

Jobs for the boys?

Summary report of **Set to Lead**

Increasing the opportunities for women engineering undergraduates

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funded by HE STEM

Set to Lead is an HE STEM funded project developed by an association of UCL with Katalytik and Oxford Policy and Research



1. Introduction

Women are less likely than men to be working in engineering and technology roles six months after graduating

Women in the final year of undergraduate engineering courses are as likely as men to express the intention to work in engineering and technology roles

Female graduates more likely than male graduates to be undertaking some form of further study



The *Set to Lead* project builds on evidence and anecdote to increase awareness and better practice so women realise their ambition and potential to the same level as men to pursue engineering and technology careers.

Women's participation in engineering in the UK reached a plateau in the 1990's at an average of 15%. Figures published in 2010 revealed that 42% men compared to 21% women science, technology, engineering and maths (STEM) undergraduates were transferring into STEM employment. Suggestions from an employer survey, open events, roundtables and interviews identified the following possible reasons for the gap:

- Lack of visible female senior women role models
- Bias or poor practice at some point of the recruitment process
- Lower confidence of women
- Roles women played or defaulted to in teams and associated performance in assessment.

Discussions with employers and analysis of general good practice shaped the project outputs around activities and materials to improve employability skills and create a positive, inclusive and respectful working environment that did not seek to 'fix' women, but to address contemporary good practice to benefit all students.

Engineering academics asked for role models and real life situations to improve students' employability skills and self awareness. Employers wanted to see students' communication skills improved and a vocabulary around strengths, values and people. The aim was to enhance interpersonal interactions, awareness of self and others and improve the ability of students to communicate and 'sell their strengths' at interview in a more mature way. The agreed focus was on leadership and team participation.

STEM GRADUATE RECRUITMENT PIPELINE

school/college → university → recruitment processes → employment → retention → realising potential

2. Background

The retention of female SET graduates is much lower than their male counterparts¹ which constrains the pipeline. Increasing the diversity of the SET workforce² through the recruitment and retention of women and promoting technically-qualified women into executive roles requires a focus on the early part of the career pipeline and on developing leadership skills.

Reports on the state of engineering education and training of engineers³ provide an excellent overview of data relating to this study. Career decisions of engineering students and the competition for their talents^{4,5} have been well studied. This work looks in greater depth at gender differences and a qualitative on-line survey informs future practice to increase female retention.

Seron⁶ asserts that women's lack of *professional role confidence* – an individual's confidence in their ability to successfully fulfil the roles, competencies and identity features of a profession – compared to men, reduces their likelihood of remaining in engineering majors (courses) and careers.

Seron's diary analysis supports the survey findings of lower confidence in women students.

1 Report for the Office of Science and Technology and the Department of Trade and Industry, *Maximising Returns to Science, Engineering and Technology Careers*, London: DTI, 2002.

2 Women on Boards, *Business Innovation and Skills*, 2011 <http://www.bis.gov.uk/news/topstories/2011/Feb/women-on-boards>

3 Engineering UK 2011: The State of Engineering, Engineering UK, 2011 (http://www.engineeringuk.com/_db/_documents/Engineering_UK_Report_2011.pdf); Engineering UK 2012: The State of Engineering, Engineering UK, 2012 (http://www.engineeringuk.com/what_we_do/education_&_skills/engineering_uk_12.cfm).

4 STEM Graduates in Non STEM Jobs, Department for Business, Innovation and Skills, 2011

5 The career thinking of UK engineering undergraduates, CRAC, 2007.

6 E. Cech, B. Rubineau, S. Sulbey and C. Seron, *Professional Role Confidence and Gendered Persistence in Engineering*, *American Sociological Review*, 76(5), 641–666.

1.1 Methodology

Fieldwork included:

- Interviews and roundtable meetings with employers and academics and a survey of company recruitment processes
 - On-line survey investigating undergraduate career intentions and the variation through the course of study. 4,624 cleaned scripts from undergraduates on engineering and technology courses included 1,200 from women
 - Analysis and comparison of survey data with the Higher Education Statistics Agency (HESA) Destinations of Leavers from Higher Education (DLHE) data.
- Conclusions are drawn from the data at the subject group level and/or for the whole sample.
- The full report is available on the UCL Engineering website.

3. Undergraduate experiences and career intent

8%

of women in their final year who have had a period of work placement or an internship do not intend to study or work in a related area.

22%

of women in their final year who have not undertaken a period of work placement or an internship do not intend to seek relevant employment or study.

Undergraduate course experiences for nearly 70% of all undergraduates reinforce their intent to pursue an engineering career. Those not wanting to pursue an engineering career rose from the first year.

- Work placements play a significant role in influencing career intent and this is greater for women than men
- 22% of women in their final year who have not undertaken a period of work placement or an internship do not intend to seek employment as an engineer/technologist, or, undertake further study in engineering/technology

- 8% of women in their final year who have had a period of work placement or an internship do not intend to study or work in a related area
- Students on bachelor degree courses are significantly more likely to intend to undertake further study, in particular masters courses, than those registered for enhanced first degrees
- 3.4% of men and 3.6% of women regret undertaking their courses.

3.1 Employment Intentions

Female final year students were less likely than men (74% compared to 72%) to express an intention to work as an engineer or technologist in industry or commerce.

While both men and women had aspirations to work in similar places there were differences in the kind of role that they would like to undertake; and differences in their awareness of career options. Men rated their career awareness higher than women.

Careers advice is vital and opportunities for careers support should be brought closer to engineering and technology students. *Women-only or women-targeted careers sessions should be held in engineering and technology departments, and careers modules incorporated into courses to build career confidence of women.*

Action by: HEIs

Occupations	Graduate occupations	Male	Female	Overall
Engineering and technology occupations	Graduate	92.8%	93.9%	92.9%
	Non-Graduate	7.2%	6.1%	7.1%
Non-Engineering and technology occupations	Graduate	46.2%	44.0%	45.9%
	Non-Graduate	53.8%	56.0%	54.1%

Figure 1: Destination difference between male and female students six months after graduating

Source: HESA

3.2 Employability, self belief and confidence



Students believe they possess the majority of general skills that employers seek. Employers though complained of poor communication skills including presenting to a technical but non specialist audience.

Self belief rose with time on their course for both men and women, however significantly more men than women believed they had the majority of technical skills that employers often look for. Women were more confident that they would gain those skills when they finished their course, though this still wasn't as high as the men's belief.

Work placement and/or an internship enhanced student's self belief that they had the majority of technical skills that employers seek but again a higher proportion of men than women. This reaffirms the increased confidence of men that they possess the technical skills required for employment.

Lack of confidence can limit the roles students play in teams and their assertiveness.

Students need to appreciate and practice being team leaders, followers and team members. Academics also need to be able to assess different team behaviours. Training for academics in using the resources developed through the HE STEM Set to Lead project could help here.

Action by: HEIs

Some students find it difficult to collaborate and work in teams. Using commonly used business tools (many free to use) within courses will give students a new vocabulary and personal insights.

Action by: HEIs

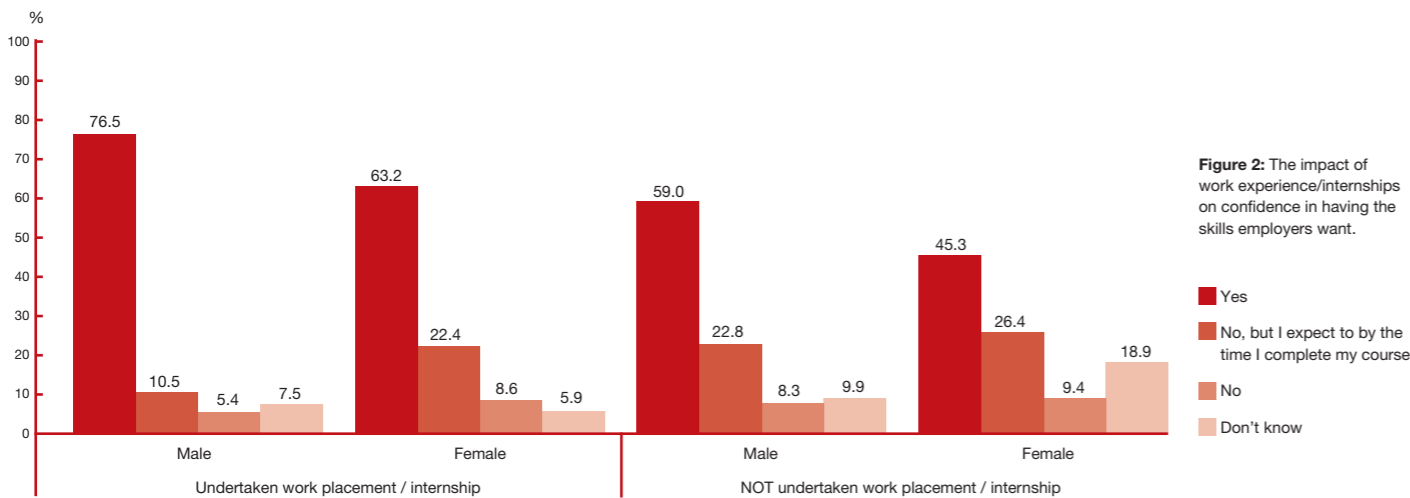


Figure 2: The impact of work experience/internships on confidence in having the skills employers want.

3.3 Women engineering and technology first degree graduates

In 2009/10 22% of males and 20% of females graduated from enhanced first degree courses in engineering and technology. At subject group level this breaks down to:

- 15% of engineering subject graduates
- 24% of computer science subject graduates
- 36% of technology subject graduates.

There is considerable variation by course:

- 9% in mechanical engineering
- 88% in polymers and textiles.

At the subject group level, women are more likely than men to gain first and upper second class degrees.

- Engineering subjects 64% of women and 58% of men

- Computer sciences subjects 55% of women and 50% of men
- Technology subjects 68% of women and 56% of men.

Women are better qualified than men.

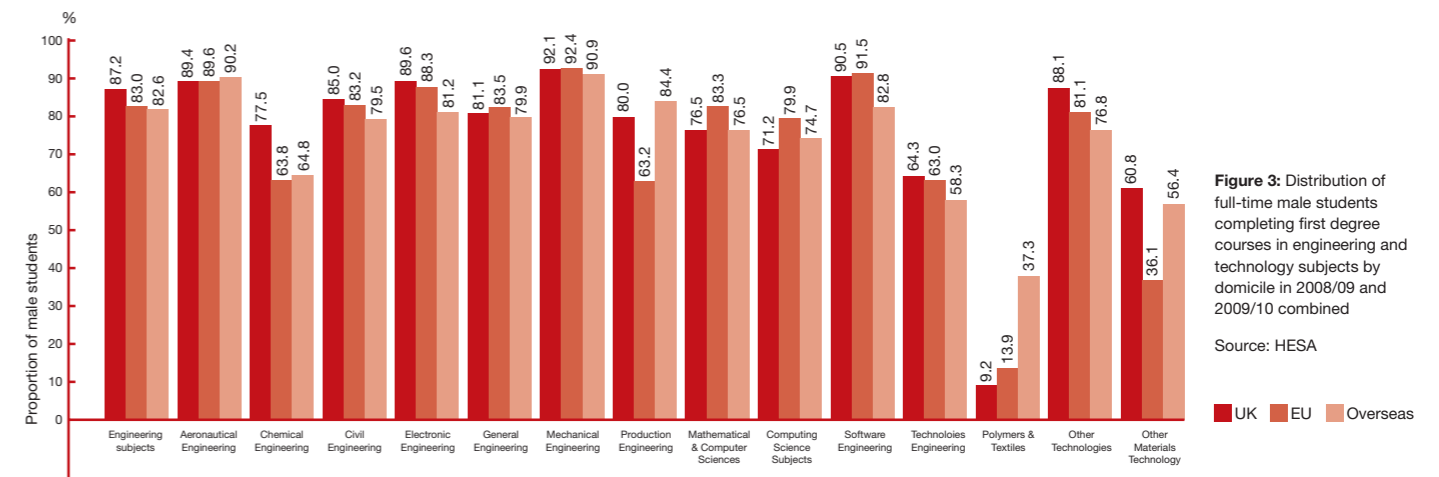


Figure 3: Distribution of full-time male students completing first degree courses in engineering and technology subjects by domicile in 2008/09 and 2009/10 combined

Source: HESA

3.4 Ethnic composition

The popularity of engineering and technology subjects varies both in respect of gender and ethnicity (figure 2 & 4). Most engineering and technology subjects are more popular among black, minority and ethnic (BME)

groups, apart from mathematics and computer science subjects where male White students are over represented. The proportion of White female students in mathematics and computer science subjects is in line with expectation.

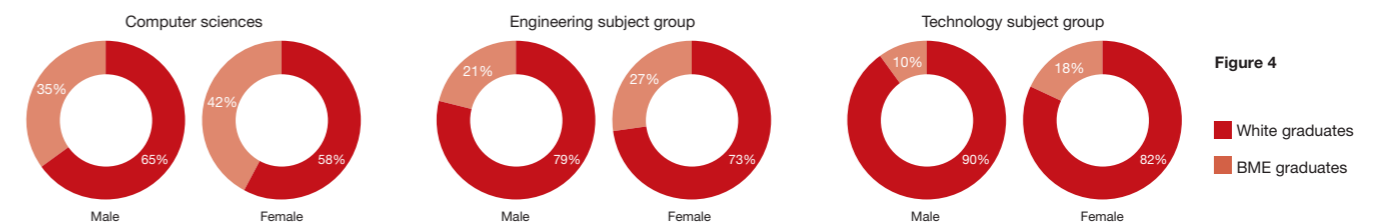


Figure 4

4. Where graduates go

4.1 Employment destinations

Of key importance from comparison of the survey data and HESA data is that while similar proportions of male and female final year respondents expect to be working in engineering roles after completing their courses, (about three quarters), in reality six months after completing their courses 50% of male and 39% of female graduates in 2008/09 and 2009/10 were doing so.

- While only 7% of male and 6% of female respondents expected to be working in non-engineering and technology roles, DLHE data shows that 23% of male and 27% of female graduates are in such roles
- It is likely that a significant proportion of graduates in the non-engineering and technology roles are in temporary positions
- Male and female graduates from enhanced first degrees have more similar destinations six months after graduation than bachelor degree graduates.

Technology female graduates are more likely to be in work than male graduates. Similar proportions of male and female graduates from computer sciences subjects were in work and were undertaking further study.

Women with enhanced first degrees are more confident to enter the job market than those with bachelor degrees, as are men, but less so than the women.

The differences appear to relate to women's lower confidence in their technical abilities when compared to men and in the career options open to them. Comparing the DLHE data with survey responses shows a link between good quality industrial placements and receiving good careers advice increasing women's confidence and their likelihood of applying successfully for engineering and technical roles.

The research explored the recruitment process to examine possible issues. Of 11 companies surveyed, seven routinely monitor the proportions of men and women who apply for jobs and the proportions of men and women that progress through the recruitment process.

- Three companies supplied recruitment data and in all three cases the proportion of women who accepted job offers was in line with the proportion of women who applied
- Six of the seven companies that monitor data stated they compare the data with that from earlier years.

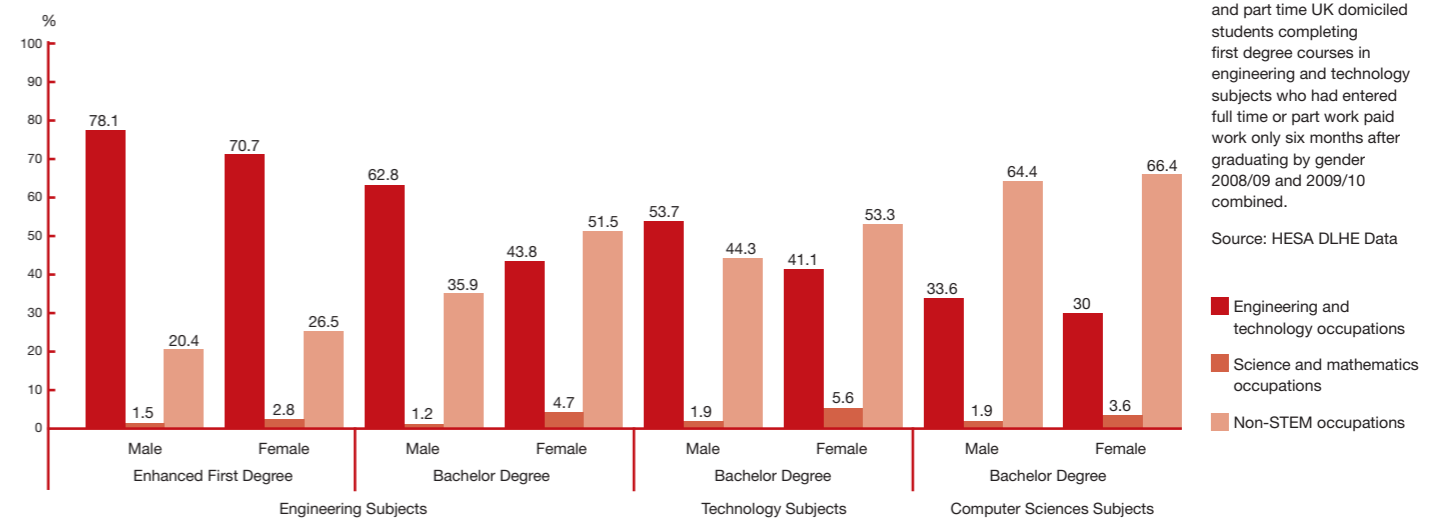
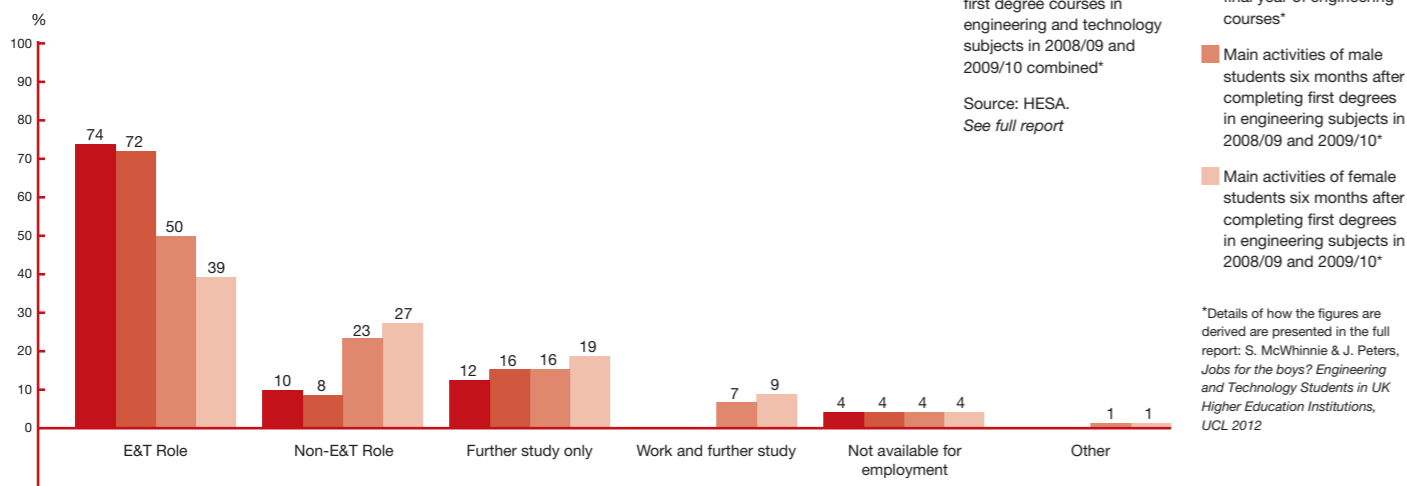
Companies though, possibly don't monitor the pool of students they are drawing from. Indeed, some companies do not access the gender disaggregated data easily.

4.2 STEM Occupations

WOMEN WITH ENHANCED FIRST DEGREES ARE MORE CONFIDENT TO ENTER THE JOB MARKET THAN THOSE WITH BACHELOR DEGREES...

Male graduates who studied full-time or part-time and were working six months after graduation were more likely than women to be in engineering and technology occupations.

- 63% of male bachelor degree graduates compared to 44% of females were in engineering and technology occupations
- Engineering graduates from enhanced first degree courses: 80% of men and about 70% of women in engineering and technology occupations
- Bachelor graduates from technology subjects: 54% of men and 41% of women were in engineering and technology occupations
- Computer sciences subjects bachelor degree graduates were much more likely to be in non-STEM occupations than in engineering and technology occupations.



4.3 Employment roles

In engineering and technology subjects women are more likely than men to enter non-graduate level jobs, possibly these are temporary.

- Men are more likely than women to enter professional occupations
- Women are more likely than men to enter associate professional and technical occupations.

Again this reinforces the lower confidence and aspiration of women from engineering bachelor degrees, even though women are more likely than men to graduate with first class or upper second class degrees. Women are less likely to be offered professional occupations than men.

The patterns observed in the DLHE data suggests that women are less confident than similarly qualified men to enter the job market and may be less likely than men to apply for engineering and technology and/or professional occupation level roles.

A small survey of 11 employers indicate women perform as well as men during the interview and assessment process. While this was supported by many employers in interview, some examples of lower than good practice were recalled by employers and students.

The reality is that despite wishing to, women are less likely than men to end up on a technical career path.

SET TO LEAD HAS INVESTIGATED GOOD PRACTICE FOR ASSESSMENT CENTRES AND PRODUCED A SUMMARY GUIDE OF FACTS AND ACTIONS RECRUITERS CAN IMPLEMENT.

Improving the career confidence of women to support their technical competence is a key priority and the following recommendations will help realise this:

Increasing HEI engineering and technology staff awareness that women are likely to have lower “career confidence” than men in their technical abilities and in the career opportunities open to them.

Action by: HEIs, Engineering and technology departments, Professional bodies

Engineering and technology employers and learned societies should consider holding women’s career days/open days reaching students through the women’s engineering society, the purpose of which should be to tackle head-on women’s relative lack of confidence.

Action by: Engineering and technology employers, engineering and technology learned societies

A MODEL FOR OPEN DAYS WAS DEVELOPED WITH MICROSOFT, ARUP AND THE WOMEN’S ENGINEERING SOCIETY TO SHOWCASE JOBS, ROLES AND APPLICATION PROCESSES. THESE WERE VERY POPULAR AND SHOULD BE EXTENDED.

The visibility of women in senior technical roles needs to be increased so the women undergraduates see that women do have successful careers as engineers and technologists.

Action by: Engineering and technology employers, HEIs

SET TO LEAD PRODUCED A SERIES OF VIDEOS OF SENIOR WOMEN AND MEN TALKING ABOUT SCENARIOS, INCLUSIVE WORK PLACES AND THEIR CAREERS.

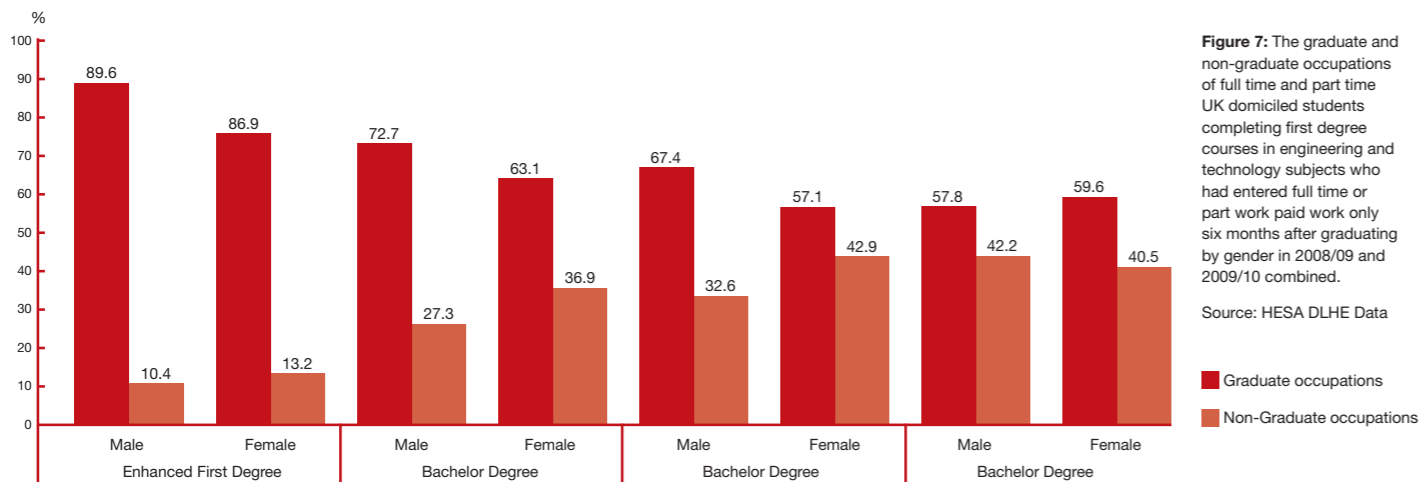


Figure 7: The graduate and non-graduate occupations of full time and part time UK domiciled students completing first degree courses in engineering and technology subjects who had entered full time or part work paid work only six months after graduating by gender in 2008/09 and 2009/10 combined.

Source: HESA DLHE Data

■ Graduate occupations
■ Non-Graduate occupations

4.4 Why women chose engineering



The majority of undergraduates (nearly 90%) didn’t regret their course choice. Only 3% had any regrets. The most popular reasons for course choice was, “*Out of interest and enthusiasm for engineering,*” women were less likely to have selected this than men. Women were also less likely than men to have selected, “*I have an aptitude for engineering,*” and more likely to have selected, “*I ‘wandered’ into this course after my A-levels.*”

Analysing course choice by year shows the proportion of women selecting “*Out of interest and enthusiasm for engineering*” falling as their year of study increases. The data suggests that women undertaking engineering and technology courses are less enthusiastic than men about engineering and technology and have less confidence in their ability.

4.5 Influence of work experience

Work experience reinforces respondents’ commitment to careers in engineering and technology. Overall 69% of men and 67% of women who had undertaken at least one work placement or internship during their course were more intent on pursuing a career in engineering/technology.

The more positive a respondent’s experience regardless of gender during work placement or internship the more intent they were on pursuing a career in engineering/technology.

Undertaking work placements and internships provides increased confidence and likelihood of a STEM job. Placements must be high quality and offer a positive experience.

A “code of practice” for employers to sign up to should be developed setting out the key elements of positive work placements. A checklist setting out the key elements of positive work placements could support students in researching suitable work placements.

Action by: HEIs and Student Groups

HEIs should stress to students the positive impact that undertaking work placements has on employability.

Action by: HEIs

Internship programmes enable students to gain experience of working in technical roles and improve confidence. Funding should be provided through central government for these programmes. Internships provided should be paid. Such as in the biopharmaceutical sector.

Action by: HEIs, Engineering and technology employers, BIS

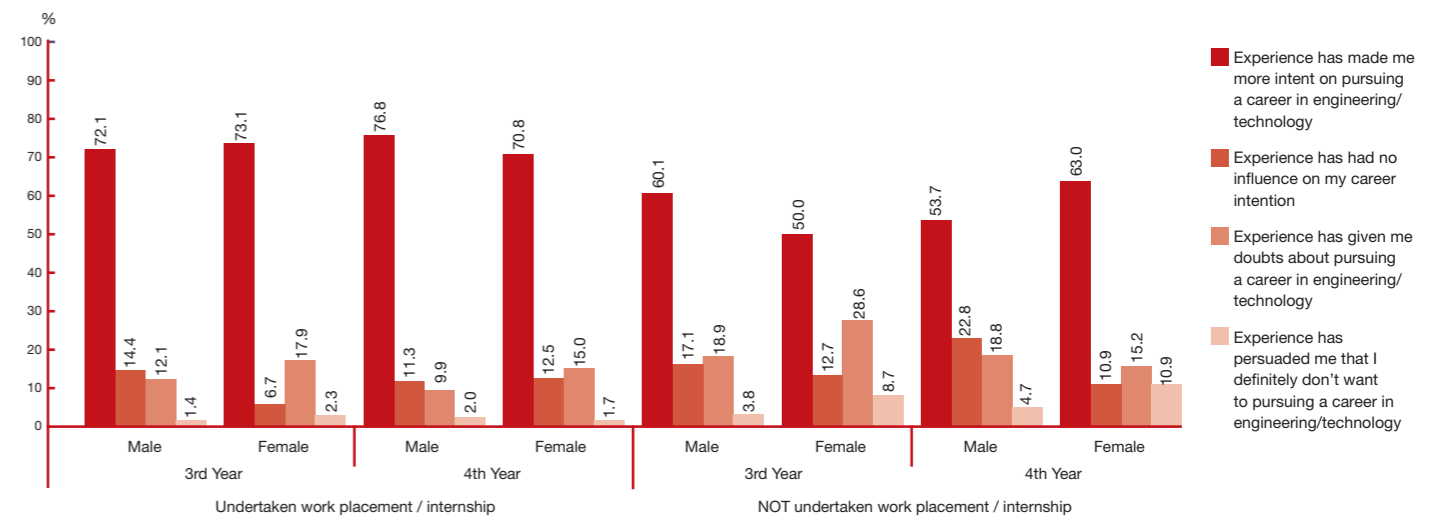


Figure 8
Source: Set to Lead

■ Experience has made me more intent on pursuing a career in engineering/technology
■ Experience has had no influence on my career intention
■ Experience has given me doubts about pursuing a career in engineering/technology
■ Experience has persuaded me that I definitely don’t want to pursuing a career in engineering/technology

5. Enhanced materials for academics



SET TO LEAD RESOURCES FEATURE THREE LEADERSHIP LEARNING SCENARIOS DEVELOPED WITH ARUP, HIGHWAYS AGENCY AND THOUGHTWORKS. THESE INCLUDE ACTIVITIES, WORKSHOPS AND VIDEOS.

Discussions with employers suggested reasons for the difference in employment between men and women SET graduates as:

- Lower confidence of female students in general
- Lower performance in group work in assessment centres
- High expectations of male students of themselves
- Unconscious stereotyped attitudes.

This was added to by reports of occasional poor behaviour by male students towards women at assessment centres and subtle marginalization in team work supported by research conducted using monthly diary analysis of American undergraduate engineers.

Few universities deliver specific leadership training for undergraduates and that it is mostly limited to team roles based on well developed models used for many years – the most commonly (and only) cited models being Adair⁶ and Belbin⁷. Research with employers found a wide range of leadership models in use and a range of analytical tools employed to help manage internal relations and organisational development. Popular models used in 2012 are based around emotional intelligence⁸, strengths⁹ and values – all based on rigorous research from leading business schools.

Employers are beginning to move from competency based assessment to strengths based assessment.

Academics and students asked for:

- Help preparing students for team based projects and activities such as constructionarium
- Ideas about assigning group leadership roles
- Support for students on how to motivate and engage their peers.

Set to Lead has produced a set of resources, informed by industry:

- How to establish an appreciation of your own and other's strengths
- Challenging problems with no clear right or wrong answer
- Scenario based activities that were based on real life situations
- Role models from science and engineering
- To hear stories from leaders about when things went wrong or they were challenged
- To be able to introduce leadership and team skills in a way that did not require an in depth knowledge.

These are available on the HE STEM and Katalytik websites for all universities to access and use.

When trialing the materials produced a lack of confidence of some academics in delivering these was apparent.

Professional development for academics around leadership and facilitation will impart greater confidence and enable students, during degree courses to gain insights into personal strengths and absorb the vocabulary to discuss these. This will have the added advantage of aiding women graduates to articulate and appreciate what their contributions are whilst also making male graduates have greater insights into other team members' roles.

Action by: HEIs

6. Do women belong?

87% OF MEN, ONLY 75% OF WOMEN FELT CONFIDENT THAT THEY WOULD MAKE A GOOD ENGINEER OR TECHNOLOGIST

The majority of male and female students feel that women are treated equally by staff and fellow students and women feel they get as much out of their courses as men. **Men however, do not feel as strongly as women that women get as much out of their courses as men.**

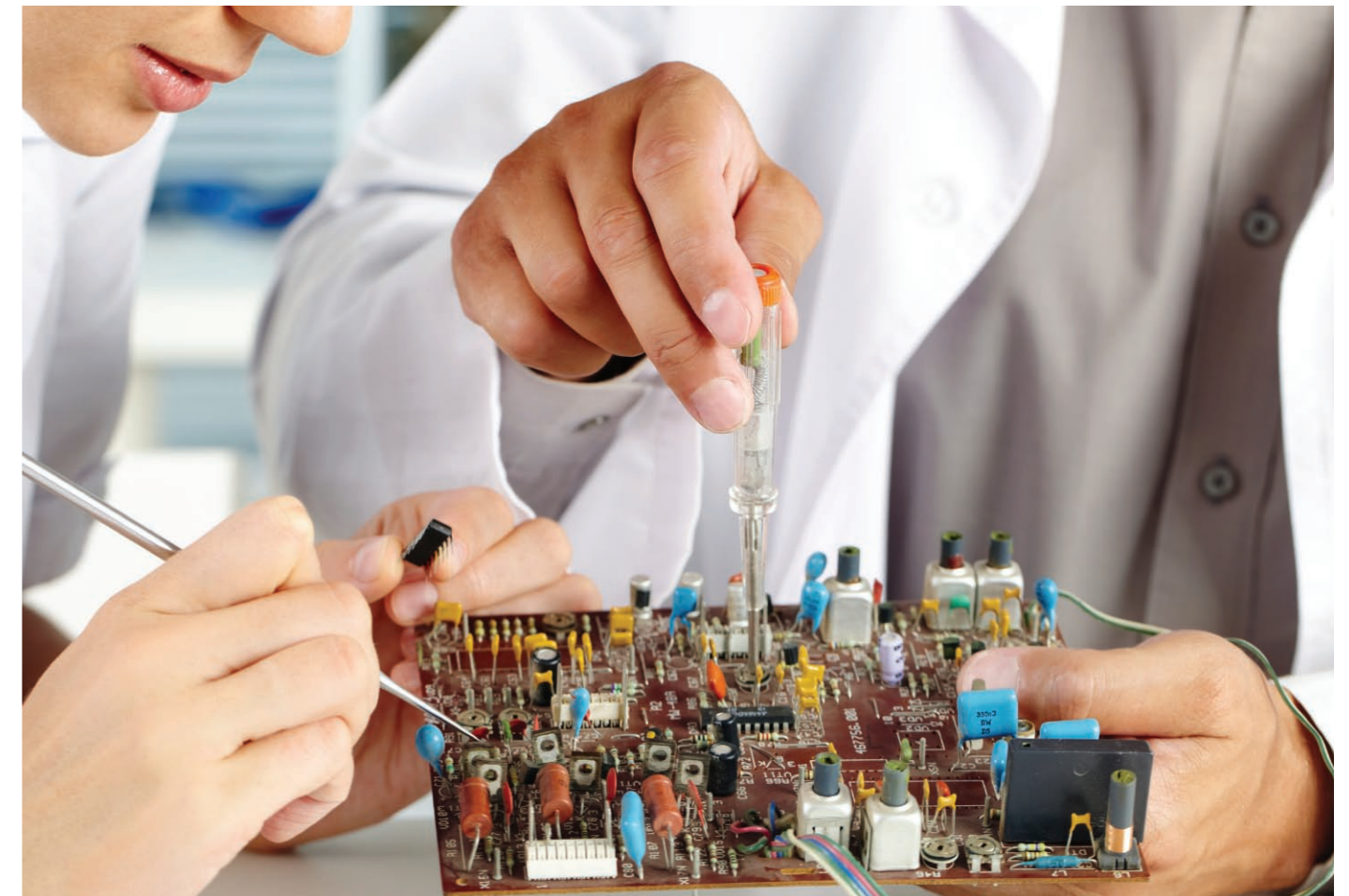
Men believe that women don't integrate as well as men in their courses and that they don't get as much out of their courses as men.

Students are ambivalent about the need for more female lecturers. Two thirds agree that their experiences of studying

at university had provided them with good role models to encourage them to pursue a career in engineering or technology.

87% of men, only 75% of women felt confident that they would make a good engineer or technologist.

Academics felt that in part this was a result of few role models and not seeing women as practicing engineers and leaders.



⁶ John Adair is one of the world's leading authorities on leadership and leadership development focused around the Action-Centred Leadership programmes he pioneered.

⁷ Meredith Belbin developed a set of team roles based on research undertaken at what is now Henley Business School. The Belbin Team Roles are used to identify people's behavioural strengths and weaknesses in the workplace.

⁸ Daniel Goleman, Working with Emotional Intelligence, 1998

⁹ Tom Rath, Strengths Finder 2.0, 2007, Gallup Press

7. Summary and further action

The paths followed by graduates into employment are complex. Analysis of the HESA data, pared down to engineering and technology subjects, shows figures that initiated the study (42% of men and 21% of women STEM graduates transferring into STEM jobs) are more positive at 50% and 39%.

There are though significant differences for women that should be addressed and recommendations have been made that focus on women's lower confidence in their technical abilities than men.

Measures have been developed to intervene to address this and are available on the HE STEM, UCL, Katalytik and the Women's Engineering Society websites.

Further action is recommended to learn more about the graduate experience:

The engineering community would benefit from some in depth case studies of students who have used the leadership tools and resources and an assessment and coaching of their strengths to illustrate to academics the outputs and benefits and follow their progress in the early days of their careers. This would aid the take up of the resources.

Further targeted engagement of a group of HEIs with more in-depth training and monitoring of the use of the resources for a whole course of students would also assist in embedding a step change in the way that team and co-working are developed in engineering departments.

Action by: HEIs, BIS, Royal Academy of Engineering

A longitudinal study of engineering and technology graduates over a 10 year period would provide a detailed picture of the career progress of engineering graduates and the impact of the resources developed for the Set to Lead. It is recommended that a study is developed.

Action by: BIS, Royal Academy of Engineering

To gain greater insight into the undergraduate experience, a diary study, as in recent work by Seron, would deepen the appreciation of the course experience and career paths of male and female engineering undergraduates.

Action by: BIS, Royal Academy of Engineering

FOR MORE INFORMATION VISIT:

www.hestem.ac.uk

www.engineering.ucl.ac.uk

www.katalytik.co.uk

www.oxfordresearchandpolicy.co.uk

www.wes.org.uk

8. Acknowledgements

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