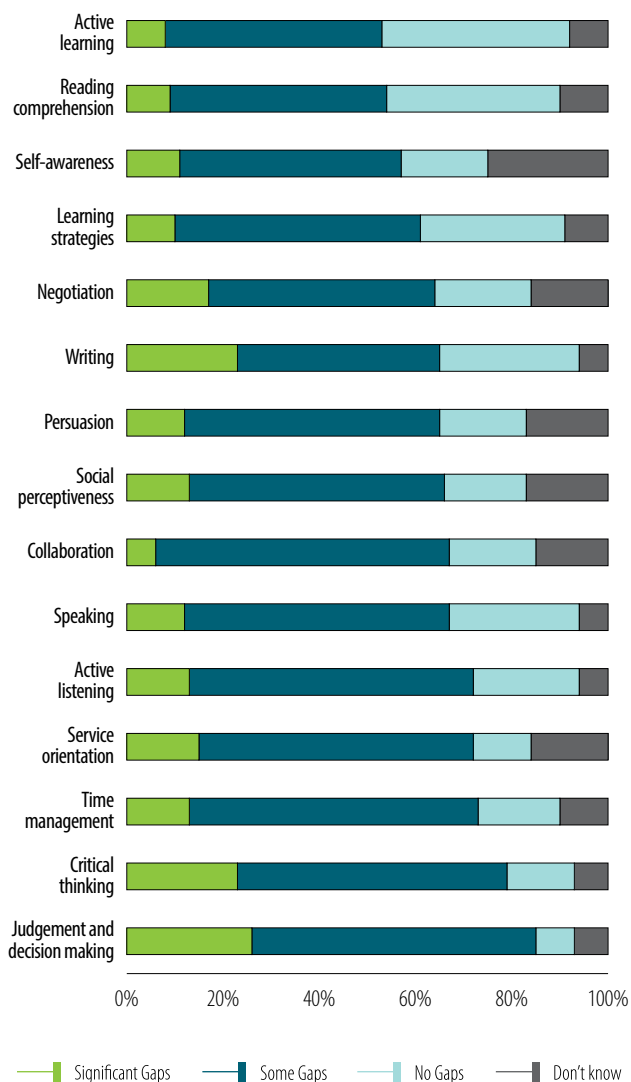




Figure 17: Employers' perceptions of skills gaps



Where should professional skills be acquired?

Our survey also asked who is most responsible for providing students with the training they need to acquire professional skills—and who actually has the capacity to deliver such training successfully?

Most respondents put the responsibility on the students themselves, with employers and educators perceived to have equal capacity to provide the necessary training. A deeper look at the results, however, shows no clear consensus as to whether educators or employers have the most capacity to help students acquire professional skills.

Students said employers and educators both have the capacity to deliver the training, while educators and employers each perceive themselves as having the most capacity. Interestingly, employers and educators see themselves as having the *capacity* to teach professional skills but not the *responsibility* to do so.

Ultimately, more conversations will need to take place between employers and educators to increase their sense of responsibility for helping students to acquire the professional skills they need as well as their understanding of what these skills are and how to define them.

It should be noted that more than three-quarters (79%) of the employers surveyed said they were involved in some form of WIL program—and those who were not participating in WIL responded noticeably differently than their peers. Non-WIL employers do not see themselves as responsible or having the capacity to develop the professional skills of students and new graduates. These non-WIL employers felt the responsibility is equally shared by students and educators, and said educators have the most capacity to help students develop professional skills.

These findings show that, in addition to enhancing students' professional skills, WIL programs also lead to an increased awareness among employers of the positive role they can play in students' professional skills development.

Figure 18: Responsibility and capacity to help students acquire professional skills

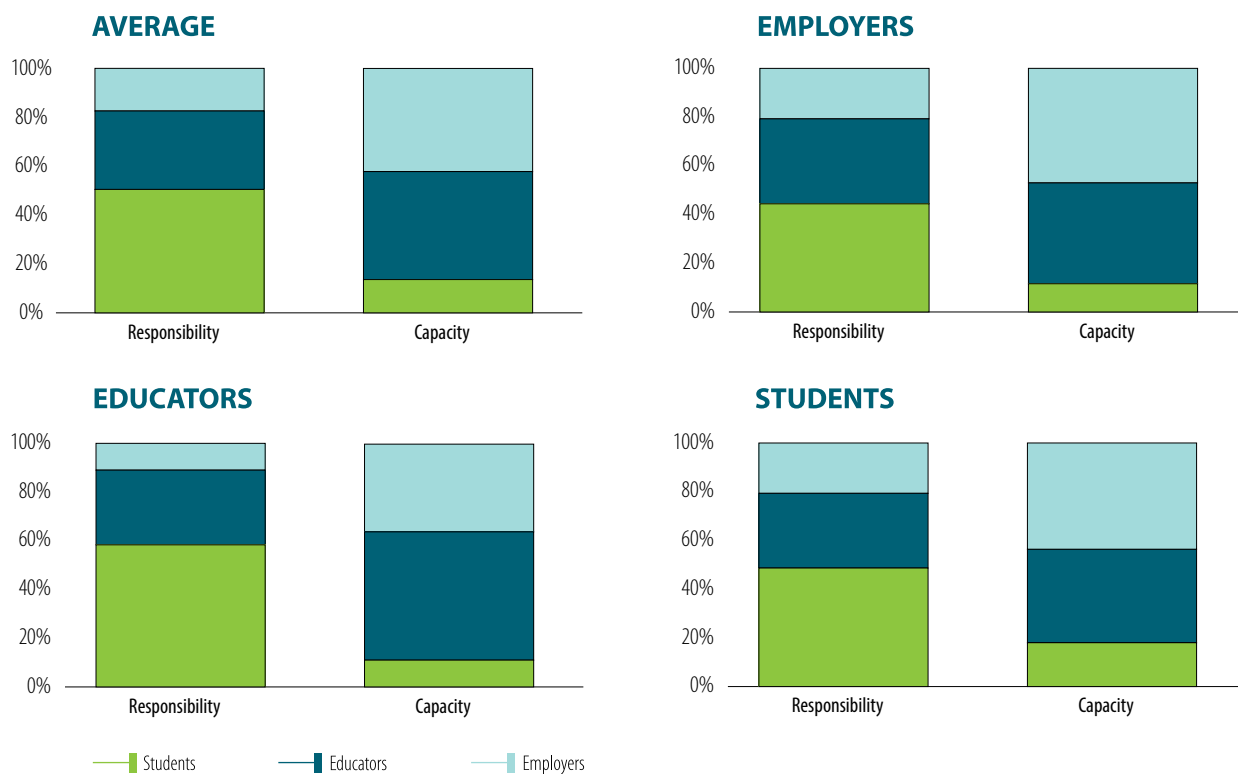
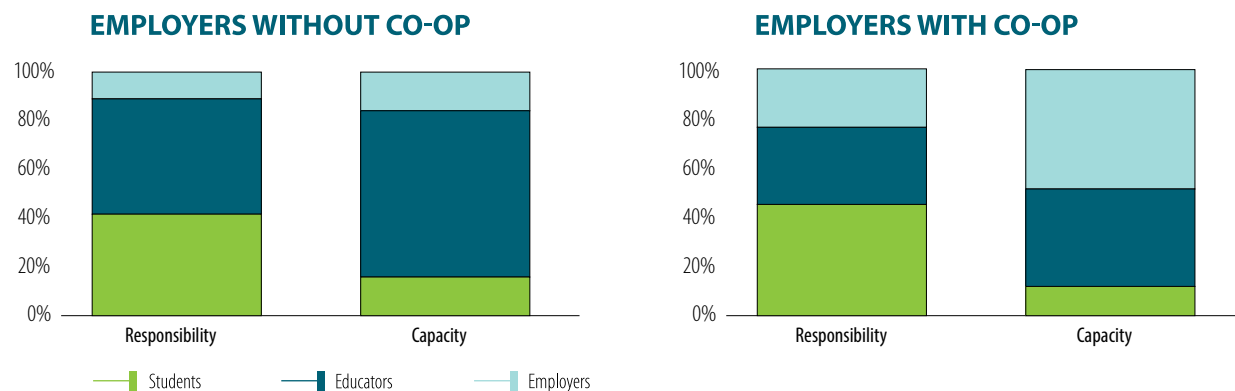


Figure 19: Responsibility and capacity among WIL and non-WIL employers





Our recommendations

Non-technical skills are in high demand by employers in the electricity sector—and increasingly important to the success of those entering the workforce for the first time. Through our study, we found that while Canada’s colleges and universities are doing a fairly good job in helping students develop these much-needed professional skills, there are still some gaps that need to be addressed.



Recommendation #1

Revise the language used to express program accreditation requirements.

Through our examination of program accreditation requirements, we found **college technician/technologist programs** are producing students with gaps in the following skills: active listening, speaking, social perceptiveness, collaboration, time management and active learning. **University engineering programs** have gaps in the same

professional skills plus an additional gap in the development of self-awareness skills, likely due to the fewer opportunities for hands-on learning.

Because we observed skills gaps for more than half of our top 10 most wanted professional skills, a more clearly defined framework may need to be put in place by the accrediting bodies to better assess how well those skills are being taught in colleges and universities.



Recommendation #2

Allow for more project- and discovery-based learning that places a greater emphasis on group work.

Our analysis of the course outlines of college and university electrical engineering programs found that the **design of the courses are resulting in skills gaps** in the following areas: speaking, critical thinking, social perceptiveness, collaboration, time management, and judgment and decision-making. As a result, most students are not as well-rounded as they should be when entering the workplace. While the severity of the gaps varies between colleges and universities—and even as one moves between college technologist and

technician programs—the gaps themselves remain, revealing a much deeper issue that might be related to Canada's educational model.

Work-integrated learning (WIL) is one way to bridge these gaps. In university programs where co-op education is mandatory, students come out with a more well-rounded professional skills profile compared to those in programs with no co-op placements. Professional development courses can help further build students' skills profiles.

With this in mind, PSEs need to review the way courses are designed and delivered. Curricula take time to change, however, so interim solutions must be developed to address the skills gaps in the near term.



Recommendation #3

Increase collaboration between employers, educators and policymakers to address professional skills gaps.

In our survey of employers, educators and students, **all respondents agreed that students or new graduates entering the workforce show skills gaps** related to critical thinking, judgment and decision-making, active listening, speaking and time management.

At EHRC, we are working to develop a “plug and play” professional skills program that can be quickly and easily delivered either by employers or educators when onboarding a student or new graduate, which would help round out those candidates' professional skills profiles as they first enter the workforce.

Appendix A: Research Methodology

During our research into the state of professional skills training, acquisition and development in Canada's colleges and universities, we:

- Reviewed pertinent research papers and articles on the professional skills that are most relevant for future jobs in the electricity sector
- Reviewed documents describing the accreditation process for college and university programs relevant to the electricity sector in Canada
- Reviewed course outlines for select university and college programs relevant to the electricity sector in Canada
- Conducted a focus group with educators and co-op office officials to verify our preliminary findings and assumptions about professional skills
- Consulted with our steering committee to confirm the observations from our preliminary results
- Conducted a survey to test various assumptions and observations from our preliminary results

Adopting a more practical methodology

Ideally, we would have had a researcher follow students as they take their courses to see their progression in developing professional skills. Yet while this would have provided the most accurate measurements in terms of student learning outcomes, doing so would have been nearly impossible given the number of factors that must be taken into consideration to carry out such a study. (See the work of Kapelus, Miyagi & Scovill for an example of a study in which the authors found a similar undertaking to be highly impractical.²⁹)

Because that approach was deemed too complex to successfully gather sufficient, unbiased information, we instead focused on reviewing course outlines and accreditation requirements. This approach was more feasible given that accreditation requirements for PSE programs are readily available and most PSE institutions now publish their course outlines online.

Scoring accreditation requirements

University engineering programs are accredited by the Canadian Engineering Accreditation Board (CEAB), which has defined 12 attributes that are used to grant or deny accreditation. Using the CEAB *Guide to Outcomes-based Criteria for Visiting Team Chairs and Program Visitors*³⁰ as our foundation, we analyzed the CEAB accreditation process against our list of 10 professional skills as follows:

- If a skill is needed for a given attribute, it was given a score of "1" for that attribute.
- If a skill is not needed for a given attribute, it was given a score of "0" for that attribute.
- The average number of times a skill was expected in the accreditation process was obtained.

The technician and technologist programs relevant to the electricity sector are accredited by Technology Accreditation Canada (TAC) using the Canadian Technology Accreditation Criteria (CTAC), which is made up of eight program general learning outcomes (PGLOs) and program discipline learning outcomes (PDLOs). We analyzed each outcome through a similar process as the one used for universities:

- If a skill is needed for a given outcome, it was given a score of "1" for that outcome.
- If a skill is not needed for a given outcome, it was given a score of "0" for that outcome.
- The average number of times a skill was expected in the accreditation process was obtained.
- A total average was obtained by considering both the PGLOs and PDLOs.

Appendix B: Survey demographics

Our survey received a total 129 responses, with 60% (n=77) being electricity sector employers and the remaining 40% (n=52) coming from post-secondary education (PSE) institutions (a mix of students, educators and administrators).

Employers

Among the employers who participated in our survey, just over half (51%) were utility companies.

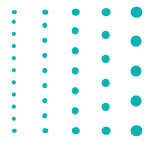
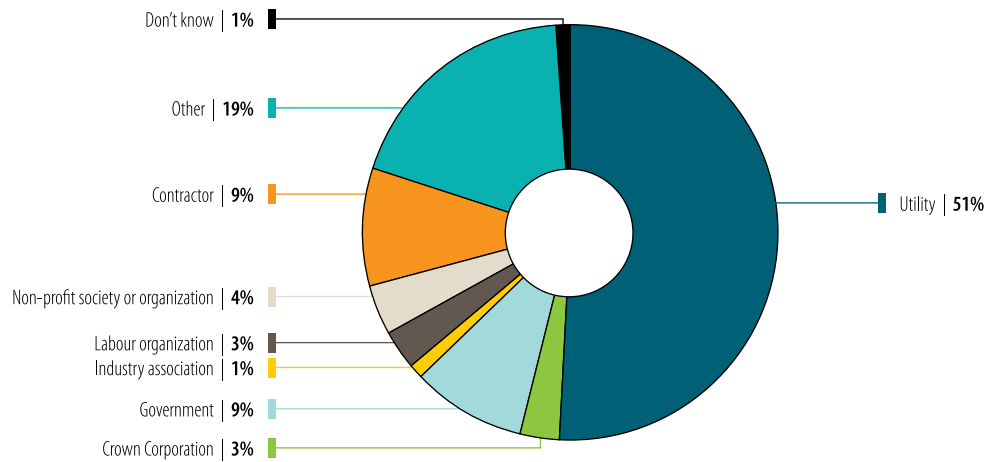


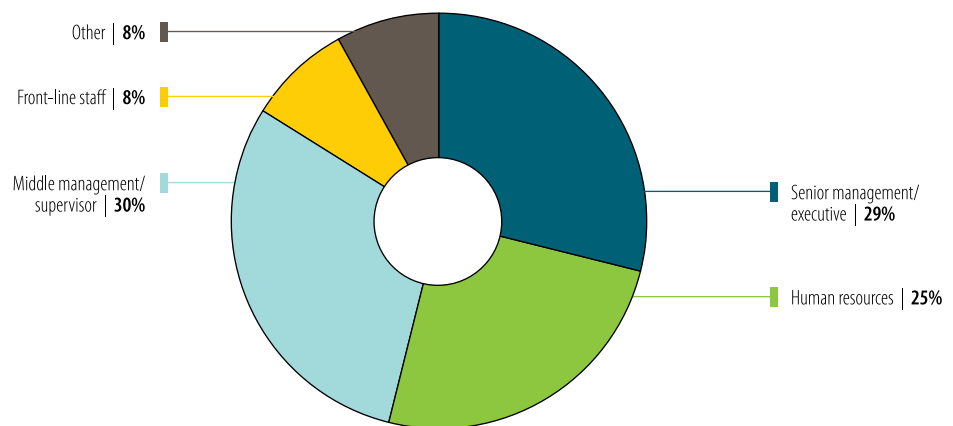
Figure 20:
Employer respondents
by organization type



The roles of the individual respondents were distributed as follows:

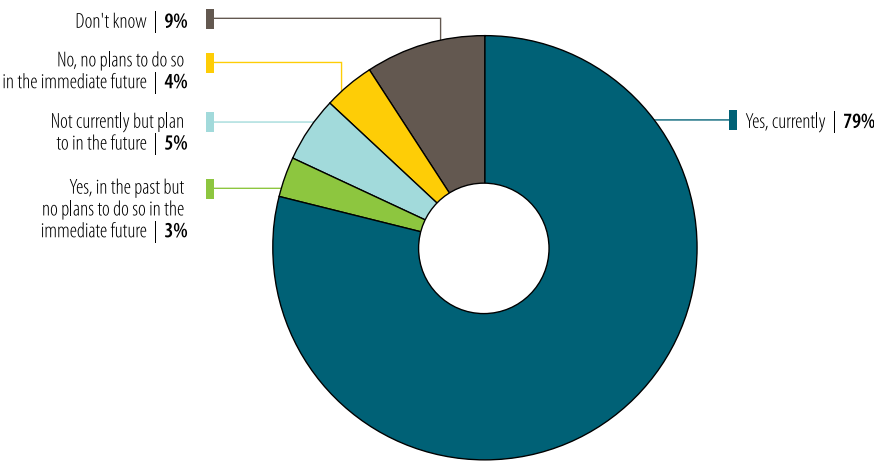


Figure 21:
Employer
respondents
by role



More than three-quarters (79%, n=44) of the employers surveyed are currently providing work-integrated learning (WIL) opportunities to students.

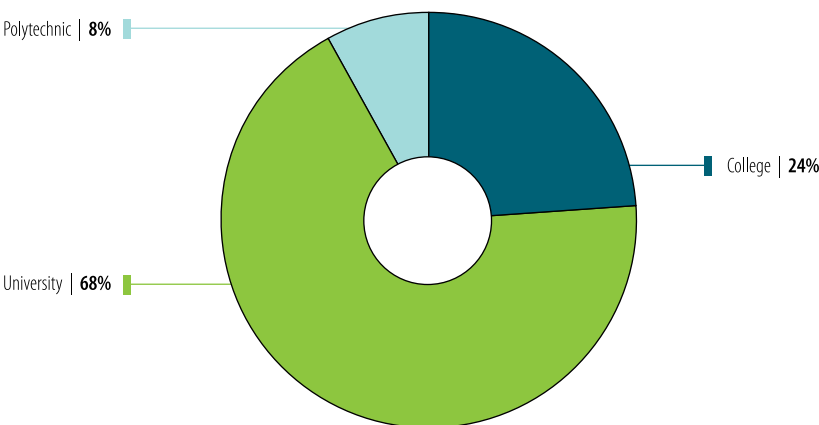
Figure 22:
Employer
respondents by
WIL participation



Educators

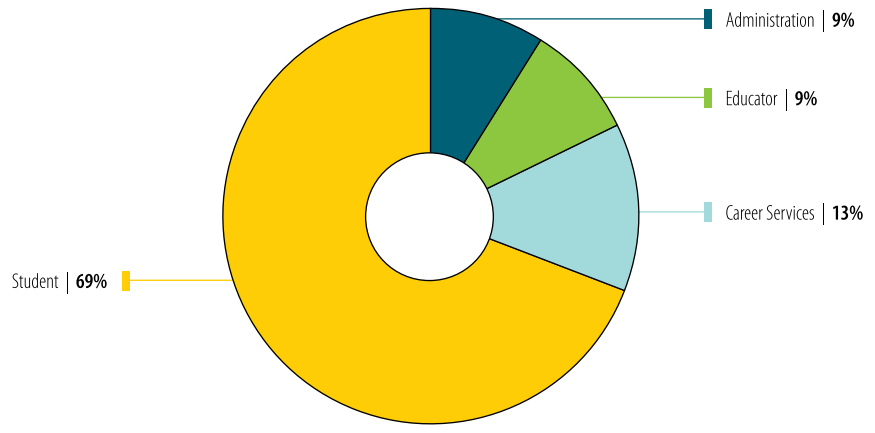
More than two-thirds (68%, n=34) of the PSEs that participated in our survey were universities, while 24% (n=12) were colleges and 8% (n=4) were polytechnics.

Figure 23:
PSE respondents
by institution type



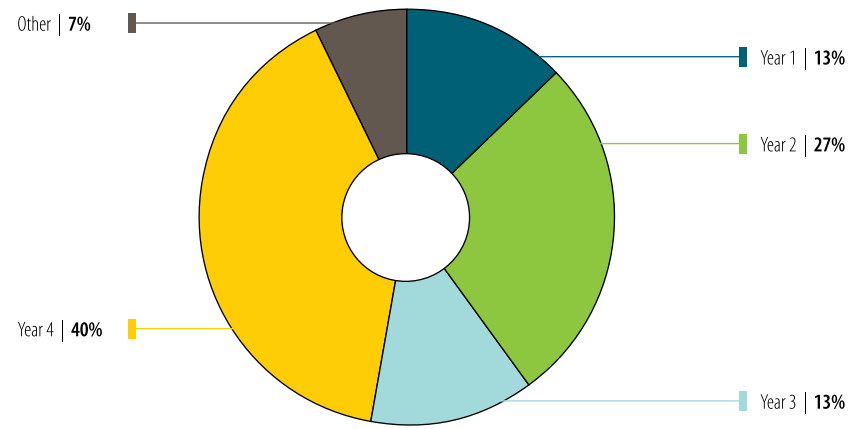
In terms of individual roles, 69% (n=32) of our PSE participants were students, 18% (n=10) were career services/co-op office and administrative staff, and 9% (n=4) were faculty members.

Figure 24:
PSE respondents
by role



Among the students who responded to the survey, 67% (n=20) were in their second or fourth year of their academic programs (meaning the majority were on either their first or last co-op work term).

Figure 25: Student
respondents
by academic year



Endnotes

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