SCIENCE MUSEUM GROUP

ENGAGING ALL AUDIENCES WITH SCIENCE

SCIENCE CAPITAL AND INFORMAL SCIENCE LEARNING

Enterprising Science was brought to you by BP, the Science Museum Group, King's College London and University College London

Illustrations by Michael Parkin

bp SCIENCE MUSEUM GROUP KING'S College LONDON UCL

The Science Museum Group is an alliance of five museums across the UK which welcome over 5 million visitors each year. As a group of museums we are committed to making a difference and to help build a STEM-literate society that celebrates science, technology and engineering. Our strategic ambition is to 'inspire futures' and our number-one strategic priority is to 'build science capital in individuals and society'.

The Science Museum Group worked in partnership with Kings College London, University College London and BP on the Enterprising Science project which used the concept of science capital to understand how people from all backgrounds engage with science and how their engagement can be increased through different science-related experiences.

We have been leading the development of a practical application of the science capital concept for the informal science learning sector and are pioneering this approach through organisational change across our museums.

So, what does science capital mean and what opportunities does it bring?

OUR MUSEUMS ARE:

Science Museum, London

Science and Industry Museum, Manchester

National Science and Media Museum, Bradford

National Railway Museum, York

Locomotion, Shildon

WHAT IS SCIENCE CAPITAL?

The concept of science capital gives us an insight into why and how some people participate in and engage with formal and informal STEM-related experiences – and why some do not. It can help to frame and shape experiences which are designed to support STEM engagement.

Science capital itself is a measure of your engagement or relationship with science, how much you value it and whether you feel it is 'for you' and connected to your life. It highlights the significance of **what you know** about science, **how you think** about it, **what science-related activities you do** and **who you know** in your life who uses and talks about science in shaping attitudes towards STEM.

A simple way to imagine it is like a bag or holdall that collects and carries all the science-related experiences you have had. This includes what you have learned about science; all the different types of STEM-related activities you have done, such as watching science TV programmes or visiting science museums/centres; all the people who you know who use and talk about science; and whether science is something that you enjoy and feel confident doing, or not.

Everyone has a different amount of science capital; it is not fixed and can change across a lifetime. The more science capital you have, the more likely you are to feel that it is useful and important in your life.

WHERE HAS THE CONCEPT OF SCIENCE CAPITAL COME FROM?

Millions of pounds have been spent on interventions and programmes that have aimed to increase participation in STEM. But this hasn't hugely changed the profile of the people who study science post-16 or those who take up careers in and from science. The problem is that many science-related experiences may, unconsciously, favour people from more socially advantaged backgrounds.

King's College London and University College London have led the research into science capital to help shed light on why many people remain underrepresented in STEM.

The research highlights that although many people like and enjoy science at school, few aspire to continue with science-related study or careers or feel comfortable in places where science is presented or discussed. They see science as something which is abstract and theoretical, with little real-life application, and only suited to the very bright – it's just not what normal people do. They can't see where it will bring value to their lives or how it could help them with their aspirations or ambitions.

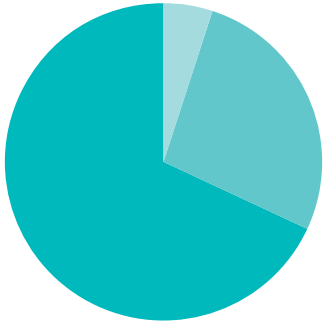
A distinct relationship between attitudes and aspirations towards STEM and levels of science capital has been identified through the research.

NATIONAL UK SURVEY OF SCIENCE CAPITAL

A nationally represented survey conducted with 3,638 11- to 15-year-olds living in areas near to the Science Museum Group sites found that[1]...

5% have high science capital (more likely to be socially advantaged and male)

68% have medium science capital



27% have low science capital (more likely to be female and/or from less socially advantaged backgrounds)

[1] L Archer et al., '"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 (2015), pp922–48

WHAT INFLUENCES PEOPLE'S ENGAGEMENT WITH SCIENCE?

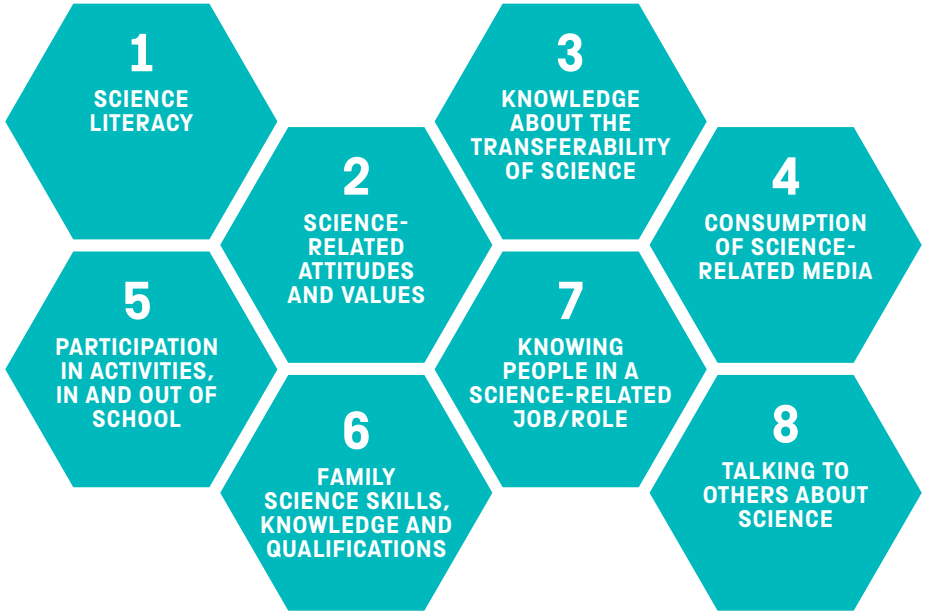
Science, technology, engineering and maths achieve amazing things, but that doesn't mean that everyone feels like they have a personal connection with them.

The research has identified eight key dimensions or sources of science capital. These are the most significant STEM-related experiences, knowledge, behaviours and attitudes people can have that will influence their science capital.

These dimensions show that it takes more than simply enjoying or learning about science to make you feel more connected with it.

We can use the dimensions to help us design environments and deliver programmes that are welcoming, inspiring and memorable for as wide an audience as possible.

EIGHT DIMENSIONS OF SCIENCE CAPITAL



HOW CAN INFORMAL LEARNING EXPERIENCES HELP TO GROW SCIENCE CAPITAL?

People experience and learn science in many different places – at school, at home and in their everyday life.

Informal science learning experiences play a key part in the STEM learning landscape by supporting and encouraging audiences to extend their learning within and beyond our spaces. They help to broaden people's perception of STEM and have the potential to inspire people of all ages and backgrounds with the opportunities and wonders of STEM.

No one place or experience can build a person's science capital alone. We need to work together to maximise the impact of our STEM experiences for the widest possible audiences.

The science capital research provides us with a good-practice framework and a common language that we can all use to play our part in helping to improve science participation and grow science capital in individuals and society.

WHAT ARE THE BENEFITS?

By helping more people to be inspired by and engage with science, we will not only help to attract a broader range of people for new STEM jobs, we will bring more diversity to the people who contribute and participate in science and innovation, which will create a fairer and more inclusive society.

We don't want anyone to feel excluded from science or see science settings as places where they don't belong or won't feel welcome. Not everyone needs to study science or take part in science experiences, but we need to help everyone to feel as if they could.

As the research gives us an insight into what influences and shapes people's attitudes towards science, as well as nurturing our existing audiences, it can help us to identify new ways to reach out and connect with absent and infrequent visitors.

The benefits for audiences will include[2]:

- Recognising the personal relevance, value and meaning of STEM
- A deepening of their appreciation of science
- Improved understanding and recall of science content
- Increased interest in/pursuit of STEM subjects and careers post-16
- Increased participation in 'out of school' science activities and lifelong connection with museums and cultural institutions

HOW CAN YOU PUT THE RESEARCH INTO PRACTICE?

A key message from the research is to focus on the environment that we invite our audiences into[3].

Every aspect of an experience or visit is an opportunity to shape someone's feelings about and relationship with STEM – whether it is the welcome they get, the signage and images they see, the people they meet, the places they go to eat, the science content and programmes or the website and practical information.

We all have different opportunities in the work that we do. There is no quick fix or checklist for applying the research to practice, it is about continually reflecting on what you do every day through the eyes of your audiences by asking questions such as:

- Are you doing all you can to make everyone feel welcome and confident in your experiences?
- How can the communication methods and language you use help everyone to feel that they are part of science?
- How do your experiences connect and relate to your audiences' rich and diverse interests, experiences and everyday lives?
- How do you value and build on the STEM knowledge and experiences that your visitors bring with them?

The Science Museum Group has created a toolkit of resources and workshops to support our staff to apply a science capital approach to their everyday work (table on page 13).

[2,3] Archer et al., (2018). *Improving science participation: Five evidence-based messages for policy-makers and funders*. London: UCL Institute of Education.

CAN YOU MEASURE SCIENCE CAPITAL?

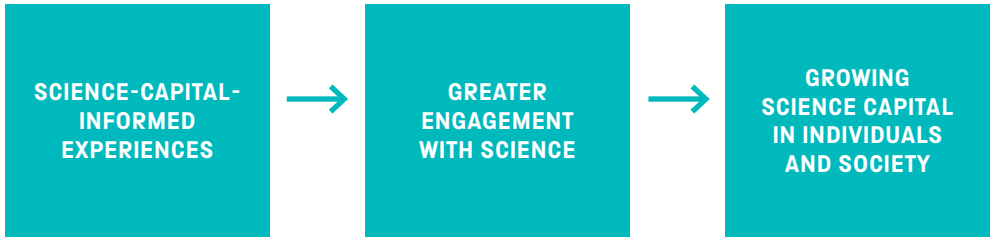
Science capital is not in itself an evaluation tool. We can't tell how a single visit or experience has increased someone's science capital as this will come from a combination of factors over time. But by using and applying the good practice, we can help increase people's engagement with science, which will, over time, grow their science capital.

People's engagement with science can be observed and measured through seeing whether they:

- Have a meaningful connection with our experiences and content
- Make links with what they know and experience in their everyday life
- Feel a sense of belonging
- Persevere, complete activities and spend longer in our museums and galleries
- Have positive emotions towards an experience
- Have purposeful involvement and contribute in our experiences and programmes

The Science Museum Group's visitor exit survey now includes a new science engagement measure which we are using to track our impact across the whole museum experience. We are also using other indicators such as representation in our audiences and summative evaluation research work.

THEORY OF CHANGE



LOOKING FOR MORE INFORMATION?

PUBLICATIONS FROM THE LEAD ACADEMIC RESEARCHERS

ucl.ac.uk/ioe-sciencecapital
ucl.ac.uk/ioe-aspires

Archer, L., Dawson, E, DeWitt, J., Seakins, A. and 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 (2015), pp922–48

Archer, L., Dawson, E., Seakins, A. and Wong, B. (2016) 'Disorientating, fun or meaningful? Disadvantaged families' experiences of a science museum visit', *Cultural Studies of Science Education*, 11/4 (2016), pp917–39

Archer, L., DeWitt, J., & King, H. (2018). Improving science participation: Five evidence-based messages for policy-makers and funders. London: UCL Institute of Education.

ANIMATIONS

Science capital – an introduction
bit.ly/sciencecapitalintroduction

Science capital and the informal science learning sector
bit.ly/scicapinformalsci

A science capital approach to building engagement
bit.ly/scicapengagement

SCIENCE MUSEUM GROUP

Find out more about how we are using science capital in our work, including practical examples and ideas in our blog:

transformingpractice.sciencemuseum.org.uk

group.sciencemuseum.org.uk/sciencecapital

GET IN TOUCH

If you interested in finding out more about the work and the training that the Science Museum Group is doing, please contact us at:

smgacademy@sciencemuseum.ac.uk

SCIENCE ENGAGEMENT TOOLKIT

For more information about these tools and how they can be used to support your work contact us at:

smgacademy@sciencemuseum.ac.uk

TOOL	DESCRIPTION	WHEN BEST TO USE
Science engagement reflection points (pages 14–15)	Practice-focused reflection points which bring together good practice around science and cultural engagement	When delivering or developing any STEM experience (eg an exhibition, event, show or resource)
Visitor learning outcomes	Defines what you want your visitors to feel, do or understand as a result of an experience	When planning and developing an experience, and to evaluate and measure its success
Audit and reflection tool	A science-capital-informed reflection framework to help critically review the strengths and the challenges of an experience	To review or audit an existing experience, resource or exhibit
Audience engagement framework (Hook, Inform, Enable, Extend)	The four core elements of a science engagement experience	When developing and delivering a STEM experience
See, Link, Wonder	A simple question framework to help people to think, talk and make personal connections with a STEM experience	When writing questions for activities or for visitor interactions
Science engagement measure	Survey and evaluation questions that can help to capture visitors' science engagement	For use in exit surveys, feedback forms and evaluation

SCIENCE ENGAGEMENT REFLECTIONS

A science-capital-informed approach is about reflecting on your STEM experience through the eyes of your audiences using these key ideas.

LANGUAGE

Think about the visual and verbal language you use, and how it can help everyone to feel that they are part of science – instead of feeling it is something 'other people' do.

Use personal pronouns, gender-neutral visual and verbal language, and explain any jargon.

CONFIDENCE AND OWNERSHIP

Consider how you can ensure that everyone feels welcome and confident to take part in your experiences.

Allow people to follow their interests. Give them choice and control in activities, and opportunities to contribute and share their knowledge and experiences with you and each other.

SKILLS

Think about how to help people recognise that they have and use a wide range of science skills.

Give examples of where and how science skills are used by different people in daily life. Highlight how these skills are useful in their hobbies and for jobs in and beyond science.

PROMOTE SCIENCE TALK

Think about how to encourage people to talk about the experiences they have had with you and about science in their life.

Invite people to share their own stories and viewpoints through questions which generate conversations among families, peers and communities – at home and at school.

EXTEND THE EXPERIENCE

Help people continue making science connections in their everyday lives.

Make your experiences last longer by giving people simple ideas and activities that they can do afterwards, such as questions to think about or research further, or challenges to do at home, at school or out and about.

PEOPLE

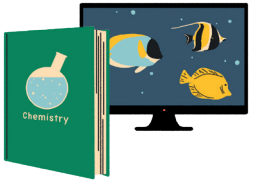
Think about how to broaden the perception of who does science by showing diverse examples of the people who use and benefit from science in their work.

Help people to recognise that they know people who use science and how science is shaped by everyone in society.

EVERYDAY EXAMPLES

Think about how to link your STEM content to people's rich and diverse interests and experiences.

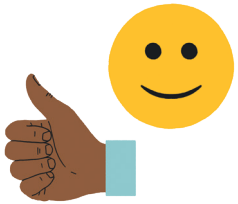
Show examples of where and how science has helped solve real-life issues. Don't make assumptions about what people's interests and experiences are. Everyone is different and may not be the same as you.



SCIENCE KNOWLEDGE

Consider how to value people's existing STEM knowledge and build on it. New information should feel like a natural extension of what people already know.

Broaden people's ideas around what science is. Communicate that science is more than just knowledge; it is a way of thinking, working and being curious.



POSITIVE REINFORCEMENT

Think about how to help people to feel that science is something they can do.

Highlight and reward when people are behaving scientifically, using science skills or knowledge. Leave them with the feeling that 'I can do this' and 'I want to find out or do more'.