

**Juliet Edmonds,
Fay Lewis and
Laura Fogg-Rogers**
explore how meeting
with engineers and
scientists and other
initiatives can help to
increase science capital



Practical steps to building science capital in the primary classroom

Figure 1
Building and
testing structures
with wine gums
and spaghetti

Science capital won't buy you the latest phone or tablet but is vital to broaden the subject and career choices that are available to our children. Science capital is based on the ideas of a French sociologist, Pierre Bourdieu. He suggested that all of us have differing amounts of cultural beliefs, values, qualification and experiences, which we gather from our families and lives and which give us value in careers and social situations. Many children in our schools will have no knowledge of adults who work or have worked in STEM (science, technology, engineering and maths) careers, which therefore contributes to them having very little science capital. That is what we are hoping to change through initiatives in schools.

Differences in science capital can have a significant impact on children's aspirations as regards STEM careers, as well as influencing their subject choices (ASPIRES, 2013). Children in primary school may not yet have qualifications or be choosing careers, but they will already have differing values and experiences of science from family interest and out-of-

school experiences. At the University of the West of England (UWE) we run a programme called 'Children as Engineers' (Fogg-Rogers, Edmonds and Lewis, 2015), where we take engineering undergraduates and trainee teachers into schools to teach science through engineering projects. The children get to meet and interact with young adults, not much older than themselves, who are passionate about science and engineering. They are fascinated by their lives.

Social cultural science capital

At a children's conference we ran recently, we asked the children what they would really like to ask an engineer or scientist. Out of 300 questions, 127 children (42%) asked questions about science initiatives and future discovery, such as 'Can you develop a robot dog?', but 95 questions (32%) were about the personal aspects of being a scientist or engineer, such as 'What do you like best about being a scientist?' and 'What inspired you to take this career?', as well as 'What do you earn?' This suggests that children want

to find out about the experience of being a scientist or engineer, perhaps to explore if it is congruent with their own ideas of themselves when they are adults.

Women in Science and Engineering (WISE) has developed a project called 'People like me', exploring attitudes to STEM careers at secondary schools for girls. They draw on research that says girls often expressed their identities using adjectives, as in '*I am a creative person*'. Some STEM career promotional materials use only verbs to describe what people do in STEM careers, which they suggest makes it harder for girls to identify with the role models.

In inviting visitors to your class, it might be useful to ask them to describe what kind of person they are, what qualities they have that make them good at their job, as well as what they do. Some ideas for providing interactions with adults in STEM careers are given in Box 1.

Informal cultural science capital

Developing children's cultural science capital is also important. Some families

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Box 1 Interactions with adults in STEM careers

- Find out which parents/carers have STEM careers and ask them to come in and talk about their working life – obviously the wider the diversity of visitors the more likely children will identify with them.
- Visit parents/carers in their STEM careers to find out about their jobs.
- Arrange for children to interview adults about their jobs and lives.
- Invite STEM ambassador volunteers to come in and work with you and your class on science topics – find your local hub at www.stem.org.uk/stem-ambassadors
- Ask local university science departments, industries and businesses whether they have outreach workers who can visit.
- Research with your upper key stage 2 class (ages 9–11) the vast range of scientific caring, design, business and research careers, to which pursuing science can lead.

Box 2 Getting families involved

- Have a 'bring your mum/dad/carer to school day' where you carry out science activities with the children and their parents and carers.
- Set a homework where the children give a 5-minute presentation to their parent/carer on what they are learning in science.
- Set a homework that involves parents/carers and children watching a fun but interesting television programme, such as *Operation Ouch!* (CBBC), related to your science topic.
- Hold a parent/carer workshop, with or without children, where the adults carry out fun science experiments to share the science curriculum.
- Advertise interesting popular science programmes on the school newsletter or website that might appeal to children and parents/carers.
- Organise trips to science centres and science events and invite all parents and carers with their children, perhaps on a Saturday if you have a high number of working parents. You could apply to the PTA to subsidise the cost.
- Invite parents/carers to science-based assemblies.
- Report your class science work on the school website/newsletter.

spend time and money visiting science centres and museums or build rockets with their children. Other families do not have the money, time or confidence to provide these experiences. We believe that getting families involved and interested in science can be fun and productive for the parent/carers and the children. WISE believes that it is particularly important to get mothers interested in science, as their attitudes, negative or positive, are passed on to their children, especially to girls. Remember, some parents/carers will be unable to come during the day. Organise twilight or weekend activities they can attend. You could try some of the ideas listed in Box 2.

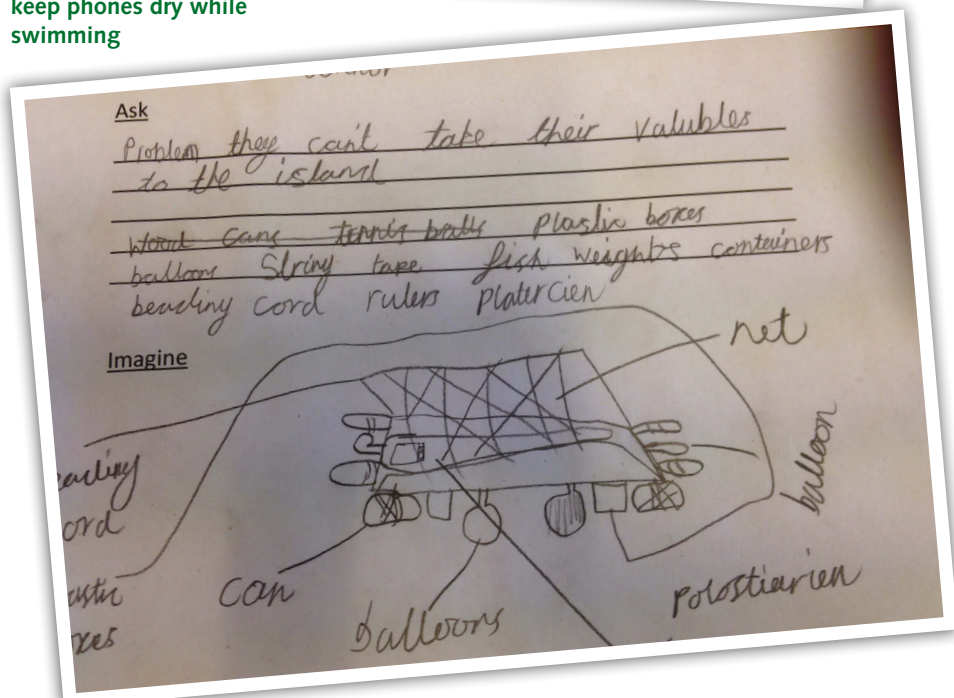
Children's attitudes to science also form part of their science capital. Although this is partially formed by their home life and parental attitudes, it is thought that it can be influenced by their school and teachers. Attitudes are not formed overnight: one-off activities are

unlikely to have a long-term impact on children's attitudes. The school and teachers can transmit messages about science through how they value science as a subject and its prominence in and around the school. Amanda Spielman, Chief Inspector of Ofsted, at the ASE Annual Conference 2018, reinforced the importance of science in the primary curriculum. However, valuing science in the curriculum and finding time for science activity can be difficult in schools dominated by literacy and numeracy. A way round this can be to fit science into classwork by breaking it up and using

Figure 2 (right) An engineer supporting children designing and testing a vacuum cleaner



Figure 3 (below) One child's design for a floating platform to keep phones dry while swimming



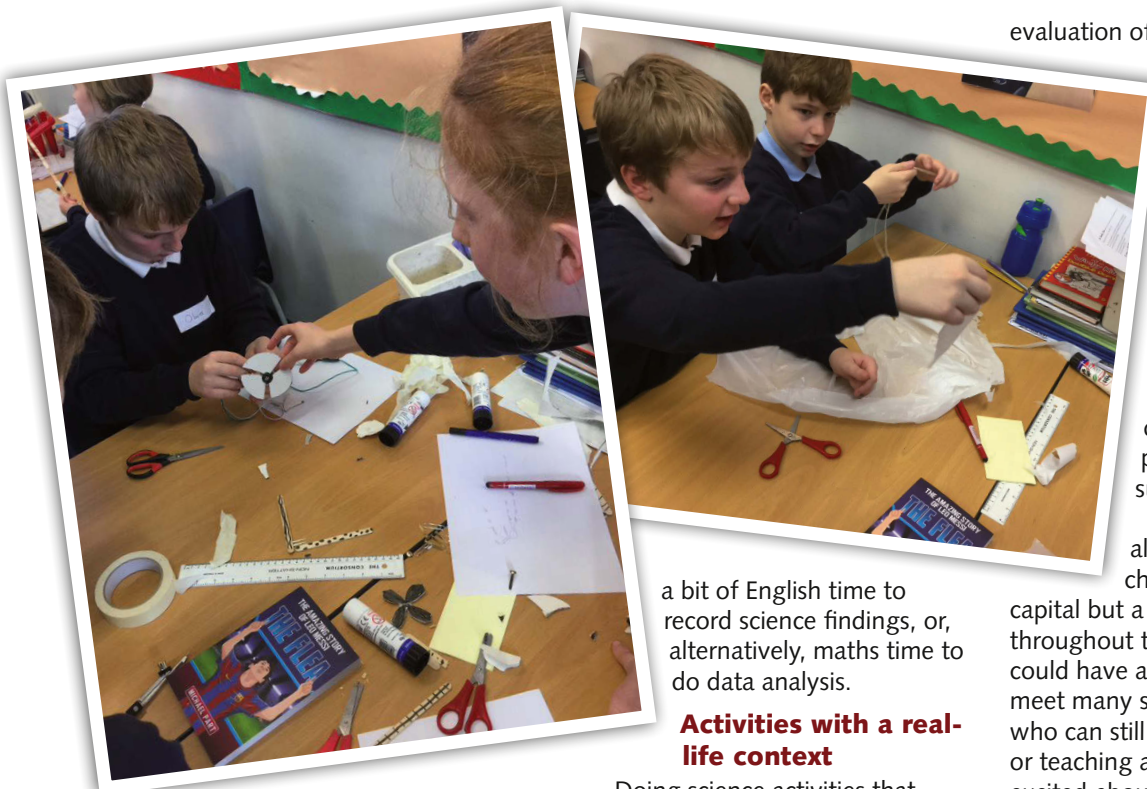


Figure 4 Testing electric fans and parachutes

a bit of English time to record science findings, or, alternatively, maths time to do data analysis.

Activities with a real-life context

Doing science activities that focus on improving life appears to be a constructive strategy for raising children's interest and attitudes. In our

Box 3 Ideas for STEM activities with a real-life context

- Provide activities and locate science work in real-life contexts that have meaning and application for the children, e.g. how to make the best bubbles.
- Explore aspects of science and scientists that benefit the quality of everyday life, e.g. the grip on training shoes for forces or the work of Professor Margaret Boden on artificial intelligence (the BBC Radio 4 series *The Life Scientific* is useful for biographies of modern scientists).
- Link science to engineering challenges for application to real life, for example through the EU 'Engineer' project challenges (www.engineer-project.eu) or by borrowing the Design Process Box free from Dyson (www.jamesdysonfoundation.co.uk).
- Involve children in planning, carrying out and evaluating the science activity or investigation to raise motivation and achievement (Ofsted, 2013; SCORE, 2008).
- Invite interactive science shows and inflatable planetariums to school.
- Put aside some time to do some fun, child-nominated (safe) activities seen on *YouTube* or the internet, such as the Diet-Coke and Mentos eruption, Alka-Seltzer explosions, compact disc hovercrafts, and so on.
- Have an '*I wonder why ...*' area/display in the classroom to develop a climate of curiosity about the world. Make time for the children to research some of the questions.
- Develop an area where old appliances, such as bicycles and hole punchers, can be dismantled and explored (reminding children not to do this at home with electrical appliances).
- Get children to recommend to each other science visits, science programmes and books they have enjoyed, or ask them to give feedback on these.
- Hold celebratory science weeks and have regular slots for science in the timetable.
- Have science displays and posters around the school.

evaluation of the EU 'Engineer' project (www.engineer-project.eu), where science is taught through engineering challenges, the children, especially the girls, appeared to value the fact that science and engineering can help to make the world a better place and make life easier – positive attitudes many did not have before the project. Box 3 gives some suggestions.

None of these actions alone will compensate children for low science capital but a consistent programme throughout the school and in class could have a significant effect. We meet many scientists and engineers who can still recall a special teacher or teaching assistant who got them excited about science, leading to a life-long career and love of science. You could be that teacher!

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Juliet Edmonds and Fay Lewis

are Senior Lecturers in Primary Education and Associates of the UWE Science Communication Unit at the University of the West of England, Bristol.

Emails: juliet.edmonds@uwe.ac.uk; fay.lewis@uwe.ac.uk

Laura Fogg-Rogers is a Senior Research Fellow at the UWE Science Communication Unit.

Email: laura.fogg-rogers@uwe.ac.uk