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Women Engineering Students' Workplace Experiences: Impact on Career Intentions, 2004-2005

DOCUMENTATION INDEX FILE
Women Engineering Students’ Workplace Experiences: Impact on Career Intentions

Methodology

The research is based on an Economic and Social Research Council funded project aimed at developing an understanding of women engineers’ earliest encounters with engineering workplaces on their future career intentions. Workplace experiences were examined in the form of the year-long industrial placement taken in HE, as this usually represents women’s first major contact with the engineering industry. A major part of this research also included an investigation of women students’ experiences of engineering education across a range of engineering and related disciplines, including construction/civil, aeronautical, mechanical, design and technology, materials. The research adopted a longitudinal, mixed methods approach, combining interviews, focus groups, documentary analysis and a questionnaire.

The initial stage of the research used a qualitative approach to explore the experiences and reflections of women engineering students at a pre- and post-1992 university, through semi-structured interviews. At this stage 49 second year engineering students were interviewed. Of these, 26 intended to go on industrial placement, 19 had chosen not to go on industrial placement and 4 were part of a programme called Network 75. Network 75 is a programme where students spend 3 days a week in industry and 2 days a week in education. The course takes 5 years and students have their fees paid and receive a salary of between £5-9000. The interviews explored issues such as, women’s influences and reasons for undertaking their particular degree, experiences of their learning environment, placement expectations or reasons for not going on placement and future career intentions.

The second stage of the qualitative research involved semi-structured interviews with 23 women engineering students on industrial placement. All of these students, except one, were from the same cohort as the students in the first set of interviews. These interviews primarily explored students’ work place experiences and the perceived relationship between work and education. The final stage of the qualitative research involved two post-placement focus groups, again with the same cohort of women. The purpose of the focus groups was to explore how women’s attitudes and career intentions had changed as a result of the placement process, and to allow the women to compare and contrast their experiences. Only 13 of the original cohort participated in the focus groups as a number of women dropped out of the research due to other commitments having to take priority.

Access to students was facilitated through university databases and industrial placement coordinators in each of the engineering, or related, departments at the two universities. Students were paid £10 for each interview to compensate them for their time. The use of a semi-structured interview schedule for the interviews meant that key issues identified by the researchers could be explored, while at the same time interviewees could define issues according to their own experiences and understandings.

The interviews were tape-recorded and the focus groups video-recorded, then transcribed verbatim, before being analysed with the computer software NVivo. NVivo was used to employ an approach informed by Grounded Theory, searching for meaning in the data and generating theory from rich, detailed descriptions in the interview transcripts. The initial analysis began with open coding, breaking down, examining, comparing, conceptualising and categorising the data (Strauss and Corbin, 1990); axial coding then ensured relationships between categories were
systematically developed and that all similarities and differences were captured in the final analysis (Langdridge, 2004). The cumulative analysis of findings led to the eventual development of theories and explanations grounded in the data, reflecting the complex nature of the social phenomena investigated.

In addition to the qualitative data collection, a quantitative email survey was conducted after the first set of interviews. The survey was informed by the first, pre-placement interviews and by the literature. The survey was distributed to all male and female undergraduates at the pre- and post-1992 university to allow a comparison between the experiences of men and women students. In order to encourage responses, students were given the opportunity to include their contact details on the survey to be entered into a prize draw for £50 book tokens. All personal details were removed from the survey responses immediately to ensure anonymity. The survey asked students about their decision to study engineering, experiences of HE, industrial placements and their career intentions. The survey was completed by 804 students giving an overall response rate of 22.0%. The response rate was much higher for women students (37.2%) than for men (19.4%). SPSS computer software was used to generate descriptive and inferential statistics from the dataset of 89 variables.
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Non-placement Interview Guide

Background Information

Course
A Levels
Type of school (e.g. all girls, comprehensive etc)
Work experience
Parents jobs
Foreign students – how long have they been in Britain for?

Pathway to Engineering at [university] / Career Decisions

When and why did you decide to study engineering at university?
What factors do you think influenced/impacted your decision to study engineering?
- Family – were they supportive
- Society – education, media, friends, careers literature, advisors
- Situation – chance, least effort
- Socio-economic factors – class, race, sex, shortage of engineers
- Individual – personal strengths - self expectations, ability, interests, attitude, need to achieve
- Psychological/emotional – fear of failure/success, lack of confidence/assertiveness, role conflict?
- Work experience, beliefs about job opportunities

What career research did you do? Did/do you know any engineers to talk to? How did you rule out other options?
What appeals to you about engineering?
What was it that attracted you to this particular sort of engineering (e.g. civil, mechanical)? How did you rule out other disciplines?
Why did you decide to study at [university]? Was it your first choice of university?

Engineering as Male-Dominated

Did you realise that engineering degrees were mostly populated by males? If so did this bother you? Were you ever concerned about the lack of women in engineering?
Do you think more women should be encouraged/enabled to take engineering? What do you think could be done at an early stage in education to encourage them?
Should they be encouraged? What if anything would have encouraged/discouraged you? What disciplines have your friends gone into (male/female)? Why do you think this is so?
What (characteristics) makes a good engineer? Describe one. Do men make good engineers? Do women make good engineers? Any differences?
What do you think are the advantages and disadvantages of being a woman in engineering?

Course Experiences

What did you expect from your degree programme? Skills taught/type of teaching/gender proportions (students/staff)
What have been the best and worst things about your course so far?
Are you pleased you chose this course? Has the course met your expectations? If so how? If not why not? What did you think engineering would be? Is engineering what you thought it would be?

**Influence of Lecturers**
Have you been taught by male or female lecturers? Proportions?
Any differences in subjects taught/style of teaching/proportions of male to female students in the group?
Do you find this encouraging/discouraging?
Do female lecturers treat you the same as male lecturers?
Do you have a personal tutor? Male/female? Do you go to them/are they approachable? Do you go to anyone else for advice on personal/academic areas of concern/worries, etc?
Who or what has been the greatest influence on you since you started your degree course? And in what way?

**Influence of Peers**
Does the type of teaching you have experienced involve much interaction with other students? For example, do you have to do much group work or presentations?
Do you choose who you work with in groups? How do you decide who to work with?
Do you prefer to work with other women? Why? What good/bad experiences have you had of working in groups?

**The Placement**
Why did you decide not to go on placement? Would you have liked to go on placement?
Do you think there are any particular advantages or disadvantages of going on placement?

**Work Experience**
Have you had any other experience in the industry? How did you find this? Was it what you expected? What type of work were you given to do?
What were the best and worst things about the experience? Did you enjoy it? Did you face any discrimination?
What did you learn from this? What skills have you gained?
Have you used anything you learnt from the work experience back in the classroom?
Do you think that your educational experience/the way you are taught reflects the reality of what it is like in the industry?

**Work**
Do you know what type of company you would like to work for when you have finished your degree?
What sorts of things will attract you to a company (e.g. equal opportunities, training opportunities, pay, career prospects etc.)?
How do you think work will differ to university (e.g. in what is expected of you, the type of work you will be doing, skills you will be using, how you are treated etc.)?
What aspects of university teaching/advice do you think will help you in the industry?
What do you think you will take from the course into the workplace (e.g. technical skills, interpersonal skills)?
What do you think will be the best and worse things about working in the engineering industry?
Do you think that the course/university experience prepares you for the workplace?
Do you think it should?

Career

In terms of your career, where do you see yourself in 2, 5 and 10 years time?
What would be your ideal career? What sort of job would be your ideal? Do you think you think you will encounter any difficulties in trying to achieve your career ideal?
What? How will you overcome difficulties?
Do you want to work abroad?
Do you think that the career prospects are good in your field of engineering for the sort of career you want?

If you are not considering a career in engineering, why is this? Did you at any point want to be an engineer? What changed your mind?

**SWOT Analysis** of career decisions to date (strengths, weaknesses, opportunities, threats):
Are you happy with the career choices so far? What are the best and worse career decisions you think you’ve made and why? Would you do anything differently if you went through it all again?

Culture

What 5 words would you use to describe the culture/characteristics of the engineering industry? If necessary provide a simple definition of ‘culture’.
Do you think the engineering culture is male? Why?
Do you think any aspects of the engineering culture will be problematic for you? Why? What will you do to overcome this?
Do you think your educational experiences differ from other students, for example in social sciences?
Women Engineering Students' Workplace Experiences: Impact on Career Intentions

Pre placement Interview Guide

Background Information

Name
Age
Course
A Levels
Type of school (e.g. all girls, comprehensive etc)
Work experience
Parents jobs
Foreign students – how long have they been in Britain for?

Pathway to Engineering at [university] / Career Decisions

When and why did you decide to study engineering at university?
What factors do you think influenced/impacted your decision to study engineering?

• Family – were they supportive
• Society – education, media, friends, careers literature, advisors
• Situation – chance, least effort
• Socio-economic factors – class, race, sex, shortage of engineers
• Individual – personal strengths - self expectations, ability, interests, attitude, need to achieve
• Psychological/emotional – fear of failure/success, lack of confidence/assertiveness, role conflict?
• Work experience, beliefs about job opportunities

What career research did you do? Did/do you know any engineers to talk to? How did you rule out other options?
What appeals to you about engineering?
What was it that attracted you to this particular sort of engineering (e.g. civil, mechanical)? How did you rule out other disciplines?
Why did you want to do a sandwich course? Was it a conscious decision?
Why did you decide to study at [university]? Was it your first choice of university?

Engineering as Male-Dominated

Did you realise that engineering degrees were mostly populated by males? If so did this bother you? Were you ever concerned about the lack of women in engineering?
Do you think more women should be encouraged/enabled to take engineering? What do you think could be done at an early stage in education to encourage them?
Should they be encouraged? What if anything would have encouraged/discouraged you? What disciplines have your friends gone into (male/female)? Why do you think this is so?
What (characteristics) makes a good engineer? Describe one. Do men make good engineers? Do women make good engineers? Any differences?
What do you think are the advantages and disadvantages of being a woman in engineering?
Course Experiences
What did you expect from your degree programme? Skills taught/type of teaching/gender proportions (students/staff)
What have been the best and worst things about your course so far?
Are you pleased you chose this course? Has the course met your expectations? If so how? If not why not? What did you think engineering would be? Is engineering what you thought it would be?

Influence of Lecturers
Have you been taught by male or female lecturers? Proportions?
Any differences in subjects taught/style of teaching/proportions of male to female students in the group?
Do you find this encouraging/discouraging?
Do female lecturers treat you the same as male lecturers?
Do you have a personal tutor? Male/female? Do you go to them/are they approachable? Do you go to anyone else for advise on personal/academic areas of concern/worries, etc?
Who or what has been the greatest influence on you since you started your degree course? And in what way?

Influence of Peers
Does the type of teaching you have experienced involve much interaction with other students? For example, do you have to do much group work or presentations?
Do you choose who you work with in groups? How do you decide who to work with?
Do you prefer to work with other women? Why? What good/bad experiences have you had of working in groups?

Placement Preparation
What aspects of university teaching/advice do you think will help you on your placement? What skills from the course will you take to the placement with you?
Do you have any previous work experience?
What skills did you acquire that you think might be useful on your placement?
Do you feel prepared and ready to go on placement? Has the university done anything to help prepare you for the placement? Do you feel that your educational experience/the way you are taught reflects the reality of what it will be like when you go to work in the industry?

The Placement
Why did you choose to go on a placement? Why do others choose to (or not to) go on a placement? Any differences between male and female students?
Did anyone encourage you, or not, to go on a placement? Either in the university or outside? What are their reasons for arguing so? Did this influence you at all? In what way?

The organisation
Do you know where you are going on your placement yet?
How much say did you have on where to go on placement? What was the advice given to you? By whom?
What attracted you to this company? E.g. type of job, pay, equal opportunities policies, training opportunities, career prospects, proportions of men and women?
What sort of research into the company did you do? Would you prefer another placement? Why?
What do you know about the organisation you will be going to work for? 
Where did you find this information (e.g. company literature, other students, internet)?
How involved are/were the university in helping you find a placement?
Are you a sponsored student? Is the placement a requirement? If it wasn’t would you still choose to go on it?

Expectations
What are you expecting to get out of your placement? E.g. ability to relate theory & practice, self-confidence, learn about attitudes and practices of management and workers, improve career prospects?
What do you think will be the worst and best things about your placement? What are you most looking forward to/apprehensive about?
Do you know what sort of work you will be doing on your placement?
What do you hope to be doing?
How do you expect work to differ from university? E.g. in what is expected from you, how you are treated, skills you will be using?

Career
In terms of your career, where do you see yourself in 2, 5 and 10 years time? 
What would be your ideal career? What sort of job would be your ideal? Do you think you think you will encounter any difficulties in trying to achieve your career ideal? 
What? How will you overcome difficulties? 
Do you want to work abroad? 
Do you think that the career prospects are good in your field of engineering for the sort of career you want?

SWOT Analysis of career decisions to date (strengths, weaknesses, opportunities, threats):
Are you happy with the career choices so far? What are the best and worse career decisions you think you’ve made and why? Would you do anything differently if you went through it all again?

Culture
What 5 words would you use to describe the culture/characteristics of the engineering industry? If necessary provide a simple definition of ‘culture’.
Do you think the engineering culture is male? Why?
Do you think any aspects of the engineering culture will be problematic for you? Why? What will you do to overcome this?
Do you think your educational experiences differ from other students, for example in social sciences?
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Placement Interview Guide

As well as the following questions, which all placement students will be asked, additional issues may be raised from interviewee’s pre-placement interviews.

Introduction

- When did you start the placement?
- Can you tell me a bit about the organisation you are working for? Who do you report to etc.? What is the nature of the company? Are they an engineering company?
- How would you describe the company’s attitude to women?

Preparation for Placement

- How useful do you think your degree course so far has been to the work you’re currently doing?
- Are there any particular skills that have been useful?
- Is there anything you wish you had learnt before you started the placement? (doesn’t just need to be technical skills, what about preparation for dealing with different relationships (e.g. boss, colleagues, clients) and culture of the organisation).
- Were you taught anything about health and safety?
- Do you think the university could have done more to prepare you for the placement?
- Before you started the placement, did the university or your department state what they hoped you to gain from the placement?

Education to Work Transition

- How have you found the transition from education to work? Has it been easy/difficult? How? Why?
- Have you had to face any new issues (e.g. office politics, learning how to work, dealing with the boss)?
- Do you feel that your educational experience reflects what it is like in industry? For example, in the way university/work are structured and what you are taught?
- How do you feel about going back to university after the placement? Will this be an easy/difficult transition?
- How do you think that work and university differ?
- Do you think that university and work have different priorities, goals and values? What are they? What impact does this have on you (as someone placed between the two)?

Organisation

- Can you describe the organisation/company you are working for? What do they do? How big are they? How many women do they employ (in professional roles)?

- Does the company have a structure/programme in place for placement students? If so, how does it work/what does it involve? What do you think about it? Is it good? Could it be improved? If not, do you think it would be a good idea? Why?
What does your job/role in the company involve? Is it what you expected, or what you were told to expect prior to starting the placement?

Do you feel that any promotional information you had about the company prior to starting the placement portrayed an accurate picture of the company? Why?

Do you feel you’ve been given an appropriate level of responsibility?

Have the company been supportive of you as a new recruit/placement student? Have they let you find your own feet? Is this good/bad?

Do you know if other women in the company have experienced any difficulties because of their gender?

Placement Experiences

How would you summarise your placement experience so far?

Has the placement been a positive experience?

What have been the best and worst things about the placement so far? (can you provide examples?)

Has the placement met your expectations? Is there anything you thought you would achieve but haven’t so far (e.g. personal development, making up mind about future career – refer back to expectations expressed in first interviews)

What do you think you have gained from the placement? What do you now think are the benefits of doing a placements? Do you think there are any drawbacks to doing a placement?

Do you think you have changed personally as a result of your placement experience? (E.g. more confident, independent etc.)

Pick up on any concerns raised about placement in first interview. E.g. were you right to be concerned about your capabilities? Has this been an issue or were you unnecessarily apprehensive?

Do you think you will use what you’re learning on placement in the final year of your degree? Give examples.

Relationships

Are there other students on placement at the organisation? Are they male or female? Do you think you are treated equally?

Do you think it has been an advantage or disadvantage having other students on placement with you? (E.g. has it made the workplace competitive, or do you support each other through shared experiences?)

Do you think you are treated the same as other permanent members of staff? Why do you think this is? If not, how do you cope with this/how do you feel about it? Have you discussed this with anyone (supervisor, placement tutor, friends)?

Has your work involved much team/group work? How has this been organised (e.g. was it to work on a specific project? Were roles determined within the group or before you started?)?

Are there any particular people you liked or disliked working with? Why?

How would you describe your overall experiences of group work? Good/Bad? Why? Give examples.

How does doing team work in the workplace compare to doing team work at university? Is it easier, harder, more focused, clearer roles for individuals? Why?

Mentors and Role Models

Have you been given a mentor in the company? What are you views on this? What do you think are the benefits and drawbacks of mentoring?
What do you think the role of a mentor is? Has this been achieved?
Would you rather have a different mentor? Why?
Have you been given any bad advice by your mentor?
What do you think the role of mentee is?
Is there anyone else you go to for advice (e.g. colleagues, other students)?
Is there anyone in the company who you regard as a role model? Why? Are the male or female?
What do you think makes a good role model?

Contact with University

- Has anyone from the university been to visit you while you’ve been on placement?
- Do you know what the purpose of the visit was? How long were they here for? Did they speak to you and your line manager?
- Did you know this person already (e.g. have you been taught by them)? Or were they a stranger to you?
- Would you be happy to go to this person if you had a problem with the placement?
- Are you in contact with this person or any other member of staff at the university at other times?
- Do you know if there is complaints procedure (at university and in workplace) to follow if you did have any problems? What do you think about this? Is it usable?

Gender Issues

- Are there appropriate (physical) facilities for women at your organisation? (E.g. women’s toilets, clothing that fits etc).
- Can you think of any occasions where you feel your gender determined reactions from colleagues or the outcome of a particular event?

Future Work/Career

- Do you want a career in engineering? What sort of career (e.g. in what field? And what sort of role – managerial or technical/specialist?)
- Do you think that your career ambitions have changed at all as a result of the placement experience? How? Why?
- Do you think the placement experience will help you when you start work after you’ve finished university? Will it still be helpful even if you want to enter a different field of engineering to your placement, or if you follow a completely different career path?
- How do you think your placement experience will help you cope when you start work after graduation (particularly in terms of coping in male environment)?
- Would you like to work for the company when you graduate?

Culture (all these questions can be compared to answers in first interview)

- What five words would you now use to describe your field of engineering? (Is this an easier task now?)
- What advantages/disadvantages do you think there are to being a woman in engineering?
- Are you still concerned/unconcerned by the fact there are so few women in engineering?
- Do you still think that women should/shouldn’t be encouraged/enabled into the industry?
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Post placement Focus Group Guide

Intro
Each participant to introduce themselves, saying who they are, what dept./course they are in/on, and where they went on placement.

Task
Post-it notes write down 1-5 how committed you are to an engineering career on the basis of your placement?
E.g. 1=I really don’t want to stay in engineering industry
      5=Love it, really want to do engineering.

• Do women want a career in engineering? Why?
• Have views changed as a result of placement?
• What is impact of placement on career intentions?
• How do you feel now compared to how you felt before you went on placement?
• What are your aspirations?
• Is that particular to your placement, work experience, discipline?
• Do you think male students feel the same as you?

Probes

• Do women in industry work in different roles to men in industry? (e.g. health & safety)?
• What level of responsibility did you have on your work placement? Was this different to male colleagues?
• What have you learnt about the engineering culture since being on placement?
Break down – hierarchy, managerial styles, relationships, physical environment … How do people feel about this?
• What are the advantages and disadvantages of being a woman in engineering?
• Is the lack of women in engineering an issue? Does gender matter? Is engineering gendered (refer to gender continuum)?
• What are the solutions? What should schools, university, industry and government do?

Other questions
• What factors influenced the decision to study engineering?
• Focus on placement preparation – can the university do more to help?
• How useful is the degree to placement?
• What are the main differences between education and work?
• Have you had an appropriate level of responsibility at work?
• Have you faced discrimination at work? As a student, as a woman?
• Has university supported you through the placement?
• How do you feel about getting Chartered?

Conclusion
Summarise session and clarify views and opinions.
Need to reach conclusion about the impact of placement on career intentions
Completing the Survey: Please use the left hand mouse button to select your answer (only selecting one answer for each question) or type your answers in the grey shaded areas.

SECTION A – CAREER CHOICE

In this section we would like you to tell us about the things that influenced your decision to study engineering.

1. Please state whether you agree or disagree that the following items influenced your decision to study engineering?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I was attracted to engineering because of the high salary</td>
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<tr>
<td>B. Engineering provided an opportunity to do interesting work</td>
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<td>C. I wanted the challenge of solving problems</td>
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<td>D. I wanted to use my science and maths background without specialising in either</td>
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<tr>
<td>E. I was good at maths and science at school</td>
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<tr>
<td>F. I chose to study engineering with little knowledge of what engineers actually do</td>
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<td>G. I knew about engineering because a member of my family is involved in the industry</td>
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<tr>
<td>H. My hobbies and interests are of a technical nature</td>
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<tr>
<td>I. Engineering will be a good degree to have even if I decide not to enter the profession</td>
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<tr>
<td>J. Engineering appealed to me because it is so varied</td>
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<td>K. My mother encouraged me to study engineering</td>
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<td>L. My father encouraged me to study engineering</td>
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<td>M. My careers advisor encouraged me to study engineering</td>
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<td>N. My school teacher(s) encouraged me to study engineering</td>
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<tr>
<td>O. Nobody encouraged me to study engineering</td>
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</tbody>
</table>

2A. Have you ever attended an engineering insight course?

Yes [ ] No [ ]

B. If you answered YES please state whether the course encouraged you to study engineering?

Yes [ ] No [ ]

3. Did anyone discourage you from studying engineering?

Yes [ ] No [ ]

If you answered YES please state who it was that discouraged you from studying engineering:

SECTION B - EXPERIENCES OF HIGHER EDUCATION

In this section we would like you to tell us about your experiences (so far) of engineering or design technology in Higher Education.

4. Please state whether you agree or disagree with the following statements about your degree

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. The level of practical work (such as working on real life projects) on the course is just right</td>
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<td>B. The engineering curriculum is more difficult than I expected</td>
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<tr>
<td>C. I am pleased I chose to study engineering</td>
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<td>D. It is difficult to understand the relevance of some modules</td>
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<tr>
<td>E. Engineering students are competitive</td>
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<tr>
<td>F. Male students are more confident in class than female students</td>
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<td></td>
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<tr>
<td>G. Female students get more help in class than male students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Please state how satisfied you are with the following items about your course

A. Quality of lectures
B. Support from lecturers
C. Support from my personal tutor
D. Group work
E. Number of teaching hours
F. The friends I've made
G. The quantity of coursework we have
H. Theory
I. Practical work
J. Design work
K. The variety of subjects the course covers

6. Have you/do you intend to go on placement?
   Yes □ (please go to Q7)
   No □ (please go to Q8)

7. Why did/do you want to go on placement?

A. For the work experience
B. Because I need the money
C. I needed a break from education
D. To improve my chances of getting a job when I finish university
E. To help me decide what I want to do when I finish university
F. To give me an idea of what industry is really like
G. Personal development (e.g. to increase my confidence and independence)
H. To improve my grades when I return to university
I. It will be an opportunity to apply the theory I've learnt at university
J. It will help me decide what to do for my final year project
K. The year in industry counts towards getting my Chartership
L. Other (please state)
8. Why did you choose/have you chosen not to go on placement?

<table>
<thead>
<tr>
<th>Option</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I already have work experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. I could not find a placement in a suitable location</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. I thought it would be too difficult to get back into education after a break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. I want to finish university as soon as possible so I can start earning money</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. I don’t think there is anything to be gained from going on placement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. I could not find a placement where the work I would be doing appealed to me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. I applied for placements but was not accepted</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Other (please state)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION D - FUTURE IN ENGINEERING

In this section we would like you to tell us about your career intentions and the type of things you will look for in your chosen career.

9. What area of engineering would you prefer to specialise in? (please tick only one box)

- Consultancy
- Manufacturing
- Design work
- Don’t know
- Contracting
- I do not want a career in engineering
- Other (please state)

10. Would you like to go on to further study?

- Yes
- No

If you answered YES please state the area/subject you would like to study

11. How important will the following be when making a decision to accept a job or when deciding where to work when you leave university

<table>
<thead>
<tr>
<th>Option</th>
<th>Very Important</th>
<th>Important</th>
<th>Neither important nor unimportant</th>
<th>Unimportant</th>
<th>Very unimportant</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Salary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Working Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. People you work with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Opportunity to travel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Benefits like a company car</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Training Opportunities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Opportunities for promotion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Equal opportunities policies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Opportunity for flexible working</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Child-care policies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. In the future, would you prefer your work role to be:

- Managerial
- Technical/Specialist
- Don’t know

13. In your opinion, how important is it for you to get Chartered Engineering status?

- Important
- Not important
- Not applicable (i.e. my subject area does not have chartership)
## SECTION E – ABOUT YOU

This section seeks background information necessary for us to interpret your other responses. In NO circumstances will attempts be made to identify individuals.

### 14. Are you?

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
</table>

### 15. What is your age?

<table>
<thead>
<tr>
<th>18</th>
<th>22</th>
<th>23</th>
<th>24-29</th>
<th>30 or over</th>
</tr>
</thead>
</table>

### 16. What is your religion?

<table>
<thead>
<tr>
<th>None</th>
<th>Jewish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christian</td>
<td>Hindu</td>
</tr>
<tr>
<td>Muslim</td>
<td>Buddhist</td>
</tr>
<tr>
<td>Sikh</td>
<td></td>
</tr>
<tr>
<td>Other (please state)</td>
<td></td>
</tr>
</tbody>
</table>

### 17. What is your ethnic group?

<table>
<thead>
<tr>
<th>White</th>
<th>British</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irish</td>
<td></td>
</tr>
<tr>
<td>Any other White background</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td>White &amp; Black Caribbean</td>
<td></td>
</tr>
<tr>
<td>White &amp; Black African</td>
<td></td>
</tr>
<tr>
<td>White &amp; Asian</td>
<td></td>
</tr>
<tr>
<td>Any other mixed background</td>
<td></td>
</tr>
<tr>
<td>Asian or Asian British</td>
<td></td>
</tr>
<tr>
<td>Pakistani</td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td></td>
</tr>
<tr>
<td>Bangladeshi</td>
<td></td>
</tr>
<tr>
<td>Any other Asian background</td>
<td></td>
</tr>
<tr>
<td>Black or Black British</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td></td>
</tr>
<tr>
<td>African</td>
<td></td>
</tr>
<tr>
<td>Any other Black background</td>
<td></td>
</tr>
<tr>
<td>Chinese or Other</td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td></td>
</tr>
<tr>
<td>Any other ethnic background</td>
<td></td>
</tr>
</tbody>
</table>

### 18. Which type of secondary school did you attend?

| Mixed sex school | Single sex school |

### 19. Which year of study are you in?

| Part A | Part B | Part C | Part D | Placement year |

### 20. Which department are you in?

### 21. Which course are you on?
The following space is available for any additional comments you would like to make about your experiences of engineering in higher education.

If you would like to take part in the prize draw (£50) please complete the details below. Please be assured that these details will be separated from your completed questionnaire and that your answers will remain confidential.

Name:

Email Address:

Thank you for taking the time to complete this questionnaire

Please return your completed survey via email to [email] as an attachment ASAP
ACTIVITIES AND ACHIEVEMENTS QUESTIONNAIRE

1. Non-Technical Summary
A 1000 word (maximum) summary of the main research results, in non-technical language, should be provided below. The summary might be used by ESRC to publicise the research. It should cover the aims and objectives of the project, main research results and significant academic achievements, dissemination activities and potential or actual impacts on policy and practice.

Introduction
In the UK several Government initiatives have been introduced to encourage women to pursue careers in the engineering professions. Such initiatives have had some success in increasing the number of women studying engineering. However, the increase in women engineering students has failed to translate into an equivalent increase in women engineering professionals.

Aims & Objectives
Accordingly this research aimed to develop an understanding of the influence of women engineers’ earliest encounters with engineering workplaces on their future career intentions. One of the novelties of this approach is that it recognises that engineering is a term used for a heterogeneous and wide-ranging set of subjects. The research objectives were to:

- Compare the nature of women engineers’ early career experiences through the experiences of women engineering students on their industrial placements from university, with their pre-experience expectations, and establish any mismatches likely to affect their transition into engineering professionals.
- Compare the attitudes and experiences of women engineering students going on industrial placement with those who choose not to go on placement, and to explore the impact this has on career intentions.
- Investigate the role of lecturers in influencing women’s attitudes towards the workplace.
- Explore the wider validity and applicability of the findings of the Bagilhole et al., (RES-000-22-1679) ESRC-funded study on women’s experiences within the construction industry, in particular investigating the distinct aspects of different engineering workplaces and cultures.
- Identify aspects of engineering sub-cultures and structures that play a positive role in women’s career satisfaction and achievements, and to develop a framework of transferable initiatives capable of application across engineering disciplines.

Research Methods
The research adopted a mixed methods approach, using qualitative interviews and focus groups to explore the experiences and reflections of women engineering students from a pre- and post-1992 university, before, during and after their industrial placement.
Alongside this, an email survey of all male and female engineering undergraduates, at the same universities, was conducted.
**Key Findings**

The research revealed a number of key findings, outlined below. However, it should be noted that these are neither mutually exclusive nor exhaustive. The summary of findings necessarily makes generalisations, masking many of the nuances and variety of experiences resulting from the different personalities, engineering disciplines and sectors and types of organisations explored.

- The research found a significant difference between students studying at the pre- and post-1992 universities. Students from the post-1992 university were more likely to be mature students or part-time students with different experiences and priorities to the mostly post A-level students at the pre-1992 university.
- Women engineering students identify engineering degrees as a good basis for a variety of career paths, not just in the engineering sectors. Women engineering students have not necessarily decided to pursue an engineering career.
- Women engineering students are not always comfortable with the teaching and learning methods (e.g. curriculum content, assessment methods, emphasis on theory) used in higher education (HE). Women and men students want a more practical, relevant curriculum.
- Women found that the skills most transferable from HE to the workplace are practical and generic skills, not the technical and theoretical knowledge taught throughout their degree programmes.
- The transition from education to work can be difficult for students in terms of adjusting to the practicalities and routines of work, as well as the workplace culture. The industrial placement can therefore ease the transition to employment following graduation as well as informing career choice amongst women engineering students.
- Women engineering students adopt a variety of strategies for coping both as an industrial placement student and in a male-dominated environment. These include acting like one of the boys, accepting gender challenges, building a reputation and downplaying any disadvantages in favour of advantages. Such coping mechanisms focus attention on the women themselves, rather than on processes implicit within organisations.
- Women overwhelmingly found that, both in the engineering classroom and workplace, their gender was, unwittingly, likely to ensure that they received more help than their male counterparts. On the negative side this indicates that women are widely viewed in engineering as less capable than their male counterparts.
- Women perceived themselves to be more employable as a result of their gender. Women felt that companies were trying to recruit more females in order to improve their image. Whilst a drive to recruit more women into the industry is commendable, this has had the effect of making women doubt their own abilities (‘have I been employed for my capabilities or my gender?’). Alternatively, this also led women to believe, possibly falsely, that engineering workplaces would be equitable for women, posing the question of whether ‘getting in’ is the same as ‘getting on’ in engineering industries.
- Women students were found to value their status as a ‘novelty’ in engineering and held traditionally stereotypical views of women outside engineering. These attitudes may be a result of women’s assimilation into the engineering culture, and do little to further women’s causes in engineering.
- Students are unlikely to be critical of a career in which they just embarking. Therefore not surprisingly women in this study were found to have a positive attitude towards engineering and their chosen professions and did not feel that any negative aspects about the industry affected them as individuals.
**Significant Academic Achievements**

The research makes a significant empirical and theoretical contribution to the field of gender, work and organisation. The research has provided an insight into engineering education and work, women’s experiences, and the strategies they develop for coping in a male dominated environment.

The research has also enabled a member of the research team to undertake a PhD, which is due for completion in Autumn 2006.

**Dissemination Activities**

The research team has presented seven refereed papers at leading conferences and published one journal article in Equal Opportunities International during the course of the project. One more journal article has been accepted for publication, and two further papers have been accepted for presentation at forthcoming international conferences. An additional journal paper and invited book chapter are in preparation.

The research findings will also be published in collaboration with the UK Resource Centre for Women in Science, Engineering and Technology (UKRC), which will ensure a very wide audience including engineering employers in the private sector.

**Impact**

These research findings have led the research team to make a number of recommendations for improving women engineers’ education and workplace experiences, which are detailed in the main report. A number of engineering employers and the DTI Implementation Group for Women in Science, Engineering and Technology (SET) have also been consulted.
6. Major difficulties

Please detail below any major difficulties, scientific or administrative/logistical, encountered during your research and comment on any consequent impact on the project. Further details should be included in the main report, including any advice you might have for resolving such problems in future projects.

The research team had some difficulties recruiting research participants to take part in placement interviews at Glamorgan University as a result of the limited number of students undertaking such placements. At the time of writing the research proposal far more women were registered on sandwich courses in relevant disciplines at Glamorgan than at the time the research was conducted. The fact that fewer students chose to take part in the industrial placement at Glamorgan University in comparison to Loughborough University is an interesting finding and may reflect the different socio-economic backgrounds of students at the two universities, (see 4.1 University Differences, in the main report).

Therefore, to compensate and extend the research, students on courses related to engineering (such as design and technology students) and non-placement students were interviewed. In addition, the email survey was developed to include male engineering students as well as females for comparative purposes.

7. Other issues and unexpected outcomes

Please describe any outcomes of your research, beneficial or otherwise that were not expected at the outset or other issues which were important to the research, where these are not addressed above. Further details should be included in the main report.

The research revealed a number of interesting findings that were unexpected and exceeded the original aims and objectives:

- The differences between students at Loughborough and Glamorgan universities were far more apparent than that expected.
- The research showed that experiences of engineering education (including the curriculum content and classroom culture) have a significant impact on students.
- The research established that some women engineering students value their novelty status and hold traditionally stereotypical views of women outside engineering. These attitudes may be the result of women’s assimilation into the engineering culture.
- A number of modifications were also made to the research methods, including the addition of interviews with women engineering students choosing not to go on industrial placement and the expansion of the survey to include male engineering students. These changes created a greater scope for comparative data analysis.

Principal Award Holder:
Prof. B.M. Bagilhole (Loughborough University)

Co-Award Holders:
Dr. A.R.J. Dainty (Loughborough University)
Prof. R.H. Neale (University of Glamorgan)

This report summarises the findings and achievements of an inter-disciplinary, longitudinal research project, which aimed to explore the experiences of women at the outset of their engineering careers, which is a key stage identified as crucial in their future commitment to their profession.

1. Background

The UK Engineering industry is quantitatively and hierarchically male-dominated. This is highly significant given the impact of engineering on society. Engineering has a popular image of being tough, heavy and dirty. These powerful cultural images have helped to reproduce occupational segregation whereby engineering is perceived as unsuitable for women. This is despite research by the Scottish Higher Education Funding Council advising that female engineers are generally perceived to be better qualified and more highly motivated than their male counterparts (SHEFC, 1997). In fact, studies have shown that women are not driven away from technology because of lack of ability, but rather because of ‘an atmosphere of dominant masculinity’ (Sagebiel, 2003). A business case has been put forward for increasing the number of women (Bagilhole, 1997), because failure to do so means the industry is under-utilising the full range of skills and talents in the population. In addition, a more gender-balanced organisation should be able to increase efficiency and effectiveness by projecting a more pluralistic self-image.

As a result of such arguments numerous initiatives have been employed to increase the numbers of women entering engineering education and employment. In 1984, for example, the Women into Science and Engineering (WISE) campaign was established, with the support of the Equal Opportunities Commission and Engineering Council. The publication of the Construction Industry Board (CIB, 1996) report also raised equal opportunities to the top of the construction industry’s performance improvement agenda, particularly in the light of the skills shortfalls forecast in the millennium (Dainty et al., 1999). Such initiatives have had some success in increasing the number of women studying engineering. Glover (2000) reported that in 1973 only 3% of engineering and technology students were women. This is compared to 15% in 2003/04 (HESA, 2005). This, however, is still significantly below the average across all subjects (57%) (HESA, 2005). In fact, only 1.6% of all female students in higher education (HE) are based in engineering (HESA, 2005), suggesting that while the number of women studying engineering has increased, this is, in part, attributable to the rise in female students across all university disciplines. Furthermore, the increase in women engineering students has failed to translate into an equivalent increase in female engineering professionals, with indications that less than 10% of professional engineers are women (Fielding and Glover, 1997). More recent estimates suggest that women only account for 6% of engineers and
As Rossiter (1982) states, educational progress for girls, does not automatically mean occupational progress. It is important, as Evetts (1997) has claimed, to examine what happens to women once they enter the engineering professions, not only in terms of retention, but also to consider whether there are significant gender differences in experiences of professional engineering, in order to seal the so-called ‘leaky pipeline’. The ‘leaky pipeline’ analogy has been used to reflect the numbers of women leaving engineering at various points throughout their careers. Accordingly, this study aimed to develop an understanding of the influence of women engineers’ earliest encounters with engineering workplaces on their future career intentions.

2. Objectives

The original objectives of the study are stated below, along with how these have changed and an explanation of how each has been met as part of the study.

2.1 Objective 1

To compare the nature of women engineers’ early career experiences through the experiences of women engineering students on their industrial placements from university, with their pre-experience expectations, and establish any mismatches likely to affect their transition into engineering professionals.

This objective was achieved by adopting a longitudinal research approach, whereby a cohort of women engineering students were interviewed before and during their industrial placements. Focus groups were also carried out with the same cohort of students post-placement through which their experiences could be compared and contrasted. An email survey of all male and female undergraduates was also carried out exploring and comparing engineering students’ career choices, reasons for going or not going on placement, and career intentions.

2.2 Objective 2

To compare the attitudes and experiences of women engineering students going on industrial placement with those who choose not to go on placement, and to explore the impact this has on career intentions.

Once the research was in progress, it was discovered that a substantial proportion of students chose not to go on industrial placement. An additional objective was therefore introduced to explore the attitudes and experiences of women engineering students who chose to go on placement with those who chose not to. This was achieved by complementing the pre-placement interviews with interviews with second year women students who had chosen not to go on placement. A number of students that took part in pre-placement interviews subsequently also decided not to go on industrial placement.

2.3 Objective 3

To investigate the role of lecturers in influencing women’s attitudes towards the workplace.

The role of lecturers was explored primarily through the interviews with women engineering students, in which participants were asked about their experiences of engineering education, the information provided to them about industrial placements, and the perceived relationship between education and work. In addition the email survey questioned students about the role of lecturers. Departmental industrial placement
coordinators were interviewed regarding how departments’ prepare students for placement, and the relationship between lecturers and students during the industrial placement year.

2.4 Objective 4

To explore the wider validity and applicability of the findings of the Bagilhole et al., ESRC-funded study on women’s experiences within the construction industry, in particular investigating the distinct aspects of different engineering workplaces and cultures.

Bagilhole et al.’s ESRC-funded study (RES-000-22-1679) showed that men and women construction professionals experience disparate career progression. This was found to stem from the gender differentiated effect of structural and cultural factors that shaped career development within organisations and the interactive strategies of men and women in coping with such constraints and exploiting career opportunities. Large construction organisations were found to act as arenas for the manifestation of discriminatory and exclusionary behaviour towards women. Such cultures were maintained by the career structures of organisations, which led to the subordination of women’s contribution and the restriction of their development.

In the subsequent study, this objective was achieved by exploring the validity of these findings to other industries within the engineering sector. Thus, while previous research undertaken into women’s experiences and careers in engineering (e.g. Evetts, 1996) have tended to treat ‘engineering’ as a single, homogenous sector, this research has considered whether specific structures and cultures underpin individual engineering disciplines and professions. This has been accomplished by interviewing women engineering students from a number of different engineering disciplines (including manufacturing, aeronautical, civil, chemical and design and technology) and workplaces.

2.5 Objective 5

To identify aspects of engineering sub-cultures and structures that play a positive role in women’s career satisfaction and achievements, and to develop a framework of transferable initiatives capable of application across engineering disciplines.

This objective was achieved using the qualitative and quantitative aspects of the research. Analysis of data adopted a holistic approach, addressing not only issues that deter women from pursuing an engineering career, but also those factors within engineering education and workplace cultures that encourage them. The findings emerging from the analysis were then used to make a number of policy recommendations which were discussed with, and evaluated by, a number of engineering employers and professionals, the UK Resource Centre for Women in Science, Engineering and Technology, and the Department of Trade and Industry Women and Science, Engineering and Technology Implementation Group.

3. Research Methods

The research adopted a longitudinal, mixed methods approach, combining interviews, focus groups, documentary analysis and a questionnaire.

The initial stage of the research used a qualitative approach to explore the experiences and reflections of women engineering students. Two semi-structured interviews were conducted with 26 industrial placement students at a pre- and post-1992 university.
Access to students was facilitated through university databases and industrial placement coordinators in each of the engineering, or related, departments at the two universities. Students were paid £10 for each interview to encourage participation. The use of a semi-structured interview schedule for both sets of interviews meant that key issues identified by the researchers (such as, influences and reasons for undertaking their particular degree, experiences of their learning environment, the transition to work, placement experiences, future career intentions, and so on) could be explored, while at the same time interviewees could define issues according to their own experiences and understandings. Following this stage two focus groups of the same women were conducted. The purpose of the focus groups was to explore how women’s attitudes and career intentions had changed as a result of the placement process, and to allow the women to compare and contrast their experiences. Only 13 of the original cohort participated in the focus groups as a number of women dropped out of the research due to other commitments having to take priority.

The pre-placement interview stage of the research was complemented by including an additional 26 interviews with women students at the pre- and post-1992 universities, who had chosen not to go on industrial placement. These interviews explored similar issues to those described above as well as investigating women’s decisions not to go on placement. Access to these students was facilitated through university databases and programme coordinators. These students were also paid £10 to participate in the research.

The qualitative data collection also included interviews with eight industrial placement coordinators (four from each university). These interviews explored a range of issues including the aims of the placement, numbers of students that go on placement, how students find placements and the departmental support provided, how placements are monitored and problems that previous students have encountered on placement. In addition, documentation surrounding the placement, such as the information given to students and employers, was also analysed from the post-1992 university and from each of the seven engineering, or related, departments at the pre-1992 university.

The qualitative data were analysed using a Grounded Theory approach, searching for meaning in the data and generating theory from rich, detailed descriptions. The interviews were tape-recorded and the focus groups were video-recorded, then transcribed verbatim, before being analysed with the computer software, NVivo. NVivo was successfully used to employ line by line coding, enabling the researcher to remain close to the text. Categories and relationships between categories were then systematically developed through constant comparative analysis to ensure that all similarities and differences were captured in the final analysis (Langdridge, 2004). The cumulative analysis of findings led to the eventual development of theories and explanations reflecting the complex nature of the social phenomena investigated.

In addition to the qualitative data collection, a quantitative email survey was conducted. However, due to time imperatives (particularly the need to interview women students before the end of the academic year), this was conducted after the pre-placement interview stage, rather than before, as set out in the original proposal. While it was intended that the survey would inform the interviews, the first interviews and literature analysis helped to inform the survey. This in turn, helped inform the later stages of the qualitative research. The original proposal stated that the survey would be sent to all women engineering undergraduates at the pre- and post-1992 universities. However, the
survey distribution was extended to all male and female undergraduates to allow a comparison between the experiences of men and women students. The survey asked students about their decision to study engineering, experiences of HE, industrial placements and their career intentions. The survey was completed by 804 students giving an overall response rate of 22.0%. The response rate was much higher for women students (37.2%) than for men (19.4%). SPSS computer software was used to generate descriptive and inferential statistics from the dataset of 89 variables.

4. Results

The research revealed a number of key findings, outlined below. However, it should be noted that these are neither mutually exclusive nor exhaustive. This summary of findings necessarily makes generalisations, masking many of the nuances and variety of experiences resulting from the different personalities, engineering disciplines and sectors and types of organisations that the research explored.

4.1 University Differences

The research found a significant difference between students studying at a pre- and post-1992 university. As shown in Table 1, students at the post-1992 university were more likely to be mature students and part time students who therefore had different priorities and experiences to the mostly post A-level students at the pre-1992 university.

<table>
<thead>
<tr>
<th></th>
<th>Pre-1992 Uni</th>
<th>Post-1992 Uni</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full time</td>
<td>99.7%</td>
<td>53.6%</td>
</tr>
<tr>
<td>Part time</td>
<td>0.3%</td>
<td>46.4%</td>
</tr>
<tr>
<td>Under 21</td>
<td>94.3%</td>
<td>40.8%</td>
</tr>
<tr>
<td>Females</td>
<td>37.4%</td>
<td>52.2%</td>
</tr>
<tr>
<td>Male:female ratio</td>
<td>1.7:1</td>
<td>0.9:1</td>
</tr>
</tbody>
</table>

Table 1: Undergraduate Students

Students at the post-1992 university were significantly less likely to go on placement than students at the pre-1992 university as they were significantly more likely to have previous work experience. This is probably because many of the students are mature students with prior experience or part-time students combining study with paid employment. Students at the post 1992-university were also significantly more likely to be motivated by external factors, such as salary, other company benefits, equal opportunities policies and child care policies when deciding where to work after graduation. This is probably because mature and part-time students are more likely to have commitments, such as family, to consider.

4.2 Career Intentions and Ambitions

Women engineering students identify engineering degrees as a good basis for a variety of career paths, not just in the engineering sectors. This is important because although these women clearly have an interest in engineering, career decisions are still being made at university; they have not necessarily decided to pursue a career in engineering. This may go some way in explaining the low transition of women engineering students into engineering professionals. This was also confirmed by the fact that research participants hoped the experience of the industrial placement would help them to make decisions about their future careers. In the survey, 87% of students agreed they wanted to go on
placement to help them decide what to do after university, female students were significantly more likely to agree (93%).

4.3 Experiences of HE

Women engineering students are not always comfortable with the teaching and learning methods used in HE, in particular, curriculum content, assessment methods, volume of work and the emphasis on theory work. However, the survey findings revealed that male students may often feel the same, suggesting that the structure and culture of engineering education needs reviewing. The survey also revealed that design and technology students were significantly more likely to be satisfied with practical work, while students in civil and building engineering were less likely to be satisfied with levels of practical work. Possible solutions to the traditional teaching and learning methods in engineering and related courses involve introducing greater choice for students, such as the option to choose more relevant and practical engineering modules or ‘softer’ engineering modules that address the social and environmental impact of engineering or management. The difficulties with this are that core modules may have to be abandoned to make way for change; given the volume of work the students undertake, the introduction of additional modules would be unrealistic. This is also unlikely to be accepted on courses accredited by professional bodies.

The findings relating to classroom interaction, the relationships between students, and between staff and students show that the engineering culture described in other research is mirrored in the engineering classroom. While most students felt they were treated fairly and justly, the women did encounter sexist banter and often felt undermined by their male peers and staff. However, students regularly dismissed this as ‘joking’. This may be a coping strategy or a result of assimilation into the engineering culture (see 4.6 Coping Strategies and 4.7 Women’s Attitudes).

A further aspect of classroom interaction is the competition and poor communication among students. The survey showed that male and female students found engineering to be competitive, however, this finding is not conclusive. Design and technology students were significantly more likely to agree that students are competitive. However, as the design and technology students were only at the pre-1992 university, it is difficult to conclude whether this is typical or peculiar to this university. While design and technology students are not strictly engineering students, they were included in the research as a large proportion of the work they undertake is engineering-based. Furthermore, while the interviews indicate that women students perceive competition as negative, it may be that male students thrive in a competitive environment. Regardless of this, competition and poor communication appear to be an inherent part of the engineering culture, and while learning techniques can be introduced to combat this, some will not always work. Group work in education, for example, does not always lead to collaboration and the development of team skills because the university structure is individualistic; students achieve, and are awarded degrees, on the basis of individual merit.

4.4 Transitions to Work

The transition from education to work can be difficult for students. Many women commented on getting used to the practicalities and routines of work, such as commuting to work and long hours. Students also had to adjust to the context of their work, or work environment, including issues such as bureaucracy and office politics. Specifically women interviewees discussed working on projects only for a limited time,
rather than seeing them through from start to finish as in the university; dealing with commercially sensitive information and the need for confidentiality; and coping with highs and lows in the workload. Few of these issues are experienced within the classroom environment, which may be why 94% of male and female students agreed that they wanted to go on placement to get an idea of what industry is really like. The industrial placement therefore has the potential to ease the transition to employment following graduation.

Women engineering students also found that the skills most transferable from HE to the workplace are practical and generic skills, such as report writing and presentation skills, not the technical knowledge gained throughout their degree programmes. Failure to prepare students for industry suggests that engineering education is difficult to reconcile with industry. Given this situation, the industrial placement is an ideal opportunity to bridge the gap between education and work, although this raises questions as to whether students should be better prepared for the placement itself.

4.5 Engineering and Workplace Cultures

The research found a number of important differences and similarities between engineering education and workplace cultures. The research showed that design and technology students were significantly less likely to perceive their degree as an asset if they chose not to pursue a career in this field. This is particularly important given that interviewee’s described a shortage of jobs, especially well-paid jobs, in the design and technology industry. This may also go some way to explain why design and technology students are so competitive (see 4.3 Experiences of HE).

Women engineering students overwhelmingly found that, both in the engineering classroom and workplace, their gender was, unwittingly, likely to ensure that they received more help and co-operation than their male counterparts. The survey showed this was particularly the case in design and technology education, although students from all disciplines (aeronautical, automotive, chemical, civil, environmental and mechanical engineering) commented on the issue in interviews before and during the placement. While a number of women found this to be patronising, most perceived this as positive. However, this finding may indicate that women in engineering are seen as less capable than their male counterparts; ultimately a fact which, in the future, may cost women in terms of promotions. This could also be detrimental to women’s confidence in their own capability.

Women also perceived themselves to be more employable as a result of their gender. It was felt that companies were trying to recruit more women in order to improve their image. Whilst a drive to recruit more women into the industry is a positive step, this had the effect of making women doubt their own abilities (‘Have I been employed for my capabilities or my gender?’). Alternatively, this also led women to believe, possibly falsely, that engineering workplaces would be equitable to women, posing the question of whether ‘getting in’ is the same as ‘getting on’ in engineering industries.

Despite many similarities between women’s experiences in different engineering sectors, it is apparent that some subtle differences and nuances exist, which indicate the presence of engineering sub-cultures. For example, while few women experienced, or acknowledged experiencing, overt discrimination as a result of their gender, those that did were based remotely, and not in an office (such as on construction sites). While this
finding is inconclusive it does suggest that women not based in an office, are more likely to be on the receiving end of sexual discrimination.

Given the skewed nature of the interview sample (the majority of informants worked for large companies), whether employer size is a determinant of women’s experiences is uncertain. However, the results suggest that small companies represent a more problematic arena for women engineers developing their careers. Despite identifying a number of important issues, the differences and similarities between engineering and workplace cultures therefore need to be explored further (see 8. Future Research Priorities).

4.6 Coping Strategies

Women engineering students adopt a variety of strategies for coping both as an industrial placement student and in a male-dominated environment. The majority of women felt that they were treated equally to other members of staff. However, there was evidence that women were subconsciously adopting coping strategies. These included:

- *Acting like one of the boys*: women attempted to fit in with their male colleagues by showing that they did not require special treatment and by sharing their camaraderie;
- *Accepting gender challenges*: women were reluctant to admit they had been discriminated against, frequently justifying their colleagues actions, suggesting, for example, that in the instance described they did not deserve to be treated equally;
- *Building a reputation*: women sought to overcome discrimination or negative attitudes by demonstrating that they were good, capable engineers, and believed that consequently their gender would be insignificant;
- *Advantages over disadvantages*: women suggested that the advantages of working in engineering outweighed the disadvantages of being a female in a male dominated environment. Although women recognised that there were negative aspects about engineering, positive aspects balance them out. This is particularly important, as it implies a potential for the balance to be tipped in the opposite direction.

A complicating issue when discussing discrimination was the fact that some women felt they had been treated differently to their colleagues in the workplace because of their status as students. Also, it was implied that overt discrimination (for example, so-called ‘jokes’) from blue-collar workers may be easier to cope with than more subtle forms of discrimination. Nevertheless the coping mechanisms, which women manifested, focused attention on themselves, and how they could change their own behaviour, rather than on gender processes implicit within organisations.

4.7 Women’s Attitudes

Women engineering students were found to value their status as ‘a novelty’ in engineering, were critical of women engineers who used ‘feminine tactics’ (such as crying), and held traditionally stereotypical views of women outside engineering. These attitudes may be a result of their assimilation into the engineering culture, but do little to further women’s cause in engineering. If such women succeed they do so as individuals, failing to question the status quo. Any career success is unlikely to promote the interests of women in the sector. It also raises questions about the idea of ‘critical mass’; the idea that once there is a sufficient proportion of women in engineering, the traditionally masculine culture will no longer prevail.
Contrary to previous research addressing women in engineering, the women in this study were, on the whole, found to have a positive attitude towards engineering and their chosen professions. While students are unlikely to be critical of a career in which they are only just embarking, the young women did not feel that any negative aspects about the industry affected them as individuals. However, as women continue in their profession, they may realise that these issues can hinder them from progressing in their careers at the same rate as their male colleagues.

4.8 Contribution to Knowledge
This research has made a significant contribution to existing knowledge concerning women in engineering. While many of the results support previous research (see for example, Aubourn et al, 1993; Dainty et al, 2000; Evetts, 1998; Faulkner, 2006; Greed, 2000; Jawitz and Case, 1998; Women and Work Commission, 2006), the research has made some important developments and produced unexpected findings. For example, it has revealed a significant difference between pre- and post-1992 universities.

Importantly, the research has looked for the first time at women’s experiences of engineering industry at the outset of their careers. This particular stage of their careers, the various coping mechanisms they employ and their apparent assimilation into, and embracing of, the masculine culture in engineering education and workplaces produce positive attitudes. However, these do not necessarily reflect the negative impact engineering cultures can have on women as they continue in their careers. In fact, there are subtle nuances beginning to emerge in these women’s reported experiences which would indicate that engineering cultures are negatively gendered for women even from the outset of their careers. This has led to some theoretical development around the concept of gender, which will be explored in a forthcoming paper. It has also suggested a number of areas for future research (see 8. Future Research Priorities).

5. Activities
The research team has presented papers at several leading conferences throughout the project, allowing the team to collect feedback on emerging findings of the research and to discuss methods and analytical techniques. A total of seven refereed papers have been presented.

A member of the research team also took part in an International Conference and Networking Event for Young Scientists about Gender and Science funded by the British Council in Vienna. The event was an excellent opportunity to meet other young researchers in similar fields, to exchange knowledge and ideas, and to receive some critical feedback on the developing work.

6. Outputs
The research has led to a number of recommendations for industry, which have been disseminated to engineering employers and the DTI Implementation group for Women in Science, Engineering and Technology (SET) and will, in the future, be disseminated in collaboration with the UK Resource Centre for Women in SET. The main recommendations are:
• HE should develop careers advice for students and mentor schemes in order to maintain individuals’ interest in engineering and to encourage students to use their engineering education in an engineering career.

• The structure of engineering education (teaching and learning methods) should be modified in order to attract more students and maintain the interest of current students, for example by introducing more practical, project based work, team-work and optional modules.

• Students should be encouraged to participate in industrial placements. This will prepare students for, and potentially ease their transition to, industry. HE should seek ways to prepare students for industrial placements and employment. For example, using the experiences of students who have already completed an industrial placement to inform other students.

• It would also be appropriate to develop gender-oriented preparation and support mechanisms for students in HE embarking on an industrial placement, for example addressing specific problems women may face in the workplace.

• Pro-active relationships need to be established between engineering employers and universities in order to develop appropriate teaching practices that prepare students for the workplace.

• Engineering organisations should introduce greater transparency to their recruitment criteria, for example stating specific criteria that are essential and desirable to carry out the job role.

• Engineering companies should facilitate networking for new women engineers, to assist women in meeting others who may have shared their experiences. This is particularly important in areas where women are in a minority and as such it may be necessary for networks to be inter-organisational.

• Engineering employers should develop transparent career pathways and development as well as structured training programmes for individuals to follow.

• Engineering organisations should share good practice on ensuring an equitable workplace environment for women engineers, and for diversity more generally. This could be facilitated by the Engineering Council.

In addition to the practical recommendations this research has produced, the study has made an empirical and theoretical contribution to the field of gender, work and organisation. The research has provided an insight into engineering education and work, and women’s experiences and the strategies they develop for coping in a male dominated environment. The research has generated a rich dataset that has been offered to the UK Data Archive. The findings have also been disseminated at a number of national and international conferences and in an international journal paper, with several others in preparation. The research has also enabled a member of the research team to undertake a PhD, which is due for completion in Autumn 2006.

7. Impacts

As a result of experience and knowledge gained from this project, the project’s research assistant has been recruited to provide four months research support to an ESF funded project, based within Loughborough University. This project, Equalize, aims to facilitate enhanced access opportunities for women to construction, engineering and technology HE courses.
The project research assistant will also be engaged on collaborative work with the Engineering Centre for Excellence in Teaching and Learning based at Loughborough University and funded by HEFCE. This work will take six months and investigate the role of industrial placements, with a particular focus on transferable skills.

8. Future Research Priorities

As described in the report, this research has produced some important findings. However, it has also raised many questions and potential issues requiring further investigation.

The findings have shown that the transition from education to work can be difficult. Although the placement experience can facilitate the transition to employment after graduation, future research should investigate whether any aspects of the workplace can be emulated within the university environment, in order that some familiarity with the work environment exists prior to entering the workplace.

The research found that both men and women describe engineering as competitive. However, while interviews indicate that women students perceive competition as negative, it may be that male students thrive in a competitive environment. Further research is required to investigate this, exploring amongst other issues, why a competitive environment exists and its nature, what this achieves, and how it can be positively used.

The research showed a number of differences and similarities between engineering and workplace cultures and sub-cultures. However, this needs to be further explored to take into consideration a multiplicity of factors including the field of engineering, the specific work undertaken and the type and size of organisations.

A significant finding of the research was the different attitudes held by women engineering students compared to women at later stages of their careers. Women at the outset of their engineering careers have been found to have positive, uncritical perceptions of the industry; otherwise they are unlikely to have chosen this career path. Furthermore, while the women in this research were aware of the negative aspects of engineering, these were regularly downplayed and seen to be balanced out by the positive aspects. However, these views may change with time. At this early stage in their careers it may be that women do not feel that the negative aspects of engineering have a real impact on them, yet as women progress in their careers it becomes harder to ignore gender bias and other negative aspects, which may, for example, deter them from progressing in their careers at the same rate as their male colleagues (Dainty et al. 2000). It is therefore important that this gap in research is bridged by exploring women engineers’ first years in their professional careers and investigating the effect of cumulative experience.

The research also found that women had difficulties comprehending the sociological concept and understanding of gender and the impact their own gender and femininity can have. It is therefore important to develop alternative research methodologies that can tap into women’s (and men’s) understanding of these issues when they are not sociologically trained. Also, there is an important argument for introducing some sociological understanding within engineering courses to ensure the successful retention of women in engineering industries.
9. References


Research methods

The research adopted a mixed methods approach using qualitative interviews to explore the experiences and reflections of women engineering students, from a pre- and post-1992 university, before, during and after their industrial placement. Alongside this, an email survey of all male and female engineering undergraduates, again at a pre- and post-1992 university, was conducted. The study explored the experiences of students from a range of engineering disciplines.

Key Findings

Student Characteristics. The research found a significant difference between students studying at a pre- and post-1992 university. Students from the post-1992 university were more likely to be mature students and therefore had different priorities to the mostly post A-level students at the pre-1992 university.

“I knew that having an engineering degree wouldn’t, didn’t just lead you to doing engineering. I knew that if I came out with an engineering degree, I could go off and do all sorts of stuff,” Eve, Civil engineering student, pre-1992 university, non-placement student.

A Good Degree. Women engineering students identify engineering degrees as a good basis for a variety of career paths, not just in the engineering sectors. Women engineering students have not necessarily decided to pursue an engineering career.

“It kind of opens doors I suppose, to other things. You can’t go into management, then into engineering, but you can do it the other way round,” Emma, Mechanical engineering student, pre-1992 university, placement student.

Career Ambitions. Women and men engineering students that go on industrial placement are much more likely to have clearer career ambitions than those students who choose not to go on placement.

“Some of the work we do, you’re like, why? Why do I need to know this? Or, why are we learning it now? I think we could have spent more time on other stuff,” Hannah, Civil engineering student, pre-1992 university, placement student.

Teaching and Learning Methods. Women engineering students are not always comfortable with the teaching and learning methods used in higher education. Women and men students want a more practical, relevant curriculum.

“I expected it to be a bit more practical. The theory isn’t too bad, but there’s so much to take in and to understand. I’d personally like a bit more practical,” Chloe, Mechanical engineering student, pre-1992 university, placement student.

Transferable Skills. Women engineering students found that the skills most transferable from higher education to the workplace are practical and generic skills, such as report writing and presentation skills, not the technical knowledge gained throughout their degree programmes.

“I went to the motorclub … to watch a couple of my friends take out an engine. And while I’m doing all these things about engines and systems, I couldn’t tell you what these things were. I think that probably affects what I can do in industry,” Emma, Mechanical engineering student, pre-1992 university, placement student.

Transitions to Work. The transition from education to work can be difficult for students in terms of adjusting to the practicalities and routines of work as well as the context of their work (including bureaucracy and office politics). The industrial placement can facilitate the transition to employment following graduation.

“One of my lecturers said when you get out to work forget everything you’ve been taught and start again … I don’t think I could take anything I’ve learnt just now and put it in the workplace,” Carolyn, Air Transport management student, pre-1992 university, placement student.

Coping Strategies. Women engineering students adopt a number of strategies for coping both as an industrial placement students and in a male-dominated environment. These include the five A’s:

Acting like one of the boys: women attempted to fit in with their male colleagues by showing that they did not require special treatment and by sharing their camaraderie.

“I give them as good as I get. So it’s equal. And you have a laugh. If you give them respect, they’ll give you respect back,” Suzanne, Engineering environmental technology student, post-1992 university, placement student.

Accepting gender discrimination: women were reluctant to admit they had been discriminated against, frequently justifying their colleagues’ actions, suggesting, for example, that in the instance described they did not deserve to be treated equally.
Michelle, Civil engineering student, pre-1992 university, placement student. “At uni, they all reckon that I’m gonna pass just cos’ I’m a girl.” Lindsay, Electrical engineering student, post-1992 university, placement student.

Employability. Women also perceived themselves to be more employable as a result of their gender. It was felt that companies were trying to recruit more women in order to improve their image. Whilst a drive to recruit more women into the industry is a positive step, this had the effect of making women doubt their own abilities (“Have I been employed for my capabilities or my gender?”) Alternatively, this also led women to believe, possibly falsely, that engineering workplaces would be equitable to women, posing the question of whether ‘getting in’ is the same as ‘getting on’ in engineering industries.

“Even getting here because we didn’t have Physics [A level], we found that it was ‘girls, we do anything we can to get girls on the course.’” Zoe, Automotive engineering student, pre-1992 university, non-placement student.

Positive Attitudes. Contrary to previous research addressing women in engineering, the women in this study were, on the whole, found to have a positive attitude towards engineering and their chosen professions. While students are unlikely to be critical of a career in which they are only just embarking, the young women did not feel that any negative aspects about the industry did not affect them as individuals. However, as women continue in their profession, they may realise that these issues can hinder them from progressing in their careers at the same rate as their male colleagues.

“I felt like they only employed me because I was a girl and yet they didn’t want me to act feminine.” Debra, Construction management and quantity surveying student, pre-1992 university, non-placement student.

Recommendations for Change

One-size Does Not Fit All: Different types of students at different institutions have different needs and priorities, suggesting a ‘one-size fits all’ solution is inappropriate; any policy development therefore needs to be adapted to ensure it is suitable for its target audience.

Careers Advice: Higher education should develop careers advice for students and mentor schemes in order to maintain individuals’ interest in engineering and to encourage students to use their engineering education in an engineering career.

Teaching and Learning Methods: The structure of engineering education (teaching and learning methods) should be modified in order to attract more students and to maintain and stimulate the interest of current students, for example by introducing more practical, project based work, team work and optional modules.

Industrial Placements: Students should be encouraged to participate in industrial placements. This will prepare students for-and facilitate their transition to, industry. Higher education should seek ways to prepare students for industrial placements and employment. For example, using the experiences of students who have already completed an industrial placement to inform other students.
Gender-oriented Support: It would be appropriate to develop gender-oriented preparation and support mechanisms for students in higher education embarking on an industrial placement, for example, addressing specific problems women may face in the workplace.

Employer-University Links: Pro-active relationships need to be established between engineering employers and higher education institutions in order to develop appropriate teaching practices that prepare students for the workplace.

Recruitment Transparency: Engineering organisations should introduce greater transparency to their recruitment criteria, for example, stating specific criteria that are essential and desirable to carry out the job role.

Inter-organisational Networking: Engineering companies should facilitate networking for women engineers, to assist women in meeting others who may have shared their experiences. This is particularly important in areas where women are in a minority and as such it may be necessary for networks to be inter-organisational.

Transparent Career Paths: Engineering employers should develop transparent career pathways and development as well as structured training programmes for individuals to follow.
RES-000-23-0426 - Women Engineering Students’ Workplace Experiences: Impact on Career Interventions

Various Government initiatives have encouraged women into engineering - a profession regarded traditionally as tough, heavy and dirty. As a result, there has been a rise in the numbers of females studying the subject in higher education establishments. However, this has not led to a subsequent rise in women working in engineering.

Now, researchers at Loughborough University have spoken with women engineering students at two universities, before, during and after an industrial placement, and surveyed their fellow-undergraduates of both sexes. The result is a picture of women’s experiences on engineering degree courses, and the impact on their career aspirations of their first encounter with the sector as an employer.

Key Findings

Criticism of courses

- Rising numbers of women studying engineering have failed to translate into an equivalent increase in those taking it up for a living.

- Women had identified engineering degrees as a good basis for a variety of careers. However, they found that the most useful skills on transferring to the workplace were practical and generic ones.

- Students of both sexes criticised content, assessment methods, and emphasis on theory in their college courses, and wanted instead a more practical and relevant curriculum.

Placements experience

- The transition from education to work can be difficult for students in terms of adjusting to the practicalities and routines of work, as well as the workplace culture. Industrial placements can ease this process, and help women engineering students make choices about their careers.

- Women adopt a variety of strategies for coping both as an industrial placement student and in a male-dominated environment. These include acting like one of the boys, accepting gender challenges, building a reputation, and downplaying any disadvantages in favour of advantages.

Positives and negatives

- Overwhelmingly, women found that, both in the engineering classroom and workplace, their gender was, unwittingly, likely to ensure that they received more
help than their male counterparts. On the negative side, this indicates that women are widely viewed in engineering as less capable.

- Women perceived themselves to be more employable as a result of their gender, and felt that companies were trying to recruit more females in order to improve their image. But while a drive to recruit more women into the industry is commendable, it has had the effect of making them wonder whether they have been employed for their capabilities or their gender.

- Alternatively, this has also led women to believe - possibly falsely - that engineering workplaces would be equitable for women, posing the question of whether ‘getting in’ is the same as ‘getting on’ in these industries.

- Women students were found to value their status as a ‘novelty’ in engineering and held traditionally stereotypical views of women outside the profession. But these attitudes may be a result of their assimilation into the industry culture, and do little to further women’s causes in engineering.

**About the Study**

This project was led by Professor Barbara Bagilhole, of the Department of Social Sciences, Loughborough University. It included focus groups involving more than 50 women students from a pre- and post-1992 university – before, during and after their industrial placement - exploring their experiences and reflections. There was also an e-mail survey involving more than 800 male and female engineering undergraduates at the same establishments.

**Key Words**

Women, engineering, working, higher education.
Non-Technical Summary

Women Engineering Students’ Workplace Experiences: Impact on Career Intentions

Introduction
In the UK several Government initiatives have been introduced to encourage women to pursue careers in the engineering professions. Such initiatives have had some success in increasing the number of women studying engineering. However, the increase in women engineering students has failed to translate into an equivalent increase in women engineering professionals.

Aims & Objectives
Accordingly this research aimed to develop an understanding of the influence of women engineers’ earliest encounters with engineering workplaces on their future career intentions. One of the novelties of this approach is that it recognises that engineering is a term used for a heterogeneous and wide-ranging set of subjects. The research objectives were to:

- Compare the nature of women engineers’ early career experiences through the experiences of women engineering students on their industrial placements from university, with their pre-experience expectations, and establish any mismatches likely to affect their transition into engineering professionals.
- Compare the attitudes and experiences of women engineering students going on industrial placement with those who choose not to go on placement, and to explore the impact this has on career intentions.
- Investigate the role of lecturers in influencing women’s attitudes towards the workplace.
- Explore the wider validity and applicability of the findings of the Bagilhole et al., (RES-000-22-1679) ESRC-funded study on women’s experiences within the construction industry, in particular investigating the distinct aspects of different engineering workplaces and cultures.
- Identify aspects of engineering sub-cultures and structures that play a positive role in women’s career satisfaction and achievements, and to develop a framework of transferable initiatives capable of application across engineering disciplines.

Research Methods
The research adopted a mixed methods approach, using qualitative interviews and focus groups to explore the experiences and reflections of women engineering students from a pre- and post-1992 university, before, during and after their industrial placement. Alongside this, an email survey of all male and female engineering undergraduates, at the same universities, was conducted.
Key Findings
The research revealed a number of key findings, outlined below. However, it should be noted that these are neither mutually exclusive nor exhaustive. The summary of findings necessarily makes generalisations, masking many of the nuances and variety of experiences resulting from the different personalities, engineering disciplines and sectors and types of organisations explored.

- The research found a significant difference between students studying at the pre- and post-1992 universities. Students from the post-1992 university were more likely to be mature students or part-time students with different experiences and priorities to the mostly post A-level students at the pre-1992 university.
- Women engineering students identify engineering degrees as a good basis for a variety of career paths, not just in the engineering sectors. Women engineering students have not necessarily decided to pursue an engineering career.
- Women engineering students are not always comfortable with the teaching and learning methods (e.g. curriculum content, assessment methods, emphasis on theory) used in higher education (HE). Women and men students want a more practical, relevant curriculum.
- Women found that the skills most transferable from HE to the workplace are practical and generic skills, not the technical and theoretical knowledge taught throughout their degree programmes.
- The transition from education to work can be difficult for students in terms of adjusting to the practicalities and routines of work, as well as the workplace culture. The industrial placement can therefore ease the transition to employment following graduation as well as informing career choice amongst women engineering students.
- Women engineering students adopt a variety of strategies for coping both as an industrial placement student and in a male-dominated environment. These include acting like one of the boys, accepting gender challenges, building a reputation and downplaying any disadvantages in favour of advantages. Such coping mechanisms focus attention on the women themselves, rather than on processes implicit within organisations.
- Women overwhelmingly found that, both in the engineering classroom and workplace, their gender was, unwittingly, likely to ensure that they received more help than their male counterparts. On the negative side this indicates that women are widely viewed in engineering as less capable than their male counterparts.
- Women perceived themselves to be more employable as a result of their gender. Women felt that companies were trying to recruit more females in order to improve their image. Whilst a drive to recruit more women into the industry is commendable, this has had the effect of making women doubt their own abilities (‘have I been employed for my capabilities or my gender?’). Alternatively, this also led women to believe, possibly falsely, that engineering workplaces would be equitable for women, posing the question of whether ‘getting in’ is the same as ‘getting on’ in engineering industries.
- Women students were found to value their status as a ‘novelty’ in engineering and held traditionally stereotypical views of women outside engineering. These attitudes may be a result of women’s assimilation into the engineering culture, and do little to further women’s causes in engineering.
- Students are unlikely to be critical of a career in which they just embarking. Therefore not surprisingly women in this study were found to have a positive attitude towards engineering and their chosen professions and did not feel that any negative aspects about the industry affected them as individuals.


**Significant Academic Achievements**
The research makes a significant empirical and theoretical contribution to the field of gender, work and organisation. The research has provided an insight into engineering education and work, women’s experiences, and the strategies they develop for coping in a male dominated environment.

The research has also enabled a member of the research team to undertake a PhD, which is due for completion in Autumn 2006.

**Dissemination Activities**
The research team has presented seven refereed papers at leading conferences and published one journal article in Equal Opportunities International during the course of the project. One more journal article has been accepted for publication, and two further papers have been accepted for presentation at forthcoming international conferences. An additional journal paper and invited book chapter are in preparation.

The research findings will also be published in collaboration with the UK Resource Centre for Women in Science, Engineering and Technology (UKRC), which will ensure a very wide audience including engineering employers in the private sector.

**Impact**
These research findings have led the research team to make a number of recommendations for improving women engineers’ education and workplace experiences, which are detailed in the main report. A number of engineering employers and the DTI Implementation Group for Women in Science, Engineering and Technology (SET) have also been consulted.