

So what's GREAT about being an engineer?

Sarah Longshaw and Charlotte Smailes discuss how an ENTHUSE Partnership (a cross-phase collaboration between schools and industry) engaged pupils in a Great Science Share promoting careers in engineering



Pupils from Whitehill Primary School, Stockport, demonstrating what might help an egg to float

Most adults might struggle to answer the question 'What's great about being an engineer?' and yet, fundamentally, engineers solve problems. This involves identifying the problem, creating and testing possible solutions, adapting these and continuing until a satisfactory solution has been found. In this way, engineering is not that different from science – and yet, how many primary pupils have an understanding of it or see themselves as future engineers? Furthermore, of those who might, how many are female or from less privileged or BAME (Black, Asian, Minority Ethnic) backgrounds?

This was the starting point for the ENTHUSE partnership sponsored by industry partner, Worley, a global

engineering company focused on energy, chemicals and resources, with offices in Cheshire. Worley entered into a partnership with schools (6 primary and 1 secondary) in Stockport, to encourage more people from under-represented groups to know about engineering as a career, with the intention that this would lead to more students considering engineering for their future.

Engineering in the English National Curriculum

Although engineering is not explicitly part of the primary curriculum, the specific skills that it requires point directly towards the discipline. Most primary science teachers and leaders would agree that STEM subjects lend themselves most appropriately to the development of the skills that underpin engineering, such as fostering independent thinking rooted in resilience, perseverance and self-led investigation. We want the children to be hands-on and to experience safe failure.

The fact is that, in England, engineering does not appear on the timetable in primary or secondary schools; however, engineering skills are evident and often taught and explored in extra-curricular STEM Clubs, through investigations, demonstrations and experiments.

What happened?

The school and industry partnership was supported by an educational coach, Sarah, whose role was to support the primary Science Subject Lead teachers and the secondary school teacher through the project. Together they determined how engineering career awareness could be strengthened.

A Great Science Share was chosen as the best possible solution to allow the mixed age phases to work together. Having a science fair-type event meant that the planned investigative activities could be carried out either as part of science lessons or during a science club.

Worley were keen to elicit the attitudes of 9-10 year-old pupils (particularly focusing on female, BAME and pupils allocated Pupil Premium funding) towards engagement with science. They offered schools the opportunity to apply for assistance from an ambassador from their company to support the fair, thereby being able to talk about and promote careers in science and engineering, helping children to make links between where their interests in science were and how that could link to careers in engineering. Unfortunately, due to lockdown, the data have not yet been collated, although this will be a priority once the project resumes when school re-starts in September (it's a two-year engagement).

At first the teachers were a little unsure about what the focus of their clubs/lessons might be. Starting with questions, Sarah encouraged the teachers to talk openly to explore 'What could we do with a plastic bottle?' Teachers readily considered making lava lamps, modelling the lungs, making a bubble blower, a rain gauge and using the bottle to contain the reaction mixture of vinegar and bicarbonate of soda, and followed up a similar line of questioning with their pupils in school.

The Great Science Share day

Building on the enthusiasm of the Great Science Share for Schools (GSSfS) campaign, which repeatedly promotes how, if you start with a question that the children are interested in, then they will drive the investigation, the Great Science Share took place in British Science Week (March 2020).

Keywords: Industry engagement ■ STEM Club ■ Community partnership ■ Cross-phase

The Science Fair at St Anne's Roman Catholic High School, Stockport, featured two entire secondary year groups and more than 60 pupils from 6 different primary schools – accompanied by teachers and three Worley ambassadors. Pupils shared science investigations that ranged from those inspired by the desire to reduce our use of plastic, to other STEM-Club favourites such as 'What colour is black ink?', 'Which egg will float?', and 'How do you get the highest stream of liquid with coke and Mentos?'. Pupils contributed to displays, models and hands-on experiments, with plenty of willing volunteers explaining what their investigation was about, why they had chosen it, what they had learned and the skills they had developed as part of the process.

What difference did it make?

When asked about the impact of running and taking part in the Great Science Share, teachers made the following observations:

- they all felt that the pupils had increased their science knowledge and enquiry skills;
- pupils had also developed skills such as resilience, communication, working with others, independence, research and engineering skills; and
- Cale Green Primary School had specifically targeted a group of the girls who spoke English as a second language and who had previously shown limited engagement in science. They reported how delighted they were with the development and enthusiasm that resulted, as well as the success shown by the pupils in explaining their projects.

The Enthuse Partnership is a two-year project. We wanted to incorporate a science fair early on – so the initial involvement with industry included a meeting between teachers and Worley graduate engineers to understand the influence of role models on their future careers. Some of the schools worked more closely with an allocated engineer who supported them with their projects. The plan is to extend this aspect next year. Different schools chose different activities – some with a more engineering bias than others: St Joseph's, Reddish chose to make propeller-powered model boats and balloon-propelled model cars, designing their model, producing a prototype and refining to get a working model. Whatever

Pupils taking on the role of detectives in determining 'Who wrote the note?'

the project, what was important was the 'try fail learn repeat' attitude that pupils developed towards answering their particular question.

The Lark Hill Primary School experience

After meeting with other schools in the project, Charlotte (Science Subject Leader at Lark Hill Primary School, Edgeley) began brainstorming what they could do with a plastic bottle. Themes of environmentalism were discussed alongside the children's dreams of building things they had only seen on YouTube.

In the Club each week, the group constructed objects made out of plastic bottles: cars, volcanoes and marble runs. Their questioning led them to tinkering – whereby they asked themselves how they could make something faster, stronger, more secure or more explosive.

Eventually, the Club settled on a showpiece for the Great Science Share that they believed would excite new audiences the most. They experimented with different numbers of Mentos being dropped into different volumes of Diet Coke and refined the amounts. The children coupled this idea with their two favourite marble runs to allow for an interactive stand at the Science Fair.

On the day, children from Lark Hill were able to meet and engage with a range of primary and secondary children, all with the intention of sharing what part of science and engineering they were most passionate about. Every child was inspired by other projects they had seen and conversations they had with other pupils.

Back in school, children kept the buzz alive by explaining to their friends the day they had experienced. Soon after, there was a waiting list for STEM Club.

An external evaluation of ENTHUSE partnerships in 2017 reported 'a positive impact on pupils' outcomes, both in terms of academic attainment but especially in relation to pupil engagement and enjoyment of STEM subjects', which is certainly our experience as evidenced in our



Pupils from Cale Green share some of the activities that they most enjoyed at their science club sessions

GSSfS. We would like to think that, by engaging the teachers too, we have a more lasting impact since they share their enthusiasm and understanding with each new class that they teach.

Reference

ENTHUSE Partnerships external evaluation and impact report by Curee (2017) (www.stem.org.uk/resources/elibrary/resource/417168/enthuse-partnership-impact-report-2017)

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Charlotte Smailes is a Key Stage 2 teacher and the Science Leader for Lark Hill Primary School in Edgeley, Stockport. Her extra-curricular STEM Club had an open invitation for children from Years 3 to 6 (ages 8-11). In this project, her role was to guide the children through the process of engineering using plastic bottles and to bring pupils to a new, bigger audience.