ENGAGING CHILDREN WITH SCIENCE

A 'SCIENCE CAPITAL' APPROACH

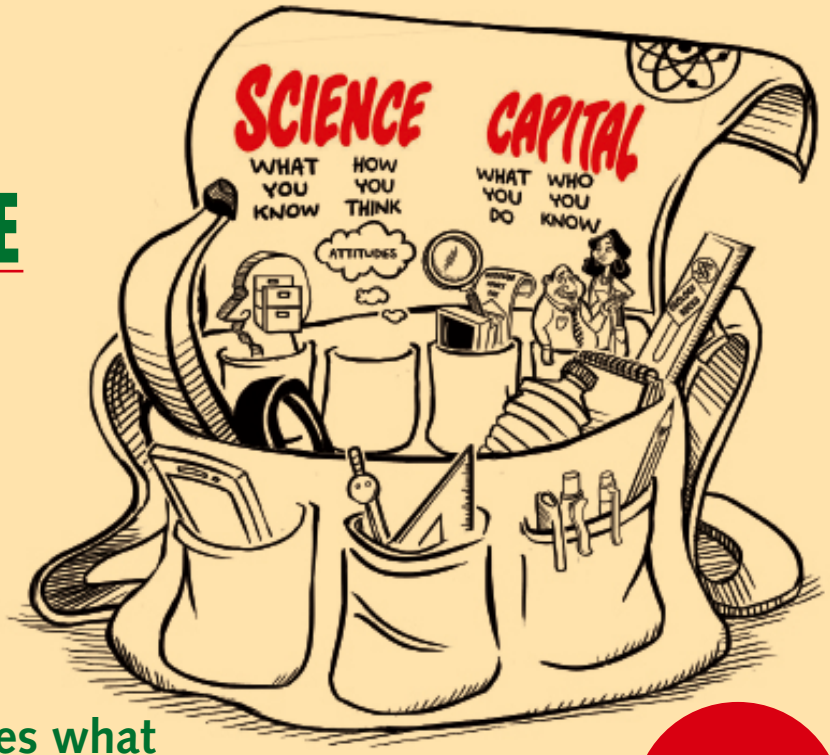


Figure 1 The science capital hold-all

Louise Archer outlines what science capital is, how it can be used as an approach to teaching and how this benefits learners

'It's interesting – but not for me.'

This is a view that we have heard time and again from children and young people in schools across the country. Indeed, our survey research suggests that, while the majority of children in England find science lessons interesting, very few consider a career in science as being potentially 'for me'.

Over the past decade, my colleagues and I have been carrying out research to try to better understand the factors that shape students' engagement with science, as well as their science and career aspirations. Our ASPIRES/ASPIRES 2 studies have tracked a cohort of students in England from the age of 10 to 18, combining large-scale national surveys with over 40,000 young people and in-depth, longitudinal interviews with 60 children and their parents.

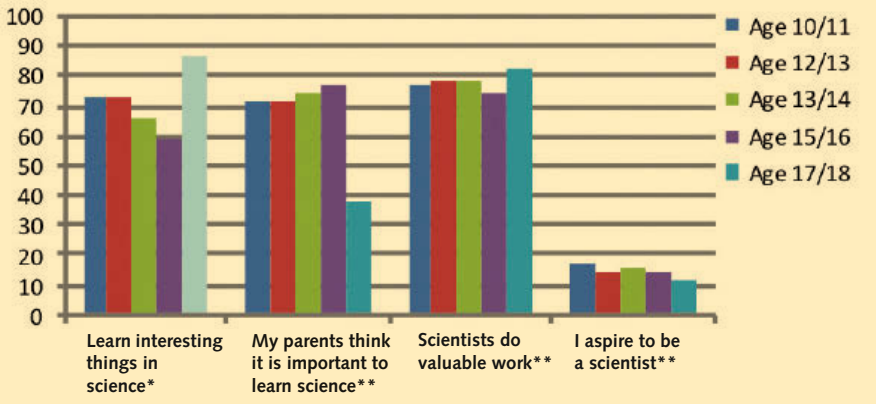
This research has shown that a lack of interest in science is not the main issue. As seen in Figure 2, most young people across both primary and secondary school say that they find science interesting. They also report that their parents value science and express a range of positive views of scientists. Yet these positive views of science and scientists are not translating into young people seeing post-16 science as 'for me'. We call this the 'being–doing divide'; young people like *doing* science, they just don't want to *be* a scientist in the future.

Our research (e.g. Archer and DeWitt, 2017) points to a range of factors producing this pattern, including:

- **gender, social class and ethnicity factors;**
- **educational factors (e.g. the way that science is structured and organised**

Figure 2 Comparison of survey responses from the ASPIRES 2 project

Percentage of students from years 6, 8, 9, 11 and 13 'agreeing'/'strongly agreeing' with survey statements



*Only asked of year 13 students studying at least one science A-level.
**Year 13 data is weighted to national A-level science entries.

Key words: Science capital | Engagement and interest

within schools – such as the 'streaming' of students into different award routes at key stage 4 (ages 14–16) and the higher entry bar for some science A-levels);

- **careers education provision;**
- **science capital.**

It is this last point, 'science capital', that we have become particularly interested in, not just because it helps explain different patterns of student participation in science, but also because we believe it offers practical ways to improve young people's science participation.

What is science capital?

Science capital is a concept that is used to refer to a person's science-related resources, such as their science-related understanding, knowledge, attitudes, activities and social contacts. It can be thought of like a hold-all or bag (Figure 1), containing:

- **what you know – e.g. your scientific literacy and related knowledge;**
- **how you think – your attitudes to science, ways of thinking;**
- **what you do – science-related activities and behaviours;**
- **who you know – science-related social contacts and networks.**

Our research found that the more science capital a young person has, the more likely they are to aspire to continue with science post-16 and the more likely they are to have a 'science identity', for example to see themselves, and to be recognised by others, as being a 'science person'.

As part of the Enterprising Science project, we conducted a national survey in England in 2014 of 3658 students aged 11–15 and found that 5% had high levels of science capital, 68% had medium levels and 27% had low levels of science capital (Figure 3).

The science capital teaching approach

We wanted to explore whether it is possible to 'build' science capital. So, over four years, we worked with teachers to co-develop a teaching approach based on the concept of science capital. We then tested the approach and collected data to evaluate its effectiveness, through two year-long pilot trials – one in London and one in schools in the north of England (Newcastle, Leeds and York).

The science capital teaching approach is a pedagogical approach that can

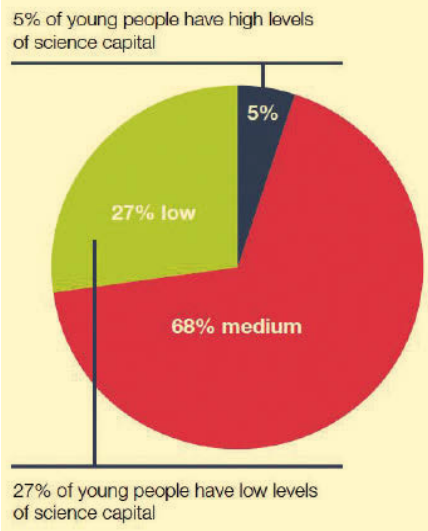


Figure 3 Enterprising Science project science capital survey pie chart for 11–15 year-olds in England in 2014

be applied to any curriculum. It is not a new set of materials and does not dilute science ideas and concepts. It is a reflective framework that involves making small changes ('tweaks') to existing practice to re-orientate science lessons in ways that better connect with the reality of students' lives and experiences.

Teachers apply the approach through cycles of reflective practice. The teachers we worked with attended two full-day professional development sessions (one at the start of the year and one mid-way through). They were also assigned a mentor, who would share ideas, observe and discuss lessons, and support teachers to reflect on their experience and development in applying the approach. As a research team, we collected a range of qualitative and quantitative data. This included carrying out student surveys at the start and end of the year, observations, discussion groups and interviews with students and teachers.

The science capital teaching approach is based on the idea that some students may struggle to relate to science, as well as finding science concepts and ideas difficult to understand. For instance, some students feel distant from the subject and find it difficult to participate in class.

As detailed in Figure 4, the approach is based on the foundation of *broadening what counts* as ways of doing science and comprises three pillars:

- **personalising and localising;**
- **eliciting, valuing and linking students' experiences, identities and what matters to them, with science;**
- **building the science capital dimensions.**

Broadening what counts involves creating spaces where all students feel able to offer contributions from their own lives; it supports teachers to move beyond typical ways of teaching science, to recognise a broader range of legitimate ways for students to contribute to and participate in science. As one student put it, '*It brings everyone together. Everyone has something to say, instead of it being just one or two people that know the answer*'.

Personalising and localising is about making science content personally relevant to students. It goes beyond contextualising, with teachers relating content to what matters within their specific students' lives and local communities. This can help students to find personal relevance in science and can reduce the distance between students and the subject, particularly among those students with low science capital.

Elicit, value, link is a technique for teachers to elicit students' home knowledge and experiences and then to value these and link them with science content, as a way to help students to make sense of and relate to science.

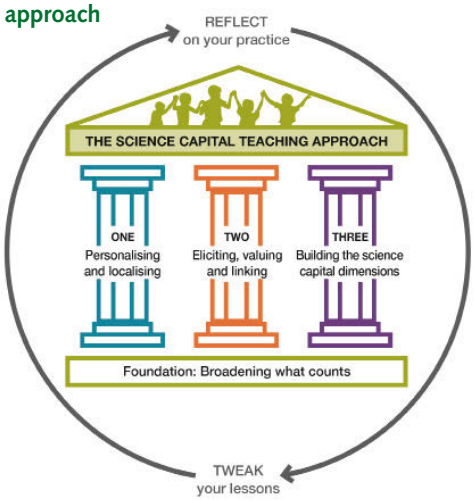
The third pillar focuses on finding ways in each lesson to build the dimensions of science capital – for instance, helping students to see how science knowledge and skills can be used in a wide range of jobs and areas of life.

The approach, together with examples, exercises and photocopiable resources, is described in a teacher manual, which is free to download or order (for hard copies).

Benefits of the approach

Our research found that the teaching approach was successful (as summarised in Figure 5), with teachers and students reporting a range of benefits. For instance, teachers who implemented

Figure 4 The science capital teaching approach



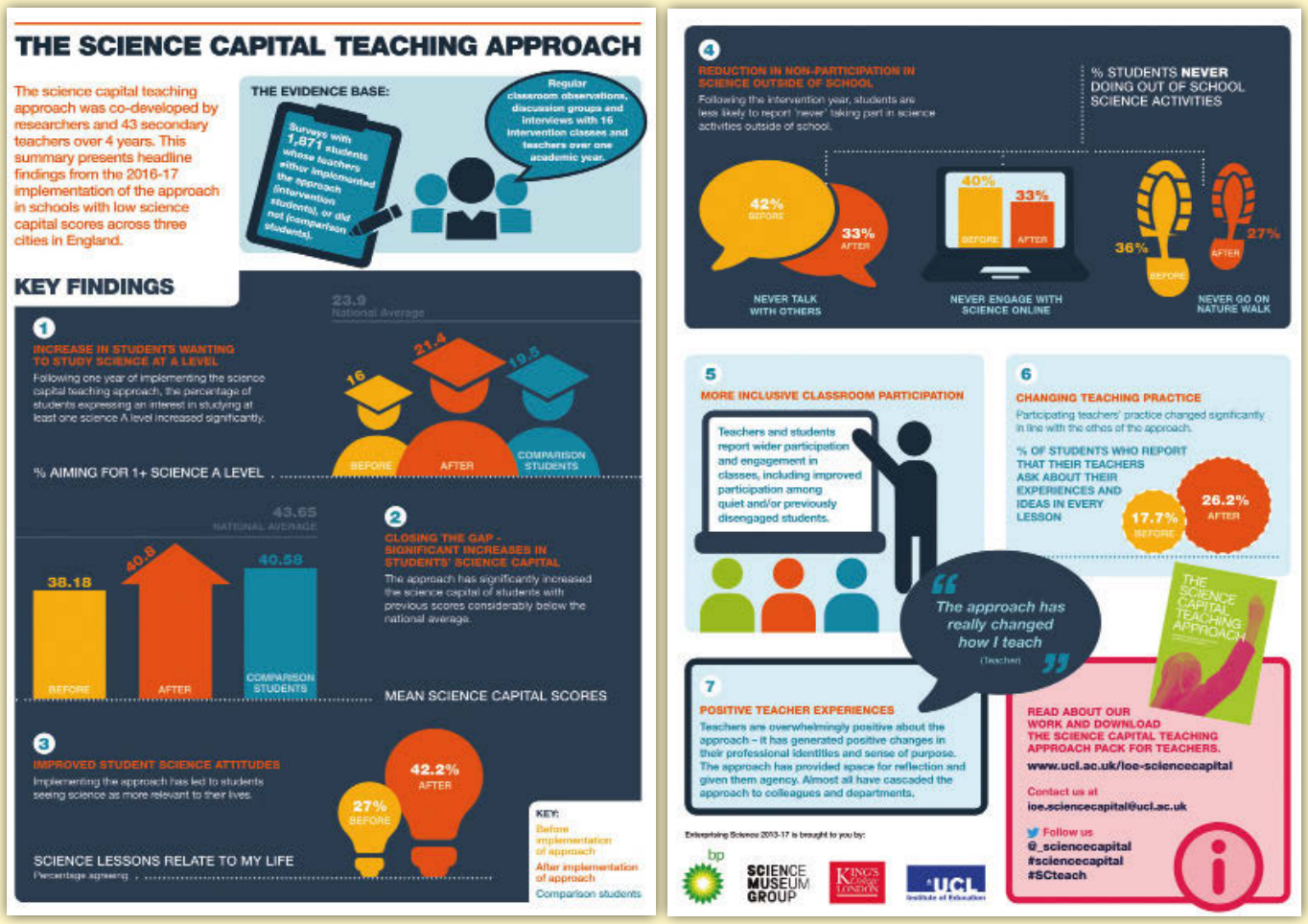


Figure 5 Infographic summarising the results of the 2016–2017 pilot of the science capital teaching approach in three English cities (www.ucl.ac.uk/ioe/departments-centres/departments/education-practice-and-society/science-capital-research/images/science-capital-teaching-approach-infographic.jpg)

the approach found that it significantly increased students' levels of science capital and their positive attitudes to science. It also significantly increased the percentage of students who wanted to take one or more science A-levels and the percentage of students doing science activities out of school (e.g. going online to look at science content). It also produced more engaged students, better classroom participation and behaviour and clear changes in teaching practice.

The teachers and students who took part were also enthusiastic about the approach and its benefits, as can be seen in our short film.

The science capital teaching approach in primary schools

Our research to date has involved working with secondary school teachers and students. But we know from the ASPIRES study findings that children's sense of whether science is 'for me', or not, starts much earlier.

Indeed, as Figure 2 shows, the proportion of students who aspire to be a scientist remains statistically constant from age 10 to age 18. For this reason, we see the next, important phase of our work as being to explore the development and potential of a science capital teaching approach in primary school. From discussions with primary teacher colleagues, we think that a new primary science capital teaching approach (co-developed specifically within the primary sector) could offer exciting possibilities and opportunities. At the time of writing we are working on plans for taking this further – and we would be very happy to hear from primary colleagues who might be interested in working with us on this.

Further information

Website: www.ucl.ac.uk/ioe/departments-centres/departments/education-practice-and-society/science-capital-research

Acknowledgements

The ASPIRES/ASPIRES 2 studies are funded by the Economic and Social Research Council. The Enterprising Science project is a research and development partnership between UCL, King's College London, and the Science Museum Group, funded by BP.

Reference

Archer, L. and DeWitt, J. (2017) *Understanding young people's science aspirations*. London, Routledge. (See also a range of our articles and publications on the website.)

Weblinks

The Science Capital Teaching Approach teacher manual: **www.ucl.ac.uk/ioe-sciencecapital**

Science capital film: **www.youtube.com/watch?v=XDCekYVTkws**

Louise Archer is Professor of Sociology of Education at UCL Institute of Education, London, and Director of three national research projects: ASPIRES 2, Enterprising Science and Youth Equity & STEM.
Email: ioe.sciencecapital@ucl.ac.uk