

SCIENCE MUSEUM GROUP

ENGAGING ALL AUDIENCES WITH STEM

AN EQUITABLE APPROACH
INFORMED BY SCIENCE CAPITAL

FOREWORD



The science capital approach was developed as part of the Enterprising Science project, a five-year research and development partnership between The Science Museum Group, King's College London and University College London to address inequalities in STEM participation. It was funded by BP.

The Science Museum Group comprises:

- Science Museum, London
- Science and Industry Museum, Manchester
- National Science and Media Museum, Bradford
- National Railway Museum, York
- Locomotion, Shildon
- National Collections Centre, Wroughton

The Science Museum Group comprises five museums that are committed to inspiring futures by building a STEM-literate society that celebrates science, technology and engineering.

We aim to create places which are equitable and open for all and a key strategic priority is to 'grow science capital in individuals and society'.

Through our value of being Open for All, we're committed to providing everyone with equal access to our museums and wider offer. However, we know from the science capital research that some people feel excluded from science and see museums as places where they don't belong and don't feel welcome.

We all need to recognise that many of the approaches we use can favour those who are already engaged and will

exclude people who face inequalities in wider society. Science capital research helps us apply equitable practice to our work so that a broader range of people can engage with and participate in science.

This is not about giving audiences the things we think they need; it's about valuing the things that they bring. To do this means transforming our practices and changing the environment we invite audiences into so that everyone can make meaningful connections with the science, technology, engineering and maths (STEM) that shapes their lives.

We know that whilst not everyone needs to study science or take part in science-related activities, everyone should feel able to do so.

WHAT IS SCIENCE CAPITAL?

Science capital gives us research-based insights into what influences and shapes people's attitudes, engagement and relationship with science, technology, engineering and maths (STEM).

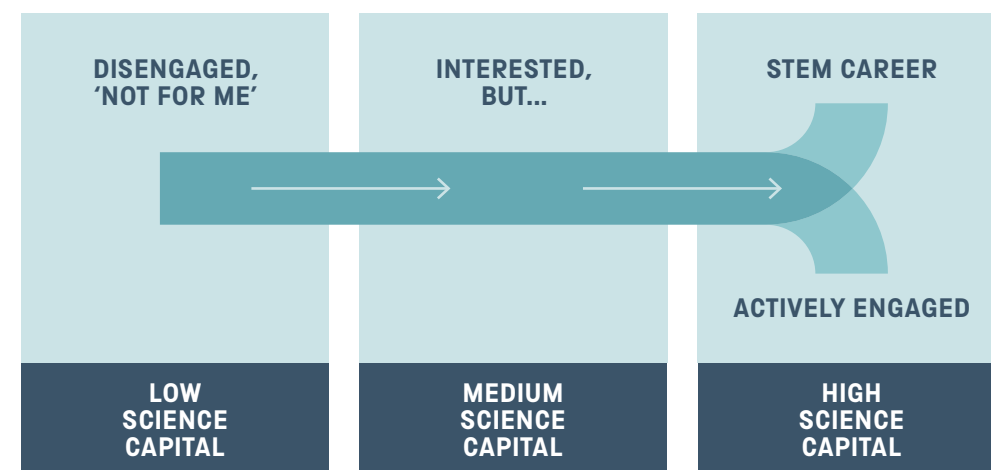
It recognises the significance of **what you know** about STEM, **how you think** about it, **what you do** and **who you know** in shaping your identity and relationship with science and maths.

A simple way to understand this is to imagine it like a bag that collects and carries all the STEM-related experiences you have had throughout your life.

Each of us has a different amount of science capital; it is not fixed and can change across a lifetime. Every experience that you have can influence your relationship with STEM both positively and negatively.



SCIENCE ENGAGEMENT JOURNEY



SCIENCE CAPITAL SURVEY INSIGHTS

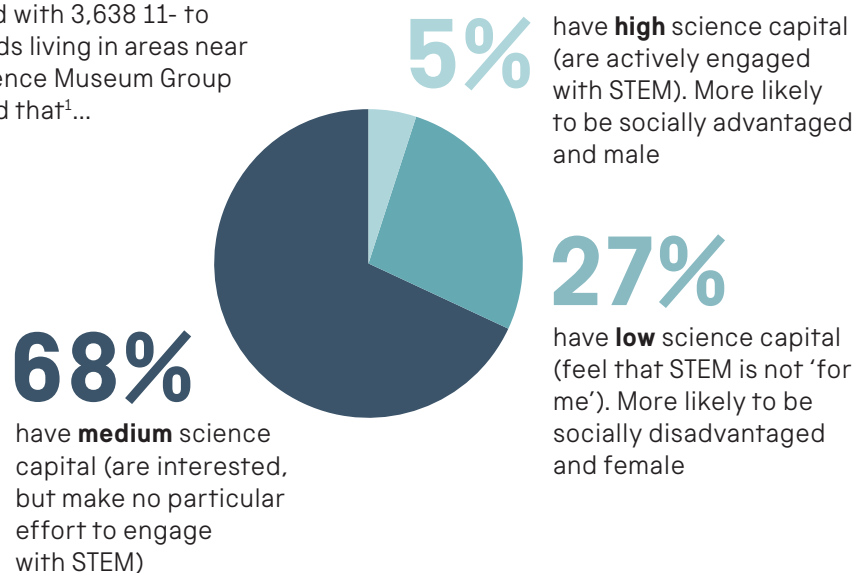
The more science capital you have, the more likely you are to feel that STEM is useful and important in your life.

Although the survey below was completed with young people, their science capital is also likely to reflect that of their families.

A further survey into science capital with adults (aged over 18) suggested that they had slightly higher levels of science capital, which may highlight the value and significance of science experiences beyond school in growing science capital.

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 that¹...



¹Archer et al. (2015)

SCIENCE CAPITAL, EQUALITY AND EQUITY

Equity and social justice are integral to the concept of science capital, enabling and empowering everyone to access the opportunities and wonders of STEM.

Taking a science capital-informed approach is about understanding and challenging inequalities, to help give everyone equal access to opportunities.



Equality aims to ensure that everyone is provided with the same resources and support to access opportunities. But it assumes that everyone benefits from the same support.



Equity recognises people's differences and ensures that everyone gets the support they need – we need equity before we achieve equality.



Justice is achieved when barriers have been removed and everyone can access all opportunities without the need for additional support.



HOW CAN INFORMAL LEARNING ENVIRONMENTS HELP TO GROW SCIENCE CAPITAL?



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

Informal learning experiences play a key part in the STEM engagement ecosystem by supporting and encouraging audiences to extend their learning within and beyond our spaces. They help to broaden

perceptions and have the potential to inspire people of all ages and backgrounds with the opportunities and wonders of STEM.

No single place or experience can be relied on to build a person's science capital alone, but through collaboration we can maximise the impact of our STEM experiences for the widest possible audiences.



WHAT ARE THE BENEFITS?

By inspiring and engaging more people with science, technology, engineering and maths, we can help bring greater diversity to the type of people who participate in and contribute to science and innovation. This will not only bring a broader range of perspectives and solutions to world challenges, it will also lead to a fairer and more inclusive society.

The benefits for our audiences include²:

- Recognising the personal relevance, value and meaning of STEM
- A deepening of their appreciation of STEM
- Increased interest in or pursuit of STEM subjects and careers post-16
- Increased participation in 'out of school' science activities and a lifelong connection with museums and cultural institutions
- Increased access to the social and economic benefits STEM brings
- Greater trust in STEM

Science capital research has resonated across the formal and informal learning sectors, nationally and internationally, and is frequently referred to by policymakers and strategic leaders. As such it gives us a strong common language to use to communicate the role and value that informal learning experiences play in society.

The research gives us an insight into what influences and shapes people's attitudes towards STEM, as well as helping us to nurture our existing audiences. In doing so it helps us to identify ground-breaking ways that we can reach out and connect with new and infrequent visitors.

² Archer et al. (2018)

WE ALL HAVE A ROLE TO PLAY

This diagram represents an organisational model for delivering engaging, inspiring and memorable experiences which are inclusive. It is based on Maslow's Hierarchy of Needs.

Every level needs to be addressed if we are to grow science capital in individuals and society – and help more people to feel at home in museums and STEM settings, like ours.

GROW SCIENCE CAPITAL

People talk about STEM to others and are inspired to find out more. STEM feels connected to their lives and they want to participate in it.

ENGAGEMENT/LEARNING NEEDS

Widen the definition of what science is; everyone has the opportunity to contribute; diverse representation of people and cultures in content; interactivity, interpretation is varied; retail products reinforce the experience.

EMOTIONAL/SOCIAL NEEDS

Everyone feels welcome and included; diverse, friendly and approachable staff; reasonably priced café and choice of food; marketing and events that reach and connect with people 'like me'.

PHYSICAL/BASIC NEEDS

Clean and safe space, accessible and appropriate experiences, and facilities inc. toilets, signage that people can follow, seating, quiet spaces/prayer room.

WHAT WE NEED TO DO



Putting science capital research into practice is about focusing on the environment we invite and welcome our audiences into.³

Every aspect of a visit – whether it is the welcome people get, the signage and images they see, the staff they meet, or the STEM content they encounter – is an opportunity to shape someone's feelings about and relationship with STEM.

It requires us to reflect on what we do and how we do it, considering the needs and experiences of a broader range of visitors. This involves changing our processes and activities, trialling them, and reflecting on the outcome.

These reflections will continually feed into our work and help us engage with more diverse groups of people. This involves us asking ourselves questions such as:

- What elements of my work or the way I behave exclude some groups?
- How does our offer connect and relate to our visitors' rich and diverse lives?
- Whose voices and experiences are we prioritising? Whose are we leaving out?
- Have we assessed whether exhibits, programmes, websites, marketing, communications and recruitment are inclusive? Who can help us examine this?
- For whom do we exist?

The Science Museum Group has created a toolkit of resources and workshops to support everyone to apply a science capital and equitable approach to their work (see table on page 17).

³ Archer et al. (2018)

HOW CAN WE MEASURE SUCCESS?

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 we can observe and measure people's engagement with STEM, which will help to grow their science capital.

Engagement can be 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 and ownership

- Persevere, complete activities, and spend longer in our spaces
- Have positive emotions towards an experience
- Have purposeful involvement in, and contribute to, experiences and programmes

The Science Museum Group's visitor exit survey includes a set of science engagement measures informed by the science capital research which we use to track outcomes across the whole museum experience (see our STEM engagement toolkit). We also use other indicators of engagement such as representation in visitor profile and audience research.

THEORY OF CHANGE



LOOKING FOR MORE INFORMATION?

Here are some selected additional resources:

FROM THE SCIENCE MUSEUM GROUP

Information on our website:

- sciencemuseumgroup.org.uk/sciencecapital
- sciencemuseumgroup.org.uk/equityframework
- sciencemuseumgroup.org.uk/transformingpractice

Animations:

- What is science capital?
bit.ly/sciencecapitalintroduction
- Science capital and the informal learning sector
bit.ly/scicapinformalsci
- A science capital approach to building engagement
bit.ly/scicapengagement



FROM THE LEAD ACADEMIC RESEARCHERS

ucl.ac.uk/ioe-sciencecapital

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, pp 922–48

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

GET IN TOUCH

Through our *Science capital in practice* programme, in collaboration with the Association of Science and Discovery Centres (ASDC), we have been building a community of good practice to continue to develop a practical application of the science capital research.

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

smgacademy@sciencemuseum.ac.uk

STEM ENGAGEMENT TOOLKIT

This toolkit contains practical tools that can help us to critically reflect on different aspects of our work through the eyes of a broader range of people.

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
Engagement reflection points (pages 18–19)	Action-led considerations that outline good practice around STEM and cultural engagement	When delivering or developing any STEM experience (e.g. an event, exhibition, resource, show)
Visitor learning outcomes	Defines what you want your audience 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 an experience	To review or audit an existing experience, resource or exhibit
Essential elements of engagement (Hook, Inform, Enable, Extend and Reflect)	The five core elements central to any audience experience	When developing and delivering a STEM experience
See, Link, Wonder	A question framework to help audiences to think, talk and make connections with a STEM experience	When writing questions for activities or for visitor interactions
Science engagement measure	Evaluation questions that can help to capture visitors' engagement	For use in exit surveys, feedback forms and evaluation work

ENGAGEMENT REFLECTION POINTS

A science capital-informed approach is about reflecting on your STEM experiences through the eyes of your audience using these key considerations.



USE INCLUSIVE LANGUAGE

Use visual and verbal language that acknowledges diversity and is sensitive to differences, to help everyone feel that they can do and be a part of STEM.

Try not to use expressions, words or imagery that might exclude individuals or groups, and be sure to avoid or at the very least clearly explain any jargon.



BUILD CONFIDENCE AND OWNERSHIP

How can you 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 the activities you create while providing opportunities to contribute and share their knowledge and experiences with you and each other.



HIGHLIGHT AND DEVELOP SKILLS

Help people recognise that they already use a wide range of STEM skills in their everyday lives. Highlight how these skills are transferable to jobs in and beyond science.

Give examples of where and how STEM skills are used by different people in daily life.



PROMOTE STEM TALK

Spark discussion and encourage people to think and talk about the STEM in their lives.

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



EXTEND THE EXPERIENCE

Provide ways to help people to continue making STEM 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 while out and about.



BROADEN PERCEPTIONS OF WHO USES STEM

Show diverse examples of the people who use and benefit from STEM in their work and everyday lives.

Help people to recognise that they already know people who use STEM skills and knowledge, while encouraging them to reflect on how STEM is shaped by everyone in society.



USE EVERYDAY EXAMPLES

Think about how you can support people to link STEM content to their own diverse interests and experiences.

Show examples of where and how STEM has helped solve real-life challenges. Don't make assumptions about people's interests and experiences – everyone is different.



BUILD ON STEM CONTENT KNOWLEDGE

Value and build on people's existing STEM knowledge and experience. New information should feel like a natural extension of what people already know.

Broaden people's ideas around what science and maths are. Communicate that they are more than content knowledge, they are a way of thinking, working and exploring the world.



GIVE POSITIVE REINFORCEMENT

Help people to feel that science and maths are something they can do.

Highlight and reward when people use STEM skills or knowledge. Empower them with the feeling of 'I can do this' and 'I want to find out and do more'.