

Social mobility and the chemical engineering profession in the United Kingdom

This is an **Institution of Chemical Engineers Diversity and Inclusion Working Group** report on research exploring the social mobility of chemical engineers in the UK.

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Context

Institution of Chemical Engineers (IChemE) is focusing on diversity within the chemical engineering profession, and diversity issues feature strongly in its forward strategy and business plan development. The Institution believes that by embracing and promoting diversity, better technical and social outcomes are possible.

During October 2016, IChemE issued a short questionnaire to its UK members. The question set explored the issue of social mobility from a number of different perspectives. Over 1,700 members completed the survey. This represented around 9% of the UK membership (excluding undergraduates) and whilst the respondents were self-selecting, the sample was considered to be broadly representative of the IChemE membership body. Social outcomes were evaluated based on factors such as university attended, qualification obtained and the time taken to obtain employment in a chemical engineering role. Comparisons were drawn between different subsets of the sample taking socio-economic factors into account. These included educational attainment and occupation of the respondent's parent or guardian and the type of school attended by the respondent.

IChemE's purpose is to advance chemical engineering worldwide for the benefit of society. The Institution aspires to reflect the community it serves and to better understand the barriers to participation in the chemical engineering profession by individuals from poorer backgrounds. The findings are intended to stimulate further debate in this important area and to inform engagement with bodies including the Social Mobility and Child Poverty Commission.

Summary of key findings

Overall, the survey findings suggest that IChemE members from families where at least one parent or guardian had attended university, or where the main family bread winner's occupation was classified as managerial, senior, or professional occupation, have a possible advantage and are more likely to have studied a chemical engineering degree programme at a top-ranked university.

No particular advantage has been identified for those respondents attending fee paying schools.

Once at University, a 'levelling of the playing field' is evident, and the ability to secure employment in a chemical engineering role after graduation is correlated to access to summer placements and work experience during the student's undergraduate years.

Detailed analysis

No compelling conclusion regarding social mobility could be drawn following a comprehensive analysis of the dataset. However, a number of interesting observations can be made, prompting further lines of investigation.

81 % of graduates obtained relevant employment within six months of leaving university. However, the trend across the age cohorts reveals that today's graduates are taking longer to find work. 90% of respondents aged 60-64 entered relevant work within six months of graduation while only 76% of respondents aged 25-29 had obtained work within the same period.

Attendance at a fee paying school, receipt of household means tested benefits during school years¹, and the ranking of the university attended appears to have little impact on employability.

85% of respondents who had secured at least one period of work experience (i.e. summer placement, year in industry or internship) during their undergraduate studies secured work in a chemical engineering role within six months of graduating compared to **68%** for those with no work experience.

Obtaining work experience has a greater impact on job prospects for those with a bachelor's degree in comparison with those obtaining a master's degree.

Time taken to secure employment	No work experience	At least one work experience (Summer placement, year in industry or internship)
Immediately	44%	60%
Within six months	24%	25%
Within one year	8%	7%
Within two years	7%	4%
It took me more than two years to find a job	3%	1%
I never secured employment as a chemical engineer	13%	3%
Total	100%	100%

Table 1 – Does work experience make a difference?

The level of educational attainment has increased significantly over the last 40 years. 76% of 25-29 year old respondents reported securing a Master's degree, compared with 20% of respondents over 65. A number of factors may be driving this trend. From around 1985 onwards more universities offered Master's level courses. This development prompted major employers of chemical engineers to specify a Master's level qualification for entrants to their graduate training programmes. In addition, the international accreditation agreement for professional engineering academic degrees known as the Washington Accord provides a widely recognised benchmark for professional registration which a Master's degree fulfills.

¹ Receipt of means-tested benefits was self-defined by respondents

Highest Qualification Achieved	Age (years)								
	< 25	25-29	30-34	35-39	40-44	45-49	50-59	60-64	> 65
Diploma or non-graduate	31%	1%	1%	1%	2%	0%	2%	1%	10%
Bachelor's degree	22%	14%	19%	30%	34%	50%	51%	63%	44%
Master's degree	38%	76%	64%	51%	53%	32%	27%	21%	20%
Doctorate	0%	8%	12%	16%	9%	18%	20%	12%	25%
No Response	8%	1%	4%	2%	1%	0%	2%	3%	2%

Table 2 - Highest qualification by age

The percentage of respondents reporting at least one parent or guardian educated to university level has increased significantly over time. 42% of respondents aged under 25 came from households where neither parent or guardian had attended university, compared with 85% for those respondents aged over 65.

In instances where both parents, or guardians, had attended university, 59% of the respondents had graduated from higher ranked² university departments; compared to 41% in cases where neither parent or guardian had attended university.

In instances where both parents, or guardians, had attended university 53% of respondents reported attaining a Master's level degree; compared to 37% in cases where neither parent or guardian had attended university.

Number of parents who attended university	Age (years)								
	<25	25-29	30-34	35-39	40-44	45-49	50-59	60-64	>65
At least one parent	58%	57%	54%	46%	42%	38%	27%	16%	15%
No parents	42%	43%	46%	54%	58%	62%	72%	84%	85%

Table 3 - Age breakdown vs parents' attendance at university

² Based on an assessment of top 200 chemical engineering degree courses in the QS World University Rankings
<https://www.topuniversities.com/university-rankings/university-subject-rankings/2016/engineering-chemical>

Respondents were asked to describe the occupation of the main earner in their household during their school years. Reported occupations were categorized and grouped using the UK Office for National Statistics' Socio-economic Classification System (ONS-SEC)³

59% of respondents described a main earner as having a job that would be classified as a managerial, senior, or professional occupation that required further education. This was consistent across all age groups.

The percentage of respondents reporting a main earner with a managerial, senior official, or professional occupation (ONS-SEC classification of 1.1, 1.2 or 2) rises from 43% amongst respondents aged over 65, to 67% for respondents aged under 25. This may be explained by changes in the nature of higher education and work over the last 40 years, or possibly by a reduction in social mobility over the same time period.

17% of the respondents reported that their household had been in receipt of means tested benefits during their school years.

A higher percentage of respondents reported growing up in a household in receipt of means tested benefits where the main breadwinner was in one of the lower groups in the ONS-SEC classification system.

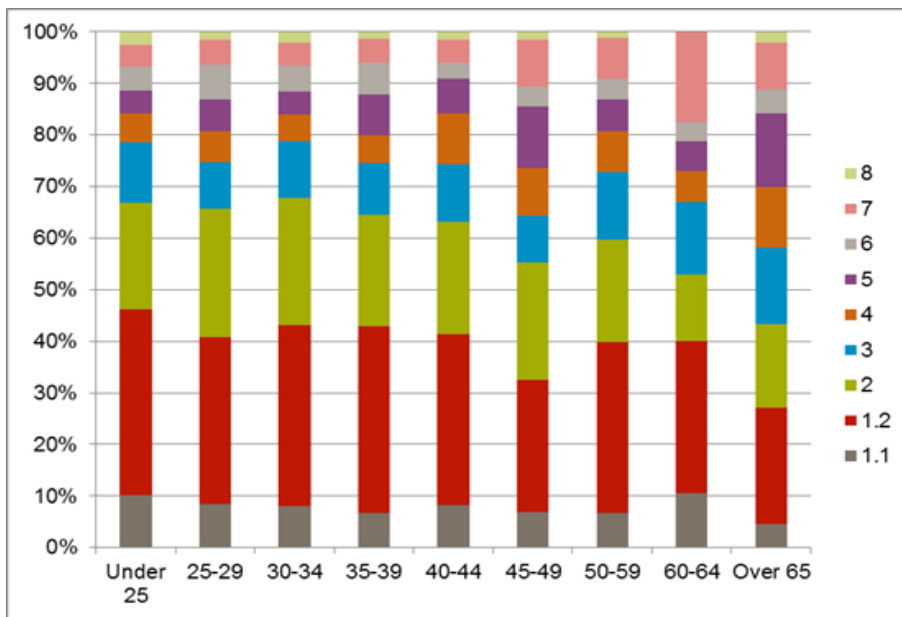


Chart 1 – ONS-SEC classification for main earner across all age cohorts

Means testing appears to have increased for respondents in the 30-34 age cohort and younger. Possible explanations may be the introduction of university tuition fees in 1998 and the application of means testing of maintenance loans from 2012 onwards.

³ <http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/soc2010/soc2010-volume-3-ns-sec--rebased-on-soc2010--user-manual/index.html>

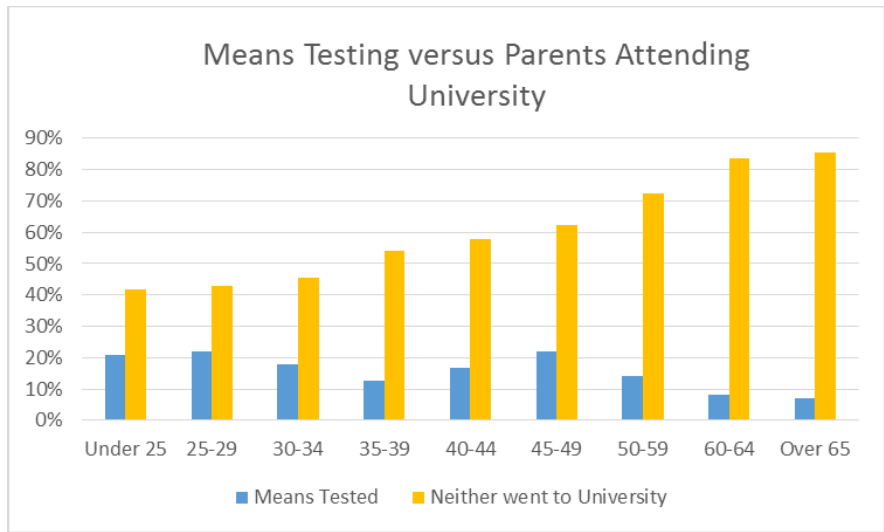


Chart 2 – Means testing v parental educational attainment

Attendance at fee paying schools does not appear to influence the level of qualification achieved.

School attended	Highest qualification achieved			
	Diploma or non-graduate	Bachelor's degree	Master's degree	Doctorate
Fee-paying	6%	34%	46%	13%
Non fee-paying	10%	34%	44%	12%

Table 4 – Degree attainment versus school attended

The ONS-SEC system categorises professional chemical engineers in the ‘Lower managerial, administrative and professional occupation’ Code 2; whereas professional civil & mechanical engineers are classified in the ‘Higher professional occupations’ Code 1.2. This classification seems arbitrary and unfair and it may be appropriate for the Institution to raise this matter with the Office for National Statistics.

67% of the survey respondents aged under 25 originated from homes where the main breadwinner fell into higher ranked ONS-SEC occupations. This compares with 56% for the UK engineering graduate

intake overall⁴. This suggests that chemical engineers may have a slight socio-economic advantage over their colleagues from other engineering disciplines.

Conclusions and suggestions for further work

This report will be circulated to all those who completed the survey and published internally within IChemE and to members via the Chemical Engineer Magazine. In addition the findings will be shared with colleagues working on diversity and social inclusion projects at the Royal Academy of Engineering and the Royal Society of Chemistry. The report will also be used as a basis for engagement with the Social Mobility Commission.

IChemE will raise the inconsistency of the ONS-SEC classification for chemical engineers with the Office for National Statistics.

Proposals should be developed to widen access to good quality industry placements for all chemical engineering undergraduates.

Follow up work in Q4 2017 might examine the impact of social background on mobility and career progression once the chemical engineering graduate has entered the workplace.

Acknowledgements

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Appendices

A – Survey questions.

B – Data tables

Further information

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⁴ Source: HESA Socio-economic classifications for 2016 engineering graduates in the UK

Appendix A – Survey Questions

1. How old are you?
 - a. Under 25
 - b. 25-29
 - c. 30-34
 - d. 35-39
 - e. 40-44
 - f. 45-49
 - g. 50-59
 - h. 60-64
 - i. 65 and over
2. Did your parent(s) or guardian(s) go to university?
 - a. Father
 - b. Mother
 - c. Both
 - d. Neither
3. During your school years, did your household receive any means tested benefits (e.g. free school meals, income support etc.)
 - a. Yes
 - b. No
4. What was the occupation of the main earner in your household during your school years?
(Open text response)
5. What is the highest qualification you have attained?
 - a. Diploma or non-graduate
 - b. Bachelor's degree
 - c. Master's degree
 - d. Doctorate
6. What type of school did you attend?
 - a. Fee paying
 - b. Non-fee paying
7. Which university did you attend/are you attending?
(Open text response)
8. Did you obtain work experience relevant to chemical engineering prior to graduation? Tick all that apply.
 - a. Summer placement
 - b. Year in industry
 - c. Internship
 - d. None
 - e. Other (Please specify)

9. Did you take/are you taking a Gap Year?
- No
 - Yes, prior to graduation
 - Yes, after graduation
10. Following graduation, when did you start work in a chemical engineering role?
- Immediately
 - Within six months
 - Within one year
 - Within two years
 - It took me more than two years to find a job
 - I never secured employment as a chemical engineer
 - I haven't graduated yet
11. Are you are Chartered Engineer, or actively working towards getting Chartered?
- Yes, I'm chartered
 - Yes, I'm working towards getting chartered
 - No, but I intend to in the future
 - No, I have no intention of getting chartered
12. Any other comments relating to the matters addressed in this survey
(Open text response)

Appendix B – Data Tables

All anonymised survey data can be accessed from the following link : <http://alturl.com/cz87n>

For more information on the data and methodology please contact diversity@icheme.org