

Honing higher-order thinking skills with GSSfs

Francesca MacLennan reflects on the Science Oxford Big Science Event run in collaboration with Great Science Share for Schools and how these are platforms to springboard pupils' thinking skills in science

Young scientists shine at the Big Science Event 2025

Science Oxford's Big Science Event joined forces with Great Science Share for Schools, showing true collaborative spirit focused on a shared mission to inspire and support pupil-led scientific enquiry. Science Oxford's programme had been running since 2010 and encouraged 5–11-year-olds to ask curious questions, conduct practical scientific investigations and sharing of findings in a competition-style approach. Both organisations knew the synergy was too close not to take the next step.

Joining with the national initiative brought two organisations with shared values and goals together to further their aims of optimising science education in the UK and engaging as many pupils and teachers as possible.

Schools entered a ballot for a place at the Science Oxford Science Share event held on 17th June 2025, as

100 schools in Oxfordshire and Buckinghamshire took part
22,200 pupils engaged



Image showing pupils and teachers in the Oxfordshire share

spaces were limited. Following a Great Science Share approach, 13 schools brought teams of six pupils to share their science with peers and take part in a pond dipping workshop as well as spend time in the Science Oxford Centre 'hands-on' Exploration Zone.

Pupils demonstrated their abundant curiosity about the world around them, and shared how they found answers as a team to interesting scientific questions, including:

- What surface does a woodlouse find it easiest to walk on?
- Which suncream provides the best protection against The Sun's rays?





- Which material will make the parachute fall the slowest?
- Do people with longer femurs jump further?
- Do magnets still attract in different liquids?
- How do rubber bands effect the shape and strength of a watermelon?

To support the application of Thinking, Doing, Talking Science in the region, members of the Science Oxford team were STEM Champions and visited science

sharing events that were held in local primary schools. They asked curious questions and celebrated the science that was being undertaken, becoming part of the audience giving pupils the opportunity to talk about their investigations with peers, parents, teachers, governors and a range of guests working in science, technology, engineering and maths.

Local industry volunteers from [Diamond Light Source](#) and [Abbott](#) also developed posters to share their



Science Oxford is the UK's first indoor outdoor science centre with 15 acres of woodland.

They are part of The Association for Science and Discovery Centres (ASDC) in the UK and The European Network of Science Centres and Museums (Ecsite) covers Europe. Find your nearest science centre here:
www.sciencecentres.org.uk/

own investigation questions, including 'Why does chocolate taste different after it has melted' and 'How much sugar is contained in different foods?'. The involvement of adults in the share showed connectivity between pupil and adult curiosity and gave direct links with local STEM organisations who could show real-world applications for the science learnt in schools.

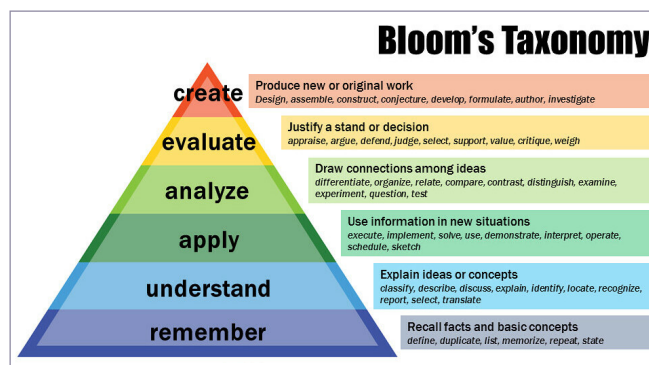
Working the Great Science Share to improve children's higher order thinking skills (HOTS)

We knew that we wanted to ensure the impact of this initiative gave as many learning benefits to pupils as possible. We considered the ways in which we would be able to foster curiosity, enhance problem solving skills, increase oracy as well as advance analysis, evaluation and creative abilities. At Science Oxford, our research-based *Thinking, Doing, Talking Science* pedagogy co-created with Oxford Brookes University, demonstrates how fundamental these abilities are to pupils' learning, moving it beyond knowledge acquisition and recall through rote learning. In this way, we considered how GSSfS could strengthen pupils' higher order thinking.

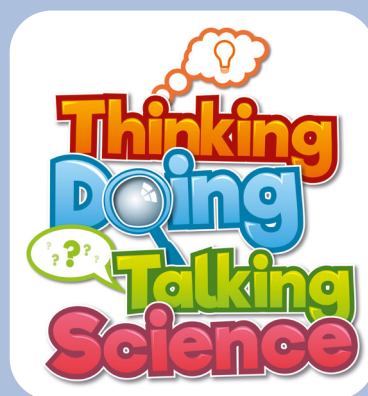
'Higher order thinking occurs when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations.'

Lewis and Smith 1993

The well-known Bloom's Taxonomy (Bloom 1956) defines the highest order thinking as involving the complex tasks of making a new creation based on prior knowledge. We acknowledge that since its initial development in the 1950s, Bloom's Taxonomy has received academic review, that highlights its benefits and limitations to learning.



Tidema (2024)



The *Thinking, Doing, Talking Science* pedagogy was co-created by Science Oxford and Oxford Brookes University in 2012 and has been proven to:

- build teacher confidence
- promote higher-order thinking skills
- allow greater time for practicals
- increase enjoyment
- foster more positive attitudes towards science

(Education Endowment Foundation 2025)

At the heart of this approach is the concept of extending children's thinking in science by encouraging higher-order thinking skills, with every science lesson including a dedicated time for thinking and talking, called the '*Bright Ideas Time*'. Here, all ideas are valued, enabling a safe space where taking risks holds greater importance than finding the 'correct' answer.

To find out more about the *Thinking, Doing, Talking Science* pedagogy visit:
<https://tdtscience.org.uk>

We were keen to ensure that pupils moved beyond remembering and reciting facts, to being able to summarise them, and draw conclusions as well as potentially applying findings to other situations. For science learning overall, we sought to promote more freedom for pupils and teachers alike, by modelling that they did not need to strive for perfection in answering every question ‘correctly’. We sought to demonstrate how important it was to discuss, question and explore concepts that are new or beyond what has been considered or encountered before.

‘I really liked the way science is very free and you can do anything. Science is so vast you can go from chemistry to biology, looking at little insects to studying the heart. It’s really vast.’

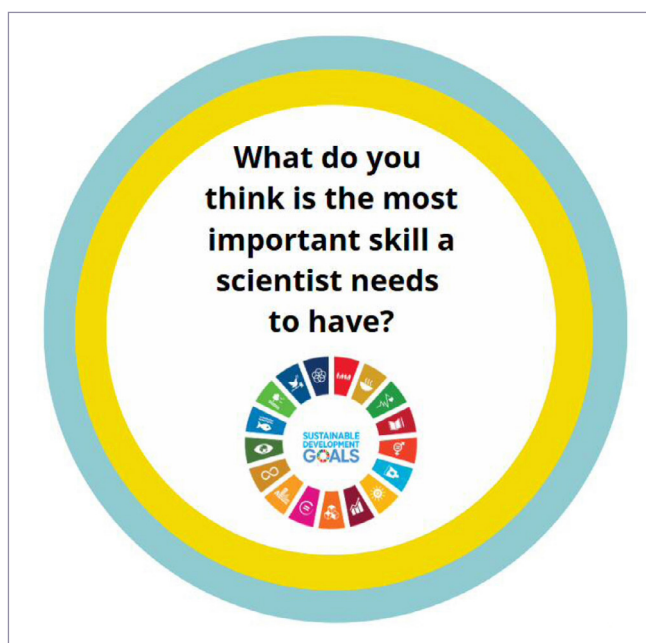
Using Thinking, Doing, Talking Science to enhance your GSSfS

A key element of the *Thinking, Doing, Talking Science* best practice pedagogy is ‘Bright Ideas Time’. Working with the Science Oxford team, GSSfS has already embedded the Big Question idea into the range of *Question Ponders*, aligned to the *Great Science Enquiries*. Other ways that teachers can support pupils to develop higher-order thinking comes through the *Bright Ideas Time* approaches. These are dedicated discussion slots during science lessons, which inspire thinking and talking where all ideas and responses are valued. The following strategies can be used to promote higher-order thinking:

- **Odd One Out:** present pupils with 3–4 items and ask them to choose and justify what makes them the ‘Odd One Out’. An example is water, chocolate and paper. Praising the thinking is the key here, rather than looking for a ‘right’ answer and multiple answers can be elicited.
- **Positive, Minus, Interesting (PMI):** pose a question such as, ‘What would be the positives, minuses and interesting points if we had a world without electricity?’
- **HOT questions:** such as, ‘How do we know that the Earth is a sphere?’

The other great way that *Thinking, Doing, Talking Science* has been infused into GSSfS is through the links with the STEM Learning *Explorify* resources. These are well-recognised resources and include ‘Bright Ideas Time’ activities, providing teachers with a myriad of activities themed to all areas of the curriculum. This means that whichever scientific questions your pupils are asking, investigating and sharing, there will likely be an *Explorify* resource to inspire and match in with it. These are inclusive and can be readily used in your science lessons on a regular basis to promote higher-order thinking skills.

Great Question Ponders



Great Question Ponders are a discussion-based activity that brought together *Thinking, Doing, Talking Science* and created a talk tool called the *Great Question Ponder Prompts* using Huthwaite International’s verbal behaviour strategies. Together these encourage pupils of all ages to explore big questions and share their thoughts and opinions in a collaborative setting.

Each ponder links to a *Great Guided Enquiry* (published each year) often connecting to themes of sustainability and global issues. The Prompts help pupils enhance their group discussions by using a range of verbal behaviours such as supporting ideas, disagreeing respectfully, summarising, clarifying understanding, sharing information and asking thoughtful questions.



These prompts not only deepen scientific thinking but also help pupils uncover and examine common misconceptions. In today's world, developing the ability to think critically and question information is more important than ever. The *Great Question Ponder* supports this by fostering thoughtful, evidence-based dialogue among young learners.

To explore the *Question Ponders* in more detail, visit: www.greatscienceshare.org/gssfs-resource-library-2023/questionponder-2025.

Impact

Empowering young people to pursue pupil-led enquiry and share their science provides rich rewards.

'You could see the children are passionate about everything they talked about and their experiments, and they were ready to share with others. The children have learned a lot today and they will take this back to their school to share with others.' Teacher

'It is incredibly heartening to see so many primary-aged pupils deeply engaged in asking their own scientific questions, conducting investigations and then sharing their findings with others. This is at a time where UK STEM talent needs are ever-rising, as we seek to find pioneering solutions to global challenges such as climate change, electrification, global health and embrace the new era of digital technologies and AI. Inspiring the next generation about science and engineering careers in these formative years and fostering curiosity is paramount.' Francesca MacLennan, Director of Science Education and Engagement

Summary

The Big Science Event and Great Science Share for Schools provide creative frameworks and the scaffolding to apply the *Thinking, Doing, Talking Science* pedagogy in the classroom and beyond, resulting in the development of higher-order thinking skills and rich science learning. This approach develops cognitively challenging, practical and interactive primary science.

The benefits are widely acknowledged by teachers and pupils alike with increased confidence, enhanced oracy skills and purposeful practical science among the added benefits.

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