

IS IT DIFFERENT ACROSS THE POND? EXPLORING GENDERED EXPERIENCES IN CIVIL ENGINEERING IN THE UK AND USA

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The construction industry continues to struggle to attract women into civil engineering. Despite drives for equality in both the UK and the US, women remain underrepresented on university courses, and thus also in the field. Increased understandings of this can inform and support positive change. A comparative study of the experiences of both male and female engineers at different stages of their careers in the UK and USA was undertaken. A purposive sample was selected which included students, graduates, and full-time engineers, with one male and one female participant at each experiential level. Interviews with n=10 UK and n=10 US engineers were held via Zoom, transcribed, and analysed to reveal the dominant themes therein. Findings reveal gendered differences in how the participants position themselves within the industry. Familiar problems also have long shadows; entry to the industry, general awareness, and perceptions of construction, as well challenges of bias, sexism and stereotypes all endure. This study updates understandings of why and how women continue to be underrepresented in civil engineering and using evidence from both countries makes suggestions to enhance gender equality in this space.

Keywords: comparative analysis; engineering; gender; women; USA; UK

INTRODUCTION

Although the language is the same, the UK and USA are very different countries, and when it comes to work-life balance Americans are often thought to be much worse off than their British counterparts. Differences highlighted by Ionescu (2021) include in the average salary of senior managers; in the USA they would be paid \$104,940 and, in the UK, they would only be paid £52,000 which, accounting for conversion rates, is 50% less. Whereas British workers are entitled to 28 weeks of statutory sick pay, Americans are entitled to none. British workers are also legally entitled to 5.6 weeks of annual leave, whilst Americans are again legally entitled to none, with employers on average offering only 10 days. However, one similarity lies in the lack of women

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in civil engineering. In the UK, 18% of engineering graduates are women (Engineering UK 2023). In the USA, that statistic is slightly higher at 23% (ASCE 2022). Once in the workforce, these numbers drop to 9% and 14% in the UK and USA respectively (Engineering UK 2021; ASCE 2022).

This situation has not gone unrecognised, not least because diversity leads to better organisational performance and outcomes (McKinsey and Company 2022). The lack of gender equality within civil engineering is therefore not a novel subject for research (Navarro-Astor *et al.*, 2017) and is only becoming ever more important as the construction industry faces a significant skills shortage on a global stage, with civil engineering a named profession facing shortages in the long term (Chartered Institute of Building 2019). Indeed, the business case for increased equality and diversity within the construction industry has been established now for some time (Sang and Powell 2012). The construction industry is also keenly aware of this, with firms such as Balfour Beatty (2023) arguing that as well as encouraging more women to join the industry, actions must be taken to ‘stop the flow of talented women leaving it’. The existing body of research has explored gender inequality within the construction industry from a variety of perspectives, including barriers to entry for women (Gurjao 2006; Powell *et al.*, 2010; Navarro-Astor *et al.*, 2017), the complexities of challenges they face when they secure professional roles (Aboagye-Nimo *et al.*, 2019), and why they often leave (Ayre *et al.*, 2013).

To add to the richness of detail to understandings of gender equality in the construction industry, and specifically within the profession of civil engineering, this study aimed to examine the experiences of both men and women working as professional civil engineers in the UK and USA at different stages of their careers. It sought to provide insights from localised gendered perspectives in both countries, thus potentially able to further support initiatives and interventions to better balance this specific workforce.

Context

Generating Awareness and Interest

It can be argued that the problem of the lack of women in engineering starts far earlier than in the workplace and earlier even than university. In fact, EngineeringUK (2019) found that whilst 30% of boys aged 11-19 knew quite a lot about what engineers do, only 18% of girls in the same age range could say the same. Research by Peixoto *et al.* (2018) argued that children, and their influencers, should be educated on the pathways into engineering which would allow them to envision their own potential career in the industry. They also lay importance on removing the unconscious bias in engineering as early as preschool age.

Strachan *et al.* (2020) suggest that the biggest influence on someone joining the construction industry, including making the choice to study civil engineering at university, comes from personally knowing someone who works or has worked in the industry. EngineeringUK (2019) found this to be broadly accurate, as 61% of young people would turn to their parents/carers for careers advice, but also found that 59% would ask a careers adviser and 56% would ask their teachers. In the USA, Blosser (2017:24) also found that school staff and ‘...faculty are influential figures who have been shown to play a central role in introducing students to the profession and can significantly impact students’ experiences’.

There have been attempts to enhance the number of female students in engineering in both the UK and USA. Research has shown that there are very few differences in the

factors that attract both male and female students to construction degree programs (Bigelow *et al.*, 2018), however their experiences can differ once there, and gender bias can become problematic for female students (King-Lewis 2021). In the USA at the University of Toledo, Franchetti (2012) developed a series of programmes that were implemented to retain students from freshman (first) year to sophomore (second) year. These programs included mentoring from older students, a focus on the society of women engineers and the 'Eberly Center for Women', employing female staff and including more practical elements and a design course for first years. These adjustments were monitored in groups of female engineering students over five years and compared against control groups that were not subjected to these changes. Findings confirmed that the programs implemented helped to significantly increase the retention of female engineers in education.

At the other end of the educational timeline, and to seek to counter ongoing preferences for hiring men (Navarro-Astor *et al.*, 2017), Strachan *et al.*, (2020) undertook a relatively small action research project involving a construction engineering careers event at Gateshead College aiming to increase diversity amongst the employers present, whilst also providing guidance to mitigate unconscious bias and any consequential recruitment decisions. As a result, there was an increase in the number of female applicants (from 8% to 19%) and a further increase in the number of successful applicants (8% to 23%). Such improved course outcomes could prove attractive to prospective female students, with clearer career paths demonstrable through the successes of previous graduates.

Experiences of Practice

Many women start their professional careers '...strongly believing in themselves as engineers, a belief that had endured despite the difficulties they encountered' (Ayre *et al.*, 2013). It is these 'difficulties' that have been identified by researchers over past decades, with seemingly little improvement in practice during that time. Ness and Green (2012:27) argued that '...the building site is one of the last bastions of a traditional working-class masculinity' and therefore a workplace where there is no obligation to be polite or "nice" to people. It is perceived to be a masculine, hostile, challenging, and dangerous environment (Galea *et al.*, 2015) resulting in a professional workplace where women are vulnerable to bias, discrimination, and harassment - which in turn become some of the root causes of the underrepresentation of women in civil engineering in the USA (National Academies 2020). More recently, the empirical work of Aboagye-Nimo *et al.* (2019) carried out in the UK found that the industry has a serious problem of women being treated unfairly, which not only discourages women from joining the industry but also negatively affects retention. Sexism remains a perpetual problem for the industry, felt to be a widely 'accepted practice' according to women who work there (Aboagye-Nimo *et al.*, 2019). Bagilhole *et al.* (2008:24) also argue that the industry largely sexualises women, with both men and women being guilty of this which often undermines qualified, professional women through the medium of 'language, humour, style and appearance'.

Another key aspect for professional civil engineers is the lack of flexibility and thus accessibility to those wishing to have and care for family. This lack of flexibility reveals itself in the lack of respect for part-time roles, the long, unchanging working hours and issues surrounding maternity leave (Bagilhole *et al.*, 2008). Maternity leave can be particularly problematic, with Strachan *et al.* (2020) reporting cases of sexism in employers surrounding maternity leave. They highlight a quote from a male

employer suggesting that between equally qualified male and female applicants, he would be more likely to hire the male because: ‘...if I think that Joe can do it rather than Jane, Joe isn’t going to get pregnant,’. Maternity leave can be an issue for female engineers working in the USA, as there is no entitlement to paid maternity leave (Ionescu 2020), whilst in the UK women are entitled to 90% of their salary for the first 6 weeks and reduced pay for the remaining 33 weeks. However, despite such legislative protections, UK women working professionally in the construction industry remain worried about taking career breaks for crucial circumstances such as starting a family, as (Aboagye-Nimo *et al.*, 2019) found in some cases, statutory maternity pay is not implemented, and women can face redundancy when/if they decide to take their entitled maternity break, despite this being illegal. Globally, the culture of the construction industry remains one of complete commitment, any-time availability, and very poor work-life balance (Bowen *et al.*, 2018) which does not only impact women but anyone with a family.

Point of Departure

Although research of women in construction has both a recognisable history and resultant of knowledge, it arguably remains a space that is only seeing incremental improvements (Navarro-Astor *et al.*, 2017). Indeed, as gender equality has slowly improved (although the industry and specifically the civil engineering profession remains a long way from 50/50 representation in either the UK or USA), issues are now becoming more evident for women who have been retained and now reached senior roles in the industry because of improvements (Aboagye-Nimo *et al.*, 2019). This study therefore sought to add to the body of qualitative data that provides rich insights and understandings of gendered experiences of professional civil engineering specifically, aiming to examine the experiences of both men and women at a variety of career stages whilst also taking in two different geographical perspectives.

METHOD

To achieve the stated aim, interviews were held with a purposive sample covering all stages in a professional career. To that end, the sample for this study comprised one male and one female respondent from the UK and US at each of the following career stages, making a sample total of n=20:

- Student
- Recent graduate
- Professional with 0-10 years of experience
- Professional with 10-20 years of experience
- Professional with 20-30 years of experience

In adopting this approach, the sample that results inevitably reduces each sample strata to a different category of experience. Thus, whilst broad patterns could be identified, attention was also paid to the variety and differences between and amongst the sample. Each of the interviewees were asked the same 8 questions developed from common themes found within the literature:

4. Why did you decide to study engineering?
5. When did you develop an interest in engineering?
6. Who has supported or influenced you in your journey so far?
7. What are your opinions on the gender split in engineering?
8. How do you perceive the opportunities for advancement within your career?
9. Have you experienced or seen any sexism within your career and, if you have, how did you deal with it?

10. How long do you think you will continue to be an engineer?

11. What do you think would encourage more women to be a part of the industry?

All interviews were carried out via Zoom, transcribed, and the resultant transcripts uploaded to NVivo for analysis. Thematic analysis was used to unpack the transcripts to reveal the structure and shape of the dominant themes therein (Silverman 2022). This was further supplemented by content analysis which mobilised text searches and word frequency queries to provide more detailed insights from the data.

As with all research, there are limitations to this study. The small sample size is a notable limitation, as it has inevitably limited the extent and variation in the experiences explored, which may have introduced bias into the findings and impacts generalisability overall. The specific geographical locations of the participants are also a limitation of the sample; in the USA participants were based in California and in the UK in the North of England. The use of Zoom limited the personal interaction within the interview which may also have influenced the depth and scope of the data collected. This research received full ethical approval from the Northumbria University and where quotes are given, pseudonyms are used to ensure anonymity.

FINDINGS

One of the most fundamental findings from this work was that although the male and female civil engineers had very different experiences throughout their careers, their geographical location either in the UK or USA did not itself generate any notable differences within the data. Despite the myriad aspects that distinguish employment more generally between the UK and USA, and thus could potentially create inter-country differences, such aspects did not emerge within the data or the individual stories as meaningful differences in experience. It had been hoped that differences could be highlighted able to inform effective initiatives for the other country, but that was not the case, reflecting the conclusions of Navarro-Astor *et al.* (2017:210) that there are '...more commonalities than divergences in gender discrimination across nationalities.' Essentially it is whether you are male or female that matters for professional civil engineers, not whether you are working in the UK or USA.

Looking Back: How Did We Get Here?

Most of the interviewees (both male and female and British and American) explained that their interest in engineering developed between the ages of 15 and 19 and there was notable commonality in the development of their interest in the field. Many of the respondents expressed an affinity towards mathematics and scientific subjects from their time at school, describing a similar foundational experience at this age, however there was divergence as to the origins of this interest. Many of the male respondents noted how they had played with Lego bricks and other engineering toys such as 'erector sets' when they were young, whilst the women did not relay this same early-childhood experience. Indeed, female respondents felt that they lacked corresponding activities within their earlier years, for example one female interviewee suggested that children's books should contain stories about women in engineering and questioned why 'Bob the Builder' wasn't a woman. This thinking was mirrored by the male respondents too, with one mid-career male engineering working in the UK asking: 'Should we have baby books that have got those roles in them, yeah. and then, if you look at some of the baby books I know from when I was growing up, they'll be gender stereotype one. Yeah, the builder will be a guy ... 'Bob the Builder, why's it got to be Bob?' This reflects Strachan *et al.*'s (2018) suggestions that children, and their influencers, should be educated on engineers and the pathways into engineering.

Regarding the influences the interviewees had been exposed to that made them choose civil engineering as their profession, the majority joined the industry because they personally knew someone who was already a part of it. This reflects a common 'reason' as to why women chose to enter the industry (e.g., Bigelow *et al.*, 2015). For these participants this was a family member or close family friend who was, or still is, working in the industry. Content analysis of the data found that the biggest influence on the interviewees becoming engineers was their parents, specifically their fathers. Interestingly, this was the case for all the UK male engineers and all of the female US engineers, with the exception of the late-career participant, but not all the UK female engineers. Across the 20 interviews, the word dad (or father) was mentioned 17 times with the word 'parents' being used 8 times. However, others were also influenced by an uncle or an influential teacher in high school.

Looking Forwards: A Long-Term Prospect?

The long-term priorities of the men and women in the sample was a notable point of difference. When asked how long they saw themselves staying in the industry, the men said they would be in engineering for the rest of their career until they retired. For example, the UK male student engineer felt this was his '...career in general probably My whole working life I'd say.' This was also the case for the US late career male: 'Well, I've been doing this for 31 years. I don't have any set timeline. I really enjoy the people; I enjoy what I do. I'd say sometime between 65 and 70 is probably, I see myself. Probably finishing up my career'.

This was markedly different to the women who were unable to have the same certainty about their future. The female engineers often brought up having children or starting a family, raising questions about the flexibility of the industry and its ability to accommodate them. As the UK early career female engineer said 'The long days to the long nights so you think sometimes [that] you might have to take time away and come back to it. I don't know, it depends... So how would you fit a family around that?' This was the same across the board, with the US late career female engineer noting '...you either have the career and family so for me, as soon as the family comes becomes a factor. The family will be what I choose.' This was a concern that none of the men interviewed highlighted. The women interviewed mentioned the word 'family' 25 times, mostly in relation to future family life and children, whilst the males interviewed mentioned it 16 times, mostly in reference to their parents.

The perpetuation of such traditional gender roles, and resultant lack of flexibility within the construction industry has a significant impact on women civil engineers. They are forced to choose part time work, or end or pause their career which, in turn, limits their likelihood of promotion and career progression. As the UK late career female engineer noted: 'If I didn't have children, I would say the advancement [potential] was just the same as male colleagues' yet she had chosen to work part time which meant she hadn't '... been given the same opportunities as my male colleagues, because of my responsibilities at home.' She felt that the larger opportunities and projects would not be assigned to her but would be assigned to a full-time member of staff and argued that she would not be awarded an increase in position or salary, as she doesn't 'have the time in my three days a week, to be able to look after that responsibility'. This identifies another potential contributing factor behind the lack of women in senior industry roles (Gurjao 2006) which also creates a self-fulfilling prophecy in which the lack of representation makes it more difficult for women to see themselves in such positions. As the US early career female engineer said: 'I've only

had one female manager in six years. And so that's really the that's really where I see the big gap right now is, is in the middle level management and up... The most important place like the higher role is probably the most, the biggest place for the change to occur.' In keeping with the truism that 'You can't be what you can't see', as the late career US female engineer said 'My experience and what I've seen is your, your high-ranking females in engineering, are single ladies' - successful women engineers with children and families are a rare thing indeed.

Confidence and Certainty

The content analysis of the data created an interesting finding around the theme of confidence and certainty. In part likely reflecting the uncertainty faced by women about their long-term future in the industry, but also potentially reflecting wider gendered positions within society, the data found women civil engineers to lack the confidence of their male counterparts through their choice of language within the interviews. The most frequently used word by women in the interviews was 'think' whilst the most used word by the men interviewed was 'know'. By saying 'I think' rather than 'I know', a person is more open to being incorrect and often willing to correct themselves. This can weaken an argument as it 'casts a shadow of doubt' on the statement and is also suggestive of the fact that women in the industry have a lack of confidence in what they are saying, that is not present in men.

Sexism and Stereotypes

When asked about their experiences with sexism, the men, at all stages in their careers, had not personally experienced any sexism and very few of them had even seen any sexism at all. As the UK male graduate said: 'I've not had any issues of sexism or observed it in my life' whilst the US male early career engineering stated: 'No, I have not. No, not at all, especially nowadays.' Conversely, all the women interviewed had experienced some sexism, including the students and graduates. Whilst the veteran engineers agreed that the number of women has increased over the last 10 years, none of the interviewees were willing to comment on whether the amount of sexism has decreased in that time.

Most of the sexism experienced by those interviewed was in the form of supposedly light-hearted comments and humour. Whilst this can be perceived as seemingly harmless, comments of this nature serve to undermine a woman's position as a qualified professional and would likely not be tolerated in other more professional industries. However, these comments, whilst degrading to women, do not seem to affect the women's day to day experiences as civil engineers, with most of them identifying it as a problem but not one serious enough to report. As the US graduate female engineer said with regards to whether she would consider an incident sexist: '...I can't say for certain sexism right ... for some reason it crossed my mind ... If it were to happen again, then I would be certain that it was. I [would say I] experienced some cynicism.' This was supported by comments from the US early career female, who felt she had experienced: 'Nothing extreme. I would say the subtleties.'

A specific aspect of their careers in which sexism became more problematic was for women seeking leadership positions, who often find it harder to gain respect and trust in leadership. One of the UK early career male interviewees referred to his previous female managers as 'fire-breathing dragons', whilst an early career female engineer in the USA explained that 'it's hard for a woman to be like a leader, without being called 100 names under the sun'. She argued that there are male role models in managerial positions whereas there are far fewer women in those positions. This is problematic

for women in senior roles across all industries, where they experience microaggressions that undermine their authority, and are far more likely than men in leadership to have colleagues imply that they aren't qualified for their jobs (McKinsey and Company 2022). When embedded within the wider casual sexism of the construction industry, this becomes more influential and impactful in negative ways.

A final and fundamental point revealed by this study was the prevalence of unconscious bias within the industry as revealed by some of the comments made by the interview participants themselves. These included a UK senior male participant asking: 'why would a woman want to be a project manager?' and many comments about engineering being a 'masculine' industry. One early-career male participant from the UK suggested that women should be in 'a compassionate profession' such as nursing rather than engineering as it is 'quite confrontational' a comment made by one of the younger people interviewed. A late career male from the UK even said about engineering 'it is still a dinosaur industry' and suggested that his generation, and the generation above him need to 'get out of it before those attitudes will really move on'.

CONCLUSIONS

This study sought to explore the experiences of male and female civil engineers at different stages in their careers working in the UK and USA. The most interesting finding perhaps was that country location made no real difference to the experiences of the engineers at their different career stages, despite the potential for different work and employment practices and legislation to make an impact. Nor were there notable differences at the different career stages examined. The most significant differences were instead simply gendered - and not all that unfamiliar. Entry to the industry remains problematic, with familial connections providing the main impetus for a career decision, with a notable lack of early-years introductions to engineering and construction for girls. Logistical challenges and bearing the burden of family and caring responsibilities remain prominent for female engineers who struggle to see a long-term career in the industry, whilst their male counterparts are able to see civil engineering to retirement. This lack of confidence could even be seen in the language used by the female participants, who 'thought' whilst the men 'knew'. Bias, sexism and stereotypes also all endure, with female engineers struggling to secure leadership roles and facing everyday sexism in their roles. The perpetuation of stereotypes and the belief that women should not be civil engineers also endures, with the worrying finding that this belief is held by those across the generational spectra, making the 'solution' that such attitudes will retire with those who hold them unlikely to be realised.

This study adds to understandings of the differences in gendered experiences for civil engineers (who inevitably work within the wider construction industry) and demonstrates that there is still much work to be done to develop a working environment accommodating to all. It is recommended that further research continues to explore the richness of the specific challenges faced, to develop a critical mass of knowledge capable of bringing about effective changes towards equality in construction.

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