Welsh 2008).

criticized for rater bias, and for ignoring other dimensions of skill many of which are important in female-dominated jobs (Boyd 1990; Gaskell 1983).

The complexities inherent in defining and measuring skill make it very difficult to assess changes in skill over time. Studies assessing skill change have provided clear evidence of both deskilling and skill upgrading (Spenner 1983). Scores of case studies examining change within specific occupations, dating back decades, have documented deskilling (see for example, Braverman 1974; Cockburn 1983; Kraft 1977; Heron and Storey 1986). At the same time, aggregate studies of the labour market as a whole have found evidence of skill upgrading (Form 1987; Spenner 1983; Livingstone). If there is a trend towards routinization over time, as some suggest, it seems that innovation brings new knowledge, new technologies, and new skilled jobs, which offset skill decline within jobs. Nevertheless, few studies have examined skill as a multi-dimensional phenomenon, and explored trends in multiple areas of skill: for example, technological change might reduce the need for manual skill is some sectors, but increase the need for knowledge of technologies (Livingstone 2019). Moreover, as the percentage of the population employed in the services sector increases, demands for soft skills, interpersonal skills, and related abilities (such as emotional intelligence) may increase, even as demand for other skills decreases. Given the complexities in measuring skill and skill change over time, our understanding of skill trends remains murky.

Professionals experience skill change like other workers in the Canadian labour force. However, there is no agreement in the literature about the nature of skill change over time.

standardized to the point that many others with less training perform these tasks (Rothman 1984; Coburn 1994). Yet Freidson (1984, 1994) and others have countered that professions are actually fairly resistant to deskilling, because professionals drive research and innovation which generate new knowledge and skills. Hence, as some aspects of their work become routinized, new knowledge, techniques, and practices take their place.
been influential, but even he postulated that change could be on the horizon. Dramatic changes to professional education and employing organizations appear to be transforming practice. Professions scholars have documented these trends, and have provided predictions of what these trends might mean for professionals in the coming years.

The first of these accounts, I refer to as the deprofessionalization thesis. Beginning in the 1970s and 1980s, scholars argued that workplace change was undermining the discretion and expertise that has long distinguished professionals from other workers in the labour market. Critical of blindly optimistic predictions of skill upgrading and professionalization prevalent in this era, Marie Haug (1975) highlighted evidence of decreasing autonomy, challenges to professional authority by increasingly educated and vocal consumers of professional services, technological change, and other trends she felt could undermine professions distinct status in society. Such arguments were expanded by neo-Marxists and neo-Weberians. Influenced by Marxian theory, some argued that professionals were experiencing proletarianization brought about by employment, and exposure to the capitalist drive for the extraction of surplus value, control over the labour process and exploitation (Derber 1983; Coburn 1994). Derber (1983: 313) argued that professionals may maintain a degree of technical autonomy, but they are experiencing they increasingly lack control over the goals of their work, and the ends to which their work is directed. Neo-Weberian scholars, highlighted the

impact of rationalization on professional workers. For instance, Ritzer and Walczak (1986, 1988) argued that the spread of formal rationality in society contributed to a decline in professional power, and especially those characteristics like discretion and the exercise of judgement that distinguished professional workers from others. The deprofessionalization and proletarianization theses suggest professionals may experience deskilling. At the very least, they predict that

are on the wane. These trends could contribute to skill decline, or skill change, in the long run.

udies has explored hybridity within professions brought about by organizational and professional change (for example, Noordegraaf 2007, 2015; McGivern et al. 2015). Organizational change

hybridity literature is not explicitly focused on skill change, but it tends to be optimistic in its outlook, and suggests that navigating competing logics leads to new skills related to

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stratification

Skill was not defined for respondents rather on the survey and in interviews they answered based on their own perceptions of skill, which given the complexity of the concept may be variable.

Key survey measures used here include questions assessing job complexity, skill use, the impact of workplace change on skill:

* Do you consider the body of knowledge you bring to your job to be complex?

* To what extent can you use your professional knowledge and skill in your current job?

* In the past 5 years has the skill required to do your job become greater or lesser?

We also have measures of workload change, managerial status, gender, and other differences to assess variations across time and professional strata.

Frequency distributions were assessed and bivariate analyses were conducted to assess engineers skill levels

*

ill change and skill acquisition, and whether these discussions varied across structural location (manager / employee) and gender.

Survey Findings:

Engineers' skills and knowledge

Engineers are skilled professionals, but survey findings reveal a skill picture that is complicated (Table 1). First, it is worth noting that most engineers consider their knowledge to

is notable that only 27% of respondents

many engineers report their skills are not fully utilized on the job.

job. About half, 51%, indicated they had more knowledge than their job actually requires, and 43% indicated they had the skills to cope with more demanding duties. Only 15% felt they needed additional training to do their jobs well. These responses suggest under-employment.

At the same time, engineers pursue many development opportunities to enhance their skills, suggesting skill upgrading. Over 50% of respondents indicated they had undertaken some formal training or education in the past year. Most also reported informal learning activities, including (in order of importance): reading about new developments (56%), reviewing standards and codes (44%), visiting websites and online forums (38%), attending webinars (36%), attending conferences (32%), and learning through trial and error (26%). Engineers also learn from their colleagues, with 47% reporting seeking advice from someone knowledgeable to advance their job skills. They pursue these learning activities to enhance their technical skills

(76%), their managerial skills (56%), their soft skills (54%), and their financial and business skills (33%).

This ongoing learning seems necessary as 63% of respondents believe the skill required to do their job has become greater in the last few years

Table 1 Frequencies on Selected Skill Variables

Do you consider the body of knowledge you bring to your job to be complex?

Very Complex	26.8%
Somewhat Complex	59.5%
Not very or Not at all Complex	13.7%

To what extent can you use your professional knowledge and skill in your current job?

Fully	23.5%
Moderate to Good	64.3%
Little to Not at all	12.2%

Which of the following alternatives best describes your skills at work?

I need more training to cope	15.3%
My duties correspond with my skills	41.3%
I have skills for more d24.07 EMC /P9 T391.03 4(lt)-3(eic] TJETBT1 0 0 1 283.73 334.61 Tmw 469.03	

Informal Learning	Technical Skills	75.9%
Informal Learning	Managerial Skills	56.4%
Informal Learning	Soft Skills	53.8%
Informal Learning	Financial / Business	45.9%
Seek Advice from Someone Knowledgeable		46.6%

Bi-variate analyses were conducted to assess variations in skill complexity and skill use across organizational position and gender (as well as several others that were not statistically significant). As Tables 2 and 3 show, differences between managers and employees were evident, as were variations across gender. Managers were more likely to view their knowledge as very or somewhat complex than were employees. Also, more employees than managers reported having jobs that did not use their skills and expertise. With respect to gender, men were more

more likely to report using their skills on the job. Almost 1 in 5 women engineers said their jobs used their skills and knowledge only a little, or not at all.

Table 2: Knowledge complexity by managerial status and gender

Amount	Manager	Employee	Men	Women
Very complex	30.1%	23.2%	29.2%	13.5%
Somewhat complex	62.1%	55.7%	58.6%	

Skill Change

Differences in perceptions of skill change over time were also evident across managerial status (but not gender). Engineer employees were much more likely than managers to report no skill change over time. As Table 4 shows, managers and employees were equally likely to experience significant skill increases or decreases; however almost 42% of employees indicated the skill required to do their job had stayed the same, compared to only 27% of managers.

Table 4: In the past 5 years, has the skill required to do your job become greater or lesser?

	Manager	Employee	Total / N
Much greater	12.1%	12.0%	62
Somewhat greater	57.5%	42.5%	260
Stayed about the same	26.8%**	41.6%**	172
Somewhat / Much Less	3.6	3.8%	19

** p<.01

Skill change was also shaped by workload change. As Table 5 shows, engineers who had experienced an increase in28erienc in28eriencl change was also sha

To summarize, the survey findings suggest that engineering work requires at least time. Although there is evidence of underemployment, this is accompanied by skill upgrading through education, as is consistent with the literature (see Livingstone 1998). Many of the skills engineers endeavor to acquire are managerial and business-related as is consistent with the hybridity thesis. In line with the stratification thesis, skill does vary within the profession. Managers report more skill and more skill upgrading than their employee counterparts. Gender differences favouring men are also evident.

Overall, the survey paints a fairly optimistic picture pointing towards hybridity and skill enhancement. The qualitative research findings provide a more nuanced picture.

Interview findings

In interviews engineers were asked about skill change and the impact of workplace change on skills and knowledge. Three key findings emerged. First, and in line with the quantitative findings, reported skill trends are variable, with some respondents reporting considerable upgrading, while others reported none. Second, engineers who report having to learn new skills, suggest the skill acquisition process has changed. With workplace change, engineers often lack opportunities for deep skill development, and instead must learn on-the-fly. Third, although there is evidence of skill change, it is not easily captured by any of the three Differences across strata are evident, but there are meaningful consistencies as well. There is value in combining all three theses to understand reported trends.

Complexity, skills, and workplace change

Respondents were asked about keeping their skills up-to-date. Most talked about the same activities they mentioned in the survey: reading, surfing the web, attending webinars and conferences, and talking to colleagues. However, some indicated they felt more pressure in this area than others. For example, Macauley (employee), reflecting back on a career over a quarter-

ms of

> A skill is the ability to solve the issue, to analyse the issue, to resolve the issue. Not punching numbers into a computer and, you know, coming up with an answer. The tools have changed, but the skillset is the same and you know, that's something that, you know, you have to think about.

Thus, Macauley (employee) reported little significant change over time, except to keep up-to-date with the latest tools and technology. Similarly, Levi (manager) said that most of the information he needed to do his job was old and established. He felt little pressure to keep on top of the latest developments in his field. In a similar vein, Gabriella (employee) there are not many changes in our field

necessary. For the most part, Derrick (employee)

Linc (emp

Some more recent graduates talked about a narrowing of their skills after a few years in the labour force. According to Milo (employee),

> you get employed, those jobs end up being very specifically focused on certain portions of what you know. So you end up continuing those and keeping up with

those because you use them daily in your job. But pretty much everything else

Milo tried to keep some of his skills up-to-date, but had to . Cheryl

(manager) concurred, saying engineering program

Overall, interviews painted a mixed picture of skill change.

Skill acquisition – changing contexts

What became particularly evident in interviews, however, was that the context for learning and acquiring new skills had changed. Engineers traditionally learned on the job, but opportunities for learning at work are diminishing, they claimed. Derrick (employee) explained that in the past, e somehow had training and there was more time for self-education and stuff. Today no, because you have to charge every hour against the job.

constantly being squeezed to give more Gabriella explained that this work intensification left little time for training. When asked about keeping her skills up-to-

too busy to spend any time on that. I mean, the work rate is very, very high, and it is really frustrating for me because we never spend time on learning and reading.

Quinn (self-employed) summarizes the changes, resulting in less on-the-job training:

> In the past, engineering workplaces
>
> way you were treated. You know, they paid competitive salaries. They trained. It
> and this was a stated fact was to
> In the 1980s this changed. Now,
> p
> y want
>
> do you train them to
> do red cars? No way, you just lay them off, get rid of them. Find a red car guy. So people are viewed as engineering people are simply viewed as a commodity.

Similar stories were told by others:

exactly the skillset they're looking for. They're not willing to train (Zoe, employee)

We, as an industry, were too spoiled and instead of training our own people, we would go abroad and hire people from abroad. And so now companies are in the position where they are starting to realize that they have lost that human capital (Delilah, self-employed).

Nonetheless, survey findings show that most engineers do seek out new skills. Much of this learning they do o

make it more complex.

Workplace change, then, may sometimes bring deskilling (or narrowing of skills) and sometimes skill upgrading (acquisition of new skills). What is clear, however, is that the context for acquiring new skills has changed. Workers learn in brief moments, when they can, and on their own time. There is a need to learn more, but often at a more superficial level. Or, in

probably

Variations across strata

Analysing the interviews closely we can observe some differences across managerial status and gender. For example, managers were more likely to discuss acquiring new communication and people skills, while employees were more likely to mention keeping up with technology and regulatory codes. Moreover, several women discussed having their skills questioned by colleagues and clients, while this subject did not arise among the men (see also Adams 2019). Still, it is not so much the differences, but the similarities that are most striking. Regardless of managerial or employee status, and regardless of gender, participants highlighted

s offered few opportunities for skill acquisition, and that it was comparatively rare for a company to invest heavily in its workers. Skill development was increasingly seen as a personal journey. People had to invest in themselves. Some respondents saw this as problematic, while others did not. Margaret (manager) provides a clear example of the latter attitude:

Like if young engineers

re and looking and

invest in yourself find your tribe.

Regardless of how people felt about this change, most agreed that the context for skill acquisition had changed in engineering. Rationalizing organizations appear to see training as an inefficient use of resources. The burden is on the individual to acquire the skills they need when they need them. The best case scenario is that personal investments in courses and independent study leads to future career success. However, at least some of the time, investment in skills was piecemeal, fragmented, and focused on completing one task before moving on to the next. While skills are being acquired, it is not clear that professional skills are being enhanced in any meaningful way.

Conclusion

A large body of research agrees that professional workplaces are changing, altering what professionals do and how they do it. Although linked, the deprofessionalization, hybridity, and restratification theses advance different arguments about the impact of workplace change on professional skills. The deprofessionalization thesis highlights rationalization reducing autonomy and leading to routinization. The hybridity thesis is more optimistic about workplace change, suggesting professionals acquire new skills as they take on new organizational roles. The re-stratification hypothesis suggests that the impact of workplace change on skill varies by organizational position and professional characteristics.

Study findings suggest that trends in skill use in the engineering professions are not neatly captured by any of these theses, even though all three capture different aspects of

. Rationalization is occurring, like the deprofessionalization thesis

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