

## Early Career Female Engineers: Influences and Challenges

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### INTRODUCTION

The gender balance within engineering is a current concern, particularly in the UK. There is a great deal of interest in determining why fewer girls take STEM subjects in education and in identifying barriers to females studying and practising engineering.

With growing needs in the engineering sector for skilled resource, research suggests that there is a shortage at all levels in an organisational structure [1]. Increasing female participation in the UK's engineering markets could be worth 1.3% to 2.0% of GDP [2]. Certainly the demographic within engineering does not reflect that of society within the UK [3].

Organisations have endeavored to encourage females into the profession for over 90 years [4], yet, at a time of unpredictable social and economic conditions, engineering courses in the UK are failing to attract suitable students, and consequently the number of females entering the engineering workforce remains low [5].

This paper describes a study of early career female engineers, typically between graduation and professional qualification, based on semi-structured individual interviews. It presents the perspectives, ideas and recommendations of those interviewed with the aim of discerning the influences on discipline choice and the challenges faced.

### 1 METHODOLOGY

#### 1.1 Research Target Group

Ten early career female civil engineers were selected for the study based on meeting the following criteria.

- 0 – 6 years of working experience (including those graduated or working towards a degree)
- Stage of career prior to professional qualification

It was felt that respondents satisfying these criteria would give a particularly valuable perspective, since they would be able to recall the key influences that encouraged them into STEM subjects and engineering careers as well as being able to pinpoint significant challenges in the profession. Table 1 outlines the participants who took part in the study. The sample was based on contacts of the researcher but was carefully composed to include a range of experiences.

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Table 1. Participants in study

Participant	Age	Company	No. Years work	Notes
01	24	Consultancy	1 year	Pilot interview
02	23	Consultancy	3 months	Recently graduated
03	22	Consultancy	6 months	
04	24	Consultancy	2.5 years	Experienced negative attitudes
05	24	Consultancy	4 months	Recently graduated
06	31	Consultancy and contractor	6 years	Studying PT for degree. Previous accountancy career
07	29	Consultancy	5 years	Close to chartership
08	25	Consultancy	2.5 years	
09	24	Contractor	1 year	Site engineer
10	26	Consultancy and contractor	3 years	Left contractor for consultancy

## 1.2 Research Design

A qualitative technique of semi-structured interviewing was carried out. The use of predetermined topics provided a loose structure, but allowed participants to reveal personal experiences and views. Interactive probing was found to encourage greater reflection on the topic.

A pilot interview was carried out to evaluate the interview structure and to identify any potential issues. Prompts were adjusted slightly as a result.

Once all the interviews had taken place, recordings were summarised and key themes were extracted and analysed.

The interviewer was herself an early career female engineer, and, at the time, a part-time student. She had a strong interest in the subject but was not troubled by any particular challenges in her career or studies. Many of the issues raised by the interviewees were outside her own experience, and while it is inevitable that a different interviewer with a different perspective would have found different areas of emphasis in the interviews, she and her (male) research supervisor made every effort to ensure that emphasis in the reporting was based on the data not on any preconceptions.

## 2 THEMATIC ANALYSIS

The semi-structured approach allowed for a depth of views that had not been initially anticipated prior to conducting the interviews. Thematic analysis identified key themes which are outlined in Table 2, and explored in sections 3. and 4.

Table 2. Key themes

Influences	Challenges
School subjects and type	Cultural attitudes
Teacher encouragement	Family commitments
Peer influences	Flexible working
Careers advice	Lack of female role models
Family influences	Ignorance outside the industry
Personal interests	
Initiatives	

### 3 INFLUENCES

#### 3.1 Academic Influences

All participants showed a keen interest in STEM subjects at school. Most noted an influence from teachers of STEM subjects.

*"My head of 6th form who was a woman said "Go for it, go for it. Be the first female out of [small town] High School to go and do civil engineering." (Participant 01)*

However, the group was split on whether it was better to be taught by male or female teachers. Two participants gained their education from an all-girls school and they thought that they would have received a different experience if they had attended a mixed school.

*"I suppose I came out better at stuff...I didn't have to compete with boys who would maybe more naturally go towards maths." (Participant 08)*

Both of these participants felt that there was more encouragement for them to partake and excel in maths and sciences. Neither felt they were discouraged by their peers, as often friends were like-minded.

*"We were all encouraged because of the school to do science and maths." (Participant 04)*

Many participants felt let down with the careers advice available at school. Only a few stated that engineering was offered to them as a potential career opportunity but these participants still felt that there wasn't enough information on the topic.

*"If you asked about it, they would talk about it, but there wasn't really anything saying "oh come into engineering it's amazing." (Participant 03)*

#### 3.2 Family Influences

A strong consensus amongst participants was that their families were a large influence in encouraging them into engineering. However, reasons for encouragement differed amongst the participants. Several participants had relatives who were within the engineering industry, whilst others were encouraged by the recognised credibility of the career routes by parents.

*"...he's [father] an engineer himself. He was probably quite influential." (Participant 05)*

Surprisingly, one participant explained about being put off a career in engineering by family.

*"When I was a child I always wanted to be a car mechanic....he [father] put me off that sort of thing...my father was just being realistic I think." (Participant 06)*

However, upon changing her career path into engineering at a later date, this participant stated that women were more readily accepted than she had expected, and after several years in engineering felt that attitudes were continuing to improve.

#### 3.3 Personal Influences

*"It was more about me, my passion, experiences and what I've seen from travelling." (Participant 02)*

A large proportion of participants stated that it was also their own personal interests that led them into engineering. Some described how they were proactive in approaching an engineering career. Although they may have been encouraged by teachers and family, they also sought out information and details of engineering careers and courses themselves.

*"I've always been head-strong and self-motivated so I knew straight away that was what I was going to do." (Participant 10)*

Many felt that it was common for people to 'fall into' engineering rather than it being a planned decision, but found that females tended to enter engineering from a specific ambition to become engineers and this is why they were more focused on their careers from an earlier stage than men.

*"We (girls) did engineering because we wanted to be engineers; whereas the guys did it because they wanted to do maths...they maybe didn't want a career in engineering." (Participant 04)*

### 3.4 Influences of Initiatives

When asked to name an initiative aimed at getting women into engineering, most were able to name at least one. However, many felt they weren't generally knowledgeable about initiatives.

*"I'm not very clued up on what initiatives are." (Participant 01)*

The most commonly named initiative was WISE ([www.wisecampaign.org.uk](http://www.wisecampaign.org.uk)), and this was named by a large proportion of participants.

Two interviewees participated on schemes specifically aimed at girls whilst they were in education.

*"One of my teachers suggested the subject to take an opportunity at a university...which was encouraging women to try engineering...I got more interested in the idea of engineering." (Participant 07)*

There was a strong belief that more effective strategies are needed to target girls at a young age.

*"I think it's important that at a young age girls don't think "I can't do that because I'm a woman". But I don't think we should be encouraging people to do it when it's not their skill set." (Participant 05)*

However, a number of participants felt that although schools need to target STEM subjects effectively, initiatives shouldn't just be aimed at females.

*"I think engineering shouldn't specifically target itself at women... I think if it was done the right way, you would get more women interested anyways." (Participant 10)*

Some felt the lack of awareness at school now encouraged them to help raise awareness and take an active part in initiative schemes. Several participants noted that there is potential for initiatives to help reduce institutional barriers. Some said that by promoting the industry, people become more aware of what women can accomplish.

*"It's good to promote and show what's available and what women can achieve if given the right opportunities." (Participant 07)*

## 4 CHALLENGES

### 4.1 Cultural Attitudes

A common theme throughout was that it's not a surprise to see a female engineer within society today.

*"I only have to walk to work to see a woman on the street in hi-vis, it's not a shock." (Participant 01)*

However, a few participants commented that they had encountered negative attitudes whilst at work.

*"...gents that had been there for some time would make what would be considered inappropriate jokes." (Participant 04)*

The majority of participants felt that attitudes differ between male engineers due to two main factors: age and the type of company. Many felt that negative attitudes towards female engineers were less common or acceptable in younger teams.

*"We have a younger team. The old fashion view isn't accepted." (Participant 04)*

Many participants commented that it is the perceptions **outside** the industry that can put females off engineering.

*"When you grow up, people say "engineering is male". (Participant 02)*

The majority felt that when they told people they were an engineer, there was never a clear understanding as to what that involved. For this reason, many felt that stereotypes still exist. The collective view was that this ignorance was often related to age.

*"People just don't know what engineering is anyways so they assume it is those male dominating, butch things, that go on... It's a misconception." [04].*

However, some felt that these opinions are shifting.

## 4.2 Family Commitments

The topic of family commitments drew consistent views from all participants.

*"There's no denying, a family would hinder a woman's career. I know a lot of women who would sacrifice spending time with their young children as they are worried about their career." (Participant 01)*

Many felt that they needed to focus on their career ambitions first, as it was inevitable that their careers would be paused.

*"Career first, then family." (Participant 10)*

Many saw it as important to get to a certain level before having a family, and some explained how they thought that this might be one of the causes of having fewer women in senior positions.

*"...if I took 9 months off, I wouldn't get the same opportunities as when I came back." (Participant 03)*

Participants who worked on site felt that they wouldn't be able to carry on in that role if they decided to have a family.

*"You'd struggle in contracting to do both successfully...you work 12hrs a day, you move around the country every 6 months to a year. If there were children involved, it'd be much more difficult." (Participant 09)*

## 4.3 Flexible Working

When asked about the impact flexible working may have on their career, some felt that no matter how accommodating a company was, they would still be progressing less than their male colleagues.

*"I don't think it's a reasonable option if I want to carry on my career route." (Participant 03)*

Others believed that the flexible working arrangements offered by their companies do help women.

*"I think companies nowadays provide a lot of flexible working hours...open to women being there and having to cope with families at home." (Participant 05)*

Those working in contracting roles noted that flexible working is less available.

*"I've never heard of the option to work part time. It's not advertised." (Participant 09)*

## 4.4 Requirement of Female Role Models

When asked if they felt a lack of female role models was a barrier there was a split of views. Some did feel that having a woman to look up to would encourage and motivate them more than a man.

*"It's definitely important to have female role models in those positions. It shows that anything is possible."* (**Participant 07**)

However, many participants felt that they could take inspiration and be led by men just as well as women.

*"I prefer having a male one (line manager)...it's a lot more straight forward."* (**Participant 08**)

One participant commented that it was her own personal interests which motivated her not role models.

*"Most of my inspirations are my own. I don't need to have a woman to inspire me."* (**Participant 03**)

#### **4.5 Initiatives in the industry**

It was generally felt that having more women in the industry will result in a positive outcome.

*"...we do bring a different outlook, different attitudes on things."* (**Participant 10**)

Some felt that from a male colleague's point of view, they might appear to be receiving preferential treatment. A few participants admitted to actively refraining from taking part in activities at work aimed specifically at females. They were very conscious of the messages attending such groups might convey to their male colleagues and that they did not want to have "special treatment" just because they are female.

*"Have I got an unfair advantage just because of all of this campaigning?"* (**Participant 03**)

### **5 DISCUSSION AND CONCLUSIONS**

In considering the influences and challenges faced by early career female engineers the most notable influences came from families and teachers. Many had a great impact on influencing participants into taking STEM subjects and engineering as a career. In the participants' experience careers advisors had not provided significant encouragement into engineering. Personal interests and drive proved key in encouraging careers within engineering. Role models were seen as important to show what is achievable, but were not necessarily required to be a female.

It appeared that challenges were still faced by many of the participants, more so in having to deal with ignorance and stereotypical views outside of engineering rather than with other industry professionals. However, it was highlighted that there were differing attitudes from colleagues depending on company and sector of employment.

Strong views which emerged from all participants were that there was a need to raise the awareness of the importance of STEM subjects. If more information was available to teachers, and even more so, to families, about the application of STEM subjects, this could have a positive impact on the number of girls entering the industry.

Overall, the picture that emerges from this small study of early career female civil engineers is of attitudes in the industry slowly changing for the better, but of women engineers generally anxious that special treatment of women in the industry would make their professional lives more difficult, not easier. The attitudes and ignorance that have affected them most negatively have generally come from outside the industry not inside it. Where teachers and family have been encouraging, the route to becoming a female engineer has been a realistic one, if not an easy one. However, school and family attitudes can have a discouraging influence. And if that is the view of women who have gone on to become engineers, we can only conclude that that is a source of discouragement for many who have not.

Reversing this situation is, of course, the aim of campaigns for encouraging STEM and engineering study. The steer of this small survey would be that such initiatives should challenge old-fashioned views, but should also aim to encourage both girls and boys to choose STEM subjects.

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