

Gender role models in STEM – inspiration or threat?

Wendy Sadler MBE

Cardiff University/science made simple

Background

It is well-reported that the number of women pursuing careers in the physical sciences and engineering is in the minority. Across the UK less than 20% of engineers are women and only 22% of those taking A level Physics are female¹. In Europe the numbers are similar in most countries. With the overall shortage of graduates in these areas, much effort has been spent on trying to even the balance. With the shortage being so large, the rationale has often been that appealing to only 50% of the population (male) will not help solve the problem of supply to the STEM industries. In addition to solving the STEM skills gap, there is evidence that more diverse teams perform better and that at the very highest level women have a positive impact on organisational success².

One of the ways that has been used extensively to tackle this issue is the use of role models working in STEM to show young people a more diverse range of scientists and engineers. There is evidence to suggest that a large number of young people still hold negative views of scientists and engineers. Many young people though use positive words to describe scientists (eg useful, clever, helpful, creative) but still do not self-identify as someone who could do science. They feel strongly that careers in STEM are 'not for people like me'.

What do we know?

One of the largest studies of student attitudes to STEM is an ongoing study in the UK called 'ASPIRES'. This has been tracking attitudes and career aspirations in over 7000 young people since the age of 10. Some of the results to come out so far include the conclusion that the level of 'science capital' held by a young person is by far the largest indicator of whether they will go on to a career in STEM³. Science capital is measured using a number of indicators including scientific literacy, attitudes, behaviours and social contacts⁴. The results of this study have started a shift in the methods used to tackle the diversity issues in the UK. There was previously a belief that students felt science in school was boring or not relevant to them – but this study showed that this was not the case. The main issue was that despite positive thoughts on science in schools almost no students saw themselves as scientists in the future.

COMPARISON OF SURVEY RESPONSES FROM
YEAR 6, YEAR 8 AND YEAR 9 STUDENTS
(% STRONGLY/AGREEING)

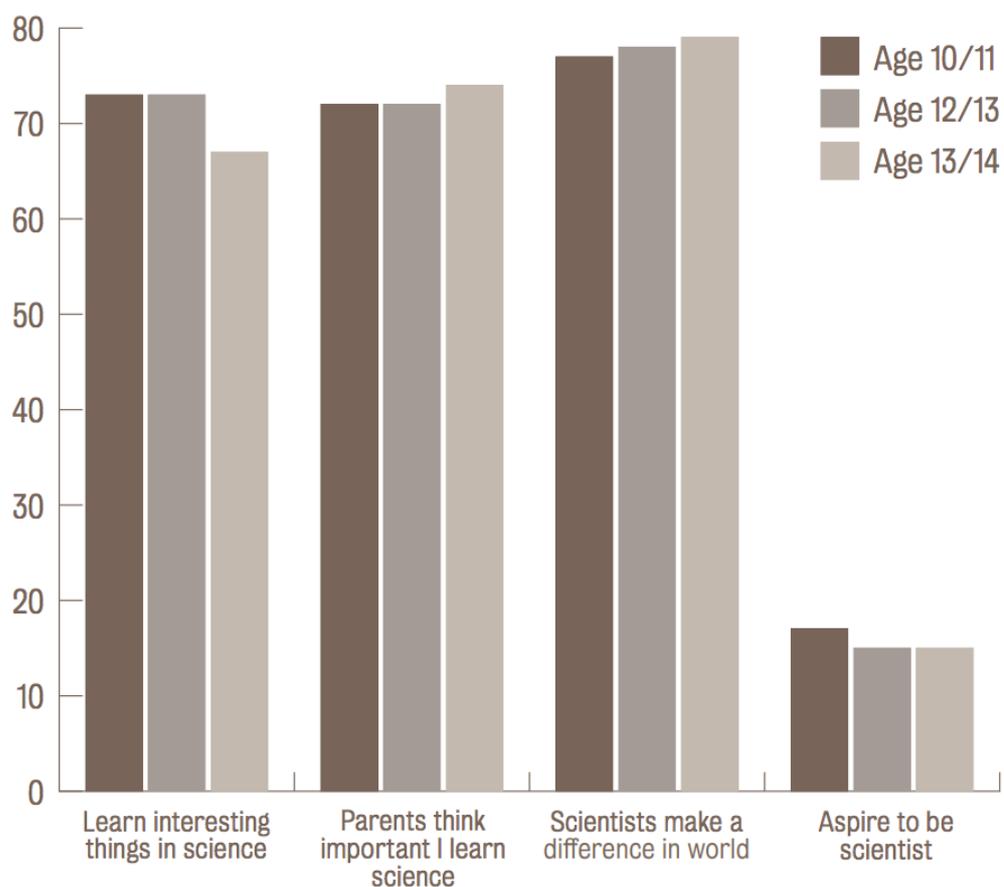


Fig 1: Data showing attitudes to science ages 10-14 (ASPIRES)

The problem that needs addressing it seems more than any other is the self-identity young people have and the fact that they think a job in science is 'not for people like me'. This is the case for both genders but is more even more of an effect with girls. One of the reactions to this research has come from an initiative by WISE (The Campaign for Women in Science and Engineering, UK). After commissioning a summary of research, they released a report called 'People like me⁵' and have followed up with a project of the same name which tries a slightly different approach. The workshop, which is aimed at girls only, gets girls to use positive adjectives to describe their own personality. The aim is to get across the messages that you are more likely to be happy in a job if the job skills required match your natural skills and characteristics. The answers to the quiz give the girls a job-type and then gives them case studies of women working in those type of roles within STEM organisations. As well as getting the girls to think of careers differently, the activity aims to show students that studying science can lead to many jobs that might use science skills without being the narrow definition of working in science that they have.

Using role models to promote a range of opportunities in STEM to girls is nothing new. Sometimes however the role models used can create an additional problem. By trying to overturn the nerd/geek image organisations deliberately choose high achievers and aesthetically beautiful women as representations in STEM. The danger here is that not only do young people think you have to be very clever to work in STEM, it now appears you have to be beautiful and thin as well! Research has shown that using ultra-feminine versions of women in STEM as aspirational role models is not a good idea for many girls. In the paper “My fair physicist”⁶ it was found that feminine STEM role models actually de-motivated young girls because the combination of career success and femininity seemed especially unattainable.

Case study of using role models in school enrichment

In 2004, the social enterprise *science made simple* received funding from the Welsh Government in partnership with WISE to develop a touring STEM show for 7-11 yr old students featuring real-life scientists and engineers in short videos talking about what they do and why they enjoy it. The show is called ‘Who wants to be a superhero?’. The show also includes live science experiments and audience interaction and is presented by a live presenter (who could be male or female). In 2013 the show was updated and new videos were made and the revised show was then toured to 60 schools. Attitudes to STEM and the scientists in the show were collected from 363 students and then follow-up focus group interviews were held with 4 groups of 6-8 students each to explore the themes that came up from the questionnaire results. The aim of the study was to find out whether the show affected student attitudes to scientists based on the descriptive words that students used to describe them. In addition, we wanted to find out if students favoured role models who they thought were most like them, or those who they felt had the job they would most like.

Students were asked if they would like a job in science or engineering before the show and after. Across all students there was an increase from 18-30% in those who would like to work in STEM with a bigger increase coming from the girls (increase from 10%-25%) than the boys (from 24-35%).

	All(%)		Girls(%)		Boys(%)	
	Pre-show	Post-show	Pre-show	Post-show	Pre-show	Post-show
Yes	18	30	10	25	24	35
No	32	18	33	17	32	21
Maybe	50	52	57	57	43	43

Table 1: Would you like a job in science or engineering when you're older?

The three words used by the students to describe scientists and engineers before and after the show were analysed and divided into positive, negative and neutral. The number of positive words used also increased after the show – again with a larger increase from the girls. The number of negative words used also decreased suggesting that overall the show had shifted the attitude of both genders towards a more positive response.

	Girls			Boys		
	Pre-show (%)	Post-show (%)	Difference (%)	Pre-show (%)	Post-show (%)	Difference (%)
Positive	28.91	42.39	+13.48	31.76	39.66	+7.90
Negative	4.95	2.14	-2.81	7.43	5.38	-2.05
Neutral	66.14	55.47	-10.67	60.81	54.97	-5.84

Table 2: Words used to describe scientists pre- and post-show.

	Boys			Girls		
	Pre-show (%)	Post-show (%)	Difference (%)	Pre-show (%)	Post-show (%)	Difference (%)
'Clever' 'Talented' 'Intelligent'	43.63	39.55	-4.08	47.69	39.87	-7.82
'Awesome' 'Cool' 'inspiring'	11.49	18.36	+6.87	10.12	21.51	+11.39
'Hardworking' 'Ambitious' 'Focussed'	6.56	7.10	+0.54	6.30	5.91	-0.39
'Creative' 'Designers' 'Pioneers'	6.08	4.87	-1.21	7.76	6.92	-0.84
'Dangerous' 'Brave' 'Strong'	5.89	3.75	-2.14	4.39	3.65	-0.74
'Helpful' 'Important'	4.44	6.80	+2.36	2.92	5.79	+2.87
'Nerdy' 'Crazy' 'Evil'	4.82	3.55	-1.27	4.27	1.76	-2.51

Table3: Most common words describing scientists, as a percentage of total responses before and after the show

By looking in more detail at the words used we can see that the most significant changes came in the use of the words that implied inherently high levels of intellect are required for science. These words reduced by 4% from boys and nearly 8% from girls. In contrast the aspirational words about the role models (Awesome, Cool, Inspiring) increased by almost 7% for the boys and over 11% for the girls. This suggests the show did manage to shift attitudes to show that a job in science might be an attractive possibility. The show is specifically designed to promote the message that scientists and engineers are helpful people who want to make the world a better place. Words relating to this societal role increased slightly (around 2%) in both boys and girls.

Conclusions & further research

The use of role models as a way to encourage young people into STEM is a widely used tool. This research tried to understand in more detail what changes might occur when primary school students encounter role models in STEM.

The survey data shows clearly that both genders enjoyed the show and could relate to one or more of the role models. It showed us that boys tend to favour male role models whilst girls choose females - although not exclusively. An interesting point arose in the focus groups where a number of students mentioned risk and danger as a reason why they might not choose STEM careers. This is something educationalists and scientist should keep in mind. As most of us behind role model projects are scientists or engineers at heart, we tend to choose role models that we think have an exciting job and perhaps we don't feel the same way about the risks encountered as the students do. This area could benefit from further research to help prevent us putting off young people with jobs they perceive to be too risky.

The intervention of a live performance featuring videos of real people (4 female, 2 male) seemed to be successful at reshaping how the students describe scientists and engineers. They moved from seeing them as purely 'clever' and 'intelligent' (properties that many young people think you are either born with or not) to 'cool' and 'inspiring' (something more people would aspire to).

We collected data from the students before the show on whether they knew anyone who worked in a STEM job. We have yet to analyse how this affects the words they use, or whether they themselves could imagine themselves as a scientist. As knowing someone in a STEM job is likely to increase the Science Capital of the student, the theory would predict that they are more likely to be positive about jobs in the field. It should be noted though that many students who said they knew someone in a STEM job were actually referring to a builder, plumber or carpenter – trade professional. These jobs certainly contain STEM elements but are perhaps not those that are referred to as STEM professions.

Further evaluation has been done on the effectiveness of the WISE People Like Me workshop with an older, female only audience. This work found that 57 % of the girls reported that they were now more interested in studying science and maths at school, and the percentage who were not interested at all had decreased from 10 % to 4 %. In this study, the girls were also asked to use words that describe a scientist. 'Interesting' was the top response (98 mentions) followed by 'clever' (26) varied (25) and useful (23)⁷.

There is more work to be done on exactly what can help the most in the use of role models as agents for change in attitudes to STEM and STEM careers but these two case studies provide some interesting areas for thought and further research. Clearly role models have an important part to play – providing they are used in an appropriate way. But they should not provide another difficult stereotype for girls or boys to live up to. A wide range of gender, race, social background and character are key requirements for any campaign to encourage more diverse students to feel that science certainly is for 'people like them'.

References

1. Engineering UK. *Key Facts in Engineering*. www.engineeringuk.com. Accessed September 13, 2018.
2. McKinsey. Delivering growth through diversity in the workplace | McKinsey. <https://www.mckinsey.com/business-functions/organization/our-insights/delivering->

- through-diversity. Accessed September 13, 2018.
3. Ker LA, DeWitt J, Osborne JF, Dillon JS, Wong B, Willis B. ASPIRES Report: Young people's science and career aspirations, age 10 –14. December 2013. [https://kclpure.kcl.ac.uk/portal/en/publications/aspires-report\(a0237ac7-cb43-473e-879a-1ea0addff0e3\).html](https://kclpure.kcl.ac.uk/portal/en/publications/aspires-report(a0237ac7-cb43-473e-879a-1ea0addff0e3).html). Accessed September 13, 2018.
 4. DeWitt J, Archer L, Mau A. Dimensions of science capital: exploring its potential for understanding students' science participation. *Int J Sci Educ*. 2016;38(16):2431-2449. doi:10.1080/09500693.2016.1248520
 5. Macdonald A. *‘Not for People like Me?’ Under-Represented Groups in Science, Technology and Engineering.*; 2014. www.wisecampaign.org.uk. Accessed September 13, 2018.
 6. Betz DE, Sekaquaptewa D. My Fair Physicist? Feminine Math and Science Role Models Demotivate Young Girls. *Soc Psychol Personal Sci*. 2012;3(6):738-746. doi:10.1177/1948550612440735
 7. Herman C, Kendall-Nicholas J, Sadler W. *People Like Me Evaluation Report.*; 2018. https://www.wisecampaign.org.uk/wp-content/uploads/2018/06/People-Like-Me-Evaluation-Report_June18-1.pdf. Accessed September 17, 2018.

Useful links

1. Information on science made simple and ‘Who wants to be a superhero?’ show www.sciencemadesimple.co.uk

2. Information on the WISE Campaign ‘People like me’ initiative <https://www.wisecampaign.org.uk/what-we-do/expertise/inspiring-girls-with-people-like-me/the-evidence-and-why-it-works/>