

A whole school approach to developing Science Capital

Clare Docking suggests ways to develop Science Capital throughout your school

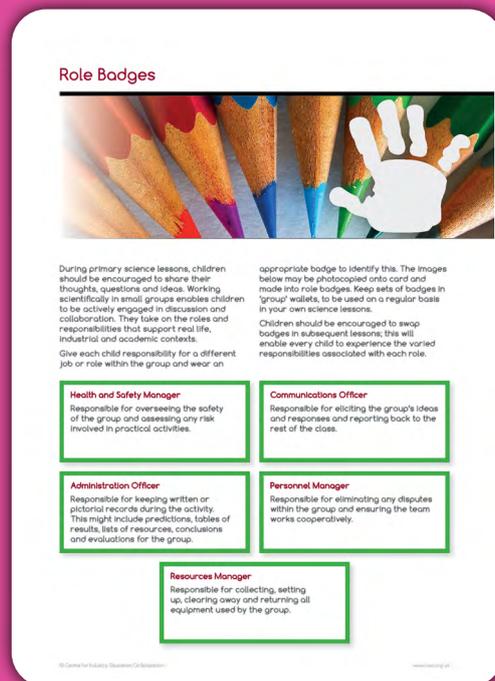


Figure 1 Role badges – used to raise science career awareness

Science Capital and primary science

An understanding of the theory of Science Capital is a great asset for primary teachers who are considering how to raise the aspirations of their pupils in regard to science and science careers. Research into young people's (age 10-14) science and career aspirations initially took place in the sphere of secondary education through the ASPIRES project (2013). One of the conclusions of the project was that primary teachers need to take the first important steps towards addressing the inequalities that lead to certain groups of young people entering a science career post-16. Research shows that, although many children find science enjoyable at school, this is not followed through with a desire to work in the world of science and that, arguably, if we have not captured a child's interest in science by age 11, it may be too late to alter their perceptions of science careers. However, research carried out by the Centre for Industry Education Collaboration (CIEC, 2020a), based at the University of York, supports the idea that

we can change the attitudes of young children of primary age who struggle to see the relevance of classroom science to their own lives and the world around them. In this article, I will explore some ways that children's Science Capital can be raised using CIEC approaches, resources and CPD.

The theory of Science Capital

Firstly, what is 'Science Capital'? Briefly, Science Capital is a lens through which to consider why and how some young people participate in and engage with science-related experiences, whilst others do not. Teachers know that children come to school with vastly different levels of understanding of and engagement with science. As Archer's team of researchers describes, a young person's Science Capital is a 'hold-all or bag' containing what you know – your scientific literacy and related knowledge; *how you think* – your attitudes to science, ways of thinking; *what you do* – science-related activities and behaviours; and *who you know* – science-related social contacts and networks (Archer *et al*, 2018).

This research shows that children with lower levels of Science Capital are less likely to aspire towards a scientific career, alongside other factors such as gender and ethnicity. A survey by the *Enterprising Science* project carried out in 2014 in England found that children who have high Science Capital tend to come from advantaged homes and be white or Asian males; their family members may well have science-based careers or know people that have. Over 25% of children surveyed had low Science Capital, and tended to be female and come from disadvantaged backgrounds.

In response to the challenge of how to develop Science Capital in primary schools, the CIEC team developed and rolled out, in three English regions, continuing professional development (CPD) for primary teachers: *A Whole School Approach to Developing Science Capital*. This CPD aims to help and support all the staff in a school to further their journey, whether they are at the beginning or partway towards enriching the children's Science Capital. Participating schools work towards a CIEC CPD completion certificate, which

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acknowledges the progress made in developing Science Capital throughout the school.

The CPD is intended for the whole staff and begins with an audit of current practice. The CPD is online, live, interactive and collaborative, and available to all schools across the country and delivered at a time to suit the school (frequently a twilight session). During the CPD, the school team takes stock of their science teaching that has a Science Capital focus – not necessarily always to change what is taught, but to ‘tweak’ the way it is planned and taught. Reflection time allows in-depth discussion and planning can take place. Once a school starts to focus on the different dimensions of Science Capital, they can begin to see where the gaps are in their provision and start developing an action plan.

We are delighted that, in recent years, all teachers attending our CPD sessions have rated our CPD as either excellent (80%) or good (20%). In the words of one Science Leader following the Science Capital CPD: ‘Thank you for the session today. I found it incredibly useful. The audit was a fantastic way to identify what we do well and the gaps which we have’ (Andrew Martin, Cowick Primary School).

Find out what children know and build on it

At CIEC we personalise learning in a variety of ways. Through our CPD, we encourage teachers to group children in small teams of four and, to develop Science Capital, we give teams a ‘company name’. All children are included and can collaborate, so discussion flows. Each child is given responsibility for a job or role within the group or ‘team’ and wears a badge to identify this (see Figure 1). For example, the ‘Communications Officer’ is responsible for eliciting the group’s ideas and responses and reporting back to the rest of the class. This collaborative approach helps all children to get involved and enables questioning and discussion.

Used at the beginning of the year, surveys can highlight your class’s experiences and knowledge, and

children can be asked what science-related interests they have and whether any of their family and family friends work in science-related jobs. With this information to hand, it is then possible to make links between a unit of work or topic and the children’s experiences at home. For example, a child whose parent is a horticulturalist may know about cultivating plants and can be encouraged to share this with the class. Surveys, as part of a homework task, can also be used to encourage discussion about science at home, therefore helping the development of Science Capital in the home. One such example can be found as an introductory activity in the CIEC publication *Sustainable Stories and Solutions for our Planet* (CIEC, 2019), which offers children the opportunity to survey their families and friends to gather their thoughts and ideas about sustainability.

The media play a prominent role in children’s lives today and most are aware of science stories hitting the news headlines. A portion of our children’s knowledge and understanding comes through their engagement with TV news or *YouTube* science documentaries watched at home. Highlighting newsworthy science discoveries alongside everyday scientific observations helps to broaden children’s engagement with science and avoid science discussion being restricted to a defined slot and topic each week. Mars exploration is very topical in 2021 and is explored in depth in CIEC’s resource *Is There Anyone Out There?* (CIEC, 2018) and another, *Potatoes to Plastics* (CIEC, 2021), explains how we can create a useful bio-plastic product from waste potato peel and explores the current topic of single use plastics.

Seeing the relevance of science by starting with the familiar

To develop Science Capital, it is important to start with what is familiar to children. CIEC resources engage children in fun scientific investigations using everyday materials that children are familiar with, and with processes



Figure 2 Children follow a ‘science recipe’ to make a bar of soap

that they know from home. Here is one example: the *What’s in a bar of soap?* activity from *Kitchen Concoctions* (CIEC, 2017) invites children to share their understanding of the properties and uses of soap. Children are then challenged to follow a recipe and use scientific processes to measure and mix ingredients to make a bar of soap. They investigate properties such as the viscosity of liquids used in everyday life.

As language can be a barrier to learning for less advantaged children, it is important to use familiar vocabulary and, through our CPD, we focus on simplifying vocabulary that is used in science industries to ensure that it is user-friendly and aligns with the vocabulary used in the science curriculum, e.g. *ingredients* rather than *chemicals* and *recipe* rather than *formula*. Using language that children are familiar with means that they all have the verbal tools to analyse and discuss their science learning.

The transferability of science knowledge is a key element of Science Capital. Children need to see how science concepts translate into familiar practical uses and everyday products to understand their relevance. CIEC resources link industry stories about the people and processes in local companies to the children’s classroom investigations. This enables the children to see practical, everyday uses for the science that they are learning. For example, the children may investigate the best food and temperature for growing the microorganism yeast and then learn about a biotech company that manufactures machines that are used to grow the microorganisms used for medicines.

Knowing people in science-related roles

Some children grow up in an environment in which they know people – family or friends – with science-related jobs. Whilst we need to value all occupations, teachers can widen children's experience of scientific careers by inviting a broad range of adults working in science-related jobs into school. It is worthwhile investigating your local area to find out what kind of science is taking place in local companies and businesses in order to explore possible connections between their work and the science curriculum.

Ambassadors from a local company could visit your classroom to work with children in small groups on an activity linking their job to the science that the children are learning. They could also discuss their careers with the young people through question-and-answer sessions in the classroom. Our latest resource, *Potatoes to Plastics* (CIEC, 2021), written by Jane Winter (see article in this issue on page 30), provides ready-made ambassador interviews translated into news articles, thus introducing STEM careers in a cross-curricular way – an idea that could be adapted and used as a way of exploring the careers of your own ambassadors.

Broadening the definition of a science-related job beyond the stereotypical nurse or doctor helps the children to see the vast amount of career options available. CIEC's *Career Cards* (CIEC, 2020b) provides



Figure 3 Yeast growth investigation in the context of making medicines

an example from one company of STEM careers open to children, whilst also challenging stereotypes and questioning gendered attitudes around expected career choices for girls and boys. These cards and the accompanying PowerPoint presentation could be adapted to build your own resource showing the profiles of the ambassadors who visit your school.

Engaging parents and family science skills

Engaging parents in your class's science learning is extremely useful, as we know that family is one of the most important influences on their child's interests and career aspirations. Making opportunities for family engagement in homework can be challenging, but is successful when equipment is easily obtained, no special expertise is needed, careful step-by-step instructions are given and there is room for exploration and questioning. Collaborative homework such as *IndusTRy AT HOME* (CIEC, 2020c) uses everyday household items to carry out fun practical investigations at home. They are designed so that children can do them with just a little help from parents, carers or older siblings. Children can then share the results when back at school, via photos, notes or drawings. Teachers can share these resources easily via the school website or newsletter.

Creating a school action plan for whole school development of science capital

The strategies above can all be included in an action plan for a whole school approach to developing Science Capital. Once you have audited your provision across the school, you can decide on which areas of Science Capital to focus. In order to do this, consider which types of activities you need to engage in, which strategies or approaches you would like to adopt, and plan how each year group will participate. Keep a record of your achievements and celebrate how far you have come on your journey as a



Figure 4 A virtual meeting with an ambassador

school, through sharing new science experiences and learning in sharing assemblies, through a whole school science event or keeping video diaries.

CIEC's research shows that personalising learning, using products and processes that are familiar to young people and introducing them to a range of scientists and engineers, has a positive impact on whether children consider that science and a future science career may be for them. As primary teachers, we can make a real difference to children's aspirations through tweaking our practice and consciously making choices to develop Science Capital through the primary science curriculum. We hope that CIEC can help you wherever you are on your journey!

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