Deloitte.

Women in STEM

Technology, career pathways and the gender pay gap

Contents

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In this publication, references to Deloitte are references to Deloitte LLP, the UK member firm of DTTL

Foreword

Traditional gender roles, where women are perceived to be responsible for running the household and men for providing sustenance for the family, have been around for centuries. It is little wonder that these ingrained cultural norms are proving difficult to shift, despite significant advances in the role of women over the last 100 years in the world of work.

Our research shows that the gender pay gap, based on median hourly earnings for all full-time employees, is closing incrementally. However, pay parity between men and women in the UK is not forecast to be achieved until 2069 and, even then, the gap is actually widening in certain occupations, such as the skilled trades and teaching and education professionals. Significantly, though, the gap in starting salary between men and women who have studied Science, Technology, Engineering and Mathematics (STEM) subjects and go on to take jobs in those spheres is smaller than in any other subjects studied. If more women were to pursue careers in these areas, not only would it give them a more balanced portfolio of skills, but it would also narrow the gender pay gap for those in the early years of their working lives.

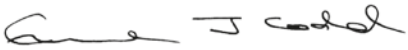
Some of the differences in pay can be traced back to societal influences that children pick up from a very young age, and to the choices they make at school and university. At GCSE, for instance, boys are much more inclined to study design and technology, and information technology, while many more girls than boys take modern languages and art and design. These differences are magnified at A-Level and in subjects taken at university – and continue into employment. Our analysis of employment data from the last 15 years alongside nearly three million university records finds that women make up just 14.4 per cent of individuals working in STEM occupations in the UK with as many as 70 per cent of women with STEM qualifications not working in relevant industries. Women are more likely than men to pursue studies – and subsequently take up employment – in caring or teaching roles. Although these jobs are less well paid than technical and commercial roles, they do place greater importance on cognitive and social skills, which we know from other Deloitte research are essential for workers to remain adaptable and employable in the future.

Technology has played an important role in the progress towards achieving gender equality. It has helped to raise the participation of women in the workplace. Also, many new jobs have been created as a consequence of the introduction of new technology in industry – jobs that demand greater cognitive and social skills rather than just technical skills like programming or physical abilities like strength. It is in these new roles and many others across the economy that women are as capable as men.

In practice, we believe that solving the gender pay gap over the long term means tackling an ingrained difference in the skills that women gain and choose to develop during their academic studies and, therefore, in the jobs they go on to take. If more women are encouraged to study STEM subjects during their education and are taught in a way that recognises their cognitive preferences, we not only prepare them for a more dynamic world of work but we simultaneously start to bridge the gap in pay. This will require clear focus by both policymakers and employers.

Deloitte is determined to continue to attract more women into our firm and increase the representation of women in senior positions. The commercial case for doing so is as compelling as the moral one – quite simply, more diverse organisations perform better. And we know that this is something our clients care about, too. Our firm reported our gender pay gap as a very public demonstration of our commitment to change. We know that we need more women in business but we also know that there is no silver bullet; meaningful change will only be brought about by a combination of change in our societal norms and culture, our education system and specific, targeted actions across business.

We hope that you find this report thought-provoking and we look forward to your feedback.



Emma Codd
Managing Partner for Talent
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Executive summary

This report seeks to contribute to the debate on the gender pay gap in two ways. First, it seeks to establish the connection between the academic choices made by girls and boys (from a young age and through university life) and the choice of jobs and career pathways that they are eventually likely to make. Second, it considers future changes in the job market, how these changes are likely to affect the job choices for men and women, and whether the gender pay gap may be affected as a result.

Our key findings are summarised below:

- Although the gender pay gap is closing steadily, we forecast that at the current rate of convergence, pay parity will not be achieved until 2069.

- Overall, almost as many girls as boys sat GCSE in STEM subjects this year. However, three times more boys than girls took computing at GCSE level. And 50 per cent more boys than girls took design and technology, but with the number of girls awarded A* – C grades in this subject nearly 20 percentage points higher than for boys.

- At A-Level in 2016, 40 per cent more boys than girls took STEM subjects, including Computing, Economics, Mathematics and Information and Communications Technology (ICT). However, girls continued to outperform boys in every STEM subject.

- Even though more young women than men go to university, men are much more inclined to study technical subjects. The top two most popular university courses by subject area for women are education and subjects allied to medicine. In contrast, the most popular university courses for men are business and administrative studies and engineering and technology.

- In employment today, more women than men work in occupations where cognitive and social skills are very important but where technical skills, including STEM skills, are not as important. While these 'softer' skills will be increasingly in demand in the age of smart machines, they also need to be part of a more balanced skills portfolio.

- Women make up just 14 per cent of individuals working in STEM occupations in the UK, but as many as 70 per cent of women with STEM qualifications are working in non-STEM related industries.

- Many top-paid jobs increasingly call for ability in STEM subjects. The difference in median starting salary between men and women graduates of engineering and technology, and for subjects allied to medicine and dentistry is zero.

- Women are disproportionately more likely to go into jobs in industries or sectors where pay levels are lower. Considering all employment, based on provisional figures from the Office for National Statistics (ONS) in 2015, the average gender gap in median hourly pay is 9.4 per cent.

- Research shows that in the past 15 years, both men and women have benefited from technology-driven changes in the labour market. Moreover, the impact of technology on jobs undertaken by men and women is fairly balanced. Thirty-seven per cent of jobs undertaken by women are at high risk of automation in the next 10 to 20 years compared with 35 per cent of jobs undertaken by men.

We conclude that technological change will not by itself help to reduce the gender pay gap, but encouraging and enabling more girls and women into STEM subjects and onwards into STEM-related careers will.

Introduction

"Gendered stereotypes about what society regards as 'men's work' and 'women's work' are a strong influence on young people throughout their education, and can have significant influence on the career choices they make."[1]

Government Equalities Office

The gender pay gap and its causes

According to the ONS, the gender pay gap for UK full-time workers in 2015 (the difference between median hourly wages for men and women, expressed as a percentage of the male median wage) was 9.4 per cent.[2]

The government's intention is that the gap should be eliminated entirely, but the task is a complex and challenging one, not least because of the various inter-related causes of its existence.

Many women take time out from work for family reasons, and may only take on a part-time job when they eventually return to work: part-time work in general is paid less per hour than full-time work. So wanting to find a suitable balance between family and working life, combined with lower pay for part-time working, contributes significantly to the pay gap. The gender pay gap is also partly related to the age of workers; it is wider between men and women at an older age. There may also be unconscious discrimination at work and within organisations that affect decisions about jobs and pay.

On the whole, women are more likely than men to take jobs where pay is relatively low, such as in care services and some aspects of teaching. In comparison, there is a disproportionate concentration of men in jobs in high-paying sectors of the economy, such as information and technology and engineering.[3] A reason for this is the difference in the choices made by boys and girls, from a young age, in the academic subjects they pursue and then in the subjects they study at university. These choices affect the skills they acquire by the time they are ready to move on at graduation from university into working life.

Decisions made early in life can have long-term implications. Our analysis of government data indicates that choices made by boys and girls, at school and university, combined in all probability with differences in attitudes that have been embedded by social conditioning, have serious implications for their future working lives – the jobs they take and the pay they receive. There is evidence to suggest that, to some extent at least, women are under-represented in high-paid jobs because, as graduates, they do not have relevant education and skills. This lack of skills can be attributed to choices made at school and in the selection of university courses.

As the requirements of work change, through technology-driven shifts and the increasing use of 'smart machines' in the workplace, the skills that women have acquired through their careers – especially cognitive and social skills – are set to become more, not less, important in the future. Deloitte's previous report, Talent for survival: Essential skills for humans working in the machine age, shows that, alongside skills and knowledge in technical subjects, these quintessentially human talents are vital if workers are to remain flexible, adaptable and employable.[4] Yet the portfolio of skills that women develop are not as well balanced as they should be.

From a national perspective there is a huge amount of female talent that could be available to employers but it is not being nurtured and developed.

Unless more girls can be encouraged and enabled to make different choices during their education, and more women encouraged to use their qualifications during their careers, the gender pay gap will persist for decades to come.

Technology and the future market for jobs

Much of the debate about the gender pay gap has focused on the current jobs market. In reality, however, the market is changing under the influence of automation, robotics and other developments in information technology. The jobs that will be available to men and women in 10 to 15 years' time will differ substantially from those that exist now.

- Some types of jobs, such as secretaries and bank clerks, are much less common than they were 10 or 15 years ago. Some jobs will disappear, perhaps entirely.
- At the same time, technology is opening up new job possibilities, which call for greater skills and which may well be better paid.
- The demand from employers for certain existing types of work will increase and some jobs will remain more or less the same, although the skills required to perform them will change.

Since the jobs market is changing substantially, it is reasonable to ask whether the foreseeable changes might have an impact on the gender pay gap. An answer to this question can be attempted by identifying the changes in the jobs market that are likely to happen, whether the changes will affect jobs that are more likely to be taken by women or by men, and if so whether this will result in a gender pay gap that is wider or smaller.

A focus of this report is to present an analysis of the likely effect of technological change on the demand for jobs, how this will impact on the choices available to men and women, and how it might affect the gender pay gap. Based on our research, we argue that in spite of developments in technology and the changing nature of the jobs market, decisions made early in life by boys and girls will continue to affect the jobs that many of them eventually take up. Unless more girls can be encouraged and enabled to make different choices during their education, and more women encouraged to use their qualifications during their careers, the gender pay gap will persist for decades to come.

Career pathways: Gender differences from school age

"Take the example of computer science, where the share of women is lower today than it was in 1985. This gap doesn't start when workers are making career choices; rather, it results from a series of events and decisions that begin at very young ages."

US Council of Economic Advisers

Gender stereotyping can be seen in a range of different jobs. We commonly associate secretarial and PA roles with women, and driving heavy goods vehicles with men. In this report, however, we focus on jobs that demand a high level of skills, which are developed initially through academic learning at school and university.

High-skill jobs, which demand a blend of cognitive, social and technical skills, are typically among the most highly paid. They are also jobs in areas of the economy where the demand for skills can be expected to grow substantially over the next few years, as the knowledge-based economy grows.

Acquiring skills in STEM subjects

One way of looking at the gender pay gap is to analyse pay differences between men and women. Two broad areas contribute to the gap: pay differences arising because women take jobs in different sectors of the economy compared with men, and pay differences that exist between men and women within the same sector.

Research by Mark B. Stewart suggests that much of the gender pay gap exists between men and women in the same industry or organisation.[6] However, taking a job in a high-paid or low-paid sector also contributes to the gap.

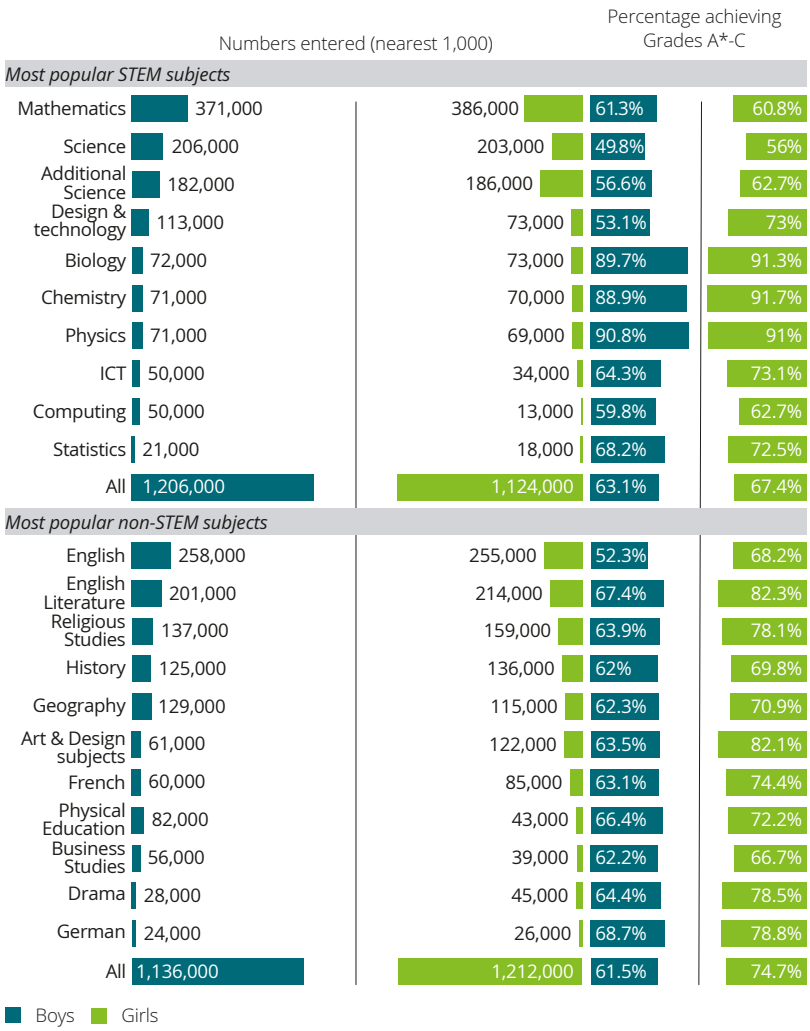
There is evidence to suggest that women are under-represented in some areas of work, notably those where some knowledge of STEM subjects is required. Women make up just 14.4 per cent of individuals working in STEM occupations in the UK, and an analysis of the Labour Market Survey data from 2013 found that as many as 70 per cent of women with STEM qualifications were not working in STEM-related industries.[7] We find both men and women in virtually all types of skilled job, but in these high-skill areas there is a disproportionate number of men and under-representation of women.

Figure 1: 'Soft' vs 'hard' skills – the difference between men and women in employment

Source: ONS, Deloitte analysis

Figure 1 shows the difference between men and women in terms of the skills that are important in their jobs. Each coloured square represents a group of occupations which have the same importance of technical, cognitive and social skills, and the intensity of the colour is proportional to the total employment in those occupations in 2015. The figure shows how more women typically work in jobs where the importance of soft skills is high but where technical skills, including technology design, programming or equipment maintenance, are not as important. Men, on the other hand, typically work in occupations where there is a more even blend of cognitive, social and technical skills. We argue that the imbalance in numbers between the genders can be traced back to choices made in academic subjects at school and university, which in turn may be attributable largely to gender stereotyping from an even earlier age.

Figure 2. GCSE results 2016



Source: Joint Council for Qualifications

Subject choices at GCSE: A gender gap emerges

Analysis of more than five million 2016 GCSE entries and provisional results by the Joint Council for Qualifications found significant differences in both the subjects chosen by boys and girls and their comparative results.8 As a proportion of all entries into a subject, girls are much more likely than boys to study Health and Social Care, Home Economics, Performing Arts, Social Science subjects, Art and Design, and Drama. However, significantly more boys than girls entered subjects including Technology, Construction, Engineering, Computing, Manufacturing and Economics.

Data for girls and boys taking their GCSEs in 2016 is shown in Figure 2.

Significantly, girls perform better than boys at GCSE in virtually all subjects, including most STEM subjects, such as ICT, Computing, Science, Chemistry, Biology and Physics. The only exception this year was in Mathematics, where boys have, for the first time, marginally outperformed girls.

Subject choices at A-Level: The gap widens

The gender differences in subject choices are more pronounced at A-Level. Boys remain much more likely to pursue STEM subjects, but their performance is still not as strong as girls.[9, 10]

In terms of absolute numbers, English is the most popular subject for girls and mathematics is the most popular for boys.

More interesting is the relative percentage of student numbers for various A-Level subjects. Figure 3 shows exam entries for subjects where there are significant differences in the proportions of girls and boys. Figure 4 shows the performance of boys and girls at A-Level for the most popular STEM and non-STEM subjects.

Subject choices at university: The influence of A-Levels

Ostensibly, students have a wide choice of subjects at university but, in reality, choices are limited to some extent by the subjects taken at A-Level. Those who have studied STEM subjects for A-Level are more likely to move on to STEM-related degree programmes, whereas those who have taken English and other humanities subjects are more likely to choose courses where science and maths do not feature.

The most popular university courses for female students are primarily vocational teaching or caring in nature and have a relatively predetermined career path. A higher proportion of women than men study biological sciences, creative arts and design, education, languages, mass communication, social studies and veterinary science. Men predominate in subjects such as computer science, engineering and technology, mathematics and physical science.

Comparative figures in a range of subjects for the academic year 2013-14 are shown in Figure 5. These figures are based on the numbers graduating in this year (in total, about 263,000 female graduates and 162,000 male graduates)

From university into working life

Through the subjects they study at school and university, men and women acquire different knowledge and skills that subsequently they take with them into their working life.

Since girls and women are significantly under-represented in STEM subjects at school, at university and in working life, it seems reasonable to conclude that there is potential talent among girls not being fully exploited, which could help to fill various skills shortages existing in STEM-related occupations.

Using data provided by the Higher Education Statistics Agency (HESA), we have mapped the subjects studied at university by male and female students to occupations they enter after graduation. The analysis has not been a simple matching exercise because there is great diversity in career choices for graduates in most subjects.

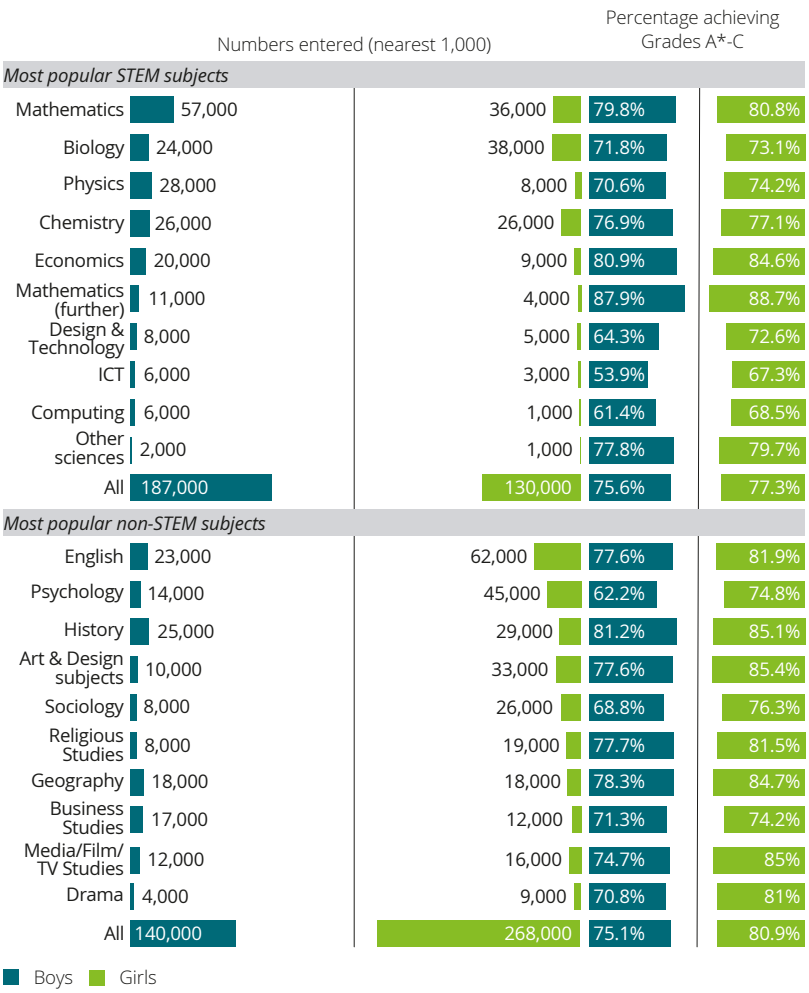
Figure 3. Gender differences among subjects entered at A-Level, 2016

Subjects with the highest proportion of girls	Total numbers (to nearest 1,000)	% male	% female
Performing Arts	2,000	10.2	89.8
Welsh	1,000	20.8	79.2
Sociology	34,000	23.1	76.9
Psychology	59,000	23.7	76.3
Art & Design subjects	43,000	23.9	76.1
Communication Studies	1,000	26.9	73.1
English	85,000	27.1	72.9
Religious Studies	27,000	30.4	69.6
Drama	13,000	30.7	69.3

Subjects with the highest proportion of boys	Total numbers (to nearest 1,000)	% male	% female
Computing	7,000	90.2	9.8
Physics	36,000	78.4	21.6
Other sciences	3,000	75.3	24.7
Further mathematics	15,000	72.5	27.5
Economics	29,000	67.7	32.3
ICT	9,000	64.2	35.8
Design & Technology	13,000	61.4	38.6
Mathematics	93,000	61.3	38.7
Physical Education	12,000	61.1	38.9

Source: Joint Council for Qualifications

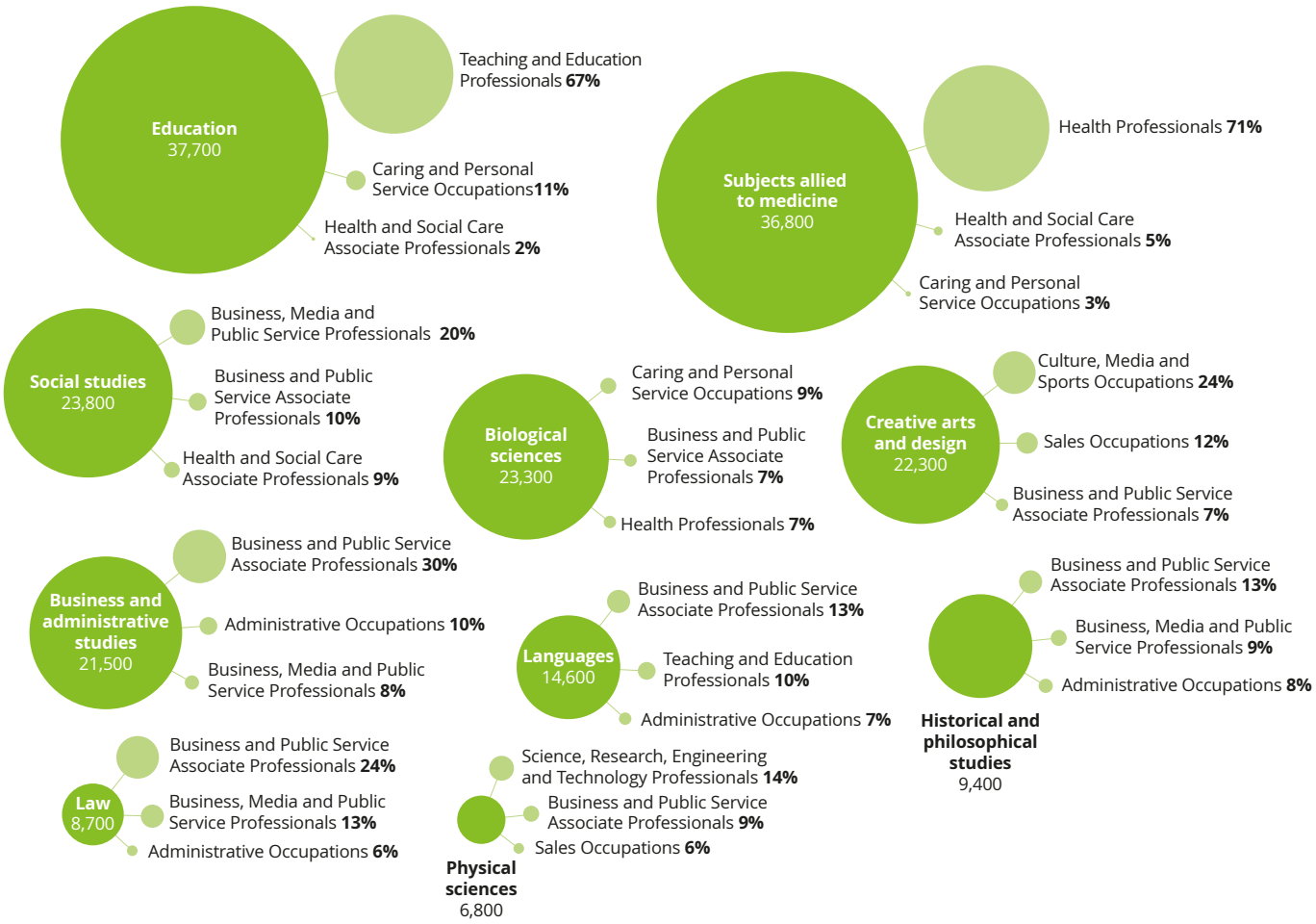
Figure 4. A-Level results 2016



Source: Joint Council for Qualifications

Figure 6. Most popular pathways for women 2013-14

BY university course (by subject area), the number of students studying this subject (nearest 100), the most common graduate occupations* and how many students studying this subject go on to work in this occupation?



*Standard Occupational Classifications
Source: HESA, Deloitte analysis

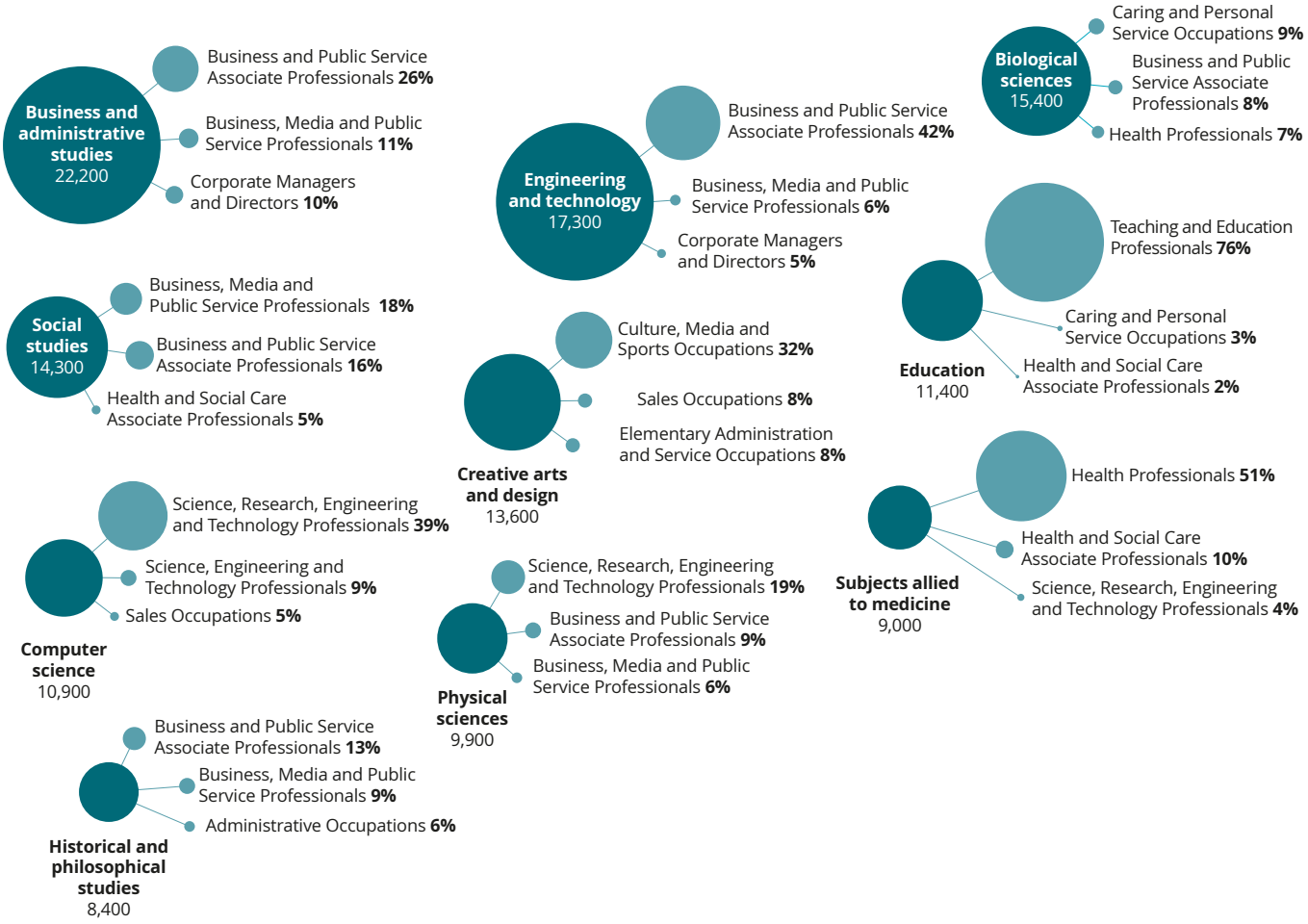
Even so, graduates in certain academic subjects are more likely to move on to certain types of job than others. In some subject areas, there is a strong connection between degree course and career choice: for example 95 per cent of nursing students go on to take a job in a nursing occupation. It also seems probable that most graduates finishing a course in education will go into teaching.

Our analysis indicates that a much larger proportion of women than men graduates move into jobs relating to caring or teaching, whereas a larger proportion of men than women move on to jobs where technical skills are required (and manual skills, although the total numbers of graduates in manual jobs is low).

Figures 6 and 7 show, for women and men graduates in 2013-14, the ten most popular subject areas and the most common career pathways that these graduates take.

Figure 7. Most popular pathways for men 2013-14

BY university course (by subject area), the number of students studying this subject (nearest 100), the most common graduate occupations* and how many students studying this subject go on to work in this occupation?



*Standard Occupational Classifications
Source: HESA, Deloitte analysis

More jobs for women, more money for men

"Our labour market remains highly divided with sectors dominated by women tending to be the lowest paid."[11]

Evidence presented to the Women and Equalities Committee Gender Pay Gap inquiry, 2015

Choices made by boys and girls about their academic careers from GCSE through to university influence the jobs they enter into after graduation. Some types of job are paid more than others, and men are more likely to go into higher-paid work than women because of the academic choices they have made earlier in life.

A qualification in science or mathematics is essential for a wide range of jobs that carry a wage premium, but a relatively small proportion of women study these subjects at A-Level and university. For example, only 15 per cent of full-time undergraduate entrants into engineering and technology for the academic year 2014-15 were female.

It is too simplistic to explain the gender pay gap in terms of pay inequality. Instead, it should be acknowledged that the gap occurs to some extent because of the differences in job pathways followed by men and women. These in turn are affected by academic choices earlier in life, the differences in the subjects that male and female students study, and the wider skill sets that they acquire during their education. The choices that students make ahead of university have a profound impact on the earning potential in their future working life.

Using HESA's data, we measured the median starting salaries for new graduates for all subject areas, which are shown in Figure 8. It can be seen that the gap between men and women is smallest for subjects such as Engineering and Technology, and for Medicine and subjects allied to it. In Figure 9, we show the most popular occupations entered by graduates for which both salary and occupation information were recorded. It can be seen that even in occupations dominated by women, male graduates are, on average, paid considerably more. Considering median annual earnings for full-time workers in the wider workforce, as obtained from the Annual Survey of Annual Earnings from the ONS (using 2014 figures, which were the most recent, definitive figures available at the time of writing), the gap between men and women widens considerably for every occupation.

Figure 8. Starting salary and gender pay gap for graduates of all subjects

Subject area	Number of graduates*	% women	% men	Median starting salary for women graduates	Median starting salary for men graduates	Graduate starting salary pay gap (%)
All STEM subjects*	**76,526**	**53**	**47**	**£22,000**	**£24,000**	**-8**
Medicine and dentistry	5,712	57	43	£30,000	£30,000	0
Subjects allied to medicine	25,115	80	20	£22,000	£22,000	0
Biological sciences	13,285	62	38	£18,000	£19,000	-5
Veterinary science	455	75	25	£26,000	£27,000	-4
Agriculture and related subjects	1,391	63	37	£18,000	£21,000	-14
Physical sciences	6,336	41	59	£20,000	£23,000	-13
Mathematical sciences	2,833	41	59	£22,000	£24,000	-8
Computer science	5,980	15	85	£22,000	£23,000	-4
Engineering and technology	10,184	14	86	£26,000	£26,000	0
Architecture, building and planning	5,234	28	72	£22,000	£24,000	-8
All non-STEM subjects*	**96,824**	**62**	**38**	**£20,000**	**£22,000**	**-9**
Social studies	16,444	62	38	£21,000	£23,000	-9
Law	5,227	60	40	£18,000	£20,000	-10
Business and administrative studies	21,138	49	51	£20,000	£23,000	-13
Mass communications and documentation	3,697	58	42	£17,000	£17,000	0
Languages	7,093	71	29	£18,000	£19,000	-5
Historical and philosophical studies	5,679	52	48	£18,000	£19,000	-5
Creative arts and design	10,379	62	38	£16,000	£17,000	-6
Education	25,819	75	25	£22,000	£24,000	-8
Combined	1,348	60	40	£21,000	£26,000	-19

*STEM subjects defined at high level by the Parliamentary Science and Technology Committee[12]

Source: HESA, ONS, Deloitte analysis

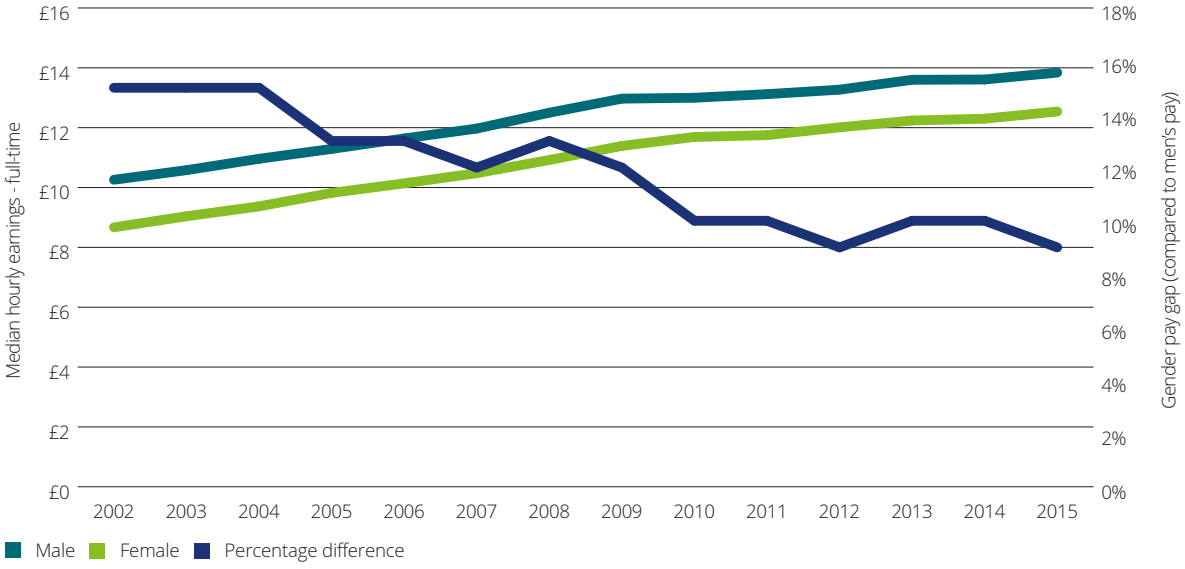
Figure 9. Starting salary and gender pay gap for graduates for ten most common occupations entered

Standard Occupational Classification	Number of graduates*	% women	% men	Median starting salary for women graduates	Median starting salary for men graduates	Graduate starting salary pay gap (%)	Median full-time salary for women	Median full-time salary for men	Potential pay gap (%)
Health Professionals	27,625	78	22	£24,000	£28,000	-14	£32,472	£40,943	-21
Teaching and Education Professionals	26,409	72	28	£22,000	£23,000	-4	£35,023	£39,538	-11
Business and Public Service Associate Professionals	26,360	54	46	£20,000	£22,000	-9	£28,752	£36,646	-22
Business, Media and Public Service Professionals	18,319	51	49	£24,000	£25,000	-4	£33,588	£38,695	-13
Science, Research, Engineering and Technology Professionals	17,489	26	74	£25,000	£26,000	-4	£34,543	£40,415	-15
Administrative Occupations	8,407	65	35	£17,000	£17,000	0	£20,526	£23,502	-13
Caring and Personal Service Occupations	7,109	81	19	£14,000	£15,000	-7	£16,408	£18,922	-13
Culture, Media and Sports Occupations	6,418	50	50	£17,000	£18,000	-6	£25,096	£28,305	-11
Corporate Managers and Directors	6,023	41	59	£30,000	£35,000	-14	£37,129	£46,645	-20
Health and Social Care Associate Professionals	5,187	69	31	£20,000	£22,000	-9	£23,992	£27,586	-13

*For whom occupation and starting salary are known

Source: HESA, ONS, Deloitte analysis

Figure 10. Gender pay gap (all employees) between 2002 and 2015



Source: Gov.uk

We have also examined how the gender pay gap is changing overall for all occupations. Figure 10 shows the difference in median hourly pay awarded to men and women in full-time work as a percentage of male pay from 2002 to 2015. The difference in hourly pay is closing at approximately 2.5 pence per annum. In percentage terms, the rate is slowing because both men's and women's pay is increasing. However, if the rate of closure remains the same, we estimate that women's pay will equal men's in approximately 53 years.

Technology and the changing UK jobs market

"Through robotics, big data, the digitisation of industries and the Internet of Things, the nature of occupations and whole industries is changing and also the dynamics of economic growth."[13]

Carl Benedikt Frey and Michael Osborne

Technology and job creation

The jobs market is continually changing in response to technological developments. Robotics, 'big data', artificial intelligence and information technology in general are changing the workplace. Different skills are needed by humans to perform valuable jobs in such an information-based, digital economy. Advances in technology in the workplace require the workforce to be nimble: a 2015 report by Deloitte, *From brawn to brains: The impact of technology on jobs in the UK*, found that the UK had benefited from a technology-driven shift away from routine jobs in the past 15 years.[14]

Instead of technology simply replacing human labour, the report identified a strong relationship between technological advancement and job creation. In the future businesses will need a range of social and cognitive skills, such as management capability, creativity and complex problem-solving.

Over the last 15 years, there has also been a corresponding shift in the skill-sets of men and women in the workforce. For women, employment has moved away from repetitive administrative functions, such as secretarial and administrative support, towards lower paid caring and teaching roles. Whereas for men, employment in repetitive physical tasks, such as operating machinery, has declined and shifted towards technical employment, such as computer programming, which is relatively high paid. We can expect similar changes to continue in the future.

New jobs are being created in various sectors of the economy, not just in 'high tech' occupations. However, it appears that new jobs created in the professional, scientific and technical sectors pay significantly more than new jobs in the health, social work and education sectors.[15]

Jobs: At risk from technology or future-proof?

Research by Carl Benedict Frey and Michael Osborne for Deloitte in 2014 produced estimates of the probability of automation for occupations in the UK, indicating the likelihood that particular jobs were at high-, medium- or low-risk in the next 10 to 20 years.[16] High-risk jobs are more likely to be lost as a result of technological advances, whereas low-risk occupations are relatively future-proof and might even increase in numbers. Their general findings are summarised in the sidebar, Gender effects in the fourth industrial revolution

Graduate jobs and the risk of automation

We analysed data from HESA's Destinations of Leavers from Higher Education survey for graduates in 2013-14 and matched the occupations identified by the survey against jobs that are classified in the Frey and Osborne research as high, medium or low risk. We found that about 60 per cent of jobs held by graduates six months or so after graduation can be classified as being in the low-risk category (or more likely to be future-proof against technological advances).

These future-proof occupations can themselves be classified into six broad areas:

- Creative occupations like musicians, artists and designers
- Manual occupations that require sophisticated dexterity like farming or building trades
- Teaching occupations, including teachers and driving instructors, which develop skills in others
- Caring occupations in the health and social care industry, like nursing and child protection

Gender effects in the fourth industrial revolution

Low risk

- Men are mostly employed in high skill, technical jobs and also in C-level positions, such as programmers and software developers, managers and directors in manufacturing and retail industries or as business development managers. Sales account managers and business development managers are the top occupations in the low-risk category where most men are employed.
- Women are mostly employed in caring, teaching and creative positions such as nurses, teaching professionals, hair dressers and barbers.

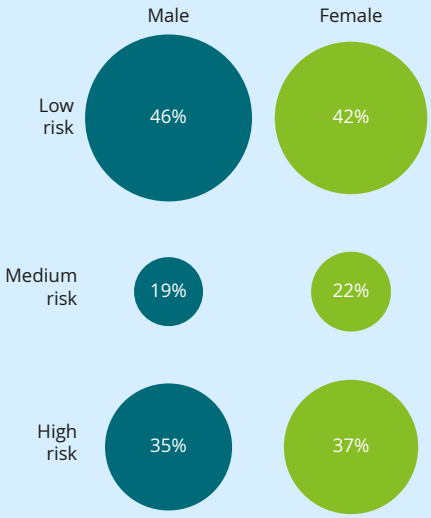
Medium risk

- Men are mostly employed in occupations that require some physical activity such as vehicle technicians, plumbers, gardeners etc. Chef is the top occupation where most men are employed in the medium-risk category.
- Women are mostly employed in jobs such as Teaching assistants, nursing assistants, educational support assistants. Care workers and home carers and cleaners and domestics are the top occupations where most women are employed in the medium-risk category.

High risk

- Men are mostly employed in occupations such as goods vehicle drivers, taxi drivers, van drivers and also in elementary storage occupations, sales and retail assistants, and carpenters and joiners. Driverless cars and 3D printing might pose a threat to drivers and carpenters and joiners, and robots might pose a threat to elementary storage occupations, and sales and retail assistants. Elementary storage occupations top the high-risk category where most men are employed.
- Women are mostly employed in occupations such as sales and retail assistants, book-keepers, receptionists, personal assistants and other secretaries. Virtual personal assistants – software robots powered by artificial intelligence – might pose a threat to these jobs. Sales and retail assistant jobs top the high-risk category where most women are employed.

Percentage of jobs at risk of automation (2015)

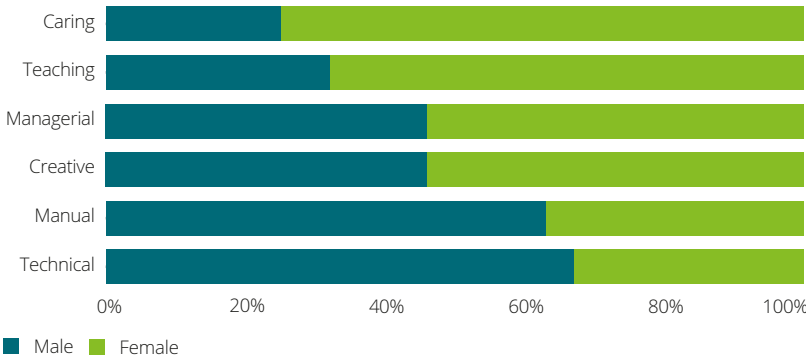


Source: Frey and Osborne, ONS, Deloitte analysis

- Management occupations, such as financial managers and project managers
- Technical occupations, which require complex problem-solving skills, such as scientists and engineers.

Our analysis found that occupations that are future-proof include the STEM-related jobs that men are more likely to take after graduation and the caring and education-related jobs that women are more likely to take. In all future-proof occupations, though, cognitive and social skills are very important. Our findings are summarised in Figure 11.

Figure 11. Number of graduates securing employment with a low chance of being automated, by skill 2013-14



Source: HESA, Deloitte analysis

It is too simplistic to refer to the difference in average salary between men and women in terms of a straightforward lack of parity in pay. Instead, upon first entering an occupation it should be acknowledged that the variation in pay relates mostly to the differences in the subjects men and women study.

Although both men and women in the workforce face a similar degree of risk of displacement (or opportunity) arising from automation, the profile of gender representation across occupations is very different. Therefore, we believe that technology will benefit male and female workers in very different ways.

However, the results of our analysis also suggest that, on balance, the impact of technology on future jobs will be 'gender-neutral'. Jobs that require cognitive skills and emotional intelligence, such as caring and teaching, in which women are disproportionately represented, will remain in demand and probably increase in number. Similarly there will be growth in the number of jobs that require complex technical or problem-solving capabilities, in which men are over-represented. This suggests that the divide in skills between genders, which we see from A-Level onwards, is likely to continue in the future. Technological change will simply reinforce this element of the gender pay gap, creating further divergence, unless more can be done to encourage girls from an early age to reject gender stereotyping and pursue academic qualifications and careers in which STEM subjects are as prominent as the cognitive and social skills.

Therefore, it is too simplistic to refer to the difference in average salary between men and women in terms of a straightforward lack of parity in pay. Instead, upon first entering an occupation it should be acknowledged that the variation in pay relates mostly to the differences in the subjects men and women study. The choices that students make ahead of university have a profound impact on the scope and earning potential of their future career.

Conclusion: Technology will not achieve gender pay equality

Despite notable advances in information, communications and many other forms of technology, the labour market in the 21st century still remains unequal in terms of the pay awarded to men and women – the gap in median hourly earnings between men and women in full-time employment currently stands at 9.4 per cent. At today's rate of progress, pay parity for all employees, on average, is not expected until 2069.

Since the gender pay gap has various causes, no single measure will be sufficient to eradicate it. We have suggested in this report that a part of the problem lies in the choices made by girls and boys at school about the academic subjects they take and consequently the skills they acquire in their learning. Forty per cent more boys than girls study design and technology or information technology at GCSE level, and at A-Level nearly twice as many boys as girls study STEM subjects. And despite more women than men studying at university, the choices they make in higher education continue to drive a considerable wedge between the genders later on in their careers.

However, job opportunities will continue to grow in an increasingly technological workplace, and ability in STEM subjects also drives up median pay. But women are disproportionately more likely to go into occupations where pay levels are lower, such as caring and personal service or administrative and elementary occupations. These occupations provide a strong platform for developing cognitive and social skills – the essential talents of a flexible future workforce – but these skills are not being transferred across into the wider pool of occupations currently dominated by men. Without a change in perceptions by women (and probably also of women) the skills gap that begins to emerge at school age will not disappear. Moreover, advances in technology, which should improve the situation in the future, are if anything likely to contribute to maintaining or even further widening the gender pay gap.

This clear divide in the skills between genders needs to be addressed so that all students – whether male or female and at all stages of their education – are provided with an equal foundation upon which they can build the career of their choice. To be successful will require greater equality in the nature of the support provided to students, improved recognition that the way males and females are taught may need to be different, and greater encouragement and breadth of careers advice from schools and parents. Only then will women be able to make better-informed choices about the potential of their future careers.

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Key actions for businesses

Tackling the gender pay gap, and its root causes, depends upon strengthening the engagement that already exists between businesses, educators and policymakers. In particular, businesses have to take a greater role in helping to reduce the ingrained differences in the skills that women gain and develop during their academic studies, and therefore in the jobs they go on to take. If more women are encouraged to study STEM subjects and subsequently given the support they need to apply their skills in business, we not only prepare them for the future world of work but simultaneously tap into huge latent potential.

Our recommendations

1. Provide educators and policymakers with practical careers insight
No-one knows the world of work better than the businesses and other enterprises that populate it. All enterprises have a selfish interest in helping educators and policymakers to understand what a business of the future is likely to look like. We recommend that businesses educate the educators about the shift that is needed from acquiring knowledge to developing the technical, creative, management and practical problem-solving skills that human workers will need to complement technologies like artificial intelligence.

2. Provide more support for women returning to work
A large majority of women with expertise in STEM subjects are not working in industries that require these skills. The consequences of this 'missing talent' is two-fold: a disproportionate number of women are working in roles that are not well paid, and the economy as a whole is missing out on a hugely valuable pool of ideas and skills. Part of the challenge is that many women cannot participate in STEM-based occupations in a flexible way, balancing the often-competing pressures of work and home life. We recommend, therefore, that businesses develop or strengthen programmes for helping mothers transition back into work and examine the further potential for using technology to help more people work flexibly.

3. Publish detailed information on the gender pay gap
As more organisations publish details of their gender pay gap, the additional scrutiny applied will act as an incentive and spur businesses to greater action. We acknowledge that publishing sensitive data can be difficult, but it also represents a bold commitment to changing the status quo – and will speed up the time that it takes to achieve pay parity.

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