
The gender gap in the tech industry starts in the classroom.

So why aren't girls choosing to study Computer Science?

TARGET AUDIENCE:

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1: Introduction

It is well documented that the technology sector is considered a male-dominated industry, with few women making up the workforce (*Tech Nation Report 2021*). By having a more diverse team working on product development, the team will be enhanced by additional balanced perspectives, views, and ideas. As a result of this diversity in the team, a more balanced product will be created that will consider both male and female use of the product.

According to research carried out by Microsoft, (*Girls in STEM: the importance of role models*) a girl's interest in the subject of computing starts to decline during primary school. By the time they are choosing careers and taking GCSE subjects the number of girls choosing computing drops. The figures for GCSE and A-Level candidates and for those taking a degree in computer science being female (Figure 1) indicate it is not something that improves over time. There are many factors that I will discuss in this report that affect why girls do not choose to study computer science.

The government is aware of the lack of computer science teachers, and to address this is offering bursaries and scholarships to entice people to train to teach the subject. However, I believe the curriculum and delivery of the subject is an area that requires consideration and change. As minister for education, you have the power to implement these changes. There has already been a large change in removing Information Computing and Technology (ICT) and introducing the subject as Computing, in this report I aim to offer further possible solutions and changes that could be made to improve the number of girls considering the subject. Alongside changes in the curriculum, it is important that the tech industry plays a part in promoting careers for girls to aspire to, and I also aim to offer solutions to this problem in the report.

2: Background

In 2014 Under the coalition government, Michael Gove the minister for Education at the time made changes to the national curriculum replacing ICT with Computing. He did this after consultation with the British computer society and the Royal Academy of Engineering to determine changes in the content of the curriculum. His opinion was that children in school learning ICT were not being equipped for further education in computer science or for entering the technology industry to start a career. At the time there was a decline in the number of students continuing to study computer science at the university level. This was seen as a problem because students were not being inspired, by the subject at a time when there was an increase in the need for skills in the technology sector. (*'Harmful' ICT curriculum set to be dropped to make way for rigorous computer science.*)

3: Statistics:

It is a well-known fact and it does not take much research to discover there is a gender gap in technology. Across GCSE, A- Level, and University, as well as in the technology industry there is only an average of 18% at each stage that are women. Figure 1 shows the percentage of females and males taking GCSE, and A-Levels in Computer Science, and the percentages of females and males applying for a university place on a computer science course. It also shows the balance between males and females in the Tech industry.

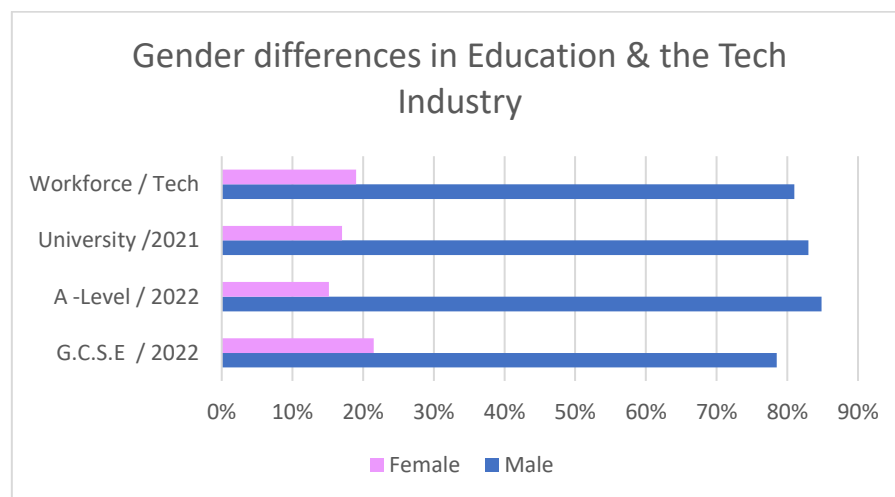
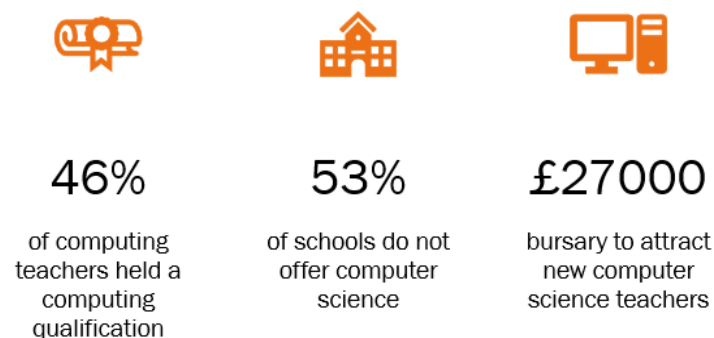


Figure 1: Gender differences in GCSE, A level, University, and the workplace

Owing to the lack of computer science teachers, more than half of secondary schools do not offer computer science as an option for students to study at GCSE level (*Computing education / Royal Society*). Furthermore, only 46% of computing teachers have a computing qualification (The Royal Society). In 2018 and 2019 teachers without the relevant qualifications were teaching half of the computing hours that were being taught in secondary school (*Research review series: computing.*). This has already been recognised as a problem by the government. To tackle this, incentives have been put in place in the form of large (£27,000 - £29,000) tax-free bursaries and scholarships for those who undertake a PGCE to teach secondary school computing.



Statistics are taken from (Ofqual - Analytics. 2021) ('8 Facts About Women in The Tech Industry', 2019) (UCAS Undergraduate sector-level end of cycle data resources 2022. 2022)

4: The reason girls do not pursue computer science

Confidence in the subject: Having confidence in a subject influences whether a student will choose to study that subject further, and also impacts their ability to achieve high grades (Jiang, Simpkins and Eccles, 2020). When girls feel that boys are more capable than them in a subject, it leads to them asking for less help and excelling less in the subject, the consequence of this is that they become disinterested.

Lack of role models: Girls have little access to female role models in the classroom. Girls who in secondary school, are taught by a female teacher have a higher likelihood of continuing to study the subject further (Olga Victoria Dulce-Salcedo, Dario Maldonado, Fabio Sanchez, 2022). This research regarding the importance of female role models is further backed up by a survey carried out by Microsoft. The survey indicated that the girl's interest in computing doubles when this coincides with them having a female teacher as a role model. Microsoft's research also showed that role models from the industry were also considered to be influential, whereas celebrities were not (*Girls in STEM: the importance of role models.*).

Stereotypes in the industry: Stereotypes are formed at a young age and affect the beliefs and motivation of students toward computing (Jiang, Simpkins and Eccles, 2020). alongside this, parents also hold these ideas towards stereotypes in the tech industry, so when influencing a daughter's choice of career this will have an impact on the decisions she makes.

The curriculum: Not many girls are going to develop a passion and interest in computer science if the content of their early introduction to computing is dry with topics such as systems architecture. The curriculum does not include elements such as creating relatable programs and solving challenges, which are not abstract but are relevant to students. The curriculum does not inspire girls with the possibilities that computer science can offer in the real world.

5: Recommendations for change

5.1 Education

As minister for education, the curriculum is your responsibility. The following suggestions could be made into a 5-year plan for education, thus making a start to reduce the gender gap in subject choices in secondary school. The effect of this will filter through to future university figures, and ultimately make a difference in the tech industry.

Segregation: Offering a space for girls to learn without boys was historically the case. In school, boys studied joinery, metalwork, and tech whilst the girls studied home economics and sewing. This was very gender stereotypical and not inclusive. My suggestion is to segregate the genders so that they can be taught differently, not so they can be taught different topics. By segregating the genders at an early age, they will have the ability to gain confidence in the subject and increase their interest in the subject. The same content would be learned but it would just be delivered differently. This would only be implemented in the

early years of secondary schooling, and then when the girls come together with the boys at GCSE level, they will have built their confidence and will have more inclination to continue studying the subject.

Segregation in the classroom however could have some downsides. It was questioned by Ellie Mulcahy (Adams, 2018), whose concerns were that segregation may reinforce stereotypes. She felt segregating the girls may have an adverse effect, reinforcing their need to be away from boys to excel in the subject. However, if only for a short time, then I believe the increase in their confidence would be beneficial.

There is research that indicates that when girls are in a single-sex school, the uptake for computing is higher than in mixed schools which would support the idea that segregation would increase girls' confidence and lead to their advancement in the subject. (Aedín Doris, Donal O'Neill, Olive Sweetman, 2013)

Cross-disciplinary Subjects: By having subjects taught in school that crossover each other, such as computing with the creative subjects that girls appear to prefer and choose, allows for introducing computing to them through other subjects. I support this suggestion with evidence from a study conducted by Raspberry Pi (Childs, 2022) where storytelling was combined with computing. The study suggested that storytelling was considered popular with young girls so was an advantage to help increase their confidence, through their enjoyment.

Pure & Applied Computer Science: Computer science could be taught similarly to maths. By having applied Computer Science and Pure computer Science, real-world uses of computing could be introduced to girls. The elements of computing that they enjoy most could lead them to study computing further in education and into the industry without the elements of the subject they do not enjoy putting them off.

5.2 Tech Companies

Promoting Women: As leading tech companies, you can make a difference by promoting the women you have in the workplace. Collaborating with schools and engaging with girls in the younger age groups, showing them that it is possible to be successful in tech and that there is a place for them in the industry. This collaboration can be through insight days, and career days held in school, and would give you as industry leaders an opportunity to try and help make a difference.

Promoting Diversity & Inclusion: Another difference could be made to address the gender imbalance, by promoting diversity and inclusion and making it a priority in the tech industry. By educating the current workforce and promoting zero tolerance in the workplace regarding bias and sexism. Furthermore, flexible working should be a positive option and a natural option. Female employees often leave mid-career to have families. By ensuring all employees have flexible working there is the possibility for progression in careers for all not just for men.

Benefits for Women: By offering benefits that are orientated towards women, roles will become more desirable to women, and will encourage them to pursue a career in the industry. Creating more career advancement opportunities for women, in addition to offering flexible working, will help to attract women into the industry.

Community-Based: Because you the leading tech industries are already well known to girls. Your involvement in community activities will give girls an opportunity to try computing away from the school environment. These community-based activities would provide a place where girls can explore different elements of computing, in a setting that can develop a sense of belonging. Such clubs do already exist, but by having you as industry experts involved these could be made more exciting and appealing and help by building confidence, and skills.

6: Conclusion

The problem will take a long time to solve. If the suggestions were implemented now, with girls about to start secondary school it will be at least 10 years before these girls would be able to complete university education and be ready to enter the workforce.

Whilst steps have already been taken to improve the number of teachers, it is also important that there are more female teachers, and that teachers who are teaching the subject are qualified in the subject. By encouraging more female teachers, girls will not only have a role model in the classroom but will also have instilled in them that there is a place for women in tech. The introduction of more female role models to girls can help go some way towards changing their views on the stereotypes in the industry.

For things to change, it is down to you as education minister in collaboration with the leaders of the UK tech companies, to introduce change. It is important by collaborating and working together, changes can be made so that the level of girls taking computer science for GCSE and continuing into further education increases. With the attraction of a career that offers benefits that suit women, the gender gap can be reduced, and the future of the tech industry could be much more balanced and improved.

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