



**Figure 1** Bridging the gender gap – encouraging girls' engagement with STEM as they assemble parts for ambr 15

**Claire Seeley**  
looks at  
*STEM in the*  
context of  
the Big ideas  
and ASPIRES  
projects

# What do adults do all day?

**M**uch has been said about the shortage of young people choosing careers in STEM (science, technology, engineering and mathematics) subjects in the UK. The Institution of Mechanical Engineers' *Big ideas* report (IMechE, 2016) noted:

*The UK is not producing enough engineers or engineering technicians, and the engineers it is producing are typically from a strikingly narrow stratum of society. Not only do we need more engineers, we require a greater diversity of people to become engineers.* (p.5)

So, not only is there a shortage of people pursuing STEM-related careers today, but few people want these jobs in the future.

The *ASPIRES* report (King's College London, 2013) firmly threw down the gauntlet to primary science education. Their research found that:

*very few young people (approximately 15 per cent) aspire to become a scientist. This aspiration remains consistently low across the 10–14 age range. It is lower than many other types of aspiration and appears disproportionately low compared to students' reported interest in science.* (p.1)

This places a huge responsibility on primary educators not simply to foster a love of science from an early age, but also to encourage longer-term aspirations among children. The researchers also discovered that a key influence on aspiration was the amount of 'science capital' a family has. Part of what defines science capital is whether a family knows someone with a science-related job, which not all children do. From time to time, many of our friends and family may tire of our 'teacherly' shop talk! However, as teachers, we need to ask ourselves: are children exposed to shop talk in the home? Do our children know about different jobs?

The issue of talking about work can be complex. For example, about ten minutes walk from where I live there is an enormous research and development

facility employing a vast number of people working in STEM-related jobs. Friends who are close to, or even married to, people who work there are often unable to explain what they do, beyond 'it's something to do with computers'. Usually, after this question, we change the subject and continue drinking our tea. This issue isn't so rare and is highlighted in the *Big ideas* report, which remarks that 'engineers believe they are doing a poor job in communicating the value of engineering and what engineers actually do.' (p.47). Through their survey they discovered that people's perceptions of the work engineers do are very limited. It revealed that 'non-engineers had little awareness of the importance of engineering in areas such as food production or development of medicines' (p.18). So not only do we

Key words: ■ STEM ■ Industry links ■ Careers



**Figure 3** Preparing the liquids to put into ambr 15, to grow yeast in

**Figure 2** In the design lab, exploring how computer-aided design allows you to plan ahead

it together, from the initial idea to its final realisation. This people-centred approach focuses on inspiring children to think that they could do those jobs in the future, by introducing them to the world of work and people in the course of their daily jobs, and by seeing how science and technology enables amazing things to happen every day.

**Practical problem solving**

The Sartorius Stedim schools' programme focuses on a bioreactor known as ambr<sup>®</sup> 15 (Box 1) and is a great example of how robotics can be used in industry. Slightly disappointingly, it isn't a sentient robot such as BB-8 from *Star Wars*, but the bioreactor ambr 15 is an amazing robotic machine packed with lots of small miniature bioreactors growing cell samples in different conditions (e.g. temperature and pH). The machine takes continuous measurements from each bioreactor, providing a much quicker, as well as safer, solution for medical research compared with the hours of laboratory bench work otherwise required.

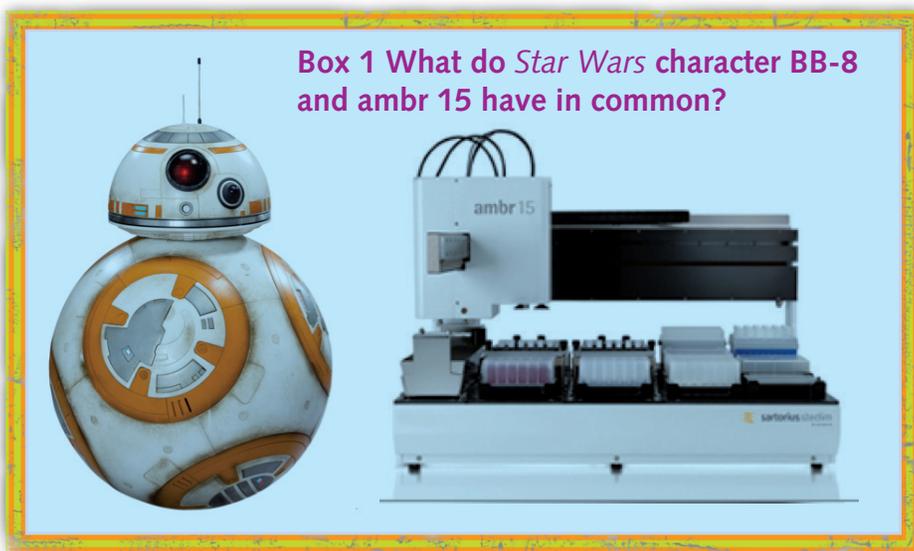
To create a meaningful link with Sartorius Stedim, school children first carry out activities focusing on making medicines, using the freely downloadable CIEC resource *Cough Syrup* (see end). This resource sets the scene for a series of real problems experienced by the pharmaceutical industry, such as: *What are the best conditions for growing microbes?*, *How can we use filtration to recover solids from a suspension?* and *Can you design a reliable test to discover the best viscosity for the cough mixture?* Children work through each challenge and devise their own methods for reliable, repeatable, ways

need to talk about the world of work with children, we also need to help to clarify and explain what goes on there, in a way that is accessible, inspirational and relevant.

**Broadening horizons**

Identifying and interpreting the narrative of what happens in industry and sharing it with primary schools is where projects and activities developed by the Centre for Industry Education Collaboration (CIEC) can be really powerful. CIEC works to make links between industry and primary classrooms, supporting both parties to communicate meaningfully with each other in order to extend children's perceptions of STEM careers and broaden horizons. CIEC works with industry to create series of practical classroom science lessons that can culminate in a visit to an industrial site or from industry representatives, depending on the availability and willingness of companies in the region. A good example of this in action is

CIEC's latest partnership with Sartorius Stedim, a biotech company that designs and manufactures automated laboratory and pharmaceutical testing equipment. This project enables children to see the whole story of how a product is made through the eyes of the people that put



of solving these problems. We then talk about how robotic machines might usefully carry out some of these activities in industry.

Teacher, Rhian Bateman, commented on the enquiry-centred approach promoted throughout the project:

*The children gained a greater understanding of different types of industry. The project really brought out their enthusiasm for, and love of science. They showed a much greater understanding of the benefits of learning science in school, as well as the impact that science has on everyday life. It definitely inspired careers in science! The problem-solving approach allowed children to see the benefits of teamwork, the importance of different roles and the way that scientists continue to ask questions, learning from their answers and from things going wrong. As well as all this, they learnt specific skills using new equipment, developing enquiry skills, recording data and using technical vocabulary.*

An important aspect of what CIEC seeks to achieve is the support for teachers' continuing professional development (CPD). In some regions, CIEC advisory teachers offer a very practical model of CPD, through coaching and modelling practical science within the classroom. These advisory teachers run sessions, modelling best practice, and then teachers are left the resources and equipment they need to lead a second practical session. The advisory teacher then returns and leads a third session to strengthen the industry focus of the science lessons, introduce children to STEM careers, and prepare them for a visit to industry, should they be in a position to visit a local site.

Site visits are the 'icing on the cake', should such a trip be possible. CIEC brokers such visits regularly and ensures that companies are fully prepared for each class of primary children that walks through their gates. In the example of Sartorius Stedim, children go on a journey around the site, being introduced to all the people that created ambr 15 and the range of processes involved in its use (Figures 1, 2 and 3). At each stage the children are greeted by a different person with a different STEM career. This helps them to see that a team of people, each with different areas of expertise, is needed to create the final product.

There are benefits not only for the children but for the industry employees too. Nick Cooke, Managing Director of Sartorius Stedim, commented:

*Being part of this project is a good team-*

*building exercise. It builds a feeling that what we do is worth showcasing to others – you need to be proud of what you do to enthusiastically promote it to children. Ultimately, it makes a contribution to filling the skills shortfall in the UK in science and engineering.*

### Championing equality

Both the ASPIRES report and the *Big ideas* report note that the inclusion of STEM careers in education promotes social justice and mobility. Raising aspiration through broadening children's horizons can play its part in creating a fairer society:

*Enhancing the attractiveness of engineering careers, and broadening the range of individuals pursuing them, could make a significant contribution to social mobility. (IMechE, 2016: 46).*

The authors warn that additional effort will have to be made in telling the stories of minority groups working in STEM careers. This is something that we have had to work hard to overcome in creating our CIEC projects. It has been harder to find female role models and we have worked hard to ensure that their stories get told.

One of the ways that CIEC tackles this issue is through our Science Ambassador scheme, where we take ambassadors from industry into the classroom.

Johnson Matthey chemist, Pippa Chalke, accompanied me on one of my school visits. I asked her why she thought it was important to visit classrooms. She said:

*I think STEM Ambassadors can help to engage the children with science. Although their teachers may have industrial experience, I feel that this is often overlooked by students. I have noticed when I stand up at the front of a class and give suggestions they are often more attentive than when it is their teacher. I think it is also helpful for them to be able to interact with someone who has chosen science as a career. Being a STEM Ambassador has helped me see the importance of promoting science within schools.*

I asked Pippa what would have helped her on her journey into STEM careers. She highlighted how much meeting people who work in STEM careers would have helped her along the way:

*I initially chose to study chemistry because I was good at it and not because I wanted to follow it as a career path. It was only in the final stages of my degree that I decided I would enjoy taking the subject further. Despite having been in a school where science was heavily promoted I was still unaware of what I could actually do with a chemistry degree.*

### What do children think about CIEC's projects?

Both the *Big ideas* and the ASPIRES reports highlight the importance of fostering a love of science at a young age, maximising children's natural curiosity and developing their STEM literacy. So the most important test of the success of schemes such as CIEC's is what the children think: do they now see STEM as more relevant to their own futures?

When I asked Megan and Beth what they thought about the project, Megan said:

*It's helped me. It's good because you can experience and see industry in front of you. Some people think science isn't important and there's not much to it. But there is. So it is really helpful. I will use this memory when I decide what I want to be.*

Beth said:

*It helps you understand what adults do and what work will be like when you are older. It gives you ideas of what you might want to be. I would recommend it for other children because I think it's important. It's made me realise the amount of things we use have been manufactured and the process things go through!*

CIEC's projects definitely make an impact and will be a factor in developing these children's science capital but the journey needs to continue beyond the programme. We all need to seek out ways of helping children to answer the important question: What do adults do all day?

### References

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Cough syrup resource is available free from: [www.ciec.org.uk/resources/cough-syrup.html](http://www.ciec.org.uk/resources/cough-syrup.html)

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