The Co-op Internship Experience in Science and Engineering

Perspectives of Women Students and Advisors

CFSG
Chaire pour les femmes en sciences et en génie

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PREFACE

For over 65 years, our company has built its success on our founder's values and on using fundamental engineering principles as a platform for innovation. Knowledge sharing, collaboration and a diversity of ideas are key to developing the best solutions and solving the most complex problems.

Attracting and retaining women in science and engineering is essential for ensuring that our work teams are diverse. And because first impressions count, offering women positive internship experiences in these fields is paramount. For most of them, internships are their first contact with a work environment where they will grow as professionals and put their career choices to the test.

Companies and organizations working in science and engineering must therefore be able to provide women students with a work environment where the organizational culture creates an inclusive environment free from harassment and gender bias. This will not happen by chance in a field that has always been predominantly male. Hatch's association with the Chairs for Women in Science and Engineering has helped us move forward on the path to diversity and inclusiveness by improving our understanding of the underlying causes of gender issues and discussing best practices.

This study of student internship experiences underscores how important it is to continue raising awareness about equality and harassment issues within our teams so we can offer women students inspiring female role models and stimulating challenges. Tangible action by corporate managers and firmly established onboarding procedures promote personally fulfilling and rewarding professional development experiences. Male allies are also key to creating an internship environment where women students can develop confidence.

As an employer, it is our responsibility to provide a corporate culture and work environment that convey a passion for science and engineering to women students to motivate them to pursue these fields and realize their full potential so we can build a better world together.

Stéphane Raymond, eng.
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HATCH

CONTEXT

Even though women make up half of Quebec's labour force (51%),[1] they continue to be underrepresented in science and engineering (SE), despite an increase in female enrolment in recent years. For example, in bachelor's degrees in Quebec, for the year 2007-2008, women's enrolment amounted to only 18% in physics, 10% in computer science, 10% in mechanical engineering and 10% in electrical engineering.[2] In comparison, for the year 2020-2021, they stood at 25% in physics, 21% in computer science, 15% in mechanical engineering, and 13% in electrical engineering.[3] Clearly, progress is slow.

Research shows that the problem of women's underrepresentation in SE is the result of many factors such as the influence of gender stereotypes[4] and social belonging[5], the effects of family and peer environment[6,7,8,9], low exposure to female scientific role models[10], or girls' and boys' representations of science and engineering and associated careers.[11,12,13,14] The question now arises: What role does the co-op internship experience play in addressing the underrepresentation of women in SE?

Numerous studies show that co-op internships, which are offered by various universities across Quebec, have positive impacts on students (women and men), including on an academic[15,16,17,18,19], career development[20,21,22,23] and personal level.24,25,26 Even so, few studies have specifically explored women's experience in internship settings where they are underrepresented compared to men. In this context, the Chair for Women in Science and Engineering (CWSE) asked itself: How do women students in male-dominated fields such as SE perceive their internship experience?

To answer this question, the CWSE conducted semi-structured individual interviews with 36 women undergraduate students in SE (14 in science and 22 in engineering) and 3 professional development advisors from the Service des stages et du développement professionnel (SSDP) at Université de Sherbrooke.

The purpose of this text is to present the main findings of this study in a simplified and popularized way so as to make the co-op internship experience of women students known to various stakeholders, such as host environments for interns, supervisors and advisors, as well as a broader audience. For this reason, the verbal statements of the students and advisors have been transcribed at a standard level of language, without changing the meaning. Also, for the English version, they have been translated. A brief recommendations section has been added at the end of the document. It is our hope that this text will encourage concrete action to enable women students in SE to have better internship experiences in the future.

Happy reading!

Perspectives of Women Students

Co-op internships are an important first work experience for all students. However, certain questions arise in connection with women students who undergo co-op internships in predominantly male environments. What are the views of women students in SE regarding co-op internships? How do they experience women's underrepresentation in these fields? What are the perceived benefits and the challenges they encounter in internships? We now turn to a few answers to these questions from the 36 women students interviewed for this study.

Women in the Minority in Science and Engineering

More than three quarters (81%) of the interviewed women students considered that there was a low proportion of women attending university in their fields (SE). This perception was stronger in engineering (91%) than in science (64%). Almost two-thirds (61%) of the students felt that there was a low proportion of women in internships in their field. However, this perception was mostly reported in engineering (91%) and was low in science (14%).

(For sure, it is low. I personally think there would be room for more girls. I find that there's a lack of girls in electrical engineering especially. In my internships, it was particular. I had two types of internships. University-based and business-based internships. They're really two different worlds. For sure, in the companies, I was the only girl on the team. The proportions are really low or zero. In academia, it's kind of the opposite. I found that girls and boys were almost 50-50.

Woman engineering student

There are much fewer. There aren't many women. Actually, maybe not in the bachelor's degree, but when you go up to the graduate level, there are fewer women. There are fewer women researchers, so there's lower representation at that level.

Woman science student

In the life sciences (biology, biochemistry and pharmacology), the women students interviewed (86%) seemed to be less aware of under- or overrepresentation prior to beginning their university studies. In contrast, in fields where women are more underrepresented (electrical engineering, computer engineering, physics, chemistry, computer science), they (90%) were generally more aware of the issue of women's underrepresentation prior to starting their studies.

I already knew about that! In CEGEP, I was in math and computer science. There were maybe fifty of us in the program. There were three of us girls in the beginning and I was the only girl who finished the program. There were maybe 30 boys remaining, in all.
I wasn't surprised that there were so few girls in computer engineering.

Woman engineering student

I knew it, but it wasn't something I was worried about. It was not a factor in my choice. It's true that in electrical engineering, I was surprised, because there aren't really many girls compared to mechanical engineering, where there are at least ten or twenty. This surprised me, but other than that, I was already aware of it.

Woman engineering student

I didn't think it was so bad. I'm currently working at the hospital.
I often see women in the lab.
I thought it was mostly women. But when I really got into the job market, that's when I saw... I was like, "Yikes. No, it's the opposite. It's really just an exception to the rule at this one little lab, basically." .

Woman science student

Because I did a year of biochemistry before where it's like the opposite.
I was really aware of the ratio in chemistry because I was already interested in chemistry and I wanted to change programs. But, before, when I was in college, no. I wasn't aware that there were so few. I didn't know that in the more applied sciences there were so few women.

Woman science student

Positive Aspects of Internships

More than a quarter of the women students in the study identified acquiring work experience (33%) and developing new skills (31%) as the main benefits of internships in SE. This perception was shared by the women students in engineering (32%; 27%) and in science (36%; 36%). In terms of other benefits, the comments varied between the women engineering and science students. The engineering students mentioned developing a better knowledge of different environments or fields and different tasks (45%), building self-confidence (36%) and building up a network of contacts (32%). The science students mentioned different benefits, namely validating their career choice (36%), being financially compensated for an internship (29%), developing a better knowledge about their own areas of interest (29%), and applying what they had learned at university (29%).

With five internships, it lets us test different workplaces. It's just four months, so if I don't like it, it's just four months. I know I won't be applying for a similar job later on. For example, the first internship I did, in research, I really didn't like it. So, I know I won't be applying for a research job.

Woman engineering student

It also allows you to develop a network of contacts. When you've done internships in various places, like in mining, it's a small field. If for example a company doesn't have many opportunities, it doesn't mean that they won't know someone else who will, they might recommend you. It can help!

Woman engineering student

It also allowed me to make some money since the internships are paid.

Woman science student

They're cross-cutting skills that we develop significantly. For example, organizing your work, being efficient at what you do, finding good time management methods and all that. Maybe more than applying knowledge.

Woman engineering student

More than a third of the women participants considered the most interesting and stimulating elements of the internship to be involvement in projects (44%, namely 50% in engineering and 36% in science) and gaining responsibility and autonomy (39%, namely 36% in engineering and 43% in science). Also, more than a third of the women students interviewed mentioned significant learning during the internship, such as going deeper into technical aspects in their field (44%) and discovering a new field or sub-field (36%). The former was more prevalent among the engineering students (50%) than the women science students (36%). Conversely, the latter was more prevalent among the women science students (50%) compared to the women engineering students (27%).

It was really in my design internships when I was given a project and told, "Do what you like, I trust you." It's really sort of having carte blanche, doing a project yourself, starting from scratch and doing all the design. Then it's about manufacturing, testing, and seeing the whole design process through to completion. It's not just designing it, but being able to manufacture it afterwards and get it into production.

Woman engineering student

I find that what got me most excited was the responsibility. Taking charge of a project for a certain period of time and communicating with the people involved.

Woman engineering student

It was something I hadn't really done before. It was new for me to read the identification guides, read the method, the new procedures. I think it added to my training. I might do this again later in my future jobs.

Woman science student

They told me, "Try to set up a project, a program that we could use with bacteriophages, with bacteria, to try to be able to do the same test so that it would cost less instead of always sending it outside." It was one of the experiences I found really rewarding because I learned so much about everything associated with virology, which was completely different. I had never had a class on that.

Woman science student

Generally speaking, the atmosphere of the internship settings was considered positive (67%) by the interviewed women students, and more so in engineering (77%) than in science (50%). Specifically, relationships with internship supervisors were described as positive (44%). These positive relationships were reported more by the women science students (64%) than the women engineering students (32%). In contrast, 31% of the women students perceived these relationships as negative, namely 36% in science and 27% in engineering. Relationships with colleagues and other interns were more often described as positive (39%) rather than negative (8%) in both science (29% vs. 7%) and engineering (45% vs. 9 %). Only the women engineering students reported experiencing negative relationships (32%) in internships with operators, technicians or other workers. Indeed, none of the women science students mentioned this (positively or negatively).

People were smiling and collaborative, they focused a lot on people talking to each other and helping each other, sharing in discussions to come up with good ideas. It's a work environment where everything is important. They'll emphasize quality of life because out of the interns, there are some that they will train and try to attract afterwards. They're smart about this. It's going to give me the drive to surpass myself without burning out.

Woman engineering student

Otherwise, in the factories themselves, it was more of a challenge. You do get judged for being a woman, a little. I wouldn't say it's a direct judgment, but it's the terms. There are terms that might not be a big deal to one generation, but to our generation, they're not really appropriate. There are gentlemen, on their timesheet, the contractors, they would write "my little lady." Things like that.

Woman engineering student

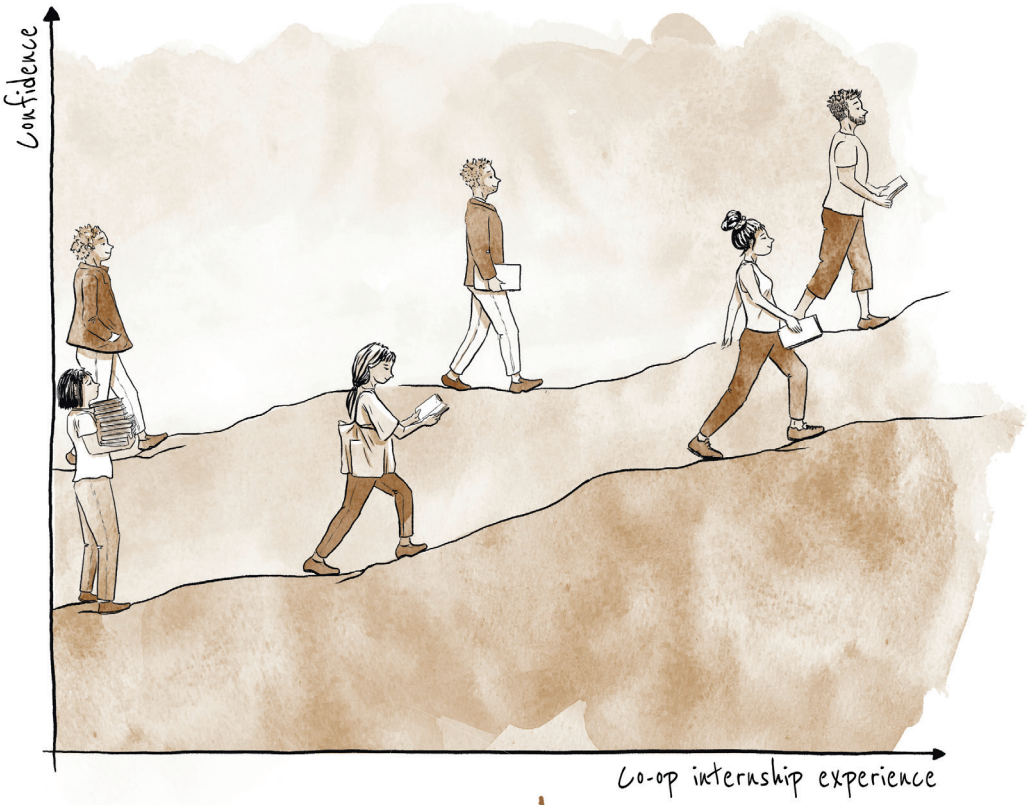
My supervisor and I get along well, and he's very approachable. I don't feel the hierarchy so much. I can just talk to him and he will consider my point of view. So it still helps to not be afraid to give my opinion or turn to him if I feel like something didn't work out so well.

Woman science student

I think it was a positive impact for the most part. I also think that the work environment can tell you a lot, not about how you're doing in your internship, but about whether you enjoy it. I also think the fact that I associated people that I knew with something positive, well, that had an influence on my internship being a positive experience for me. That's true of every internship I've done.

Woman science student

Just over half (56%) of the interviewed women students in both engineering (55%) and science (57%) reported lacking confidence at the beginning of their internships. However, 39% did feel fully confident from the beginning, namely 45% in engineering and 29% in science. One-third (33%) of the women students, namely 36% in engineering and 29% in science, mentioned a change in their sense of confidence over the course of their internships. In addition, just over half (56%) used strategies to overcome a lack of confidence, and this was more common in engineering (68%) than in science (36%).



My confidence was always going up during my internship. At the beginning of the internship, honestly, no. My lack of experience, you know! The worst part is that I noticed throughout my undergraduate degree in college that I was putting pressure on myself. I don't know why, but my male colleagues seemed to have more confidence than I did. Even though they had no more experience than me. I know that I'm a hard-working and driven person and that is what has made me strong.

Woman engineering student

I trusted myself. Usually, I knew I was going to have help from a master's or doctoral student while I was starting my internship and after that, I was going to be able to do my things more independently. Each time, after a month of internship, I knew I was going to finish my term. I was making good progress with my work without too many problems. I was confident every time.

Woman science student

If I ever struggled, I knew where to go to get my information, who to ask for help. So, that's when I realized that it was important to develop good work relationships. Whenever you have a problem and you get stuck, you can turn to the most experienced people in your work team, don't be afraid to talk to them and ask them questions.

Woman engineering student

They said, "You haven't learned that, you're supposed to know that" Every time I asked questions, I felt like it was wrong. So, yes, I lost confidence in myself. No, I didn't belong. But, ultimately, I said to myself, "This makes no sense, we should talk." We talked. And that's when I learned that this is how he likes to be treated in a learning context. But I told him, "Clearly, not everyone is like that." There was an adjustment period between the two, but because we talked, it turned out all right.

Woman science student

More than three-quarters (92%) of the women students in the study considered that they had significant autonomy in carrying out their internship tasks, both in engineering (95%) and science (86%). In addition, many (61%) liked having significant autonomy (68% in engineering and 50% in science). Almost half (47%) received substantial support during their internships. However, the presence of support was more prominently mentioned by the women science students (64%) than the women engineering students (36%). Indeed, 32% of the women engineering students reported receiving little support in their internship.

I had a lot of autonomy generally speaking. A whole lot. Starting with the first internship, I saw the supervisor for thirty minutes every two weeks. That was it. He came to see where we were and that was that. In the second internship, if I had questions, I went to see him, otherwise I took care of things as they came up. In the third and fourth internships it was the same thing, if I was given a job that took a few days, if I had a question, I went to see [him], otherwise I went about my business. In the fifth internship, it was even more up to the interns to go out and do their projects independently.

Woman engineering studente

I really appreciated this independence because it allowed me to develop my knowledge further. It was more representative of the job market for later. Even though I was independent about 90% of the time, I often had to work as part of a team.

Woman science student

The Challenges Encountered in the Internships

The main challenges raised by the interviewed women students were interactions with supervisors and superiors (53%) and interactions with operators, technicians and other workers (25%). While difficulties interacting with supervisors and superiors were reported by both women engineering (64%) and science (36%) students, difficulties interacting with operators, technicians and other workers were reported by women engineering students only (41%).

> In fact, a friend of mine, her supervisor was very sexist. She experienced that in her internship. She was ignored when she had questions, left out or given a lot of work without explanation. I know my colleagues experienced this.
>
> Woman science student

It happened during my internship and I didn't even think I was experiencing harassment because it was implied and I didn't know it could be that implied. It took me a while to say: "Yes, that's really what I experienced in the internship. That's really what it was!"

Woman engineering student

I didn't know that harassment prevention services existed. I didn't know that I could turn to the SSDP. I could have done something about it. I didn't know!

Woman engineering student

As I talked about earlier, with the operators, I think the hardest thing was dealing with people who don't want you there. It's hard for someone, you already don't feel like you belong in an internship, because people tell you that you're just an intern. It happens a lot. But then, on top of that, people make you feel like you don't belong in the plant, it's really hard. e.

Woman engineering student

My first internship was in a mine. When I mentioned to you about the mechanics and all that, they were making a few remarks that were a little inappropriate. You're not used to it, it's your first internship. You don't take up much space and they say things to you. You tell your supervisor, but he answers you: "They're guys, just let them be." No, it's really upsetting. At some point, you take your place, and you say to their face: "If you don't stop, I'm a girl, so this can go very far." So I really confronted them, I really had no choice, the supervisor wasn't doing much.

Woman engineering student

According to the women participants, more than half (53%, namely 50% in engineering and 57% in science) had questioned their career choice at least once, while just over a quarter (28%, namely 23% in engineering and 36% in science) had never questioned it. In addition, 47% of the women students (50% in engineering and 43% in science) cited resilience and perseverance as factors, while 44% (45% in engineering and 43% in science) cited questioning themselves and dropout as factors.

Because afterwards, I talked to people, they were telling me: "You're great. You understand chemistry. You love it." Afterwards, I realized: "Of course! I still talk about chemistry even after I've gone home. And I love it." It was the project that kind of wore me out and the atmosphere at the lab. At some point, I realized that it had nothing to do with my career choice, but more with the situation I was in.

Woman science student

Each time I thought that maybe the problem [difficulties with the operators] was just limited to that one place. For sure, during my first plant internship, I wondered if I really wanted to work in a plant. But ultimately, when I got to another plant, I saw that it wasn't like that in all plants. That reassured me.

Woman engineering student

For example, I see the other people in my cohort who are really motivated, they do projects in the evenings and they were very happy with their internships. Sometimes I could see that even though there was nothing wrong with me, I hadn't had as much fun in my experience. So, sometimes I would wonder: "Was it because I didn't enjoy it enough?"

Woman science student

Most (78%) of the women students in the study reported no difficulties integrating into the predominantly male internship settings. Comments along these lines were more often shared by the engineering students (91%) than by the science students (57%). More than one-third (36%) of the women science students reported experiencing at least one difficulty with internship integration and 29% had examples to support this. Examples of successful integration were shared by the majority (72%) of the women students in both engineering (68%) and science (79%).

In all my internships, I noticed that it was always a smooth integration.

Woman science student

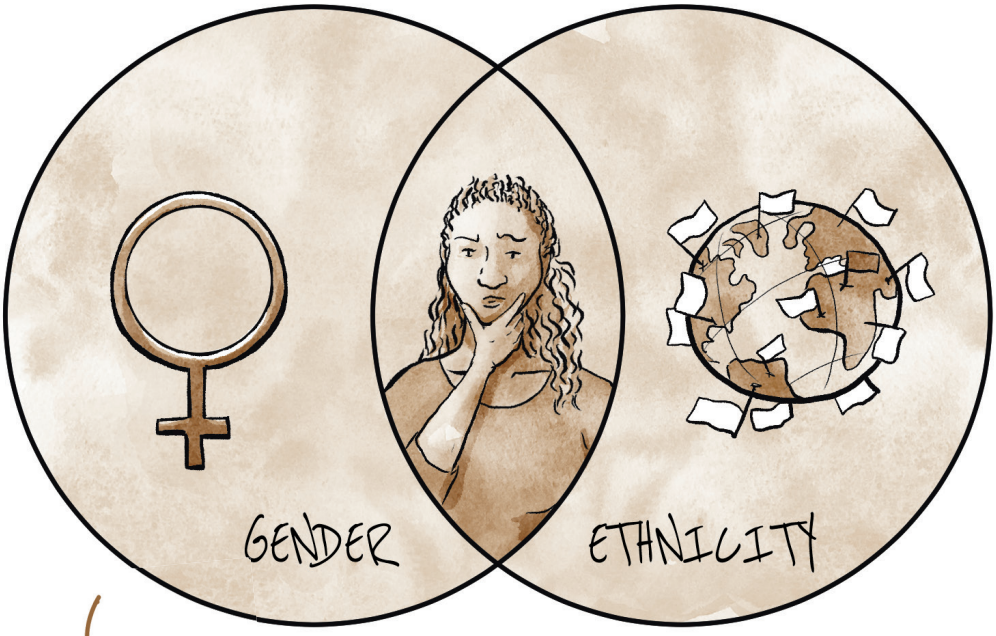
JI felt welcomed, very welcomed in fact. I think it sort of connects with the way of thinking in IT. What is increasingly fashionable is diversity on teams. It raises your chances of having different creative ideas, that kind of thing. Having more and more girls in computer science is very encouraged, we are very fortunate, it's not frowned upon at all. "Thank God, we have a girl in our team, for once" (laughing). We are not revered, but people appreciate and find it really great.

Woman engineering student

I also had a chemistry intern who was next to me. There were two of us that term. No one was going to help him. For sure he was a year older than me too. He was in his third year and I was in my second. It's true that there was this gap, but no one was concerned with him. It was like: "Oh, just go about your business. You can do that." Whereas with me it was: "Oh, I'll help you. It's going to be alright." I was being pampered a bit, let's face it.

Woman science student

The feeling of being perceived differently than a male colleague in an internship was mentioned by more than half of the interviewed women students (53%), while just over one-third (36%)—and more so in science (43%) than in engineering (32%)—expressed no such feeling. Examples were reported mostly by engineering students (68%, vs. 29% in science). More than one-third (42%, namely 45% in engineering and 36% in science) of the women students did not feel that they had to prove themselves more in their internship than a male colleague. However, half (50%) of the women engineering students gave examples in interviews of situations where they had to prove themselves more than a male colleague in an internship, compared to 14% of the women science students. Additionally, more than one-third (41%) of the women engineering students reported experiencing a sense of favourable bias in their internship.



"In my experience, I've often wondered if it was more because of my skin colour than the fact that I was a woman. That's been my life experience. That's more what affects me. They kind of go together. When certain events happen and you notice that the person is acting a little strange, as a woman or as a visible minority, you think: "OK, when it's out of the ordinary, it's a little strange." You ask yourself, "Is it because I'm a girl or because my skin isn't white?"

Woman engineering student

There was one instance, when I did an interview. The hiring supervisor told me: "Normally, I don't really hire girls, because they have great grades, but ultimately they don't perform well. But you look super competent." And he thought I was really competent. Just that one comment made me stop and think: "So you're judging me because of what I have between my legs. You're funny."

Woman science student

Intersectionality

In equity, diversity, and inclusion (EDI), intersectionality refers to the confluence, or intersection, of designated groups and multiple historical disadvantages such as employment challenges.[27]

I had to prove myself a little more. There was a friend of mine who was an intern, his job was more project engineering, while I was more of an administrator. It's a little different, but there is a similarity. Sometimes we worked on separate things, but not always. Sometimes, in the meetings, I had the impression that if we had the same points to make, he was listened to more than me. The supervisor would ask me questions like: "What's your basis? Why are you saying that?" I was questioned more. I even turned to the other intern at one point and told him: "Do it! Say it!"

Woman engineering student

At my last internship, it was kind of funny, the boss said, through a girl I was working with: "I really want to have girls, there aren't any in the department. If things go even remotely well with her internship, I'm offering her a position." She said she was willing to keep me and lay off someone else, just because they needed to have more girls. It put some pressure on me and at the same time, I didn't necessarily think I was doing a good job (laughing), I felt a bit guilty. I was favoured."

Woman engineering student

More than half (67%) of the interviewed women students considered that the division of labour was fair between men and women in their internship. This perception was stronger in engineering (79%) than in science (59%). The engineering women students gave more examples of an unfair distribution of tasks (41%) than the science students (14%).

There may be a difference in the manual tasks. A supervisor saying: "I'm going to send you with a boy because there are heavy things to carry." That has happened to me, especially when there's some lifting that has to be done. But, in the context where it happened, people didn't have bad intentions. It's just that they figure she's a girl, she has less strength. But I would have been able to do it on my own.

Woman engineering student

It probably depends on the company, for sure, but I think it really depends more on the person's abilities as the internship goes on. On companies seeing the talent or skills we have. I don't think it depends on being a girl or a boy.

Woman science student

From my perspective as an intern toward the people who were working full time, I could see that it wasnt equal. I could see that if there was anything heavy to carry, it was only the boys doing it, and the girls werent. If there was an office task to be done, it was more the girls who did it, because they were 'better' at French than the boys. Otherwise, you could see that there was a bit of discrimination on the tasks. Being an intern, it was still fair, but I could see that on the job market, it might not be 100% fair.

Woman science student

Benevolent sexism

Benevolent sexism is a form of sexism "that manifests when women are treated as if they cannot handle the difficult challenges or lack the common personality traits in STEM and are ill-suited for a competitive environment" (freely translated).[28]

More than one-third (36%, namely 41% in engineering and 29% in science) of the women students in the study considered work environments to be poorly suited to the needs of women students and provided examples to support this. However, 44% reported examples of well-suited workplaces. This perception was stronger in science (71%) than in engineering (27%).

> Except, as I said, if women want to have children, I think. In any case, I don't see myself having one until I finish my studies. There were several who said they couldn't stop their PhD to do that. I think there are some who do, but it's more complicated. You don't really have maternity leave either.
>
> Woman science student

> We were always welcomed. I was with an intern and we had exactly the same things, same salary, same benefits, same gift at the end. At first, it was the same thing. No advantage or disadvantage in terms of the final presentation, the tools we had in our possession or the supervision we had. It was very fair.
>
> Woman science student

Plants, in general, are male environments. Just in terms of the equipment, there was a mask, a full suit, it was all guy stuff. I had guys' shoes, guys' steel toes. Just from that perspective, it's clearly adapted to men. Boots for girls are no more expensive than boots for guys (laughing).

Woman engineering student

Microaggression

Microaggressions are subtle, mundane and often unconscious interactions that convey hostile or hurtful messages to individuals based on their belonging to a group. They can take many forms (verbal, behavioural or environmental).[29]

A Future Career in SE

In choosing a future career and future job, more than half of the women students we met with named at least one of the following priorities: position or type of work (61%, namely 68% in engineering and 50% in science), type of schedule (56%, namely 50% in engineering and 64% in science), and activity sector (56%, namely 45% in engineering and 71% in science). More than one-third of the women students (39%, namely 45% in engineering and 29% in science) mentioned the importance of corporate values and organizational culture. In addition, one-third talked about the size of the company (33%, namely 27% in engineering and 43% in science) and the social environment (33%). The social environment was mentioned more by the women engineering students (45%) than by the women science students (14%).

Yes. I realized that my strengths were really more in project management. Managing projects and all that. I'm not aiming so much for something very technical, like product development, I'm not sure. In maintenance, I'm not sure (laughing). Throughout my undergraduate degree, I wondered if I was going to end up in mechanical engineering. I didn't know. I knew I didn't like anything technical. Then in my last internship, I did something that was much more related to project management and that's when I realized that I liked it. I saw myself making a career out of it.

Woman engineering student

The first thing that comes to mind for me is the level of competition. There are companies where they encourage a lot of internal competition. I find it so unhealthy. That's what made me not want to go back, because the atmosphere was unpleasant. It's cool to be in competition, but not that way.

Woman engineering student

Actually, there was definitely a lot of office work, but also field work. What I would like in a job later... I understand that the office is part of the job, but I would like it to be about so-so direct field or lab work.

Woman science student

> What I really liked was the environmental side of their project. I realize that I would rather go for something that has a more humanistic focus.
>
> Woman science student

According to the women students, the skills developed in internships that appear to be most relevant to a future career in SE are communication (50%, namely 59% in engineering and 36% in science), autonomy at work (44%, namely 41% in engineering and 50% in science), organizational skills (36%, namely 36% in engineering and 36% in science), use of field-specific knowledge and skills (31%, namely 27% in engineering and 36% in science), leadership and self-confidence (25%, namely 23% in engineering and 29% in science).

The first thing that comes to mind is the human side, the ability to develop good relationships with the group. It's very important. As engineers, we are there to improve the plant, to make changes, and often people are reluctant to change. You have to know how to do it right, how to make the change properly so that everyone feels comfortable. This requires good work relationships.

Woman engineering student

Otherwise, maybe also prioritizing, when you have five things to do, what should you do first? What should you do second? What can you drop or delegate? I think it's priority management. That's something I've learned well.

Woman engineering student

Otherwise, autonomy is something that we have no choice but to develop in order to be good at our job. It's good to be able to develop your autonomy during an internship when you know that there are people there to supervise you. I think it's a good opportunity for that.

Woman science student

I would say the technical skills, being able to try out new technologies. This allows you to sort of build your toolkit to be able to excel in business.

Woman science student

Avenues

The participating women students raised potential avenues for improving women's integration in SE fields. These avenues included raising awareness of SE among young girls (33%), working on changing mentalities (in general; 31%) and implementing interventions in schools (25%). Changing mentalities was raised by both the women engineering (32%) and science (29%) students, while the other two recommendations came mostly from the women engineering students (50% raising awareness of SE among girls and 32% implementing interventions in schools).

I also don't know if anything can be done at the college level, I don't think it's talked about enough. You know, in high school, we never talked about what an engineer is. We take career tests, we have classes for that, we have activities to find a job. Some work needs to be done on this, it's very rarely addressed. I've always been very good at science and math, and no one ever talked to me about engineering. Never. I don't think we've sufficiently targeted girls from a young age yet.

Woman engineering student

It's hard, because you have to change people's mentality. That's often the problem, people have the mentality that women don't belong in engineering in plants.

Woman engineering student

It's just that there's such a stereotype that it's just boys, that most girls will say: "Well, I don't want to go into a guy's field." That's how it is! Maybe we should start breaking the stereotype at a younger age. That way, we will be less psychologically blocked and be able to move forward. I'm often told even by family or colleagues that I meet elsewhere: "Oh yeah. You're in science and you're a girl."

Woman science student

The main action (e.g., mentoring, women role models) mentioned by the students in order to help prepare women students for SE internships was to pair new students with former students who have already completed an internship (25%, namely 23% in engineering and 29% in science). The women engineering students (27%) also raised the possibility of holding awareness workshops on harassment, discrimination, inclusion, emotions, and conflict.

> Maybe we could think about pairing up with someone who has already done an internship. Sometimes it might be nice to be able to ask a question of a student who has been there already.
>
> Woman engineering student

> Before the first internship, in my mind, it would have been helpful to explain it to me. Harassment or bullying situation: This is the kind of behaviour that is unacceptable, whether you're on the giving or receiving end. If a situation ever comes up, here's how to react. My impression is that this process is never explained to you, you don't necessarily know it intuitively. You don't always think to jump on Google to see what university services are available related to harassment, what the internship service should do in this situation, etc.
>
> Woman engineering student

Perspectives of Advisors

University internship advisors have a global view of the internship experience of the student community given their key role in this process. Their experiences with women students' internships in SE are therefore an important and relevant source of information. What are their views on co-op internships in SE? What is their perception of women's underrepresentation in these fields? What are the perceived benefits and challenges of internships in SE? What are the observations of these key individuals regarding the different pathways of interns? The following section provides some food for thought and discussion about the internship experience of women SE students, based on insights from interviews with three advisors at the Service des stages et du développement professionnel (SSDP).

It is important to note that due to the small number of advisors (3), the answers may not be representative of women students' experiences. In addition, for the same reason, only information supported by two or more people was generally reported, with the exception of elements on which there was no consensus.

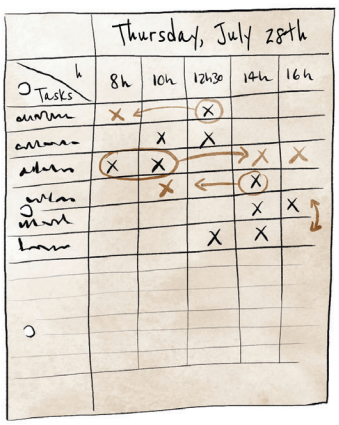
Positive Aspects of Internships

All three advisors we interviewed identified career validation as one of the main benefits for women students completing a co-op internship in their field as part of their undergraduate degree. Two advisors also spoke of a better knowledge of their own areas of interest, the financial benefit of internship pay, and a greater knowledge of different fields/settings or tasks.

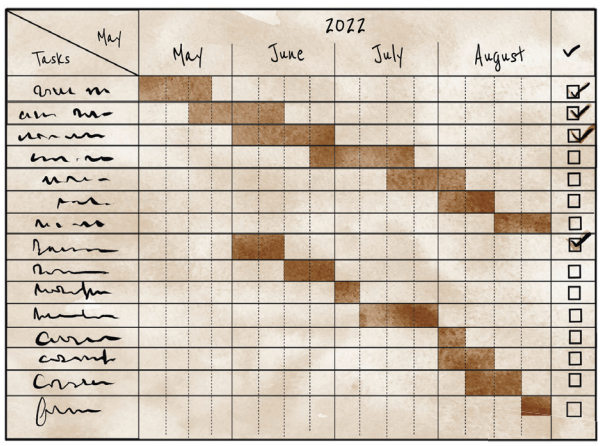
Quickly finding out if they're in the right field, if they like it. Whether the potential challenges or jobs match what they're looking for. So, it's finding out: "Am I in the right program?"

Two of the interviewed advisors identified positive atmosphere and relationships with colleagues as key elements in motivating women students in the context of internships. In addition, according to two of the advisors, the skills and qualities that are most developed in internships are communication and organizational skills.

1st Internship



5th Internship



Confidence and support can go a long way to motivating them in internships.

Communication too. Sometimes, in the first internships, it's much harder to take your place, to speak up, to communicate your progress every day, but often, toward the end, it's one of the skills that are developed the most. In school, you have less time to develop this.

There are certain elements that always stand out, such as getting organized. During the first internship, just managing to organize one day is sometimes a challenge. By the fifth internship, you're able to organize your entire internship and talk to your supervisor about it: "Here's what I'm going to do, what do you think of my delivery schedule?" This progression happens through internships.

Perceived Challenges of Internships

The difficulties, challenges and barriers encountered by women students in their internships and acknowledged by advisors included sexist and derogatory comments (1/3), feeling that they had to prove themselves more than other students (1/3), difficulty interacting with operators, technicians and other workers (1/3), difficulty interacting with their supervisor or superior (1/3), and perceiving an unfair distribution of tasks and responsibilities (1/3).

Some of the women students reported feeling that they had to do more to earn credibility. I would say that this especially happens in plants where they have to work with a lot of men who arent necessarily at the same level as they are. So, if they have to supervise male environments, there are women students who have often reported to me that it takes longer to become credible because they have to prove themselves, which maybe a male student wouldnt have to do.

Once, a woman student was put down by her supervisor on a daily basis for being a girl, but she didn't necessarily hear him. It was her male colleague, also an intern, who thought it was crazy what her supervisor was telling her every day.

Ally

"An ally is any person that actively promotes and aspires to advance the culture of inclusion through intentional, positive and conscious efforts that benefit people as a whole."[30]

All three interviewees considered plants and industrial settings to be the most problematic internship environments for women students. Two also mentioned construction sites. The advisors interviewed (3/3) gave more examples of women students who had no trouble integrating into male-dominated environments. Only one of them reported ever having observed integration difficulties.

I think in the sciences, in biology or chemistry, I don't see much of a problem with that, in other words, the environments are more equal. Maybe it's because I haven't had many women students working in typically male environments in those fields. But in engineering, coming back to my earlier example, of course most of the feedback I've had has been about women who work in plants where the employees are typically male and they're under the intern's supervision.

For construction sites, it's somewhat similar. You really have to be strong, to assert yourself, to take your place. I know some girls who have had more trouble than others exactly because they take their place.

I'm fortunate to mostly work with companies that have a good integration process for interns. So, I think I haven't seen that much because often they're supported by their superior. And the integration process is pretty good. So I haven't seen any integration problems because they were girls.

All the advisors we interviewed perceived a difference between boys and girls with respect to their level of self-confidence in their internships. One advisor felt that there was a progression in women students' level of self-confidence. Another noted that having too much confidence at the beginning of an internship can sometimes be problematic.

I think it's true that girls generally don't have a self-confidence that they've built up over a long period of time. They need to be sure they know an answer before they say it, whereas I have men students who are able to answer even when they're unsure.

In that sense, I think there's a big difference between a woman student doing her first internship versus her fifth engineering internship or third science internship. Once they have experience on the job market, [...] I think the level of confidence goes up significantly.

I was surprised when I found out as an advisor that there were still [differences between boys and girls], and then that there were so many biases present. The battle is not over. There is still work to be done. I try to get involved as much as I can, and also to be there for any woman student who finds herself in a particular situation. Often, they too are able to fight this battle and they understand that they are part of the solution.

Only one interviewed advisor reported having witnessed psychological harassment toward a woman student in SE during an internship. Two advisors gave examples of strategies to overcome such cases. In addition, two of the interviewed advisors explained that they had followed up with women students who had dropped out of their SE program during or following an internship. They identified the work environment and the unsuitability of the field as factors that can cause students to question their choice of career during SE internships.

In terms of harassment, I once followed a student who had trouble with an employer who didn't think she was very good and told her so. It wasn't sexual harassment, not at all. I would say more like psychological harassment. Yes, it happened, but it hasn't happened often. But I do have an example in mind where a supervisor was harassing a woman student. Then there was another time when I had women students who didn't want to go with a supervisor anymore, saying he was too pushy, but never has a woman student complained. There have been no instances of assault, but there has been harassment. But, you see, in my entire career, this has happened to me twice.

This student was very active in the girls' movement. And on the work sites, often, that's where there's a bit more [harassment] ... I didn't follow her in the internship, but she admitted to me that she was often told things with sexual connotations on the work sites. And that one of her initiatives was to talk to her boss and put in place a clearer harassment policy for everyone she had to interact with so that she had measures to protect herself.

In fact, in the beginning, I said that the internships helped them, it allowed them to validate their career choice. It's often happened where women students have said, "I don't want to spend my life in a lab" or "I don't want to, I started in engineering, but I don't like it." It's more the field that makes them question themselves, it's not necessarily a bad internship experience.

Other Observations of SSDP Advisors

Two of the interviewed advisors considered that the division of tasks or responsibilities between male and female interns in SE depends on the individual's initiative, regardless of their gender. In addition, two of them reported feeling that the division of labour was generally fair.

> The only difference I would say is that there are internship settings where the jobs are given very much according to the student's initiative. So, for sure, if a boy and a girl arrive at the same time, and the boy has lots of self-confidence but the girl doesn't yet have much, well, the tasks will not be assigned equally. The boy will ask for more, and take on more.

> This might happen more in candidate selection than in task distribution. Often, in terms of tasks, [employers] are asked, as much as possible, to have a project or something ready for interns. I've taken internships lately where it was a boy doing the internship and then it was a girl. It was the same internship. The internship wasn't changed because she was a girl, no.

Organizational practices cited by advisors as possible ways to support women's and women students' integration, progression and retention in SE included having fun co-ed activities at work (1/3), promoting work-life measures starting from the time of internship (1/3), involving women in the onboarding process (1/3), highlighting harassment policies (1/3), having supervisors hold "open houses" (1/3), and encouraging interns to take initiative and make suggestions (1/3). Two of the advisors we met with also felt that the factors that could help women students prepare for internships were not being shy; asking questions; and trusting themselves as interns.

Where I've seen the most girls in engineering drop out is when they arrive as graduates. The fourth or fifth internship! The biggest discussions I've had are about starting a family: "I don't know how I could go to a construction site and have a family," "I don't know how I could go when my male colleagues are working 50-60 hours. I won't be able to do that when I have two, three children."

They could apply good harassment policies on the worksites. There could be zero tolerance, basically, to avoid encouraging inappropriate behaviour. Sure, this is supposed to be the case everywhere, but sometimes it's not necessarily applied to the letter.

It's very important for the employer to introduce her in the same way they would have introduced a boy. And not say jokes like, "We have a pretty little girl coming to work with the rest of us."

Recommendations Suggested by the SSDP

Two of the advisors explained that SSDP could promote internship experiences for women students in SE by offering to participate in projects, talks or events to raise awareness. They additionally mentioned that SSDP should follow up with women students during their internships and collects feedback from students following their internships in order to make adjustments and improve in the future.

Definitely, to make sure each woman student is properly followed up with during their internship, this is something very important to maintain in my opinion so that they can consult someone from the university, to answer their questions and validate: "Hey, this happened to me, is this normal? Should I respond?" So, to continue to follow up during the internship, I think it's critical for the person to have a reference outside their workplace that they can go to and ask questions, where they can validate information or a feeling that they have.

METHODOLOGY

The present findings stem from a study conducted from 2018 to 2021 with the overall objective of exploring the experiences of undergraduate women students in science and engineering (SE) during their co-op internships in predominantly male environments. To this end, and to answer the research question (in male-dominated fields such as SE, what is women students' perception of their internship experience?), a qualitative and exploratory approach was chosen.

Semi-structured individual interviews were conducted in person and by telephone. Due to the COVID-19 pandemic, some of them were held via video conferencing on the Teams platform. A total of 39 interviews were held. The sample consisted of 36 women undergraduate students in SE from Université de Sherbrooke, namely 22 bachelor of engineering students who had completed one to five co-op internships and 14 science students who had completed one to three co-op internships. The sample also included three advisors from the Service des stages et du développement professionnel (SSDP) at Université de Sherbrooke:

- **22** women students in engineering;
- **14** women students in science; and;
- **3** SSDP advisors.

For both women students and advisors, a specific but flexible interview guide was developed that allowed for specific questions to be answered while giving participants the freedom to elaborate on their experiences and perceptions.

In order to analyze the data collected through the individual interviews, the chosen method was content analysis. For this purpose, the complete accounts of the participants were transcribed verbatim. Next, using QDA Miner qualitative analysis software, the data was organized in order to categorize the themes most frequently mentioned by the participants (e.g., challenges encountered).

Participation in the research was voluntary. The students and advisors were recruited by email. The student sample was created in keeping with the principle of saturation, i.e., it remained open until the information obtained would be sufficiently rich that adding more participants would offer no further insights. The sample of advisors followed the same principle, but was limited due to the occupational overload caused by the COVID-19 pandemic. The overall sample (women students and advisors) also followed the principle of diversification, as it was made up of students from different SE programs as well as advisors with a variety of years of experience.

RECOMMENDATIONS

This section offers a total of seven recommendations that can be applied to help ensure that women students have a positive internship experience. All of the recommendations are based on analysis of what the students and advisors said in the research presented in this text. They are also based on an exploration of the literature conducted by the CWSE in the course of producing its report *Collaborating for Greater Gender Diversity in University Engineering Programs*.[29] Note that the recommendations may apply to other groups as well (e.g., visible minorities, Indigenous persons, members of the LGBTQ2+ community) who may experience difficult situations in internships.

Recommendation 1

That academic institutions promote mentoring among women undergraduate students to allow for peer support (e.g., listening, sharing experiences and exchanging advice).

Recommendation 2

That academic institutions provide support and assistance services for women students (e.g., by the internship administration, trained faculty members and trained women students).

Recommendation 3

That academic institutions offer preparatory workshops based on the needs of women students (e.g., on emotions and conflicts; informative workshops on harassment, discrimination and possible recourses).

Recommendation 4

That academic institutions provide training workshops for internship advisors to make them more aware of and prepared to support women engineering students during their internships (e.g., on the challenges of diversity in an organizational setting, what to do in case of discrimination or harassment).

Recommendation 5

That academic institutions work to eliminate potential sources of sexism and harassment by educating employers on women students' onboarding, integration and presence during internships (e.g., providing training to employers wishing to hire women interns).

Recommendation 6

That employers wishing to hire women interns in predominantly male environments take action to promote their integration and diminish stereotypes (e.g., by adopting a zero-tolerance policy to foster a respectful workplace; offering equity, diversity and inclusion awareness activities to their staff; providing a welcoming physical environment; and hiring more women to increase the presence of women role models).

Recommendation 7

That academic institutions meet with women students after they receive their internship grades in order to interview them about their experience (e.g., to document the difficulties and best practices encountered by the students in order to be able to follow up with companies).

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ABOUT

THE CHAIR FOR WOMEN IN SCIENCE AND ENGINEERING

The mission of the Chair for Women in Science and Engineering (CWSE) in Quebec is to increase the representation and maintain the participation of women in the field of science and engineering (SE).

The Chair's main action area is working with young girls and the people close to them to introduce and demystify the opportunities that SE have to offer. The Chair also works with students and professionals to better equip them to overcome the obstacles that continue to affect their careers. Furthermore, the Chair collaborates with various stakeholders to rally efforts around equity, diversity and inclusion in higher education and research. The second action area of the Chair is to conduct research in order to understand and raise awareness of the problem. In this way, the Chair contributes to submitting solutions to the various bodies concerned, with a view to bringing about change.

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How do women students in male-dominated fields such as SE perceive their internship experiences? Based on a study of women undergraduate students and advisors, this text aims to answer this question by addressing several themes such as women's under-representation as well as positive aspects and challenges experienced during internships. The text concludes with recommendations to help ensure that women students have a positive internship experience.

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