

Black student voices in engineering work-integrated learning experiences across Canada

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Work-integrated learning (WIL) is essential for students' academic, career, and personal development. In Canada, engineering programs have long incorporated WIL through capstone projects, research initiatives, co-operative education, and internships. Despite these opportunities, Black students remain underrepresented in engineering, and their voices are rarely included in discussions about WIL. This study explores the experiences of Black engineering students in WIL across Canada. Using a conceptual framework incorporating CEWIL Canada and other global WIL types, social cognitive career theory, critical race theory, and intersectionality, interviews were conducted with 17 Black engineering graduates from diverse backgrounds. Findings revealed challenges included systemic barriers, such as lack of access to internships for international students, microaggressions including negative research project experiences, as well as engineering identity formation, for example, capstone projects providing opportunities for autonomy and cultural expression. This study offers insights to help educators and administrators create more inclusive WIL experiences for Black engineering students in Canada.

Keywords: Black, Canada, equity, engineering, student voices, critical reflection

Work-integrated learning (WIL) plays a crucial role in academic, personal, and career growth. In Canada, its significance is increasingly recognized in higher education, particularly in engineering. Engineering programs have long incorporated WIL through capstone projects, where students solve industry-based design problems. These technical projects now appear at various points in the curriculum and include research projects. Engineering was also an early adopter of co-operative education (co-op), integrating work terms into undergraduate programs. These initiatives make engineering degrees highly sought after due to their career alignment. However, not all students have equal access to these opportunities, with marginalized groups, including Black students, facing barriers that impact their WIL experiences and future careers.

Black individuals have been underrepresented in Canadian engineering for decades. Despite systemic racism (Cranston & Bennett, 2024) and socio-economic challenges, research on Black student experiences in STEMM, particularly engineering, remains limited (Handler et al., 2024; Statistics Canada, n.d.; U.S. Census Bureau, n.d.). Existing Canadian studies address broader underrepresentation issues but do not focus on WIL-specific barriers (Hanson, 2021; Katila et al., 2024; Khan et al., 2024).

United States research provides some insights. Strayhorn and Johnson (2016) examined how engineering internships impact underrepresented minority students, showing that those who participated reported greater learning gains. However, interviews revealed racial challenges, with one Black male student feeling "looked over, ignored, or invisible" (Strayhorn & Johnson, 2016, p.10). Another study explored how internships influenced racial and engineering identity, highlighting issues of codeswitching and cultural mismatch (Dietz et al., 2022; McCluney et al., 2021). Participants noted

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pressure to outperform White colleagues and conform to professionalism standards that often marginalize them.

In Canada, the sole study on Black engineering students addresses structural inequities but not WIL experiences (Burke et al., 2021). Another study on WIL for equity-deserving groups mentions barriers but does not examine their long-term career impact, highlighting an area for further research (Khan et al., 2024).

Purpose and Research Questions

The purpose of this research is to shed light on the experiences of Black engineering students in work-integrated learning across Canada and how those experiences may influence WIL outcomes, that is, career pathways for Black engineering graduates. This research aims to answer the following research questions:

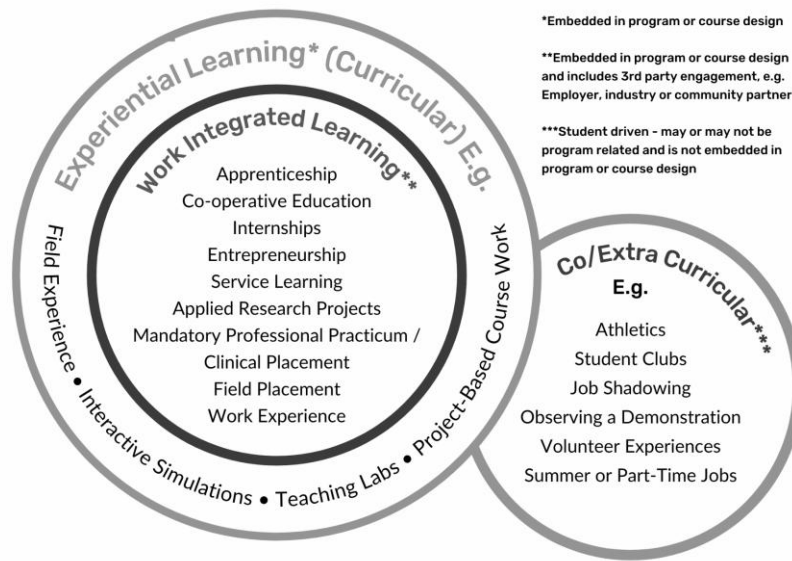
1. What are the experiences, barriers and motivations for Black engineering students in work-integrated learning across Canada?
2. How might these work-integrated learning experiences influence the career pathways for Black engineering students after they graduate?

RESEARCH DESIGN

Conceptual Framework

Within Canada, the national governing body for work-integrated learning (WIL) is Co-operative Education and Work-Integrated Learning Canada (CEWIL Canada, 2021a). CEWIL defines work-integrated learning as “a form of curricular experiential education that formally integrates a student’s academic studies with quality experiences within a workplace or practice setting” (CEWIL Canada, 2021b). The CEWIL Canada framework mirrors similar frameworks across the globe. One such framework is the NACE Career Readiness framework in the United States, which includes internships, externships, apprenticeships, co-ops, study abroad, faculty-led research projects, on-campus student work, practicum (or clinical) experiences, and microinternships as forms of experiential learning focused on career readiness skills (Kahn & Patil, 2025; Mekolichick, 2021). Another is WIL Australia, formerly known as the Australian Collaborative Education Network (ACEN), which recognizes three categories of WIL; work-based WIL, non-workplace WIL and global WIL (Jackson, 2023). This research took place in Canada and primarily draws from the CEWIL framework, however it draws insights from other global WIL and experiential learning frameworks. The image below developed by CEWIL Canada shows an overview of the recognized WIL experiences and adjacent co/extracurricular experiences.

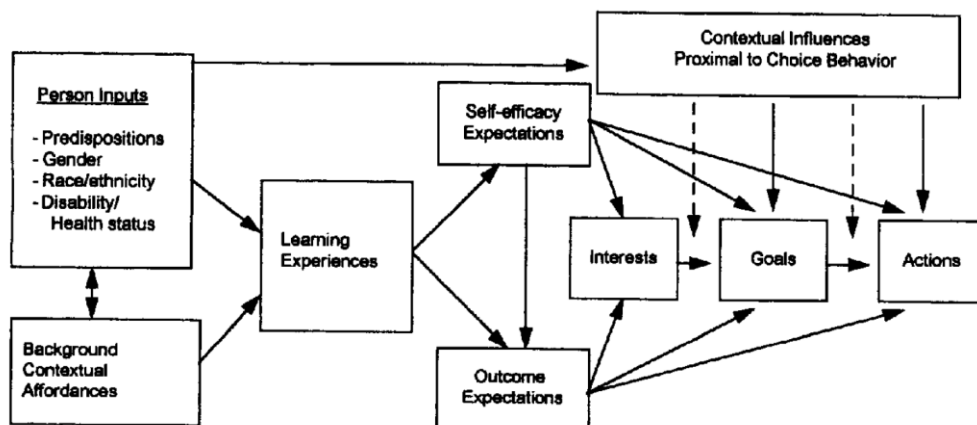
FIGURE 1. Work-integrated learning types defined by CEWIL Canada.



Note. From *What is Work-Integrated Learning (WIL)?* by CEWIL Canada, 2021 (www.cewilcanada.ca/WIL). Copyright 2021 by CEWIL Canada.

These WIL experiences are a part of a larger engineering learning experience. Social cognitive career theory (SCCT) conceptualizes how these learning experiences might influence career pathways (Lent et al., 1994). SCCT proposes that learning experiences can be influenced by person inputs, such as race and gender. These learning experiences can then influence self-efficacy as well as outcome expectations, which can ultimately influence career pathways (Lent et al., 1994). Figure 2 below was created by Lent et al. to visualize SCCT.

FIGURE 2: Representation of social cognitive career theory.



Note. Reprinted from "Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance," by R. W Lent, S. D. Brown, and G. Hackett, 1994, *Journal of Vocational Behavior*, 45(1), p. 93 (<https://doi.org/10.1006/jvbe.1994.1027>). Copyright 1994 by Academic Press. Reprinted with permission.

Combining the WIL frameworks with SCCT, while also leveraging aspects of critical race theory and intersectionality (Crenshaw, 1991, 1995; Delgado & Stefancic, 2017), allows for a conceptual framework that considers the learning experiences in various forms of WIL, the input of race and other intersectional identities, as well as the influence to engineering career pathways.

Methodology

To draw out the student voice from a marginalized group such as Black engineering students, a qualitative approach was deemed as the best methodological approach to use. When also considering how these WIL experiences may influence careers, understanding the lens of the Black engineer, both as a student and after graduation was important. Thus this research focused on Black engineering graduates and employed an ethnographic approach (Hammersley & Atkinson, 2019). More specifically, this work employed narrative ethnography (Hackett & Hayre, 2021), allowing subjects to tell their stories which could be subsequently analyzed for themes to understand their experiences.

Methods

A survey was conducted in 2023 as a part of a broader body of research focused on student experience and career path. The survey targeted graduates from Canadian engineering programs at least 5 years prior (2018 or earlier) and asked demographic questions as well as questions on undergraduate student activities and career pathways. Throughout the survey, the respondents were asked to reflect on their time as a student and answer questions on their student experience with the voice of a student. The questions also prompted the respondents to reflect on their career after graduation and how their student experiences, and in particular, their WIL experiences, may have influenced their careers.

From the survey respondents, interview participants were selected from those who identified as Black and also identified their willingness to participate in a follow up interview. This list was further narrowed down to identify a subset of Black engineering graduates that represented a variety of engineering disciplines, institutions, career pathways, and generation status in Canada.

Interviews were one hour in length and took on a semi-structured approach designed to guide interviewees through a reflective process. These interviews allowed the interviewees to reflect back on their student experience and take a narrative approach to tell the stories of the work-integrated learning experiences and experiential learning activities, and then to reflect on how these experiences may have impacted their careers.

This research was approved by the University of Toronto Research Ethics Board under Human Participant Ethics Protocol Submission Number 43856.

RESULTS AND DISCUSSION

A total of 17 participants were interviewed. The tables below show the demographic breakdown of the interviewees.

TABLE 1: Demographic breakdown of interviewees.

Category	Details
Gender	10 women 7 men
Immigration Status	5 recent immigrants (completed undergraduate degree as international students) 8 first-generation Canadians (born outside Canada, immigrated young, and gained Canadian citizenship) 4 second-generation Canadians (born in Canada, with at least one parent born outside Canada)
Ethnicity	11 African descent 6 Caribbean descent
Age Range	30 to 49 years old
Undergraduate Degree Completion	Between 2002 and 2016

Findings

Using the conceptual framework and the WIL types as defined by CEWIL Canada, the interviews were reviewed for involvement in different WIL types. When analyzing the interview responses, it was noted that interviewees used the terms co-op, internship and work experience, interchangeably, so those were combined for the analysis. Conversely, the interviewees distinguished between different types of Community and Industry Research & Projects. For this reason, Community and Industry Research & Projects were split into 'Applied Industry Project / Capstone Project' and 'Applied Research Projects'. It should be noted that for those that participated in Community and Industry Research & Projects, not all engaged directly with an external partner. For some capstone projects as well as research projects, the project was provided by a partner, but the student did not always interact directly with an external partner. In these cases, the project or challenge statement was provided to the supervising professor by the community or industry partner. In some of these cases, students may have had access to industry mentors that may or may not have been from the same community partner. This is still considered as WIL for this study as it involved a third party or "host organization" that the students were developing a solution for, even if the student did not always directly interact with that third party, and aligns with various global interpretations of experiential learning, "innovative WIL" and "non-workplace WIL" (Business + Higher Education Roundtable, n.d.; Jackson, 2023; Kahn & Patil, 2025; Mekolichick, 2021; WIL Innovation, n.d.). Table 2 below shows a summary of the participation of each of the interviewees in the various forms of WIL during their time as an undergraduate student.

TABLE 2:WIL participation for each interviewee.

Subject	Gender	Co-Op/ Internship/Work Experience	Applied Industry Project/Capstone Projects	Applied Research Project	Entrepreneurship
AA	Woman	X	X		
AB	Woman		X	X	
AO	Man	X	X		
BI	Woman	X	X		
CA	Woman	X	X	X	
CK	Woman	X			
CP	Man	X	X		
CW	Woman		X	X	
DR	Woman	X	X	X	
DY	Man		X		
EG	Woman	X	X		
KO	Man		X		
MB	Man		X	X	
NI	Man	X	X	X	
SC	Woman		X		
SI	Woman	X	X	X	
XG	Man	X		X	X
Total Count		11	15	8	1

Co-Op Internship/Work Experience

Of the 17 interviewees, 11 of them participated in some sort of internship, co-op or work experience. As the Black engineering graduates reflected on their time in these internships and student work experiences, these forms of WIL seemed to be cited most often as being influential to their career pathways. Both in good ways and in bad ways.

Access to Internships

The access to participate in internships and co-ops varied for Black engineering students, with factors such as institutional support, family influence, and international student/work permit status affecting the level of access for Black students to these WIL opportunities.

One interviewee noted how they had the opportunity to participate in multiple and various experiences that helped them narrow down what they wanted to do with their career.

I interned at an architecture firm and thought it was great, but I just know I didn't want to do it as a career. I thought at one point, I wanted to do geotechnical and transportation and interned at a geotechnical transportation firm. I know I didn't want to do that. I entered a structural and civil firm, which was great, but I knew it wasn't exactly what I wanted to do. And then I interned at the coastal firm, two coastal firms, the one in Miami, and then the one here. And I knew it was exactly what I wanted to do.

Others did not have the luxury of opportunities in varying fields and one interviewee noted how that pigeonholed them.

I think my co-op terms are the most influencing factors. I think in many ways, you do get pigeonholed a bit. For better or for worse. Because once you're writing your resume and you need to show your experience, whatever experience you've gathered up until that point is what speaks the most to you.

Others had no option at all, due to lack of structures in their institution to accommodate a co-op or internship experience: "For the [Institution] at that time, there were no co-ops, co-op was not a lot for international students, which in hindsight, I might have gone to another university because I always wanted to do that." Another said: "So I remember going to school, and they were like, oh, sorry, international students, you can't do a co-op, and that was a real bummer."

Even for those that had some sort of structure, there were still barriers for international Black students to participate in co-op and internship.

By my second year, they opened [co-op] up to international students, but I don't think they realized the implications of that because a lot of like 80% of the jobs or more that they posted on the [co-op job board] were jobs with different government organizations where a lot of them required, especially if you're going to work in an engineering lab doing testing on something that's like high profile, they required you to have a certain level of security clearance. So it didn't work out for me.

For those who had connections in industry, this helped to get a foot in the door. For domestic Black students, this may have been through one of few family contacts, for international students, their only connections were back in their home countries and some ended up using connections back home to intern there instead of in Canada.

I was very fortunate. My dad was a machinist. So he worked on, like, an assembly line. But it was a company that ended up being bought out by GM defense. So generally, it was an engineering company. So they did give preference to employees, children, I presume.

The internship that I got back home was because my parents were coming back from an event and they got a flat tire. And [business owner] and his wife were driving and gave them a ride. And they would have said, how are your sons, what are they up to? And [business owner] said you should come and let him intern with me. And that's how that's how that happened.

For those that had supports in their institution, such as career and academic advisors, this also help to provide access to co-ops and internships. "I had a great relationship with the co-op counselor. And she's like, Oh, this is one opportunity. And I said, sure, and I applied."

Motivations for Participation in Internships

During the interviews, the Black engineering graduates also reflected on their motivations for participating in co-ops and internships, with financial factors and a break from coursework being some of the main reasons.

In my second year, I also decided to sign up for the co-op program with my university. And so I did. And then I was going through interviews for different jobs, and I was honestly just randomly applying to jobs. I don't think I had a specific type of internship in mind. My goal was get a break from school, make some money, get some experience on my resume. And I applied to a bunch of jobs. I was excited because it was a one-year break from school. And at that point I was sort of getting tired of school as well. And yeah, it was just a new adventure. That's what I saw it as, an opportunity to make money.

Other interviewees re-emphasized the financial implications of participating in co-ops and internships: "I mean the fact that co-ops paid for my education, all the better, debt free" and "So I talked to my dad because my dad was sponsoring me. And because all this is money related."

So everyone's applying for these great jobs one they pay well and I had student debt, they were like these jobs that had like they were reputable and like respected, I guess in our in our peer group of engineers so to end up in like kind of tier one automotive was a going to be financially helpful to clear some student loans.

Experiences on the Work Site

Black students noted a range of different experiences on the work site while participating in their internships. Some were positive, while others experienced microaggressions.

This interviewee noted the biases she experienced coming from a different cultural background.

Countries like Nigeria, for example, are very top-down, which is how I grew up. I can't question an adult...in Canada, if someone who's older than you says something...you're expected to like, speak up and like, question it. And in fact, that is a measure of your intelligence. And so I think I struggled with that when I was on my internship.... So my supervisor, I remember, she ended up giving me this one feedback..., I can see that you're good. But you're also very quiet. And you don't say anything. So she's like, it's hard for people to tell that you're actually like present and engaging. And that you're actually smart, because you don't just say anything in meetings.

Another Black woman engineering student noted the rampant toxic masculinity on her work site.

There was a lot of, like, toxic masculinity. There was a lot of like the way you manage people is yelling and cursing at them. And then people telling me if that's not how I manage people then I'm not gonna be able to manage people while in this industry. And so it felt like I was going to have to, like, change how I engage with people in the world and or put up with being yelled at like executive meetings.

Yet another Black woman noted that the workplace environment and culture at a bank that she interned with, did not align to her values: "I loved the work that I was doing, but it was through that experience that I started to become aware of some of the challenges that I had with the bank's priorities and my personal values."

And a Black man noted biases from co-workers and his manager about his age:

And so some of that, some awkwardness there, right, you know, trying to be a bit too direct with people who are obviously maybe a bit resentful of having a student lead them, you know, dealing with that sort of approach. and then, you know, having your leader kind of pull you back a bit and say, hey, slow down, make sure you're not pushing too far, little things like that.

On the positive side, many Black students noted that the internships and co-ops helped them to develop important skills, competencies and confidence for their future careers: "I felt like the co-op jobs really helped to kind of reinforce what we were learning" and

I realized I was actually, I was good at it. And I could make a decent living from being an engineer. So I think it was a very pivotal experience for me because I left that internship feeling a lot more confident that this is what I want to do. This is what I know I can do and do well.

I was trying to understand where the trends were and then advising senior management about what those trends meant and trying to, sort of, predict what the data would also say in the coming months.... It was just a great 16-month experience in leadership, but also in project management and data analytics.

Impact of Internships on Career Pathways

Interviewees noted that internships were very influential to their career pathways, and as might be expected a few noted that they got jobs at the locations where they interned: "I actually did several internships in manufacturing. So I was at a manufacturing plant at GE, did internships, and then they actually hired me part-time before I even graduated just to kind of work on manufacturing projects there" and "So I ended up working two work terms, one at Ontario Hydro, one at Ontario Power Generation, which is where I work today. So that worked out."

One Black graduate noted that her internship influenced her going back to school for her master's degree because she was interested in the topic area: "I did also work with consultants there on some projects and then that ended up influencing my master's thesis, because then I wanted to understand a bit more as well about how consultants work in various organizations."

The Black engineering graduates who ended up taking entrepreneurial career paths strongly noted the influence of internships with small businesses/entrepreneurial organizations as an influencing factor. The quotes below are from two different Black graduates that ended up starting a business with their former boss, back in their home countries.

I was hired [for my internship] through, like, a UN program that was hiring from the diaspora with specialized skills...[After graduation], my old boss when I was working [on the UN program], he was thinking about starting something.

So [my former boss] started this firm. I was connected with him and I did an internship with him. So when I finished up [my undergraduate degree], I had a few job offers. And [my former boss] called me up one day and said, 'Why don't you come back home and help me to build this firm.'

Applied Industry Project/Capstone Projects

Applied industry projects or capstone projects were the most frequently participated form of work-integrated learning for Black engineering students, with 15 of the 17 participating in industry projects.

Access to Industry Projects

Access did not seem to be an issue for Black engineering students, as it was embedded in the curriculum for most students, which is a key part of the engineering accreditation process for Canadian engineering undergraduate programs (Engineers Canada, 2012). However, some Black engineers noted that prior to undergrad they hadn't had access to any technical team projects. One interviewee noted that his undergraduate program was the first time he participated in a team project: "I remember this class, it was the very first year and it's like almost a thousand people in the class. You have all these projects. Yeah, it was the first time I ended up doing, you know, projects."

Another student noted that even though there were no barriers to access the capstone projects, some students had more resources than others.

I remember like you were supposed to build this thing within a certain budget, everybody blew their budget, right? Like you have to buy so much stuff. There was so much trial and error just to figure it out. And like now looking back, I'm like, it was just like, so wildly inequitable, right? Because if you were well to do, then spending all this money for all this trial and error was fine, like, or maybe not a big deal. But if you were there on [student loans], you know, with parents who were new immigrants, who were working precarious jobs, and were scrounging together to have you stay in residence and pay your tuition, then every time I had to buy something new that I wasn't sure was going to even work, it was so stressful.

Experiences in Industry Projects

Many interviewees noted the positive aspects of the industry projects was the team environment and getting to develop the interpersonal skills and to build deeper relationships with their classmates.

The way the teams worked was that each person on the team had a different specialty. So like one person is doing the programming, another person was doing, like, the mechanical aspects, and another person was doing the, like, electrical components.

You form relationships with the people that you might have to work on projects on, especially as I get to those later years, like year three, year four, we have to do like capstone projects and things like that.

Others really noted the creative aspect and that reinforced their interest in engineering.

It was the opportunity to think outside of the box and be innovative, and just brainstorm and come up with ideas. Like the part about engineering that drew me to it was the problem solving aspect of it.

One of the classes I think we ended up designing heated floors, solar panel powered heated floors. And I volunteered to write the whole report. And I'm a procrastinator and I wrote it like in one night. I was so excited. I never, like, I was just so motivated and excited about this idea.

I was the one who came up with the idea within my group. I was just like, Oh my God, this would be so great!

Many noted how the technical aspect of this industry projects really stood out, and helped to reinforce the technical learning from their courses.

My senior project was doing the bridge, so, with that, obviously we had to draw the architectural drawings. We had to do the engineering calculations. We had to do the geotech, uh, because it's a bridge, so it obviously has abutments that are over land and piers that are in the water. Um by that time I knew what coastal was, so there's the coastal dynamics of being in the water and navigation and clearances, and things like that then there's the geotech. So there's the transportation civil side of it, because it's still a road that has feeders, and then as obviously road deck and AASHTO standards and girders, this is the structural side of it, and modeling all of the vents and those structural components.

However, some noted that these team projects and technical focus led to some microaggressions. One Black woman noted the need to go above and beyond in showcasing her technical competency because she was Black.

So, we were a group of three, and, if I'm not mistaken, my group was the only all female group. And also the only group that had the two black students in the group. And one of the things that I remember discussing with the other black student, who is now a very good friend of mine, was the feeling of the pressure of we could not fail. We could not make a misstep, that we had to show beyond a shadow of a doubt that we excelled, and excelled beyond everyone else. Because there's no way we would want our performance to be tied to the fact that we're an all-female group and that this is where the minorities are hanging out. So, I mean, we succeeded in that, but I would say that looking back, looking back, it was definitely an added pressure that I know the others did not have, right?

Impact on Career Pathways

Black engineering students noted that being able to choose their projects was important and allowed them to develop skills and deepen interests in specific subject areas. This highlights the importance of allowing some level of flexibility and autonomy in design projects to allow students to explore their interests. The following quote showed how developing that interest led to an impact on her career path: "I did a design project focused on the impact on green roofs and solar panels, it was me and another colleague. My job now is focused on making the business case for climate change."

Another interviewee noted how the alignment with cultural interest was important. As a student from the Caribbean he partnered with another student also from the Caribbean to focus on an industry project targeted in the Caribbean.

Some of my team members were from St. Kitts, they recommend [a bridge design project]... down there in St. Kitts so you got hurricane codes as well as earthquake right so it was very you know it was a rounded study because it touched all of the areas that i had interned and as well as it basically touched all of the courses that i had taken so it was it was a very good project that stood out for me for sure.

Some interviewees noted that by working with an industry partner on a capstone project, that it led to connections for a role after graduation and a career in that field.

My degree project topic, of course, had to do with the industry that was prevalent ... it's a pulp and paper sort of community. You have a paper mill, and by virtue of that, you have a company that I eventually worked at five years right from graduation.

Capstone projects were a key influence to the types of roles Black engineering graduates took. This interviewee spoke about how it led to him going on to project manager roles after graduation.

The reason why I said it kick-started a lot of things is because now, I mean, I ended up as a business analyst for like a year and a half, and then became a project engineer, and a project manager and then a consultant who runs projects.

Another interviewee noted how the technical work led to a role in instrumentation.

I did learn a lot from my capstone because that played into my first job with instrumentation. The piece that I handled in the capstone was instrumentation. And my first job had to do with instrumentation as well.

Applied Research Project

Of the 17 interviewees, 8 of them participated in an applied research project. As the Black engineering graduates reflected on their time in these experiences, it seemed to have a polarizing effect on participants.

Access to Research Opportunities

Similar to internships, the access to research opportunities varied for participants. For some participants, research formed part of their undergraduate degree, e.g. an undergraduate thesis. Thus for these participants, they did not have to go in search for these opportunities as it formed part of their curriculum. For others, they applied and either received a research award or were brought on board by a professor to do research: "I reached out to one of my professors and he had an opening in his lab and he said, hey, you could shadow this one student that is doing his master's and do some, you know, yeah." For another participant, "I got an undergrad research award. And so then I did my summer research in my third year."

These participants who applied for such opportunities however, did not mention in their interview any barriers to entry. For these participants, an interesting note was when asked how they found the professor, some mentioned how they would usually reach out to professors they had previous interactions with and had a good relationship with.

I really liked that professor. Yeah, I think he was, I think about some of my favorite professors in school, he's probably in the top three. He had an opening, I think I reached out to the three that I liked and then he had an opening.

For some participants, even the choice of research topic was influenced by the professor:

And I don't exactly know why I was very interested. I think it was because the supervisor that I had spoken to, he was the professor for, what was it, biological treatment systems. And it was my first exposure to that sort of stuff.

Noting these observations, although no participant directly mentioned a barrier to access for research opportunities, some participants made comments about the lack of a connection with professors and negative interactions with professors which could have been deterring factors for never participating in research opportunities.

You know, you would see professors connecting with students in ways that felt familiar and maybe it's like they saw themselves as they're often really seeing yourself in these, you know, younger academics, did not have any real relationships with any of my professors, despite being highly relational.

There was one professor that only took questions from men and there was even less so from, that's why there's like, there's layers to this, like, you know, if a woman asked a question, we knew very quickly, it would be a dumb question. If a guy asked the same question, what an interesting perspective. So you just learned how to navigate some of these worlds.

You might have a professor expressing his surprise at how well maybe a research topic or project or assignment was done. And unwittingly, right, you know, trying actually in their way trying to be nice and normal, but almost like oh wow yeah like I did not really expect that right from you.

Motivation for Participating in Research Projects

The motivation for participating in research projects seemed fairly consistent for most participants using research to explore their interest in graduate school: "I wanted to focus a little bit more on research to figure out if grad school is what I wanted to do." And:

I thought I would do a master's degree of some sort. I think in my fourth year for my electives, I could take some master's level electives. Then I thought, I have never tried research before, so why don't I see if it's something that I would want to do, like a research-based master's or course-based master's.

For one participant however, research served as an opportunity to gain experience in a field they were interested in with different faculty that they otherwise did not have the prerequisites to be involved in.

I was in a bit of a unique situation where a lot of my colleagues went into either mining, or petroleum... None of those really interested me. ...I approached the department of pharmacology and asked them to do a graduate certificate in pharmacology... Pharmacology at that time was only a graduate program and I did not have the prerequisites to enter... I basically pushed and convinced them to give me a [research] supervisor... and also that I would come and promise to complete the pre certain prerequisites.

One participant's response was particularly interesting. This participant was motivated to go into research to defer figuring out their career progression:

Working in a research lab allowed me to defer figuring out my career progression ... I could do school all day, every day, but what terrified me was the rules of being a working adult with a

career. That was partly due to my raging imposter syndrome, where I never saw myself as a full-fledged engineer.

Experiences

The experiences of participants varied with majority liking their research experiences and it having a direct impact on their career pathways while some disliked their experiences. Out of the 8 participants in research, two clearly stated they disliked their experience with one attributing this to negative interactions with graduate students and the other disliking the research environment. For example: “We're just in this essentially windowless room all day. And then we'll go out for lunch or breaks, but it just seemed rather boring actually.” Also:

The graduate student and I didn't have the best relationship. I think it felt like I was being forced on them. Every time I wanted to expand the topic or explore new areas, the response was aggressively negative. At one point, the PhD student even complained to my supervising professor about me trying to go in a different direction.

Many other participants, however, liked their research experiences.

I did my undergrad thesis with [Research Supervisor]. I liked that project a fair bit ... And it was kind of a great project and great experience. And that was something that then made me feel like, okay, like, research is, research is interesting.

I thought research was kind of engaging, like doing things, which was kind of enjoyable, like using the machines, getting images, getting data. I was like, oh, this is kind of fun. This is engaging. You're actually doing things. And then you get information and you're making your case. And so I liked that about research, getting information, making your case.

Impact on career pathways

Depending on whether participants had a positive or negative experience dictated how research impacted their career pathways. For those that took academic career paths and chose to do PhD, all cited their undergraduate research experience as contributing to that decision, some more enthusiastically than others.

I got an undergrad research award. And so then I did my summer research in my third year with, with [undergraduate supervisor], who is cross appointed with materials and, and biomaterials ... then that's why I did biomed for my PhD and all that was I'm starting to get closer and closer to this idea of we actually do like health care.

In my fourth year, the pivotal experience there was doing my undergrad thesis ... in many ways, I think that opened up this door of curiosity of like, oh, I'm seeing something through these conversations with people, and I can actually try to pursue trying to understand what's happening here ... and I think that really sparked an interest in research for me. So that informed me pursuing a master's right after undergrad.

On the other side, negative interactions with the graduate students also influenced the future career choice of one participant to not pursue research. This highlights the importance of graduate students, as well as professors, being equipped to properly lead and support undergraduate students, especially Black undergraduate students, and how cultural differences can also be a factor.

Interestingly, some participants commented on the pigeon hole effect of participating in research, because they did not have any other options, they chose to do graduate school because “research was all they knew.” Thus, they stayed in research.

Entrepreneurship

Of the identified WIL types from the CEWIL framework, entrepreneurship was the least frequently participated in, with only 1 Black graduate participating in a formal entrepreneurship program during their undergrad. This one interviewee noted that he only actively sought out an entrepreneurial incubator program because of the influence of family.

Both of my parents are entrepreneurs in Jamaica, I say these growing up, so I've always lived an entrepreneurship lifestyle, while both of them have had jobs and I would say that's probably what they ultimately settle into as careers. Throughout my formative years and both of my parents, each of them owned their own businesses, my mom had a dressmaking business and my dad owned a bakery.

Additional research could be done to better understand any potential barriers to accessing entrepreneurial WIL opportunities for Black engineering students.

THEMES

Looking across the different WIL types identified in the interviews, certain key themes emerged across the WIL types for these Black engineering students.

Systemic Barriers

It was noted that there were systemic barriers to accessing some of the WIL opportunities, in particular the internships and co-op placements. This was especially true for the Black international students who noted that at some institutions international students were not eligible for some co-ops. Barriers were both at the institution as well as within industry. Some industries required additional background checks that international students were not able to provide. While some institutions lacked the proper support to help international Black students navigate their co-ops, and for those without family connections to industry, these institutional supports are all the more important. Some also commented on how the financial support of their families imposed an additional pressure on them to “make money” and ensure their family has a “return on their investment.”

For industry and capstone projects, there were barriers for students that may not have the financial flexibility to implement the project to the same extent as others. A student noted that the teams were given a budget, but some teams had the means to go above and beyond that budget amount. For research projects, some Black students also noted lack of exposure or lack of encouragement from family members to consider research projects and thus some opted for the industry projects in lieu of research. Due to some of these barriers, programs have begun to develop to specifically support Black students in WIL to address systemic barriers (Saçak et al., 2025).

Microaggressions

Microaggressions were noted across all of the identified WIL types.

In internships and co-ops, Black women in particular noted feelings of isolation and toxic masculinity in the workplace and noted that certain workplaces did not align to their values. International students noted biases based on cultural differences, in particular, the difference in cultural norms of speaking up and advocating for themselves, while also not being considered as “pushing too hard.” This aligns with previous work in the US on “code switching,” where Black students switch behavior to assimilate into workplace cultures (McCluney et al., 2021). This aligned to other work that is beginning to emerge in Canada looking at other marginalized groups and microaggressions faced (Khan et al., 2024). Some Black students also noted the idea of being “pigeon-holed” by their internship experience in their future career.

For industry and capstone projects, Black students noted the pressure to perform flawlessly in the technical component of their projects, feeling as though they needed to represent their entire race.

For research, many of the Black students noted significant microaggressions from their supervising grad student, noting that it felt as though the grad student did not want them there. This impacted feelings of belonging, which is an essential part of quality WIL (Drewery et al., 2026). Black students also noted some of these microaggressions from their professors, saying that professors expressed surprise when they performed well. A lack of Black engineering professors was noted by many of the interviewees, and that lack of shared cultural understanding leading them to have barriers to forming deeper connections with their professors.

Engineering Identity

For these Black engineering students who are a marginalized and underrepresented group in engineering, being able to shape their role identity in engineering can be pivotal to their future careers (Macdonald-Roach et al., 2023). For Black engineering students, participation in WIL was shown to foster that development of an engineering identity. Internships and co-ops in particular were important for this engineering identity development. Some of the interviewees noted only feeling confident as an engineer after their participation in internships, noting how the internships allowed them to apply engineering learnings in the real world.

Industry and capstone projects were also really important for solidifying engineering identity, allowing these Black students to combine the technical aspects of engineering with personal and cultural interests. Some noted how the industry projects reinforced their reasons for choosing to study engineering, and many noted the importance of being able to choose topics that were relevant to them personally.

Applied research did not seem to have the same effect on ‘traditional’ engineering identity, but did seem to support the formation of identifying as a ‘researcher’ leading to academic focused careers.

This theme of WIL reinforcing professional identity can be seen in other literature (Higgs et al., 2019), however with a lack of representation of Black engineers and researchers, the opportunity to build professional identity through WIL is more critical (Fleming et al., 2013; Ross et al., 2021).

CONCLUSION

This research aimed to shed light on the experiences of Black engineering students in work-integrated learning across Canada.

Some limitations of this work is that it looks at a small sample of 17 participants. The findings from this research could be used to develop a data collection tool and methodology to collect data from a wider sample of engineering graduates. Another limitation is that the survey used to identify participants was primarily distributed through the network of the author and may have skewed the results based on the types of graduates that may have responded to the survey.

Based on the findings of this research, we recommend institutions invest in supports to disrupt oppressive and inequitable practices in WIL (MacKay et al., 2024). For Black engineering students specifically this could include:

- Collaborating with industry and policy makers to develop support for international Black students to participate in WIL, such as ease of access to work permits and reviewing requirements for background checks
- Designing curriculum that allow for flexibility in industry project choices that align to Black students' interests and identities
- Supporting engineering professors and graduate students in cultural awareness to help them effectively mentor and engage Black students in WIL, especially to encourage them to consider research focused career pathways
- Collaborating with industry and policy makers to provide equitable access to resources for WIL, such as budgets for industry and research projects
- Providing access to a variety of WIL opportunities, especially for Black students who may not have the networks of some of the counterparts, which will help these Black students explore a variety of options and not feel 'pigeon-holed'
- Working with Black owned and international enterprises as community and industry partners, that allow Black students to explore career pathways aligned to their culture or home countries, especially entrepreneurial career pathways

Overall, this research was primarily focused on highlighting the voices of Black engineering students in WIL, however by listening to these voices, educators, administrators, policymakers and industry and community partners can reflect on how to create a more inclusive environment for Black engineering students in WIL.

ACKNOWLEDGEMENTS

This research was supported by the IBET PhD Project, the Canadian Black Scientists Network, as well as the Institute for Transdisciplinary Studies for Engineering Education & Practice (ISTEP). The authors also acknowledge the use of artificial intelligence in some sections of the paper to support language improvements.

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The International Journal of Work-Integrated Learning (IJWIL) publishes double-blind peer-reviewed original research and topical issues related to Work-Integrated Learning (WIL). IJWIL first published in 2000 under the name of Asia-Pacific Journal of Cooperative Education (APJCE).

In this Journal, WIL is defined as:

An educational approach involving three parties – the student, educational institution, and an external stakeholder – consisting of authentic work-focused experiences as an intentional component of the curriculum. Students learn through active engagement in purposeful work tasks, which enable the integration of theory with meaningful practice that is relevant to the students' discipline of study and/or professional development (Zegwaard et al., 2023, p. 38").

Examples of practice include off-campus workplace immersion activities such as work placements, internships, practicum, service learning, and cooperative education (co-op), and on-campus activities such as work-related projects/competitions, entrepreneurship, student-led enterprise, student consultancies, etc. WIL is related to, and overlaps with, the fields of experiential learning, work-based learning, and vocational education and training.

The Journal's aim is to enable specialists working in WIL to disseminate research findings and share knowledge to the benefit of institutions, students, WIL practitioners, curricular designers, and researchers. The Journal encourages quality research and explorative critical discussion that leads to the advancement of quality practices, development of further understanding of WIL, and promote further research.

The Journal is financially supported by the [WILNZ](#), [WACE](#), [WIL Australia](#), and the [University of Waikato](#).

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Types of manuscripts sought by IJWIL are primarily in two forms: 1) *research publications* describing research into aspects of WIL and, 2) *topical discussion and conceptual* articles that review relevant literature and provide critical explorative discussion around a topical issue. The journal will, on occasions, consider good practice submissions.

Research publications should contain; an introduction that describes relevant literature and sets the context of the inquiry. A detailed description and justification for the methodology employed. A description of the research findings - tabulated as appropriate, a discussion of the importance of the findings including their significance to current established literature, implications for practitioners and researchers, whilst remaining mindful of the limitations of the data, and a conclusion including recommendations.

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Zegwaard, K. E., Pretti, T. J., Rowe, A. D., & Ferns, S. J. (2023). Defining work-integrated learning. In K. E. Zegwaard & T. J. Pretti (Eds.), *The Routledge international handbook of work-integrated learning* (3rd ed., pp. 29-48). Routledge. <https://doi.org/10.4324/9781003156420-4>

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ISSN: 2538-1032

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