

The Women in Technology Project Research Report 2015

Be A Tech Woman Today!

Can you see a woman
in a man's world?



Acknowledgements

This report has been compiled by Bev Jones and Christina Conroy OBE from Coralesce Ltd.

We are grateful to the Education and Training Foundation for funding and commissioning the Women in Technology Project which seeks to address this important gender equality area within the FE and Skills sector. We would also like to thank the girls and women who attended the Tech Parties in March 2015 who shared their ideas and creativity with us in developing materials and resources.

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1. INTRODUCTION

The Women in Technology Project seeks to engage more girls and women into technology by developing a two-way street leadership programme that focuses on women leaders in the sector engaging with the technology industry. The aim is to build leadership capacity and address major gaps in the workforce. The project funded by the Education and Training Foundation has been carried out by Coralesce Ltd, a curriculum development and project management agency.

The aim will be to build the leadership pipeline in the sector and also develop a model of distributed leadership to create whole systems change. It will also seek to develop strategies to engage more girls into technology. Recent figures show that only 5,604 female students are currently enrolled in university computing courses, compared to 24,908 male students. In other words, for every one woman studying computing, there are just over five men: the lowest proportion of female computing students in recent years. With so few girls graduating with these vital technical skills, the UK economy is missing a number of opportunities for growth, innovation and success.

The agenda for action has been highlighted in the recent report from the Lords Select Committee chaired by Baroness Sally Morgan, “Make or Break: the UKs Digital Future 2015” (February 2015) which urges the incoming government to seize the opportunity to secure the UK’s place as a global digital leader. They state that increasing the number of women working in IT could generate an extra £2.6 billion each year for the UK economy. Women make up under 30% of the ICT workforce, comprising around 20% of computer graduates and under 10% of app developers “If we can crack the issue of getting more girls into those types of careers, there could be huge business benefits... Significant efforts need to be made to increase the pool of talent”.

Whilst women’s representation in the workforce has risen over the years and now stands at 46% however women make up under 30% of the ICT workforce, comprising around 20% of computer graduates and under 10% of app developers.

Diversity Data published on major global Technology companies indicates that only around 1 in 4 technology and leadership roles are undertaken by women. *Lightner, R & Molla, R, ‘Diversity in Tech companies’, Wall Street Journal 30 December 2014*

Percentage of Women and Men in Technology Jobs (world-wide) by company

Name of Company	No. of Employees	%Male	%Female
Ebay	31,800	76%	24%
Apple	92,600	80%	20%
LinkedIn	6,442	83%	17%
Google	51,564	83%	17%
Microsoft	128,000	83%	17%
Facebook	8,348	85%	15%
Yahoo	12,200	85%	15%
Twitter	3,600	90%	10%

Percentage of Women and Men in Leadership Roles in Technology Companies (world-wide)
by company

Name of Company	No. of Employees	%Male	%Female
Ebay	31,800	72%	28%
Apple	92,600	72%	28%
Amazon	117,300	75%	25%
LinkedIn	6,442	75%	25%
Google	51,564	79%	21%
Microsoft	128,000	77%	23%
Facebook	8,348	77%	23%
Yahoo	12,200	77%	23%
Twitter	3,600	79%	21%
HP	302,000	80%	20%
INTEL	107,600	84%	16%

Source: Company Data collated by Renee Lightner and Rani Molla (Wall Street Journal) 30th December 2014

E-skills (the sector skills council for the IT industry) estimates in the UK that the number of women working in the technology sector has fallen from 17% to 16%. If we want more girls to see the technology sector as a career option we need to make small changes, try new approaches, take risks. Rather than searching for one single big solution to bringing more women into technology, we need to look for many, many small actions” *Parmar,B, ‘If we want more women in tech, we need to sweat the small stuff’, The Guardian. 8 October 2014*

This project builds on the good practice developed in the USA in relation to women in technology. (“*Women who choose computer science. What really matters: the critical role of encouragement and exposure*” *Google May 2014*) which has led to positive action by the tech industry in the USA. The economic rationale in the ‘tech industry’ is that by achieving a more diverse workforce this leads to better products for diverse users.

Whilst the US is taking positive action, even in Silicon Valley women are woefully under-represented in start-up and innovation technology companies. Research from the Silicon Valley bank in 2014 found fewer than half of organisations in innovation hubs around the world had even one women in a board or director role. Intel’s Chief Information Officer Kim Stevenson states “it’s important to have a diverse workforce, diverse teams produce better results as they understand who the end customer will be for technology. At Intel we are focused about diversity about asking what we are doing to ensure we have a pipeline and workforce and a set of leaders that are diverse by nature...we’re doing it by bringing technology to young women and creating a supply chain of diverse talent”. (*CIO(UK) Magazine February 2015*).

2. AIMS

The aims of the project are to:

- engage women leaders and practitioners in developing positive strategies within their institution to encourage female staff and students into

programming and the technology industry;

- develop a clear line of sight to work in the technology industry for the whole institution;
- drive up the effective use of technologies in teaching and learning by emulating best practice in the technology industry;
- develop an ongoing dialogue between the sector and the technology industry to provide internships and mentorship for women staff to improve understanding and engagement.
- encourage women to participate in the leadership register and create a strong community of practice for #techwomenuk

3. METHODOLOGY

The methodology for the baseline report was primarily desk based research. The focus was to explore girls' and women's engagement in STEM and specifically technology in the US and UK. The research also reviewed an analysis of good practice nationally and internationally to gain insights into initiatives and networks to encourage girls into computing and women and technology networks.

Additionally, Coralesce Ltd bought together a range of stakeholders to contribute to four informal focus groups entitled 'Tech Parties'. The stakeholder groups were women technologists; industry and FE leaders and girls aged 16 and 17. Ideas were shared on:

- Barriers to engagement
- Action to overcome barriers
- Initiatives to support girls into technology

4. RESEARCH FINDINGS

The literature highlights the wealth of research that has been undertaken on gender issues in STEM subjects, employment and their impact on the global economy. Many of the studies focus on engaging girls into STEM subjects and exploring the barriers to access and approaches to positive action to increase engagement.

4.1 Participation and Interest

In the US Women's representation is low at all levels of the STEM pipeline from interest at elementary and middle school through to take up of careers in STEM as an adult. Research shows that girls remain interested in STEM past middle school through to High School, with 74% of girls showing interest in STEM subjects, this is thought to be due to be a different perception of STEM which has been fuelled by young people engaging with digital technology. However, by the time they get to college only 20% of girls intended to major in science or maths compared to 50% of boys. *'Generation STEM', Girl Scout Research Institute, USA, May 2012*

Further US research indicates that equal numbers of boys and girls engage in Science and Maths at elementary, middle and high school. As many girls as boys leave school

intending to major in STEM subjects, however, fewer actually pursue a career in STEM. Significantly less women take up careers in the area of STEM compared to men which is significantly higher in physics, engineering and computing (20%). The research report *'Why so few Women in Technology, Engineering and Science'*, AAUW, USA, (2010) reviews the social and environmental factors and their impact on girls' achievement and engagement in STEM.

The UK report *'Not for People like me, Women in Science and Engineering'*, Macdonald, November 2014, highlighted that participation by girls in STEM was rising in many subjects, with the exception of physics, and that generally girls were out performing boys in STEM qualifications. This is in contrast to figures published by E-Skills *'Women in IT Scorecard'*, ESkills/BCS, June 2014 which noted that:

- The proportion of females who sat an IT related GCSE in 2013 was 44% (51% for all GCSE courses), a decrease of 3 percentage points compared to 2012
- In 2013 females accounted for just 6.5% of those taking Computing A-Level, a decline of 1.5 percentage points compared to 2012

However E-skills noted that females, although fewer in number, continue to outperform their male counterparts at GSCE and at Computing and ICT A-Levels. (76.3% of females compared to 69.2% of males who took an IT related (ICT and Computing) full course GCSE were awarded A*-C at GCSE level).

In vocational information technology (IT) qualifications, girls made up 38% of the cohort at Level 2 but around a third (31%) gained a distinction, compared with 21% of the boys. www.bbc.co.uk/news/education-23181672 However, participation fell at Level 3 with "The proportion of girls taking the more challenging Level 3 in IT was just 18% but again their grades were strong with 15% gaining the top grade, compared with 12% of their male classmates". www.bbc.co.uk/news/education-23181672.

At higher education level, females accounted for only 12% of those applying for Computer Science Degrees and 13% of those accepting taking up Degrees in Computer Science. *'Women in IT Scorecard'*, ESkills/BCS, June 2014.

Female participation in the UK workforce is now at 46%, but the number of women in STEM careers is still low. In particular, women only make-up 15% of ICT Professionals. *Labour market statistics, February 2014. Office of National Statistics, February 2014* The NAO statistics also show that "in general the country has seen a rise, albeit from a low base, in the number of women entering STEM careers. However, ICT is an exception, and the take up rate is still much higher for men and there has been a 15% decline in the number of female ICT technicians, with women now only making up 21.5% of the workforce compared to 25% in 2012". E-Skills research reveals that female representation in IT positions in the UK is lower than the EU norm (based on 15 EU member states). *'Women in IT Scorecard'*. E-Skills/BCS, June 2014.

4.2 Aspiration and STEM Identity

The Aspire survey of 19,000 students in years 6, 8 and 9 also found that there was no “evidence of a ‘poverty of aspirations’ among students or parents with almost all students reported that their parents value education and want them to do well. ‘*Aspire Young Peoples Science and Career Aspirations*’, Kings College London 2013. Evidence suggests that whilst girls aged 10 to 14 have relatively “high aspirations” for careers in professional, managerial and technical careers but by the ages of 10 to 14 girls had disengaged with STEM as a potential Career Pathway. ‘*Not for People like me*’, *Women in Science and Engineering*, Macdonald, A November 2014.

Disengagement in STEM is thought to be influenced by a number of factors including an individual’s STEM identity. Students develop a STEM or non-STEM identity at an early age and research suggests that students’ confidence and perception of their abilities and reinforcement by society play a big part in shaping STEM or non-STEM identity. In fact, by the age of 10 or 11 many girls have developed a non-stem identity and those of average academic ability, whilst enjoying STEM subjects perceive them as for the “brainy few”. (*Institute of Education*) <http://tisme-scienceandmaths.org/the-tisme-research-projects/upmap/>.

US research postulates that societal belief and learning environments impact on girls’ engagement in STEM subjects. It indicates that parents and teacher’s reinforcement of a student’s ability and intelligence plays a big part in girls’ achievement in STEM subjects, as does the stereotyping of boys being better at STEM subjects than girls. ‘*Why so few Women in Technology, Engineering and Science*’, AAUW, USA, (2010). This Research found that whilst girls set themselves high expectations when compared to boys, they generally assess their own Maths skills as being lower than they actually are as they believe boys are naturally better at Maths. In the UK research by the National Foundation for Educational demonstrates a “positive causal link between a students’ self-confidence in their ability in STEM subjects, and their actual achievement”. www.nfer.ac.uk/publications/BGASo1/BGASo1.pdf. This is often consciously or unconsciously reinforced by teachers’, parents and society who generally see boys as better at STEM subjects than girls.

Researchers also found that female working class and some minority ethnic students experience lower teacher expectations, often as with the findings of US research, caused by conscious and unconscious bias with “teachers favouring boys and perceiving them to be ‘better’ (and more ‘naturally able’) at science than girls, giving them higher marks for work, even where attainment data indicate otherwise”. Spear, M. (1987) “*The biasing influence of pupil sex in a science marking exercise*”, in A. Kelly (ed.), “*Science for girls?*” (pp. 46-51), Milton Keynes, Open University Press ; Archer, L., Osborne, J. & DeWitt, J. (2012) “*The Case for Early Education about STEM Careers*”, (p.8), London: The Science Council; Institute of Physics, “*Closing Doors: Exploring gender and subject choice in schools*”, December 2013.

4.3 Technology is for Boys – the impact of Stereotypes

Stakeholder groups(see Section 5) identified a key barrier to engaging girls in technology which is the perception that it is “ for boys” .They felt that the industry is still very much a male dominated environment with very few, if any, visible female role models. In fact, a report commissioned by telecommunications company Telephonica, reported “there are narrow stereotypes among the young about what it might be like to work in a digital job”. In an informal survey run within schools and using social media (by the Young Digital Taskforce), young people were asked to name people working in the digital industries. “Most were able to name Bill Gates, Steve Jobs and Mark Zuckerberg without any trouble..... but not a single woman was mentioned”. ‘UK Digital Skills Taskforce’, Telephonica, July 2014.

The government and the industry itself recognise the problem of under-representation of women, the report from the Lords Select Committee chaired by Baroness Sally Morgan, “*Make or Break: the UKs Digital Future 2015*” (February 2015) makes a clear link to the business benefits “If we can crack the issue of getting more girls into those types of careers, there could be huge business benefits... increasing the number of women working in IT could generate an extra £2.6 billion each year for the UK economy.

In a recent interview, Intel’s Chief Information Officer Kim Stevenson states “it’s important to have a diverse workforce, diverse teams produce better results as they understand who the end customer will be for technology. At Intel we are focused about diversity about asking what we are doing to ensure we have a pipeline and workforce and a set of leaders that are diverse by nature...we’re doing it by bringing technology to young women and creating a supply chain of diverse talent” (CIO(UK) Magazine February 2015).

Stereotyping was also identified as a barrier to entering a career in technology by the all-girl student focus group(see Section 5), who felt “there were strong social pressures on girls to veer away from technology as a subject choice despite them being interested in science and maths”. Their main concerns were being a minority in the course group, male behaviour, family pressures and fear of being seen as a social outsider”.

The research suggests that lack of female role models in the industry contributes to girls developing a non-STEM identify and influences their career choices and their parental perception of careers in STEM subjects. This view is supported by the annual ‘Girls’ Attitudes Survey’, *Girl Guiding UK, December 2011* which explored the opinions of over 1,200 girls aged 7-21, from a range of backgrounds (not just those participating in Guiding) “60% said they were put off careers in science by a lack of female role models” http://girlsattitudes.girlguiding.org.uk/about_the_survey/past_surveys_-_2011.aspx The UK Digital Skills Taskforce report goes onto say that “although there are misconceptions among those who choose not to come into digital roles, their view of tech jobs as male dominated is all too accurate. As of 2013, only 16% of IT specialists and just 11% of IT specialists within the IT sector are women”.

This bias invades the educational workplace, within universities in the US, only 22% of tenured staff within departments of computing and information science staff are women. This concern was echoed by the leaders and managers in the sector, most of whom had a largely male cohort of technology teachers, support staff and managers (see Section 5).

4.4 Early Engagement and building STEM Capital

Early engagement (at nursery and primary school) with technology is also seen as critical to increasing the number of girls entering technology as a course or career. By the time girls reach further education they have disengaged with STEM subjects and in the case of technology they do not understand how technology impacts on other sectors and careers. This view is supported by the research which found “primary teachers’ knowledge and confidence in science had [a direct effect] on students’ attitudes towards science and their attainment and progression in it” Wellcome Trust, 2008. <http://www.wellcome.ac.uk/Education-resources/Education-and-learning/Our-work/Teacher-training/WTS052326.html>.

Engaging girls in technology early was seen to be a critical factor to ensure they develop confidence in their abilities and support the development of science capital which is shown to have an impact on the likelihood of young people developing aspirations to enter science based careers. The five year longitudinal study by the Aspire Project developed a concept of science capital. ‘Science capital’ is not a separate ‘type’ of capital but rather a conceptual device for collating various types of economic, social and cultural capital that specifically relate to science – notably those which have the potential to generate use or exchange value for individuals or groups to support and enhance their attainment, engagement and/or participation in science.’ (Archer et al., 2013).

The five year longitudinal ASPIRE study demonstrates the significance of ‘science capital’ (the extent to which the family is positive towards STEM events and careers and incorporates STEM activities into family time), on children’s likelihood of seeing STEM as relevant and of value” and goes on to state “that a child from a family with medium or high science capital is more likely to aspire to science or STEM-related careers.” High and medium science capital was defined as qualifications, jobs and interest in STEM.

<http://www.kcl.ac.uk/sspp/departments/education/research/aspires/index.aspx>

However, they recognized that this early engagement and education brings its own challenges as teachers’ confidence, knowledge and competence in technology was a potential barrier to early engagement in STEM. Research by the Institute of Physics shows that teacher student relationships and quality of teaching were also important factors influencing the development of girls’ learning and suggests that girls had better relationships with humanities teachers than with STEM teachers.

www.iop.org/education/teacher/support/girls_physics/review/file_41599.pdf.

The stakeholder group (see Section 5) felt that the FE sector should work with primary teachers to develop confidence and skills in technology. By working collaboratively to encourage and support Primary schools to run technology

clubs, competitions and careers fairs to stimulate interests and provide girls with exposure to female role models from industry this would act as early encouragement.

4.5 Careers Education and Lack of female role models

Lack of information on the range of careers in science and technology is a recurring theme. These are arguably the biggest barrier to girls entering technology. All of the stakeholder groups (see Section 5) felt that there was insufficient information on the range of tech jobs available in tech and non-tech industries. Not only was there insufficient information, but the existing information also focused on the role description which might deter girls from considering a career in technology. The industry stakeholder group felt that there needed to be a greater focus on the soft skills and the need for those in the tech industry to have empathy with the end user, as well as the many rewards and benefits of working in technology (company car, overseas travel, good salaries and lifestyle). Research by LinkedIn also suggest promoting tech jobs based on the person specification rather than the job description as a way to attract more girls/women into the industry.

All research undertaken so far has indicated that the lack of female role models is probably the biggest issue facing the industry, in surveys undertaken by the TeenTech which indicate that they felt that lack of information on the wealth of job roles in technology limited opportunities for girls to join the tech industry. A survey undertaken by the National Audit Office also cited that “better careers information and guidance could impact on the number of girls going into STEM subjects. “Educating the next generation of scientists”, Department for Education & National Audit Office, November 2010. www.nao.org.uk/wp-content/uploads/2010/11/1011492es.pdf. They felt that improving the visibility of jobs and role models in technology through improved careers education, including promoting clear career pathways, jobs in technology and non-technology organisations was key to increasing the number of girls taking up technology.

To achieve this, it was felt that both parents and teachers should be exposed to the range of jobs, opportunities and benefits of working in technology companies as they are key influencers in girls’ career choices. The responses from the focus group of students’ (see Section 5) confirm that their “understanding of the job roles in the technology sector was very limited and therefore affected how they viewed potential careers in the tech industry. Only three of the 21 students in the focus group, had a good understanding of the job roles available to them and they were the students studying technology. The most recognised job roles in technology were: Computer technician (11 students), Teacher (6 students), Web Developer/Designer (5 students) and Gym Receptionist (5 students). This is reinforced by the annual ‘Girls’ Attitudes Survey’, *Girl guiding UK, December 2011* which explored the opinions of over 1,200 girls aged 7-21, from a range of backgrounds (not just those participating in Guiding) in which “43% of girls said they were put off science and engineering careers because they did not know enough about the kind of careers available.”

http://girlsattitudes.girlguiding.org.uk/about_the_survey/past_surveys_-_2011.aspx

Research commissioned by BIS suggests that “despite girls feeling that all jobs were open to them when they entered secondary school” (regardless of the traditional view

of what constituted female jobs), when interviewed at Key Stage 3 they felt “they were not sufficiently informed to make the choices their desired career paths required. They lacked information about starting salary, promotion prospects and earning potential” *John Perkins, ‘Review of Engineering Skills: The Department for Business, Innovation and Skills, November 2013, [www.gov.uk/government/uploads/system/uploads/ attachment data/file/254885/bis-13-1269-professor-john-perkins-review-of-engineering-skills.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/254885/bis-13-1269-professor-john-perkins-review-of-engineering-skills.pdf)*.

A key challenge facing the sector, is the fast moving development in technology and therefore the rapid change in jobs required and therefore the need to ensure teachers and careers education are up-to-date. This is evidenced by a recent analysis of the top ten most popular job titles amongst LinkedIn users that did not exist five years ago. Eight of the ten new titles were in roles associated with technology or digital jobs.

Source: LinkedIn Infographic. Available at: <http://talent.linkedin.com/blog/index.php/2014/01/top-10-job-titles-that-didnt-exist-5-years-ago-infographic>

TOP 8 TECH JOB TITLES

JOB TITLE	2008	2013	Growth
IOS DEVELOPER	89	12634	142X
ANDROID DEVELOPER	53	10554	199X
SOCIAL MEDIA INTERN	25	4358	174X
DATA SCIENTIST	142	4326	30X
UI/UX DESIGNER	159	3589	22X
BIG DATA ARCHITECT	0	3440	No baseline
CLOUD SERVICES SPECIALIST	195	3314	17X
DIGITAL MARKETING SPECIALIST	166	2886	17X

Employers involved in the Tech Party held at Oracle in Reading(see Section 5), suggested marketing jobs in the industry differently to attract girls, including:

- Promoting the skillset, particularly the soft skills ...required for jobs in the industry.
- Explaining that ‘Tech’ jobs happen in a broad range of companies, e.g. retail, not just in technology companies.

- Emphasising the need for empathy in designing products and the user experience.
- Exploring the range of non- tech roles in tech companies e.g. sales and marketing.

Employers also felt that not only was their lack of information on types of jobs but also about the rewards and benefits that work in technology could bring, including future prospects and a lifestyle that potentially included smart cars and overseas travel.

4.6 Role of Parents

This research report also sought to identify the key influencers on girls' study and career choices, girls attending the focus group said that "family pressure" played an important role in shaping their decisions.

A number of research reports highlight the significant role of parents and the wider family as influencers in girls' career choices. The Wellcome Trust research confirmed "that parents are the biggest influence on the career choices of 10 to 14 year olds".

www.wellcome.ac.uk/search-result.htm?q=wtp052603 (Wave 2) and Ofsted report that "only a minority of girls chose a STEM education and career path against their parents' advice" Ofsted – Office for Standards in Education, Children's Services and Skills (2011).

This in itself may be problematic as a public attitudes survey commissioned in 2011 suggests that "parents are somewhat more likely to see science as an activity for boys rather than girls". <https://www.ipsos-mori.com/researchpublications/researcharchive/2764/Public-Attitudes-to-Science-2011.aspx> Additionally, many parents will not have experienced careers in technology, seen female role models or be aware of the benefits to their daughters' of working in technology. The Telephonica report also stated that "a later survey by McAfee showed that just over 70% of adults questioned had not heard of any of Sheryl Sandberg, Facebook COO, Martha Lane-Fox, founder of lastminute.com or Marissa Mayer, Yahoo CEO" UK 'Digital Skills Taskforce', Telephonica, July 2014.

The recently published 'This report is for Everyone: The Connecting Tech City project', Centre for London, March 2015, reiterated this in its review of Digital Learning Programmes in East London Tech City Cluster, they found that "one of the major factors explaining why few local young people look for opportunities in the digital economy is that neither their teachers nor their parents are familiar with it or point them to it" The report goes on to say that companies recognized the moral and economic reasons to develop digital skills of young people and "there is widespread desire to support the development of local talent..... but commitment to time and money were limited..... especially amongst Tech Start-Ups".

4.7 Androcentric Working Environment

In the 'Encyclopaedia of Gender and Information Technology' edited by Trauth, E, Pennsylvania State University (2006) androcentrism is seen to prevail in the 'tech' industry which impacts on women choosing to work in the tech industry and being

retained in the industry. The term androcentrism has been introduced as an analytic concept by Charlotte Perkins Gilman in the scientific debate. Perkins Gilman described androcentric practices in society and the resulting problems in her investigation on *The Man-Made World; or, Our Androcentric Culture*, published in 1911. Thus androcentrism can be understood as a societal fixation on masculinity whereby all things originate. Under androcentrism, masculinity is normative and all things outside of masculinity are defined as other. According to Perkins Gilman, masculine patterns of life and masculine mind-sets claimed universality while female ones were considered as deviance. Androcentrism” therefore refer to a new kind of sexism, one that replaces the favouring of men over women with the favouring of masculinity over femininity. According to the rules of androcentrism, men and women alike are rewarded, but only insofar as they are masculine.

Doug Gross, CNN, 7th May 2012, ‘In tech, some bemoan the rise of 'brogrammer' culture’, identifies that the industry encourages the rise of 'brogrammer' culture. The term is a satirical one to describe computer pros with a fraternity party mind-set. Critics say the emerging style shuts out women and others who don't fit in. It can also have consequences, by alienating customers and potential hires. He cites the example of one of the world's biggest gatherings of Web culture, a 28-year-old executive talks about landing a tech job by sending a CEO "bikini shots" from a "nudie calendar" he created and on campus at Stanford University, a hot start up attracts recruits with a poster asking if they want to 'bro down and crush some code.'

Kimberley Weisul cites in *It's the Culture, Bro: Why Women Leave Tech*, 8 October 2014 <http://www.inc.com/kimberly-weisul/its-the-culture-bro-why-women-leave-tech.html> that the geeky "brogrammer" men of the tech industry are driving out everyone who doesn't look like them, according to 716 women who have left the industry. She cites research carried out by but Kieran Snyder, who's held senior leadership positions at Microsoft and Amazon, and is CEO and co-founder at text analysis start up Textio, who surveyed women who had once worked in tech, but no longer did, why they left via email, telephone and face-to-face conversations. She interviewed 716 women who had worked at 654 companies in 43 states. On average, they'd each worked in tech for seven years. “The answer: It's the culture, bro”.

She states that “For geeky men who never fit in socially, brogrammer culture may be reassuring in a way that more anodyne corporate cultures are not. Not only are the nerds finally on top, but they're encouraged to revel in their newfound status. It doesn't work that way for women. While motherhood is sometimes the straw that breaks the camel's back, so to speak, these camels were pretty unhappy before they became pregnant.” Some 484 women, or 68 percent, cited motherhood as one of the reasons they left tech jobs. Many women said it wasn't motherhood alone that did in their careers. Rather, it was the lack of flexible work arrangements, the unsupportive work environment, or a salary that was inadequate to pay for childcare. As Rebecca, a former motion graphics designer, put it, "Motherhood was just the amplifier. It made all the problems that I'd been putting up with forever actually intolerable. “Some 192 women, or 27 percent, said discomfort with the work environment, and either overt or implicit discrimination, factored in their decision to leave.

“Literally 28 of the 30 people in our company were white, straight men under 35. I was the only woman. I was one of only two gay people. I was the only person of

colour other than one guy from Japan. My co-workers called me Halle Berry. As in, "Oh, look, Halle Berry broke the website today." I'm pretty sure for some of them I'm the only actual black person they've ever spoken to. Everyone was the same, and no one was like me. How could I stay in that situation?"

Most of the women Snyder spoke with said they enjoyed the work itself. Many of the mothers said they would have stayed with their jobs, but their companies didn't offer maternity leaves (companies with fewer than 50 employees aren't covered by the Family and Medical Leave Act), and they had to quit to have kids.

Weisul states that "it strikes me, in reading Snyder's collected stories, that the "cool kids" of tech are imposing on women the lousy environment they once suffered through--back when they were the nerds who got teased and hassled. Some of the women reported outright harassment, but more reported something milder: the simple discomfort of not fitting in in an otherwise homogenous setting. It may not sound like a big deal if you're used to being in the majority but it was enough to drive many qualified engineers to quit."

Of the 716 women Snyder spoke with, 465, or 65 percent, are not working today. Some 251, or 35 percent, are working in non-tech jobs, and 45 of those, or six percent of the total, are running their own companies. Ninety-seven percent say they're never coming back to tech.

5. FOCUS GROUPS - 'TECH' PARTIES

Four 'Tech Parties' were organised for the four stakeholder constituencies: girls aged 16-17 years, FE leaders, Industry leaders and women technologists. The following themes came out in relation to the barriers for engagement, action to overcome barriers and initiatives to support girls into technology.

5.1 Women Technologists

On International Women's Day on the 8th March 2015 a group of women technologists in FE and Skills sector met up in Birmingham to share ideas about how to get more women in technology and also plan out the making of a short video blog with participants at the JISC Digifest15 Conference, Birmingham ICC (9th/10th March 2015) about "How would you inspire your daughter to get into technology?" These enterprising women came up with a range of ideas around 6 main themes: inspiring young women; careers in technology; tech parties; role models; recognition and links and promotions.

Question: How would you inspire your daughter to get into technology?

THEME	IDEAS
Inspiring Young Women	<ul style="list-style-type: none"> • Online profile which has awareness for young people in thinking about careers • Girls who Code clubs – free courses on coding pre-16 • Resources Pack on Coding for Girls for schools/colleges • Use pop culture such as 'Lady Gaga' in use of Digital media • Makie makie activities and competitions • Get Parent involvement in primary and secondary to develop websites to support their children

THEME	IDEAS
	<ul style="list-style-type: none"> • Robotic Building Activities (Robots are awesome) • Work with local Primary Schools to run tech workshops
Careers in Technology	<ul style="list-style-type: none"> • 9 partnerships industry/education links • Promote what's in it for me in technology e.g. salaries, exciting opportunities, industry growth, flexibility • Communicating the sector to avoid sexual stereotypes • Join FE at BETT – hands on event for women • Promote benefits of working in Tech with women's career timeline
Role Model with Industry	<ul style="list-style-type: none"> • Joint development with a sector such as Health on using technology • Knitted of Lego characters of Famous Tech women • Links to Design industry to show transferable skills • Role models that show what you can achieve • Women in history of technology • Use role models working in sector who would inspire • Job swaps • Industry internships for women • Support Network for Women - Geek Chic Clubs with networking, speed dating, share and inspire • Collective of Women Technologists in FE
Recognition	<ul style="list-style-type: none"> • Ebadge for participating in women in tech events • Digital photography competition – capture imagination of women using tech • Student competition to create an App/Game etc. • Tech challenge – find a tech solution for an everyday task • Reward and acknowledge those women already in Tech with competition Awards and features
Links and promotions	<ul style="list-style-type: none"> • Instagram- day in the life of women in technology • Key speakers of women who are already in technology on their journey • Find a new name for a women's version of GEEK • Tips for coping in a man's technology world • Blogs on a dedicated website • Women IT careers App (Tips on applying for Jobs and Highlighting opportunities) • Hook up with e-skills • Encourage girls to use in tech in self-employment (e-commerce)e.g. selling fashion, cupcakes • Power on brand(techwomenuk) for badges and sticking on equipment
Tech Parties	<ul style="list-style-type: none"> • Tupperware Party model for Tech Parties around the country • Twitter meets/chats to have online discussion • Show and tell at your tech Party • You Tube Channel for Tech party- online live stream to invite women and girls • Tech Parties in the community to attract adult women • Tech Party Resource Packs for Regional organisers • Tech Clubs with Design/App Development- sharing ideas- blogging etc.

THEME	IDEAS
	<ul style="list-style-type: none"> • Tech Recipes- Present Tech Tutorials or Activities like Recipe cards • Women’s Tip of the Day for Women in technology on a blog/website

5.2 Industry Leaders

A session was run with senior leaders from industry at Oracle HQ on 18th March 2015. The key question was how can we bring industry and FE together to inspire more women to address the under-representation of women in technology.

Question: How can we bring Industry and FE together to inspire more women?

Business Engagement

- Business Engagement - knowing who is the right person i.e. HR or someone specific in ‘tech’ to start the conversation
- Engage industry through networks/head-hunters
- Dame Sally Morgan review - seek out which companies gave evidence
- ‘Tech’ companies won't give funding but will give people and time
- Get industry to give 'teachers' to lecture on present state of industry
- Award in Education and Training - run for business in business - so swapping capabilities to share expertise - industry show senior managers about technology in business
- Industry partnerships to advise on skills required - need industry and ‘tech’ boards at college/Encourage companies to embrace ‘tech’ boards or college advisory boards as part of their community outreach- tell them it will also address skills

FE relevance

- Have to sell FE to Tech industry to understand the qualifications and capabilities - think it is all hairdressing and basic vocational skills
- Define what an FE college/UTC is and where it fits in education cycle and industry
- The way an FE college is marketed not a second class education -preparation for grown ups

Corporate social responsibility

- In Government Contracts/Bid expect ‘tech’ companies to specify in their corporate social responsibility work on diversity issues

Marketing of Jobs

- Do a marketing job on computing
- Market the benefits of being a woman in ‘tech’
- Awareness raising in FE of tech jobs
- Industry seen as dirty due to banking crisis so market the industry
- ‘Tech’ jobs happen in a broad range of companies not just in technology companies e.g. Coast, ASOS

- Present range of roles in 'tech' industry for careers inspiration
- Need to sell to academic girls BEng and BSc
- Market the diversity from small start-ups to huge corporations

Types of Jobs

- Emphasise the importance of empathy in designing products
- Most roles in technology companies are not just tech but also customer experience and sales
- Show different roles available to women in technology
- Define business requirements for soft skills as well tech skills (communication, using technology, self-motivated etc.)
- Address the skillset and work on how to sell that
- Show 'tech' developments need empathy and user experience awareness

Case Studies

- Case study of INTEL-how they have addressed diversity
- Reach out globally for good practice

Rewards

- Show lifestyle that comes with working in 'tech' e.g. money, future prospects that can buy you a lifestyle that you may desire 'Chanel handbags', smart cars and overseas travel
- Market the lifestyle target 14 year olds or earlier
- Market appreciation and respect, pay and flexible work style

Role Models

- Rich Jigsaw of video clips of women talking about role in 'tech'
- Young women 'tech' teachers as role models
- Role models in 'tech' to inspire girls

Parents

- Raise parental awareness to the range of modern careers in tech - careers more than university

Mentorship

- Women in Technology Time bank
- Provide industry Mentoring
- Peer mentorship - Women in technology register to network online -create innovative connections online

Education Initiatives

- Women in Technology Academy- co-designed and co-delivered
- Sponsored retraining programmes for women
- Hubs of technology not getting full talent pool - co-design and co-delivery of pre-entry training schemes
- Industry funding university subjects with regard to technology e.g. 3D printing
- Improve teaching methods in 'tech' so that learners can be inspired

- 16-18 critical stage for decision-making - if curriculum tailored to needs of industry will inspire more girls

Outreach activities

- Get your daughters into taster activities e.g. INTEL have Coding camp for age 6+ free courses
- Start Programmes at Primary school
- Create children's books - girls who code
- Industry Societies/Associations can support initiatives e.g. women aviators project by WISE/Engineering society

Other comments

- Once women have reached interview stage it is too late (as already lost a lot of women)
- Maternity leave if equal for men and women -so equal opportunities to advance in tech - maternity used as barrier to advancement

Two final sessions were run in the FE & Skills sector for FE & Skills Leaders and female FE students

5.3 FE & Skills Leaders

A session was run with senior leaders and managers from the learning and skills sector at the Euston Office on 24th March 2015. The representation included Principals, Vice Principals, industry and a representative of the independent training sector. A range of questions were generated from the research which resulted in 4 questions being asked at the event.

Question 1: What are the barriers to getting girls into technology?

Rationale: *Girls in year 6 and 9 enjoy STEM subjects and do well in them. A high % of girls cite STEM subjects as their favourite but are less likely to aspire to have a career in science or technology. Girls interested in STEM subjects tend to be higher achievers especially in Maths. The % of female participation in technology courses in the FE sector is generally very low.*

Results: All representatives from the Learning and Skills Sector cited examples of very low female participation in tech based programmes within their institutions or networks. A number of barriers were discussed including:

- A major barrier was considered to be lack of appropriate Careers Education which emanated from the lack of information about the range of job roles that exist with the tech industry and in other industry sectors. It was felt that technology was impacting on all job roles as outlined in the Lords Report on Digital Skills, which cites that by bringing more women into technology would generate £2.6 billion into the economy
- The group felt that technology was still seen as for “boys” and the industry was still very much seen as a male dominated environment with very few, if any, visible female role models. The working environment was also considered not to be conducive to attracting girls, it was not seen as a glamorous industry (girls would be seen to be dressing down).

- Lack of early engagement in technology was seen as a major barrier, by the time girls reach further education they have disengaged with STEM subjects and with the case of technology they do not understand how technology impacts on other sectors and careers. It was felt that education and engagement with technology needed to start early, in nursery and primary schools.
- Early education and engagement with technology brings its own challenges as teachers and parents are not confident and knowledgeable in technology themselves. The recent Lords Report on Digital Skills cite parents and teachers play a critical role in influencing future employment options for all young people (Paragraph 180).

Q2 How do we get more girls into Technology?

Rationale: Social and environment factors impact on girl's engagement in STEM, parental and teacher reinforcement impacts on girls engaging in technology. Girls interested in STEM are highly driven, especially by internal abilities rather than external factors. Parents are significant influencers on career aspirations, in USA fathers are cited as being the biggest influence, in UK mothers are cited as biggest influence on their daughters. Girls often feel uncomfortable about a career in Technology, they see it as "Geeky" and a man's world, and this is reinforced by a clear lack of female role models.

- Engaging girls in technology early was seen to be a critical factor to ensure they develop confidence in their abilities. It was suggested that this could be supported by developing books for primary age girls which reinforce females in technology. The group also felt that FE should work with primary teachers to develop confidence and skills in technology. Primary schools could be encouraged to run technology clubs, competitions and careers fairs to stimulate interests and provide girls with exposure to female role models from industry.
- Female role models, mentors and industry champions was seen as critical to raising the visibility of job roles and girl's aspirations to work in technology. Also 'girls only' initiatives run by females.
- Embedding technology into all curriculum areas and developing cross curriculum working including competitions, live briefs and projects to ensure girls see the impact of and use of technology on all careers.
- Improve the visibility of jobs and role models in technology through improved careers education, including promoting clear career pathways, jobs in technology and non-technology organisations. Parents and teachers should be exposed to the range of jobs, opportunities and benefits of working in technology companies as they are key influencers.

Q3 How do we engage FE and Industry to work together to get more women into industry.

- Draw employers in through arrange of initiatives including:
 - Careers events/fairs
 - Apprenticeships and recruitment activities
 - Shared training between FE and employees
 - Sponsoring, setting and assessing projects, live briefs and competitions

- Joint promotion activities
- Providing work experience and internships
- Bring female industry experts to run technology curriculum areas.
- Run network meetings (Tech Party Style) targeted at HR teams, linked to using FE as a recruitment pipeline.
- Work with industry to co-design curriculum and delivery.
- Build on existing work including apprenticeship trailblazer work
- Support industry to make itself more attractive to females.

Q4 Have you seen or run any effective initiatives to get more girls/women into technology?

- **Initiatives that exist and could be adapted included:**
 - Canvas organise visits to schools in USA targeted at women and ethnic groups.
 - Children’s university could be used to offer tech courses to girls aged 7 to 14
 - Jisc run a learner-led challenge programme
 - Idea challenge run by Nominet trust (Patron: Duke of York)
 - The Girls Network came out of Teach Too Innovation Unit
- **New initiatives**
 - Training nursery and primary teachers in using technology
 - Tech blogs by women for women
 - After school clubs, summer schools, competitions and role models for primary schools
 - Inclusion of technology on ALL courses
 - Develop cross curriculum projects

5.4 Female FE students

A session was run with 21 Year 1 and Year 2 students from levels 1-3 aged 16-18 from Tower Hamlets College on 24th March 2015. The students were at the College studying a range of subjects - Hair & Beauty (8 students), Early Years (3), Health and Social Care (3), Creative Media (2), ‘A’ levels (2) and Technology (3) and were ethnically diverse.

A range of questions were generated from the research which resulted in 4 questions being asked at the event.

Q1: Did you enjoy science and maths at school? If yes, why if no, why?

***Rationale:** Girls in year 6 and 9 enjoy STEM subjects and do well in them. A high % of girls cite STEM subjects as their favourite but are less likely to aspire to have a career in science or technology. Girls interested in STEM subjects tend to be higher achievers especially in Maths.*

Results: Out of the 21 girls present 11 of the girls had enjoyed either both science and maths and 5 girls had mixed views enjoying either maths or science – only 5 girls had disliked both science and maths.

- I enjoyed maths because I like working out and solving problems

- I liked experimenting and working things out
- Science is interesting
- I enjoyed science more than maths because I have never been good at numbers and I like doing the experiments
- Maths is easy and fun
- Enjoyed science course as it was interesting and fun
- Yes I did enjoy science and maths as I like problem solving and finding the cause of things
- I did enjoy science at school because I had a teacher that motivated me and especially liked the biology topics
- I enjoyed science because I loved all of the practical experiments
- Yes I did enjoy maths a little bit
- Yes I always loved it. It helps me relax-it is very interesting for me
- I did enjoy science and maths in school because they were interesting subjects. They were also fun. In science we were doing experiments and in maths when we were doing maths puzzles
- I enjoyed maths as you did not have to do practical work
- Yes maths taught me how to buy things
- Yes science - experiments were fun
- Yes maths great
- Yes it helped me learn the basics

Reasons given for not liking either Science or Maths:

- I did not enjoy maths at school because there were difficult symbols or numbers that did not make sense
- Science is boring and not interesting
- I did not enjoy the intensity of some units
- Hated maths because I lacked interest and I don't like numbers
- I did not enjoy science at all as it was quite boring and a lot of handwriting

Reasons for not liking both were as follows:

- Because they are both boring
- Because it was not fun or interesting
- Cannot concentrate in class then got bored
- Because it was very hard and it was complicated. Also because the experiments did not make sense to me. Also because you couldn't argue your own point
- Because it was difficult and it is too much

The results highlighted that the majority of girls had enjoyed science and/or maths at school and only 3 out of the 21 were taking technology the next question explored was what had discouraged them from studying technology.

Q2 What do you think discourages girls from studying or pursuing a career in technology?

Rationale: Social and environment factors impact on girl's engagement in STEM, parental and teacher reinforcement impacts on girls engaging in technology. Girls interested in STEM are highly driven, especially by internal abilities rather than external factors. Parents are significant influencers on career aspirations, in USA fathers are cited as being the biggest influence, in UK mothers are cited as biggest influence on their daughters. Girls often feel uncomfortable about a career in Technology, they see it as "Geeky" and a man's world.

Discouragement reasons cited were:

- Women don't know how to find some things on computers
- The men, environment and negative comments
- It is boring, it is masculine, it is man-made - human nature
- Men can be sexist this makes women uncomfortable
- The thing that discourages girls is that they are more male careers. If a girl does it, it is almost as if they are the only girl there. They stand out more.
- I think the thing that discourages girls from doing technology could be the lack of knowledge or due to the fact that they think it will be all boys on the course.
- Because it looks more like a role for men
- It could be just uninteresting for them
- Boring, people might judge them. It does not pull them in/ does not interest them to want to pursue a career
- Scared that people might judge them -call them names
- Women might not want to pursue a career in technology because it is not encouraged and due to the fact it is male dominated (fear of being judged)
- Girls are discouraged from pursuing a career in technology they may think girls don't know much about the field
- Knowing that they would be competing with men that have a much better understanding
- Stereotypical - boys jobs for technology not girls - family discouraging
- Lack of female role models
- Ratio of boys to girls in a class
- Peer pressure
- Career choices
- Stigma
- Religious values
- Policing of opposite gender/criticism of opposite gender
- Things that may discourage girls to do it is family- family may have a say ,as they may stigmatise
- It is a male subject
- Boys tend to choose it so girls may not feel comfortable being alone with boys
- Family don't necessarily accept girls can carry it out

The results highlighted that there were strong social pressures on girls to veer away from technology as a subject choice despite them being interested in science and maths. The main areas of concern were being a minority in the course group, male behaviour, family pressures and fear of being seen as a social outsider.

The girls were then asked why they had chosen their current subjects.

Q3 Why did you choose your subject?

Rationale: *Girls make stereotypical choices into roles where they are caring or tending to other people's needs. The roles of Hairdresser, Nurse or Teacher seem more accessible and more female friendly*

Health & Social Care

- It was something new and seemed interesting. It is also applicable within many sectors and I could take it into university
- I chose it because I would be able to gain more knowledge about health and social care. Also it would help me to get into my career which is nursing. I enjoy helping people.
- I chose Health & Social Care because I want to be a neonatal nurse

Early Years

- The reason why I chose childcare is because I enjoyed working with children and I want to work in a primary school
- I chose it because I like working with children
- I chose it because I like working with children and I also see myself working in a nursery and one day becoming a teacher

Hair & Beauty

- Because I thought it would be something I'd want to do in the future as my career
- Because I enjoy learning about hair and make-up. I like experimenting with make-up
- Because I like doing hair and styling and also doing facials
- Because I was interested in it
- I like hair and beauty because I like doing my sister's hair and friends and you get to do different hairstyles and make-up
- I picked hair and beauty because I like trying new things with make-up and hair
- I enjoy it because I have had experience before, it's interesting and a good match for me
- I chose hair because I want to progress to next level and do media make-up

Creative Media

- When I came to this college I did not speak English. I chose this course to improve my English
- I chose this course because I like to be creative and I want to be a film-maker

A levels

- English - because I have a natural talent for it, Sociology - Always found interesting, Psychology - The course appealed to me and the topics sounded interesting
- Sociology, English and Media- I chose these subjects as I enjoyed doing them in secondary and others such as media was because it was new and different and I wanted to explore subject

IT

- I chose it because it's something part of daily life now. It interests me and it's something that I feel I can express my skills on
- I chose to do technology because I was fascinated about the way computers work and I also thought it will be useful to know how they work
- Unsure

Q4 What do you perceive to be the job roles in technology?

Rationale: *Girls do not usually receive sufficient information on the wide range of jobs (including salaries and what vacancies there are) that exist in the field of Technology. Teachers, Parents and Careers Educators are not well informed about this field. Students are unaware that technology can be used to develop systems and products which help people, as research indicated that girls are more socially aware than boys. Limited information is given at school and in College regarding the different job roles there are in technology companies. It is unusual that an example of a well-known female working in the technology field is presented to girls. Where parents are interested in or work in STEM subjects girls become more interested in science/technology and develop more knowledge about technology and its relevance to everyday life.*

The responses highlighted that the student's understanding of the job roles in the technology sector is very limited which affects how they view the industry and potential careers. Only the girls studying technology had a good understanding of the job roles available.

11	Computer technician
6	Teacher/lecturer
5	Web Developers/Designer
5	Reception/Bookings/Gyms/Leisure Centres
3	Owning or Working in an Apple/Computer shop
2	Programmers
2	Game Developers
2	Software Engineers
2	ICT in Media/TV/Advert making
2	Business workers/Administrators
2	Graphic Designer
1	Many jobs
1	Photography
1	Network Engineer
1	Computer Forensics
1	Animator
1	IT Manager
1	Computer/Tech manufacturer

At the end of the session the students were asked to create posters to encourage more girls into technology which are published on the website www.techwomenuk.com

6. INITIATIVES TO TACKLE UNDER-REPRESENTATION

In response to the skills shortages being experienced in technology and digital industries and significant growth forecast for the sector, the UK and US governments, industry and not-for-profit organisations have developed (and funded) a range of formal and informal learning and networking initiatives to encourage young people to explore coding and digital technology. The summary below, is an indication of the range of initiatives taking place, and is by no means meant to be an exhaustive list. These initiatives are principally focused on

- encouraging girls and women to code through enrichment programmes and out of school initiatives;
- providing mentorship and role models

6.1 North American Schemes

Techbridge Girls Programme (US) promotes girls' interest and skills in STEM subjects through after school and summer clubs, family guides which provide advice to parents to support them encourage girls into STEM. They have developed "Role Models Matter" Online Training Toolkit which helps female role models develop skills to engage girls and underrepresented youth in STEM. www.techbridgegirls.org

FIRST (US) is a not-for profit charity with a mission to inspire young people into science and technology by engaging them in mentor-based programmes that build science, engineering and technology skills and inspires innovation, self-confidence and leadership skills. www.usfirst.org

"Made with Code?" (US) A Google-led initiative to get more girls involved in computer programming. This includes:

- a website featuring female role-model techies who write software to design cool fabrics or choreograph dances
- simple, fun coding lessons aimed at girls; and
- a directory of coding programs for girls.

Google also offer \$50 million in grants to support girls and women to learn to code in an attempt to tackle the gender inequality in tech roles as well as the deficit of women gaining computer science related degrees.

<http://www.google.com/diversity/for-the-future.html#getting-girls-to-code>

#YesWeCode, a non-profit organisation, supported by Facebook, offers a coding education to youths from low-opportunity backgrounds. #YesWeCode plans to provide a high quality education to 100,000 young people who would not normally have access to such resources. <http://www.yeswecode.org/>

Code.org (US) is a not-for-profit organisation which brings coding into the classroom and make it part of the curriculum thorough an open-source project, their resources are free to use in class and online. Code.org has backing from numerous large companies including Apple, Amazon, Facebook and Google. <http://code.org/learn>

The Girls Who Code (US) offer computer science education and tech industry exposure to 6th to 12th grade girls throughout the year. They run a summer Immersion Program which is an innovative approach to computer science education, pairing seven weeks of intensive instruction in robotics, web design, and mobile development with engaging, career-focused mentorship and exposure led by the industry's top female entrepreneurs and engineers.

<https://girlswhocode.com/clubs/>

App Camp 4 Girls (US) is a scheme for Girls in grades 6 through 8 take two-week long sessions where they brainstorm, design, code, and pitch their apps.

Geek Girl Camp (US) Geek Girl Camp hosts conferences and meet ups to connect with other women learning to code. All skill levels, from newbies just getting their

hands on HTML to more advanced engineers interested in building and marketing their own apps, are welcome.

Hackbright Academy (US) offer a ten-week fellowship for women in San Francisco, and it teaches web development fundamentals like HTML and Javascript, as well as computer science fundamentals. Hackbright introduce their students to some of Silicon Valley's biggest companies, including Facebook, Twitter, and Pinterest.

Girl Develop It (US) is a non-profit that provides coding classes for women, classes are made to be affordable and are available at many cities across America providing hackathons and tech-related events on top of classes.

Black Girls Code (US) where young and preteen girls can learn programming and computer science skills at one of the organization's workshops. Black Girls Code hosts classes at events all around the US and even in South Africa.

Girls Learning Code (Canada) provides coding camp and workshop which targets creative 9- to 13-year-old girls. The curriculum is focused on using technology as a tool for "changing the world."

Vidcode (USA) a Kickstarter project, is a web app that helps girls to learn code through applying effects to video. Based on the concept that girls like to pair up programming with their hobbies. The app they created teaches code by displaying the code when the effects are applied on the video, and explaining the code in simple language on a sidebar.

Ladies Learning Code (Canada) is a coding initiative started as a seminar in Toronto in July 2011 expanded across the whole of Canada. It provided workshops suitable for beginners and was such a huge hit that the organization decided to run additional programme for girls aged 6 to 16.

Girls Teaching Girls To Code (US) is a program where female students from Stanford's Computer Science Department teach computer science to high school girls. Not only do they help pass on the love for coding to their younger peers, these university students serve as mentors to the younger girls.

NCWIT AspireIT (US) connects high school and college women with K-12 girls interested in computing. Using a near-peer model, program leaders teach younger girls fundamentals in programming and computational thinking in fun, creative environments that are supported by program partners from the NCWIT community. The relationship between the program leaders and their program partners fosters mentoring with technical professionals, increases young women's confidence in their computing abilities, and develops valuable leadership skills

6.2 UK Schemes

Code for Life (UK) is an initiative, supported by Ocado Technology, designed to get children all around the UK into coding. Pupils use the Rapid Router web application to learn the basics of coding by programming a delivery van to drive around a series of different routes which get progressively more complex as pupils progress through the game. Rapid router is accompanied by a resource pack including lesson plans,

unplugged activity packs for use away from the computer and coding careers videos. The aim of the initiative is to equip teachers with the resources they need to facilitate a solid coding education for children, as many teachers feel they are not qualified to be teaching the subject. <https://www.codeforlife.education/>

STEMETTES encourages more girls to enter into STEM fields. They collaborate with schools to bring them interactive 'STEM in a day' programmes, and partnering with major corporations to push the girls in STEM agenda. They run a range of events including Hackathons, Meet Women in STEM and Come and Do STEM. Accenture are one of the organisations that have supported STEMettes to give girls aged 11-13 the opportunity to visit Accenture offices, address STEM-related challenges and hear Accenture women talk about their tech careers. <http://www.stemettes.org/>

STEMNET work with schools, colleges and STEM employers, to enable young people of all backgrounds and abilities to meet inspiring role models, get involved in hands-on activities that motivate, inspire and bring learning and career opportunities to life. The STEM Ambassadors Programme draws on volunteers to support teachers to make links from the curriculum to how STEM is practised in the world of work, 40% of STEM Ambassadors are female. <http://www.stemnet.org.uk/about-us/>

Teentech run a number of one day events across the country to help young teenagers see the wide range of career possibilities in Science, Engineering and Technology. The events are a collaboration, bringing together key professional organisations to create a special experience for young people. <http://www.teentech.com/>. TeenTech also provide careers and resources for parents and teachers.

Code First: Girls (UK) is for women living in the UK and aims to help young women currently attending university as they would be entering the workforce after their studies. They also offer courses for graduates but it's only limited to the general London area at the moment. Other events that they organize include hackathons and tech career talks.

Manchester Geek Girls (UK) seeks to promote science, technology and computing to girls and women through networking events and workshops. Manchester Girl Geeks is part of a wider network called the Girl Geek Dinners.

POPPET MAZAGINE (UK) Price £2.99 Launched by Mind Candy, the creators of the popular *Moshi Monsters Poppet* is a magazine targeting 7-10 year olds girls. The monthly magazine aims to inspire girls to pursue a career technology. The six main monsters from the gender neutral world of Moshi Monsters are all different colours and Poppet is the second most popular Monster. The editor Jessica King says of the magazine "The point we are trying to make is not that "pink is for girls" or that "girls can only like pink", it's that girls can like pink, or orange, or blue, or green, AND they can learn to code. AND they can be leaders. AND they can be whatever they want to be. Pink isn't the issue."

A recently published report by Centre for London identified over 60 informal learning programmes running in and around the Tech City London designed to engage young people in coding and digital skills development. *Connecting Tech City: This report is for Everyone*, March 2015,

“The East London Digital Learning Programmes are relatively informal programmes that work outside of the school curriculum to teach digital skills. These Programmes tend to share certain traits in common. Almost all of them have grown up within the East London cluster and have a sense of being part of it and of the local area. They have been founded by enthusiasts who understand digital technology and want to share its possibilities. They are both entrepreneurial and social in character – reflecting digital start up culture, they tend to be fast on their feet, innovative and focused on making a practical difference. Many rely on volunteers from the local digital sector”.

The programmes on offer are varied in how (one off taster, full-time course) and where they were delivered (in schools, workplace or community venues) and whether they were free or paid for, but generally they were highly unstructured and collaborative in nature.

Some of the Digital Learning Programmes specifically targeted girls and women in the Tech City area:

- Tech Future Girls is an after-school club designed specifically with girls in mind.
- Code Bar is a free weekly workshop run by female developers who want to share their knowledge.
- Girls in Tech London run open monthly events to raise the visibility of women in tech.
- DigiGirlyz High Tech Camp for girls, works to dispel stereotypes of the high-tech industry. During the camp session, the girls listen to executive speakers, participate in technology tours and demonstrations, network, and learn through hands-on experience in workshops.

The report undertaken by Centre for London identified that the informal and collaborative nature of the Digital Learning Programmes put them in a good position to support young people develop an interest, develop skills and find work in digital skills as those delivering the programmes had a good understanding of latest developments and employer needs and could therefore respond to the ever changing advances of technology. They also had good links with local employers and offered links to Tech Companies and those who work in them. There was also a recognition that “formal learning can only play a limited role in meeting digital skills gaps” as it is difficult for teachers in schools and FE Colleges to remain up-to-date with the fast moving changes in technology and job roles.

6.3 Industry Initiatives

Employers also support and run a range of initiatives to encourage and support women into technology.

Accenture (UK) host women's mentoring programmes which pair female leaders with leadership mentors and facilitate local women's networks which span globally. Their internal initiative, Accent on Women, provides a platform for Accenture's female employees to talk about technology and showcase role models throughout the company to inspire their colleagues to meet their full potential.

In the UK Capgemini take part in a range of initiatives under their Women@Capgemini programme. One of the most successful of these is their UK-based Women's Business Network, hosted by their UK Chair Person Christine Hodgson, and attract inspirational female speakers who share their career and life stories.

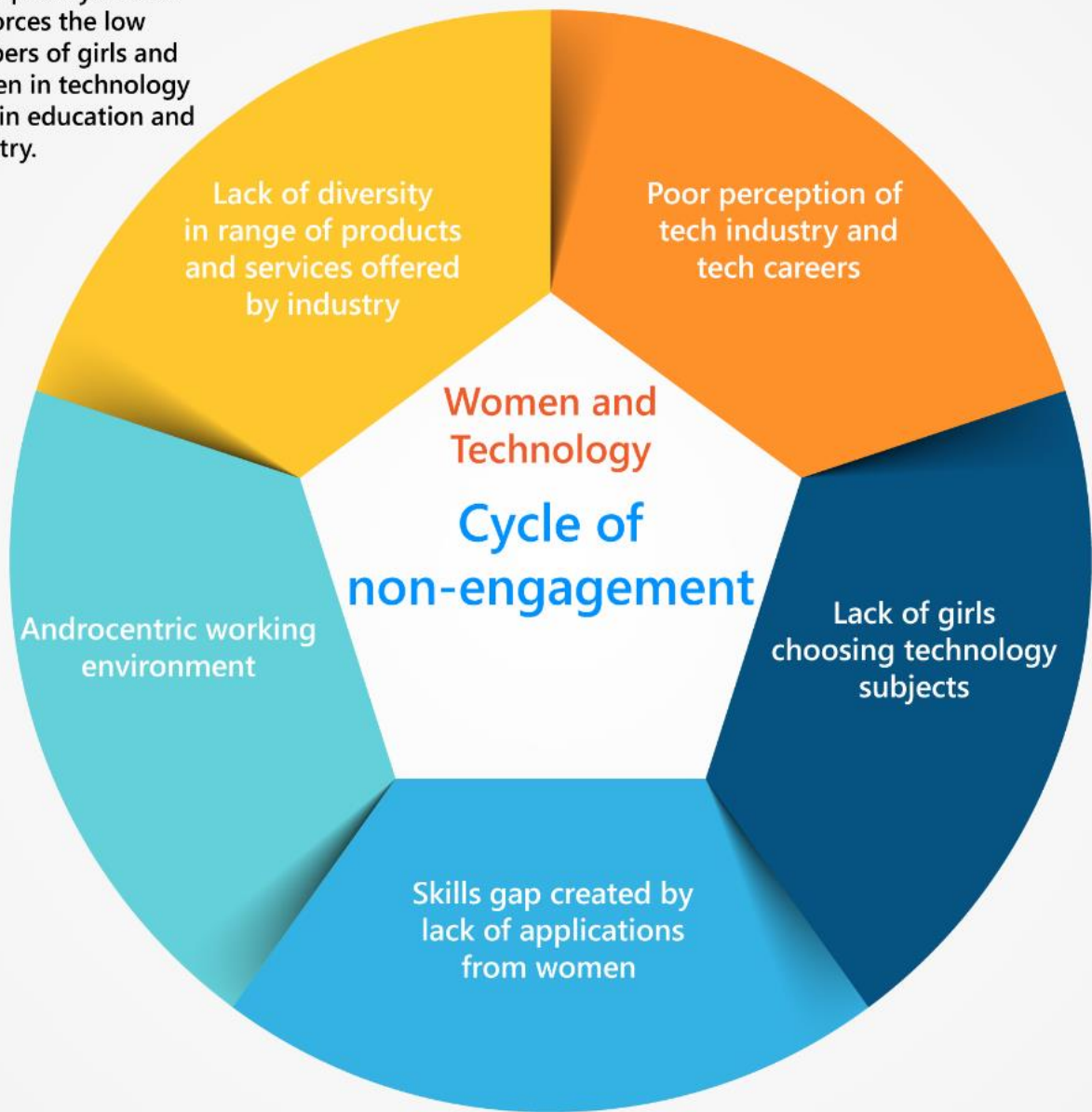
Cisco have a number of programmes and resources dedicated to helping women develop their skills as managers and executives. Women's Action Network is a grass-roots initiative aims to empower female leaders to develop through mentoring and discussion. Fujitsu hold the twice-yearly event Women in Technology. Since June 2013, leading female professionals have gathered to discuss issues such as how to get more women into tech jobs and how to nurture the next generation of female leaders in tech.

Network Rail offers girls between the ages of 16 and 18 a £9000 first-year university sponsorship as part of their 'Could IT be you?' Competition. Other prizes include paid work placements along with coaching and mentoring sessions from experienced IT professionals. Whilst O2 have drawn together research to create a guide Breaking the Boardroom. The guide offers advice to businesses on how to enable and support female leaders. It also comprises statistics on the effectiveness of current gender initiatives in the tech sector.

7 CONCLUSION

The research and ideas generated in the 'Tech Parties' suggests that a cycle of non-engagement occurs which is not only in relation to supply which causes under-representation but also the impact of the 'tech' industry environment affecting supply and maintenance. Initiatives and strategies for change need therefore to be designed in both education and industry. The two-way street model of leadership development with industry and education working together offers the scope to provide a rich collaboration to create solutions going forward to get more women in technology (see Fig 1).

A complex cycle that reinforces the low numbers of girls and women in technology both in education and industry.



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Fig 1 Cycle of Non-Engagment

BIBLIOGRAPHY

- AAUW, 'Why so few Women in Technology, Engineering and Science' USA, (2010)
- Archer, L., Osborne, J. & DeWitt, J. (2012) 'The Case for Early Education about STEM Careers', (p.8), London: The Science Council
- Kings College, 'Aspire Young Peoples Science and Career Aspirations', London 2013.
- Centre for London, 'Connecting Tech City: This report is for everyone', March 2015,
- Interview with INTEL CIO (CIO (UK) Magazine February 2015
- E-Skills and British Computing Society 'Women in IT Scorecard', June 2014
- Girl Scout Research, 'Institute Generation STEM', USA, May 2012
- Google, 'Women who choose computer science. What really matters: the critical role of encouragement and exposure', May 2014
- House of Lords Select Committee chaired by Baroness Sally Morgan, 'Make or Break: the UK's Digital Future 2015' (February 2015)
- Institute of Physics, 'Closing Doors: Exploring gender and subject choice in schools', December 2013.
- Perkins,R 'Review of Engineering Skills' The Department for Business, Innovation and Skills, November 2013,
- ONS, 'Labour market statistics February 2014. Office of National Statistics 2014
- Lightner, R & Molla, R, 'Diversity in Tech Companies', Wall Street Journal 30 December 2014
- Macdonald, Averil, , 'Not for People like me, Women in Science and Engineering', South East Physics Network, November 2014
- Parmar,B, 'If we want more women in tech, we need to sweat the small stuff', The Guardian. 8 October 2014
- Spear, M. (1987) 'The biasing influence of pupil sex in a science marking exercise', in A. Kelly (ed.), 'Science for girls?'(pp. 46-51), Milton Keynes, Open University Press;
- Telephonica , 'UK Digital Skills Taskforce', July 2014.
- Trauth, Eileen(Ed), 'Encyclopaedia of Gender and Information Technology', Pennsylvania State University (2006)
- Weisul, Kimberley, 'It's the Culture, Bro: Why Women Leave Tech', 8 October 2014



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