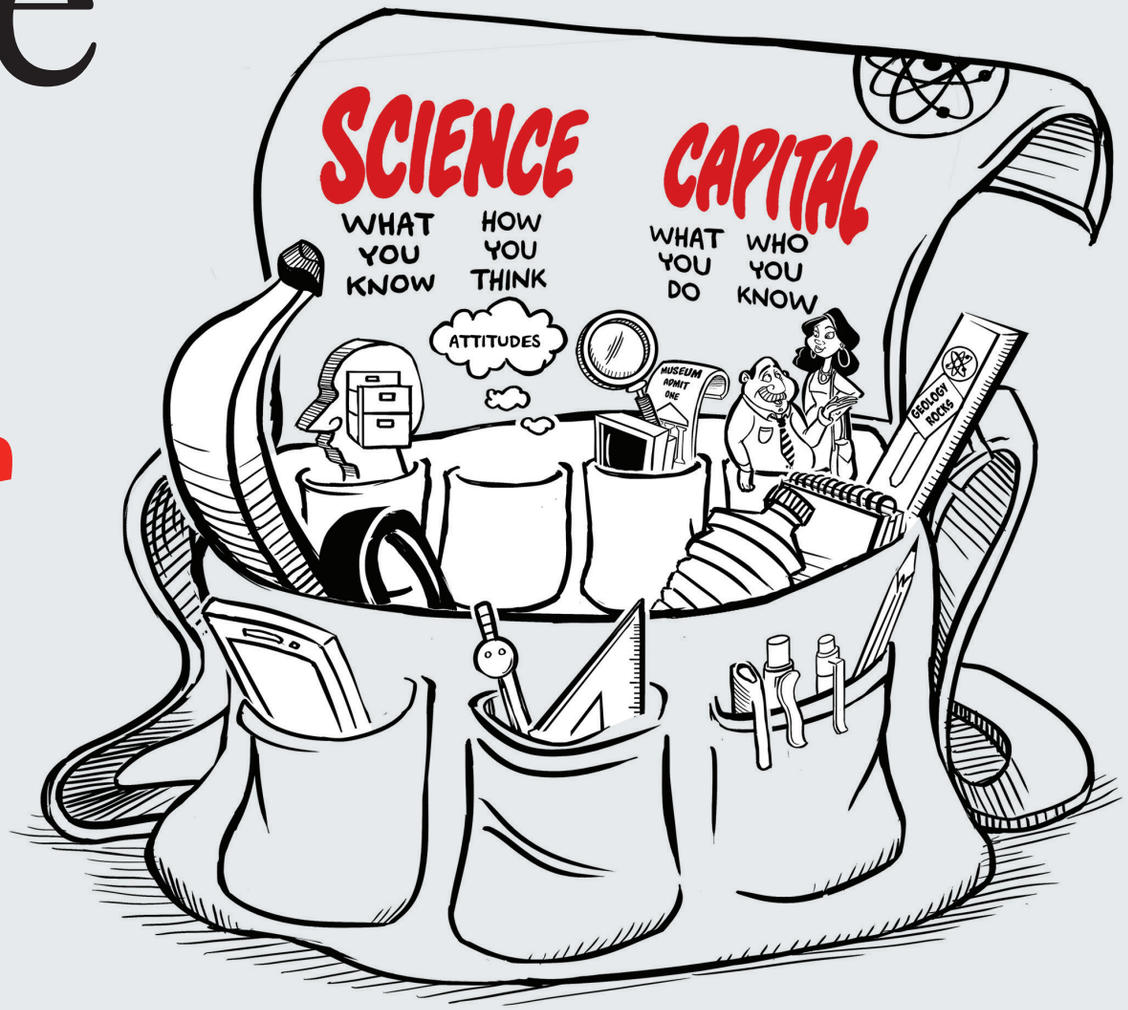
Science capital

made clear



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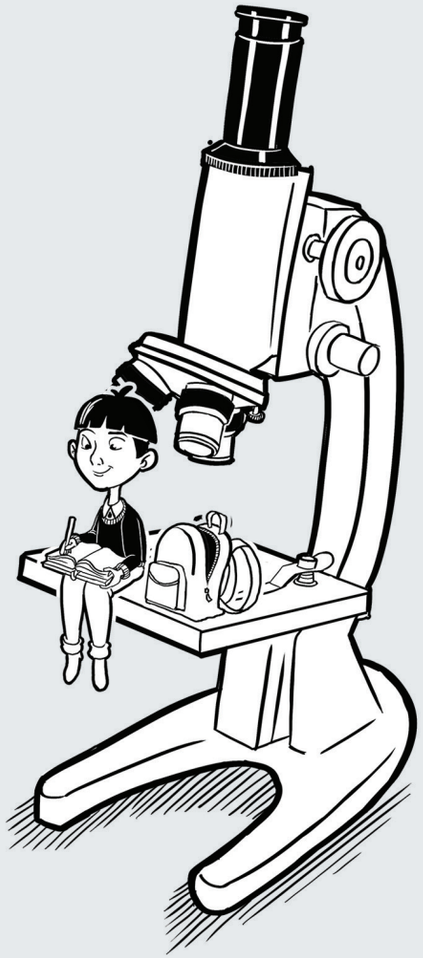
Science capital – **the key points**

Science capital helps us to understand why some young people see science as 'for me' and other do not

- Science capital is a concept that can help us to understand why some young people participate in post-16 science and others do not. In particular, it helps shed light on why particular social groups remain under-represented and why many young people do not see science careers as being 'for me'.
- The concept of science capital can be imagined like a 'holdall', or bag, containing all the science-related knowledge, attitudes, experiences and resources that you acquire through life. It includes what science you know, how you think about science (your attitudes and dispositions), who you know (e.g. if your parents are very interested in science) and what sort of everyday engagement you have with science.
- Research evidence shows that **the more science capital a young person has, the more likely s/he is to aspire to continue with science post-16 and to see themselves as having a science identity.**
- The concept of science capital is drawn from the sociologist Pierre Bourdieu's concept of capital (referring to economic, cultural and social resources) – in short, Bourdieu proposes that **the more you have of the 'right sort' of capital, the better you are able to 'get on' in life.**
- In the Enterprising Science project we are developing our understanding of the concept of science capital and are also researching its implementation in practice. We are exploring ways to help **build young people's science capital in schools and informal science learning contexts.**
- To date, we have formulated and explored the concept in relation to **young people** (school students), but we think there is useful potential for further developing and applying the concept to adults.
- Our hope is that **building science capital** will have a positive effect on young people's lives – not just in terms of encouraging more young people to continue into science, technology, engineering and mathematics (STEM) jobs, but more importantly, we hope that building science capital is a **tool for social justice,** to help improve people's lives and life chances.
- Science capital is a broad and diverse concept, which includes a wide range of knowledge, experiences, attitudes, behaviours and practices. However, our statistical analysis has identified 8 key dimensions of science capital. These dimensions are the aspects of science capital which are most closely related to post-16 participation and for fostering a sense that science is 'for me'. That is, the more a young person has, the more likely they are to plan to continue with science in the future.

Key dimensions of science capital



1. **Scientific literacy:** a young person's knowledge and understanding about science and how science works. This also includes their confidence in feeling that they know about science.

2. **Science-related attitudes, values and dispositions:** this refers to the extent to which a young person sees science as relevant to everyday life (for instance, the view that science is 'everywhere').

3. **Knowledge about the transferability of science:** understanding the utility and broad application of science qualifications, knowledge and skills used in science (e.g. that these can lead to a wide range of jobs beyond, not just in, science fields).

4. **Science media consumption:** the extent to which a person, for example, watches science-related television, reads science-related books, magazines and engages with science-related internet content.

5. **Participation in out-of-school science learning contexts:** how often a young person participates in informal science learning contexts, such as science museums, science clubs, fairs, etc.

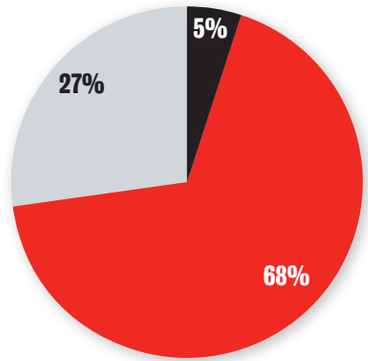
6. **Family science skills, knowledge and qualifications:** the extent to which a young person's family have science-related skills, qualifications, jobs and interests.

7. **Knowing people in science-related roles:** the people a young person knows (in a meaningful way) in their family, friends, peer, and community circles who work in science-related roles.

8. **Talking about science in everyday life:** how often a young person talks about science out of school with key people in their lives (e.g. friends, siblings, parents, neighbours, community members) and the extent to which a young person is encouraged to continue with science by key people in their lives.

The Enterprising Science national survey of 3,658 11–15 year olds in England found that:

- **5%** have 'high' science capital – these students more likely to be boys, South Asian and socially advantaged
- **68%** have medium levels of science capital
- **27%** have low science capital



Myth-busting: clarifying common misconceptions

The concept of science capital is gaining prominence within science education and informal science learning policy, practice and research. The concept is useful because it provides a common language and framework that resonates with the experiences and observations of many stakeholders across these fields.

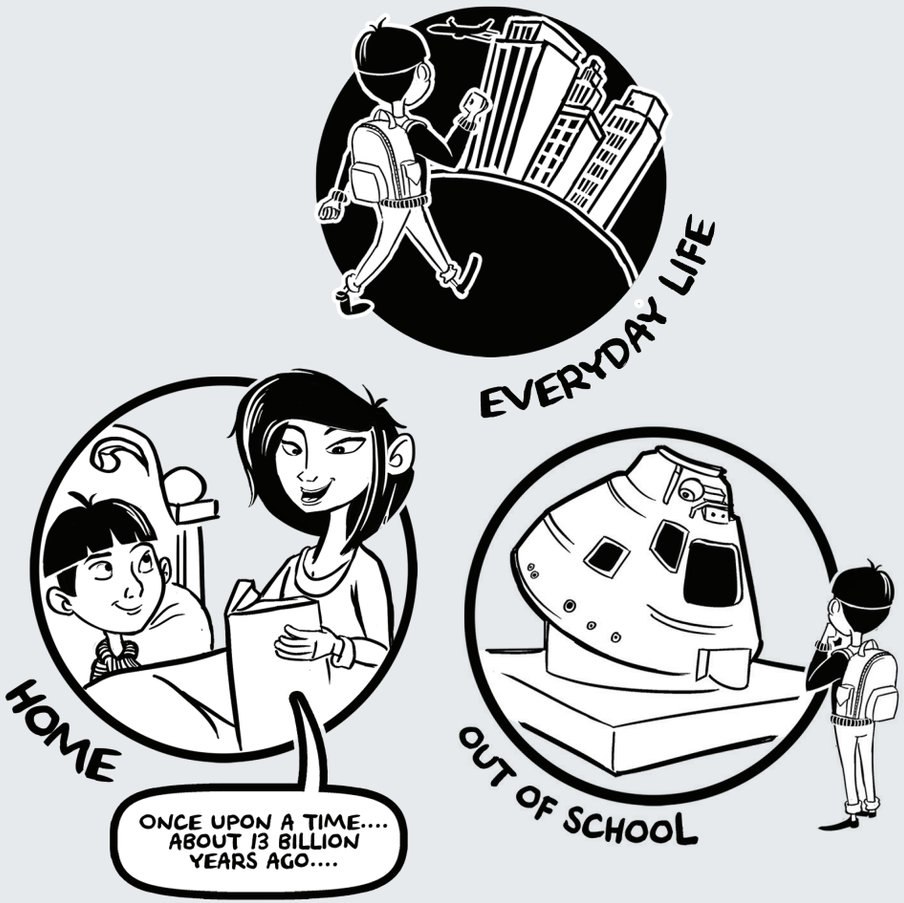
However, we have noted that, as its usage spreads, science capital is not always clearly understood and is often interpreted in different ways. Here we outline – and clarify – some common misconceptions.

Common misconceptions	Clarification
Science capital is the same as science literacy	Science literacy (science knowledge, skills and appreciation of science) is an important part of science capital – but science capital is not just science literacy. Science capital also includes other practices including what you do, who you know, and what your family values.
Science capital is just cultural capital	Students with high science capital also tend to have high cultural capital – that is, on the whole, students with high science capital are more likely to come from socially advantaged backgrounds and those with low science capital are more likely to come from disadvantaged backgrounds. However, this is not always the case. For instance, a socially advantaged student may have low science capital and a socially disadvantaged student may have high science capital, depending on their specific science-related resources. In other words, science capital is not reducible to cultural capital and statistical analysis shows that science capital produces a finer-grain analytic lens for predicting young people's science aspirations and science identity, compared to cultural capital.
Science capital is the main/ only factor affecting science aspirations and participation in science	Science capital is an important factor influencing science aspirations and participation in science but is not the only factor and it does not operate in isolation. Our research highlights the importance of multiple factors, including gender, ethnicity, teachers, educational systemic factors, issues of representation and the culture of science, and so on. In other words, a student with high science capital will not automatically pursue post-16 science – but students with high science capital are significantly more likely to aspire to post-16 science. Most importantly, they are more likely to see science as being 'for me'.
It is easy to measure science capital	The complexity of the concept of science capital does not lend itself to easy or quick measurement. Our analyses of a large number of survey questions ('items') has identified a smaller set of c.14 items which have the strongest statistical relationship to science aspirations and science identity. We suggest that these items represent a useful 'backbone' to the concept of science capital, which is amenable to measurement. However, it would not be meaningful to measure science capital quantitatively through a smaller number or subset of these questions (for instance via a very short 'exit poll'). We also believe that an interest in quantitatively 'measuring' science capital should not over-shadow the importance of qualitatively understanding the ways in which science capital 'works' in practice.

Common misconceptions	Clarification
The main value of science capital is as a quantitative 'instrument' for measuring change	Although we hope that our science capital surveys might offer practitioners and researchers a concrete way to explore, compare and map changes in science capital (e.g. as the result of an intervention), this also needs to be approached with caution and care, recognizing that this is a pragmatic and blunt application of the concept. We see a key value of science capital being its potential as a reflective tool to help us to understand the influences affecting a young person's participation (or not) in science. It is also equally valuable as a concept for informing policy and practice.
Science capital is fixed	Science capital is not fixed: what capital you possess will change over time and will depend on context. Our argument is that educators are able to help to build a student's science capital, by valuing and linking students' experiences from home with science, and by addressing the different science capital dimensions in their practice.
A science capital approach means building the human capital of individuals	Because science capital incorporates a number of dimensions, building science capital will inevitably require a holistic approach. But it also requires changes to the wider context – because the value of a student's capital will be shaped by the context that they are in. It is therefore important to focus on changing institutional and system-wide structures and policies to enable more forms of science capital to be recognized and valued.
A science capital approach is only beneficial to particular social groups/types of student	Our research, and findings from teachers who have been adopting a science capital approach with diverse groups of students (from socially privileged, high attaining students in the independent sector to socially disadvantaged low attaining students in urban comprehensive schools), shows that it can be beneficial for all young people and teachers.
We know everything we need to know about science capital	Understanding science capital is a work in progress! We are studying the ways in which educators can most effectively build science capital. From our data so far, it seems that small but cumulative changes in practice – valuing students' home experiences; encouraging science-based conversations out of school – are effective.

Adopting a science capital approach in practice

There is no single 'science capital approach', however, the following are some core principles that characterise what we would consider to be a useful and authentic science capital approach that could be enacted in policy and practice.



Key principles for adopting a science capital approach

- **Reflective** – a science capital approach is about a change in mind-set and pedagogy. It is not reducible to resources or activities.
- **Comprehensive** – a science capital approach means recognising and addressing as far as possible all the key dimensions of science capital (e.g. not simply focusing on, say, science literacy).
- **Holistic and structural** – a science capital approach requires recognising that efforts need to be targeted as much at systems, institutions, local areas and families as at the young people themselves.
- **Nuanced** – a science capital approach entails an understanding of the complexity of the concept and the issues involved. It seeks understanding of the issues, and does not just focus on quantitative 'measurement'.
- **Commensurate with the dimensions of science capital** – a science capital approach means ensuring that initiatives do not work against the key dimensions of science capital. For instance, only promoting the value of science as leading to careers in science would negate efforts to explain the transferability of science qualifications for all sorts of jobs and careers.
- **Fundamentally concerned with social justice** – a science capital approach is about trying to understand, identify, monitor and challenge inequalities. It means recognising the importance of power and how inequalities are perpetuated in society. A science capital approach is primarily concerned with helping to achieve improved life chances and outcomes for diverse individuals and communities.
- **Focused on trying to improve the wider system** – because the value of science capital is determined by the context, a science capital approach means paying meaningful attention to the institutions, systems and social relations within which people are located. It is about making sure that science contexts are supportive and offer value for everyone – not just the few. For instance, schools or museums could find ways to recognise, value and promote the varied interests, skills and experiences that diverse individuals, families and communities bring with them.
- **Collaborative and realistic** – building science capital is a challenging and complex endeavour. It means recognising that improving science participation entails changes and challenges for the whole STEM ecosystem and that there is no silver bullet (that is, a single approach or stakeholder is unlikely to be able to change the world alone). It is best attempted in partnership and with a long-term mind set!

Enterprising Science research

Enterprising Science is a five-year partnership between King's College London and the Science Museum, funded by BP (2013-17). This research and development project uses the concept of science capital to understand how young people from all backgrounds engage with science and how their engagement might be supported.

Science capital in schools

In 2015/16, the Enterprising Science project has piloted **a science capital pedagogical approach** with 10 teachers in 6 secondary schools across London. In 2016/17 the pilot is being extended to schools in Manchester, Bradford and York.

The science capital pedagogical approach aims to support teachers in delivering their usual curriculum content and complement existing practice. It includes:

- Addressing the eight dimensions of science capital across existing schemes of work.
- Eliciting, valuing and linking students' prior knowledge and experiences from home, family and social contexts to school science.
- Highlighting the relevance and transferability of science for students' daily and future lives.
- Building young people's sense that 'science can be for me'.

Emerging feedback from teachers shows that they believe the approach can **enhance student engagement** in lessons, and **reduce behavioural problems.**

Science capital in the informal science learning sector

Over the course of the project, we have been exploring ways of developing a science capital approach for the informal science learning sector. The main tenets of this work include:

- Using the eight key science capital dimensions as a reflective tool to inform the design of programmes and exhibitions.
- Finding ways to elicit, value, reflect and link the varying experiences and knowledge of diverse audiences with programmes/ exhibitions to create a more inclusive space for more visitors.
- Working in collaboration with schools to make better, more effective and inclusive use of museum visits and resources, which centre on eliciting and valuing the cultural knowledges and interests of diverse students and linking these with science.
- Conceiving a science capital approach in the ISL sector as complementary but integral to the wider science engagement ecosystem (which includes formal education, careers guidance, industry outreach etc.).

To find out more about our work

Visit our KCL project website:
www.kcl.ac.uk/enterprisingscience

Watch our 2 minute animation explaining the concept of science capital: http://bit.ly/sciencecapitalexplained

Follow us on Twitter: @enterprisingsci

Read our journal article, describing how we conceptualise and are developing the concept empirically: http://bit.ly/scicapjrst

Read some of our publications:

Archer, L., Dawson, E., Seakins, A. & Wong, B. (2016). Disorientating, fun or meaningful? Disadvantaged families' experiences of a Science Museum visit. Cultural Studies of Science, (iFirst), DOI: 10.1007/s11422-015-9667-7

Archer, L., Dawson E., DeWitt, J., Seakins, A. & Wong, B. (2015). "Science capital": a conceptual, methodological, and empirical argument for extending Bourdieusian notions of capital beyond the arts. Journal of Research in Science Teaching, 52(7), 922-948

Archer, L., Dawson, E. Seakins, A., DeWitt, J., Godec, S. & Whitby, C. (under review) "I'm gonna be a man here": Performances of masculinity and engagement with science during a school/museum intervention

Dawson, E., Archer, L., Seakins, A., DeWitt, J. & Godec, S. (under review) Selfies & Science Engagement: Girls Identity Performances in a Science Museum

DeWitt, J. et al (forthcoming) Dimensions of Science Capital: Exploring its potential for understanding student science participation

King, H., Nomikou, E., Archer, L. & Regan, E. (2015). Teachers' understanding and operationalisation of 'science capital'. International Journal of Science Education, 37(18), 2987-3014

Read the summary report of the science capital practitioner seminar:
sciencemuseum.org.uk/transforming-practice

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