Peer-to-peer learning: showcasing the power of collaborative learning

Kate Sutton of STEM Learning, considers how GSSfS provides a means to inspire and support collaborative learning between pupils

Research demonstrates that when pupils collaborate effectively, they develop social and communication skills that have lasting educational value. This is something that has been at the forefront of our minds when designing how we would involve teachers and pupils in a STEM Learning Great Science Share for Schools (GSSfS).

Aware of reports that promote collaborative learning, such as the Education Endowment Foundation's *Teaching and Learning Toolkit* (2024), colleagues at STEM Learning and I were inspired to explore how we could work towards engaging pupils in high-quality talk, reasoning and explanation in science. We were keen to explore how work that inspired us in writing, such as the Dialogic Teaching Project, could influence the design and undertaking of a teacher and pupil event. With experience of having done GSSfS in schools, we were keen to focus on how '*well-founded classroom dialogue improves student engagement and learning, especially when pupils are encouraged to build on one another's ideas through structured discussion*' (Alexander, 2018).

In this article, we consider how GSSfS provides a means to champion collaborative learning, giving practical ways to structure this with primary pupils. As the Great Science Share places strong emphasis on peer-to-peer learning through the ask, investigate and share approach, we were motivated to have this as a focus.

- How does collaboration to enhance primary science learning happen in your school or setting?
- What does successful collaboration between groups or organisations look, feel or sound like?
- What benefits emerge from collaborative learning between teachers, and also between pupils?

Harnessing the power of collaborative learning

We gave our GSSfS the theme of, '*The Power of Collaborative Learning*' and invited two local primary schools who had not worked together before to take part. This meant we had seventy 10–11-year-olds to involve in our one day GSSfS event. We selected these schools because they are in our community and within close proximity to the National STEM Centre, and we explained that we sought to encourage pupils to use a range of communication skills and demonstrate scientific thinking within a Great Science Share.

The teachers and pupils had never taken part in the GSSfS campaign prior to involvement with us. We came together as a team of ten that included primary teachers; STEM Learning staff; University of York Community, Education and Outreach mentors and a volunteer STEM Ambassador: a retired electrical engineer who had worked with trains, planes and helicopters across his career. We discussed with the class teachers and science subject leaders how we

sought to inspire and celebrate the pupils' curiosity, by making initial connections in online meetings. We liaised about how we would plan, deliver and evaluate the event and brought together our shared intentions. Working collaboratively as a team, we outlined the structure for activities we would lead on and how we could support pupils to follow their scientific curiosities and investigations within these activities.

It was evident that we all shared the same belief: that opportunities which encourage young people to be in the 'driving seat' are so vital if we are to best equip them for success in civic and work life, in a rapidly evolving world. We shared our thoughts on how essential it is that young people not only develop subject knowledge, but the ability to collaborate, communicate and solve problems. The very skills they will need as citizens and as members of a future workforce are shaped by science, technology and global challenges.

The evidence base

Developing transferable skills, including resilience, is increasingly recognised as a key outcome of primary education. Fenwick-Smith *et al.* (2018) argue that '*wellbeing and resilience are essential in preventing and reducing the severity of mental health problems*', adding that equipping children with coping skills helps them '*react positively to change and obstacles in life*'.

These attributes can be nurtured through real classroom experiences that foster adaptability and self-regulation. A recent study on the international SEE Learning program (2024) found that even a short six-week intervention led to '*statistically significant improvements in students' resilience*' demonstrating that these skills can be explicitly taught and strengthened during the primary years. Williams-Brown *et al.* (2020) also report on England's HeadStart programme, highlighting the value of co-constructing resilience with pupils, noting that pupils '*valued the support they received from others*' and underscoring the importance of '*a collaborative resilience-building approach between adults and pupils, where pupils are listened to*'.

These studies reinforce that social interaction and adult facilitation play a role in developing transferable skills such as empathy, perseverance, and emotional regulation. These areas of study relate to our work on the GSSfS, as the coordinating team shared the views that these are necessary foundational capabilities that support pupil's learning as well as inspiring to develop a mindset supportive to lifelong success.

Collaborative learning in our GSSfS

Inspiring pupils to work collaboratively during learning drew on a range of approaches, including:

- practical working that resulted from pupils asking and investigating scientific questions;
- the GSSfS Toolkit which provided support, guidance and prompts when working scientifically with others;
- *These Chips Can* storybook (see *References*);
- collaborative group role cards.

For the rest of this article we have focused on reflecting and reporting on the use of the collaborative group role cards, as our previous work with pupils led us to realise that they required support in this area. We also recognised that bringing pupils together from different schools posed greater challenge for pupils of this age.

▲ **Figure 1** Pupils engaging with the role cards

Some reflections on this approach...

What we did:

We created collaborative groups by mixing pupils from different schools before introducing them to the seven role cards. As shown in Figure 1, these defined distinct responsibilities with the aim to guide all group members to have a clear role which was purposeful to the process of working scientifically. Some of the pupils were familiar with this type of 'role allocation' from school activities, but many were not.

What we found:

Pupils chose their own roles effectively, some needing more guidance to take on an appropriate role and some needing more support/encouragement to engage. They worked well together by sharing predictions, testing ideas and drawing conclusions together. It was striking to see how most attempted to use the allocated roles to challenge, support and build on each other's thinking, not always perfectly, but with genuine intent and engagement.

> *'I was the Maker, I like getting my hands on the equipment to figure out the task.'* (Olivia, aged 10)

> *'We built on knowledge we already had about electricity.'* (Frankie, aged 11)

The teachers and adults at the event acted as facilitators, role models and prompts for the pupils. They gave support with how to talk about findings and introduced and explained scientific vocabulary when required. Some pupils were evidently more confident than others, speaking out and taking stronger leadership roles, although we didn't notice any specific tendencies related to gender. Pupils genuinely seemed to find it a challenge to work with other peers, but engaging too.

> *'I was the leader; I am confident so could do that. We got to know the other children there throughout the day.'* (Brandon, aged 10)

> *'We have worked with some of the kids from the other school before which helped. We were happy to share our ideas together. We shared our ideas to work out the best ways/techniques.'* (Aliyah, aged 11)

Teachers commented on the benefits of using the role cards. They specifically commented that less academic pupils engaged in a much more hands-on way than usual in these types of tasks. They explained that some pupils who are usually quiet became more confident when sharing their science with people outside the class/visitors.

Other benefits

We found the GSSfS Guided Enquiries really useful in supporting a collaborative approach to learning. They incorporated opportunities for pupils to work in pairs and small groups, and were designed to encourage pupils to engage in real-world contexts, share their preconceptions and understandings and discuss outcomes. Using the *Great Ocean Share* and *Great Electricity Share* supported collaboration by:

- having hands-on practical work as a core element of learning. This meant that pupils were required to select and set up equipment, take and record measurements and analyse and share outcomes. The practical nature of the enquiries were ideal for groups of between four to seven pupils working together.

  > *'I loved exploring how the sweets lost their colour – it was a really good way to help me explain what is happening to the coral in the oceans.'* (Frankie, aged 11)

- Pupil-to-pupil discussions were supported through specific tools, such as the *Question Makers*. These inspired question-asking and the *Conclusion Creator* provided prompts to support the children in articulating outcomes from their enquiries.

  > *'The Conclusion maker helped us to start to explain our answers; for example it helped me say 'This experiment shows this...'. They were good to show us how to explain our ideas.'* (Daniel, aged 11)

- Using a story (*These Chips Can* by Jules Pottle) peaked pupil interest and instigated discussions about changes to technology over time. Linking science to the real-world and their own lives was a useful way to involve pupils in talking together about their own experiences in and beyond school.

Reflections on supporting collaborative learning

There are always pros and cons to things we try, and this was no different. In hindsight, the project team considered that it would have been beneficial to have given the pupils opportunity to develop confidence with working within peer groups prior to forging mixed groups across the schools at the Great Science Share.

We also think that pupils would have benefitted from having used the role cards in regular science lessons as this would have allowed more time for the hands-on activities.

We found the group/role size of seven to be a maximum appropriate group size- teams seemed to naturally vary between four to six. This allowed for optimum group collaboration/effectiveness.

We noticed that some groups needed support to take turns or to remain focused on the task. Considering they were in an unusual space it may be that this influenced their attention, however this reinforces the importance of scaffolding the collaborative process. We could further think about the feedback for pupils to better enable them to recognise what went well and how to further improve through encouragement and explanation/reasoning about ways of working.

Lastly, we think that it may be beneficial to have a wider range of cards from which teachers can select. In this way, teachers could identify the roles that they most particularly wanted pupils to develop. It would also support a sense of progression and development over time.

Final reflections

The power of Great Science Share for Schools to promote authentic, collaborative science learning was definitely evident in our experience. As a teacher who has run GSSfS events at school over the past ten years, this experience reinforced everything I value about the campaign. When given opportunity to ask, investigate and share, there is a real opportunity for pupils to work collaboratively and build confidence and curiosity so that scientific thinking can flourish.

We are now keen to further develop these approaches and have discussed how our experience aligned with recently published research on supporting purposeful, reflective practical science as defined and discussed in the *Purposeful Practical Work in Primary Science* report by Earle *et al.*, 2025.

In this report, the researchers consider the purpose of practical work. They identify 10 purposes from a global literature search, one of which is that practical work is undertaken to '*develop personal and social skills e.g. oracy, collaboration, perseverance*'. For us, this was very much the case, and the activities we used in our Great Science Share sought to support pupils to develop skills and confidence in using the practices of science (Figure 2). However, we also recognise how the practical activities also went beyond 'just doing' and strongly involved pupils being supported and promoted to use scientific vocabulary and connect their conceptual understandings about topics such as electricity, dissolving etc.

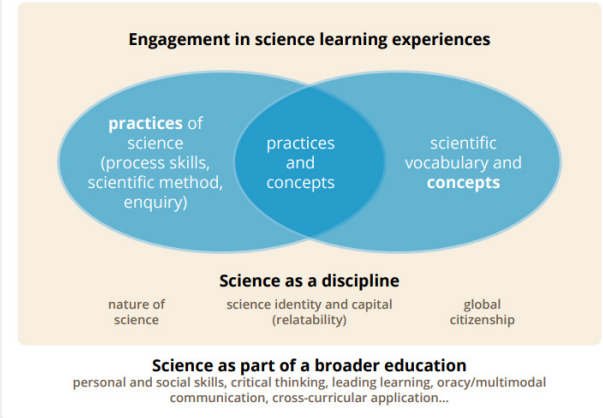


Figure 1. **The Purposes Framework:** a framework for prioritising the purposes for practical work in primary science, with core purposes in white text

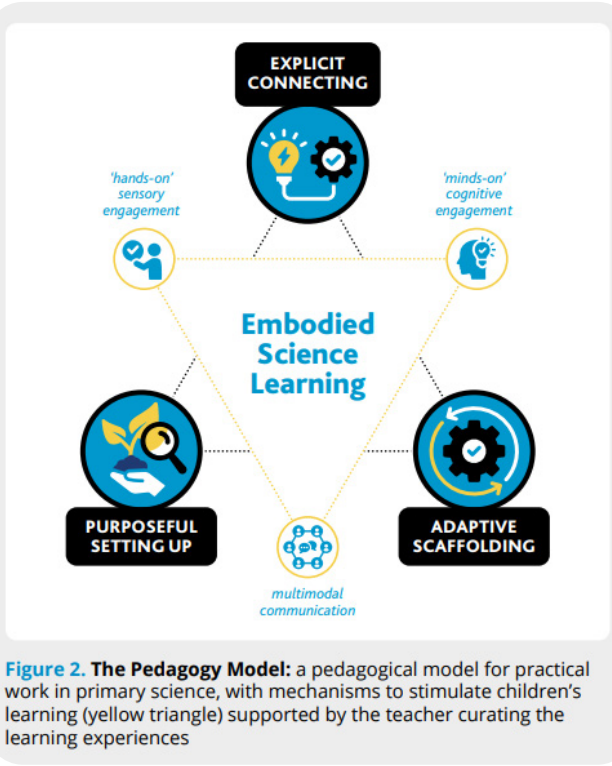


Figure 2. **The Pedagogy Model:** a pedagogical model for practical work in primary science, with mechanisms to stimulate children's learning (yellow triangle) supported by the teacher curating the learning experiences

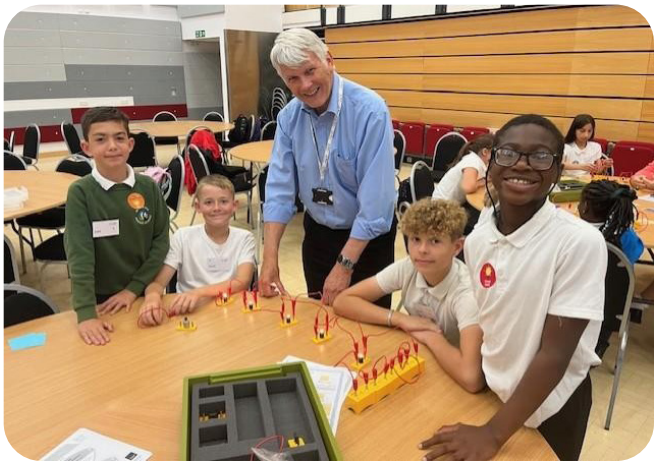
▲ **Figure 2** The Purposes Framework and Pedagogy Model, taken from Earle *et al* (2025)

By working together, we valued the way that these understandings and confidence developed with and through the engagement with others, in a social setting. Pupils were given peer and teacher support through the scientific thinking process, working together to predict what might happen and to communicate their observations and their findings using scientific methods and terms. Without the opportunity to collaborate, we don't think that the outcomes would have been so rich for the pupils who were definitely hands-on

and minds-on during the experience, drawing on both sensory and cognitive modes. In future we could explore further how we could support pupils to select styles and approaches to the way they communicated findings and outcomes to each other, which in our case relied mainly on prior knowledge, plus support from the GSSfS Toolkit and staff/volunteers.

Beyond the immediate science outcomes, we evaluated and reflected on the fact that GSSfS doesn't just support science learning. We have valued the way we can see it influencing the way teachers worked with us to build awareness and practise of the skills and characteristics that young people need to thrive as learners, collaborators and citizens more holistically.

Of course, with any work like this it is vital to keep up the drive and motivation to build on and respond to our reflections. It was an amazing experience for all and in the coming months we will hope to continue to explore how STEM Learning can further harness the opportunity that GSSfS offers to strengthen the power of collaboration between young people and scientists, thereby further deepening science learning for many more children and educators of the future. Here's to the next ten years.



▲ **Figure 3** Pupils collaborating with support and interaction with STEM Learning staff and Ray, volunteer STEM Ambassador and electrical engineering expert

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