Dropping off a cliff or flying high? Primary-secondary transition

■ Zoe Crompton ■ Zoe Hulme ■ Christine Siddall ■ Zoe Tarry
■ Josh Harper ■ Lynne Bianchi ■ Grace Marson

Abstract

Concerns about a dip in pupil progress and attitude to science in the transition from primary to secondary school have been well documented and yet persist (Ofsted, 2015, 2023; Steidtmann et al, 2023). This transition project, developed from Bianchi and Turford (2022), involved teachers from 12 schools working together and brings a fresh perspective to a long-standing challenge. We examined what a group of primary and secondary teachers can do to address the issue, given time and support to work collaboratively, as well as access to recent research and inputs from key figures in the science education community. How the transition project impacted four teachers at a personal and professional level is explored through two case studies.

Keywords: Transition, progression, pedagogical bridge, curriculum bridge

Introduction

Transition from primary to secondary school at the age of 11 has been a focus of research for many decades due to perennial fears of lack of progress in science (Earle, 2022). This dip in attainment is compounded by inequality, since pupils from lower socio-economic backgrounds make less progress at the start of secondary school (Social Mobility Commission, 2017). In addition, Nag Chowdhuri *et al* (2021) report a general decline in pupils' attitudes to science from 11 years old onwards, and fewer young people choosing to study science subjects in later years.

The move to secondary school can be a challenging period in a child's life, as it occurs during adolescence and has an impact on emotional wellbeing (Spernes, 2022), so it could be argued that the lack of progress and change in attitude to science is a consequence of this unsettling time. However, the decline in engagement with science continues across secondary school, while attitudes to English and mathematics change little (Barmby *et al*, 2008). Allen (2016) suggests that the dip is due to repetition of curriculum content, differences in pedagogy (from collaborative in primary school to teacher-led in secondary school) and disappointment – children expect to carry out science experiments in science labs, but instead spend much of the time writing.

In this work, the authors draw on findings from a 2-year transition study that sought to explore pedagogical and curriculum bridges in science between schools located in the North West of England. They focused on working with in-service teachers to identify teaching and learning approaches that could improve the consistency and progression of pupils' experience of science learning across primary and secondary. The aim was to improve transition from primary to secondary by developing inclusive approaches to science curriculum progression and practice. The project involved five science teachers (from four secondary schools) and eight primary science subject leaders (from eight primary schools). All 12 schools were located in an administrative district that operates a selective system, where pupils attend non-selective secondary schools or sit an entrance examination to attend their preferred grammar school. This results in secondary schools working with 20 or more primary schools spread over a wide geographical area, arguably making the issue of a smooth transition even more challenging.

Method

The group of teachers met 12 times across two years – six afternoons face-to-face (for which the project paid for supply cover to enable teachers to attend) and six twilight sessions. They received the following professional development sessions:

Face-to-face sessions (2.5 hours)	Twilight sessions (1.5 hours)
1. Introduction and observing practice	2. Science Capital Teaching Approach and inclusion
3. BEST (Best Evidence Science Teaching)	4. Powerful ideas and curriculum design
5. Curriculum progression and vocabulary	6. Evaluation of Year 1 and plans for Year 2
7. Funds of Knowledge and inclusive practice	8. Inclusively inspiring all pupils in STEM
9. Developing an understanding of transition	10. Support writing case studies
11. Celebration event – presenting case studies to Headteachers	12. Support writing case studies

The first session introduced teachers to the five 'bridges' that span the primary/secondary divide (Sutton, 2000):

- The 'managerial/bureaucratic' bridge;
- The 'social and personal' bridge;
- The 'curriculum content' bridge;
- The 'pedagogical' bridge; and
- The 'management of learning' bridge.

This was accompanied by the research evidence about children bored by repetition and a notable quotation from *Muddle in the Middle: 'Why are they teaching that again in Year 7? They did it in Year 4'* (Sutton, 2000, p.25). Of these five bridges, teachers agreed that those within their control were the curriculum and pedagogical bridges. None of the teachers had observed science teaching outside of their own type of setting, so this was their gap task before the next meeting – to observe and reflect on similarities and differences in inclusion, pedagogy, learning and vocabulary.

Each session included inputs from relevant experts in the field, links to research evidence and opportunities to collaborate in small groups. Other gap tasks included trialling different approaches, collecting pupil voice data, and activities to maintain the close links between primary and secondary, for example, by attending the annual Great Science Share for Schools (an annual science communication campaign where pupils ask, investigate and share scientific questions with peers). At the end of the first year, each small group of collaborating primary and secondary teachers planned their own research question relating to either the 'curriculum bridge' or the 'pedagogical bridge'. The teachers worked collaboratively, alongside developing strategies to support transition within their own setting. What follows are two case studies, written by the primary and secondary practitioners, about the impact of the project on their own practice and beyond.

Case Study 1: Curriculum bridge – Language barriers to working scientifically when transitioning from primary to secondary

Secondary science teacher: We decided to focus on the scientific language that teachers used and the curriculum bridge from primary to secondary. Many of the secondary teachers were not aware of the way that working scientifically approaches were termed and encouraged in primary schools, including: research using secondary sources, comparative and fair testing, observation over time, pattern-seeking, and identifying, classifying and grouping. They are not explicit in the secondary science curriculum. This lack of continuity in key terminology from primary to secondary school could make it more difficult for pupils to transition from primary science. The transition to secondary school comes with a new environment, usually a laboratory, with new equipment, such as gas taps, so when teachers use new terminology to describe an aspect of science in which children previously felt confident, this compounds the transition issues.

We asked the pupils in the final year of primary school and first year of secondary school to complete a short questionnaire about their views on science. The 10 year-olds highlighted that they enjoy science at primary and look forward to moving on to secondary school science. By the time they started the first year of secondary school, pupils claimed that they did not remember much about science and had not done much science at primary school. This may be due to the issues regarding when and how often science is carried out in the final year of primary school due to Standard Assessment Tasks (SATs) in English and mathematics. Science is awarded a higher status at secondary school, often due to parental expectations, and the fact that science General Certificate of Secondary Education (GCSE) is compulsory, so that it now finds itself 'up there' with English and mathematics. This may in part explain why pupils forget to recognise the high level of competency that they held when they left primary school. Science at secondary school is 'new'.

In the future, we plan to deliver in-house science training for our staff to develop their understanding of the five strands of scientific enquiry from the primary curriculum, so that secondary science teachers understand the language used at primary. This will support pupils' confidence and understanding, and it will strengthen the curriculum bridge, enabling pupils to link their prior learning to a new context. We will use the logos associated with the five strands on posters in our labs and teaching PowerPoints, as these are recognisable from primary school. These will be integrated into the schemes of learning for 11 year-olds as a scaffold for transition, then gradually removed as pupils become more familiar with the secondary curriculum.

The relationship now between secondary and primary, in terms of science, is much stronger and is a partnership that we will continue to make use of and benefit from. We are currently working on another science project together that has stemmed from this one and which is providing even more opportunities for scientific enquiry and transition possibilities. There is also the potential to include further primary schools and other secondary subjects to extend and support transition in the future. Our aim is that everything we mentioned above will have a significant impact on the children's retention of scientific knowledge, their use of scientific terminology and the reduction of their anxiety regarding transition to secondary.

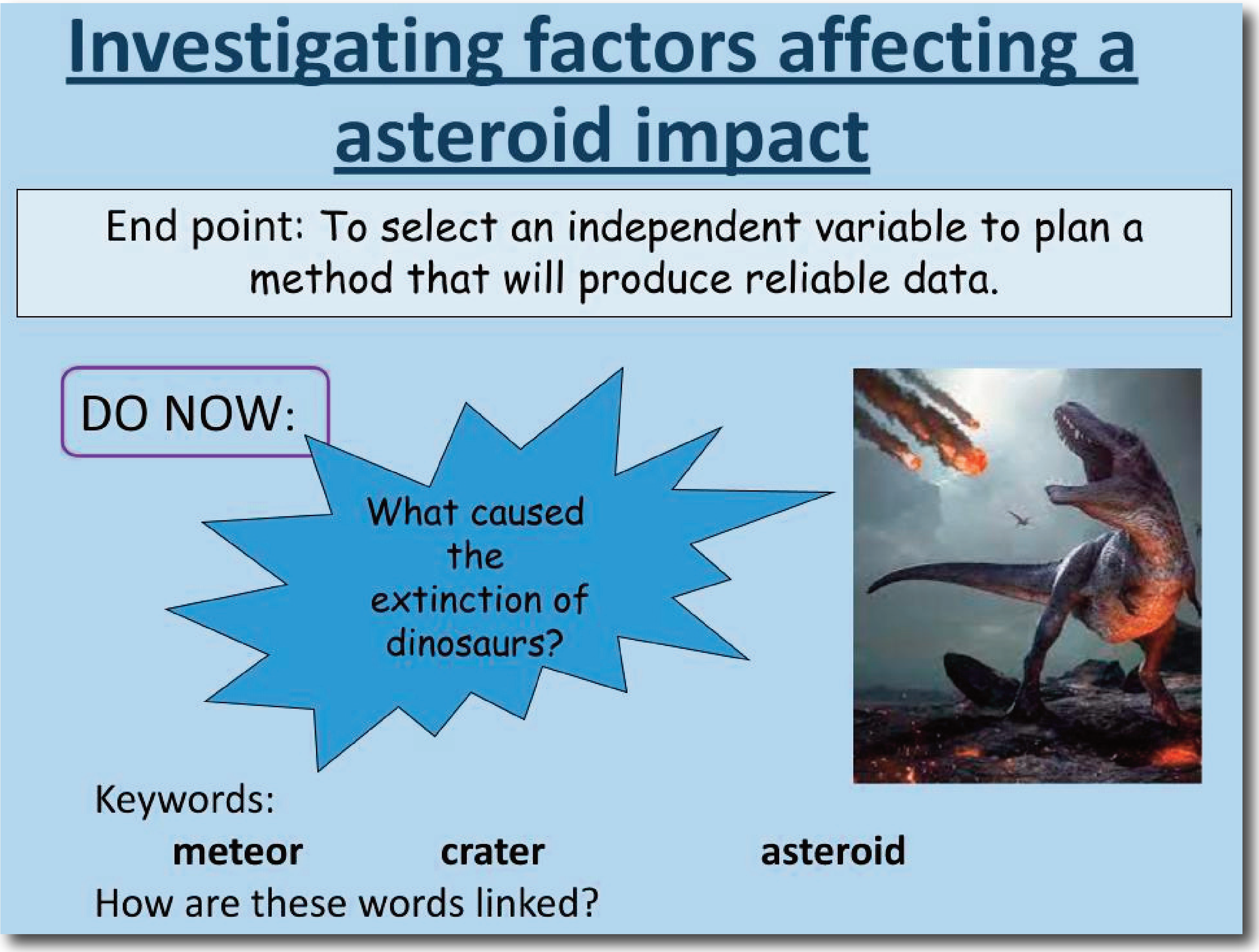
Primary science subject leader: During my visit to secondary school, I was struck by the fact that secondary teachers no longer refer to 'fair testing' but instead discuss validity of data and conclusions. Therefore, we have included the terminology of validity, reliability, repeatability, accuracy and precision into the final year of our primary school schemes of learning to ensure a smoother transition into secondary school science. We speak to the children about how the content that they are learning when they are 10 years old is going to be built upon in secondary, and how we are building a good foundation of scientific knowledge now. We have a much closer relationship with secondary school colleagues to talk as science leaders, ask questions and communicate/highlight important aspects of our curriculum.

Case Study 2: Pedagogical bridge – Fostering pupil decision-making and independence during scientific enquiry

Secondary science teacher: I was interested in seeing what a science lesson looked like and what resources were available in a primary school. I wanted to know how much science pupils were exposed to before they arrived in my classroom at the local secondary all-boys school. When I visited the primary school, I saw that the biggest difference between pupils in primary and secondary was independent learning. The 10 year-old pupils in a mixed attainment class had more responsibility for their own learning, as they were using knowledge organisers to retrieve information about the cardiovascular system. They worked efficiently and calmly under very little instruction from the teacher.

This observation made me question why we treat our pupils, in the first year of secondary school, almost as if they haven't already produced, or are not capable of producing, work such as writing longer-answer questions or problem-solving. It made me question why we sometimes hold back scientific concepts when this can create misconceptions. My enquiry then led to the question: Do we make our pupils back-pedal? Why do we do this, and is it causing pupils to disengage as they don't feel as if they are making progress?

Figure.1 PowerPoint slide introducing secondary pupils to the meteor activity.



Casserly and Wood (2023) advocate for the benefits of giving pupils choice in their science practical and learning. This article supported me to consider how I could encourage choice and retain safety in the classroom. I altered a unit on forces to replicate the lesson written about in the article, allowing pupils to choose which variable they were going to investigate. The lesson is called 'Investigating factors affecting a meteor impact'. The pupils first discussed the connections between meteors and the extinction of dinosaurs, then looked at craters on the Moon and discussed what could affect the size of the craters (see Figure 1). They produced and followed their own method, working out control variables through trial and error, rather than just being told to follow instructions regimentally to avoid behaviour issues. The pupils were allowed to select their own equipment and easily gave a justification for choosing that piece of equipment when asked.

I collected staff and pupil voices to see what the impact had been on changing the way in which the practical was taught. I was concerned that some behavioural issues may have arisen; however, teachers reported that all pupils were engaged and wanted to solve the problem. Pupils were asked to recall their learning and what they had done and spoke with confidence and excitement, as they were happy to tell me what variable they had chosen, what was difficult to control and what the outcomes were.

The Head of Science summarised the impact of the project on our school:

'By allowing more choice in the scheme of work, pupils have developed their ability to use empirical methods confidently to investigate a scientific question, the pupils appear more engaged and have transitioned from being passive learners to active learners in science'.

Primary science subject leader: Since becoming a teacher 9 years ago, I have become more and more aware of how the profession has faced an increasing amount of pressure and restraint. Much of the pressure comes from sources out of the class teacher's hands, with one of the biggest pressures being time – how can we fit all these lessons into one week, into one day? Sadly, my colleagues and I feel that this pressure often results in lessons being more prescriptive than exploratory, especially in science. As science subject leader in my primary school, I have seen this result in experiments being modelled rather than carried out by the children, videos used instead of a practical task, and many more time-saving hacks that teachers have adopted to fit in the bursting curriculum.

During the project, I was introduced to the Great Science Share for Schools (GSSfS), which inspires young people to ask, investigate and share scientific questions with new audiences (SEERIH, 2024), and decided to carry this out in my school. I provided staff with resources to support them matched to the age range that they taught. Interestingly, staff were incredibly nervous and unsure of the GSSfS. Through discussions, I discovered that this was due to the child-led aspect. They were 'scared' about what the children would decide to focus on. However, when we explained to the children that they could lead experiments on what they wanted, based on the story that we watched, there was a wave of excitement across the school. The school was suddenly filled with budding scientists eager to get started.

To support my colleagues, and to ease their nerves, I gave them the most precious asset: time. I took away the constraints of other lessons and gave them a full day dedicated to science, nothing else to be squeezed in, no 'quick readers' to be heard, nothing but science. With our resources ready, children eager and 5 hours at our disposal, we were off. I was lucky enough to be able to see all the amazing discussions and experiments going on. Children know about my passion for science, so when I entered a classroom or an outdoor space, they rushed to show me their work: *'Look at what we planned, I wanted to see which place in the school would affect how the speed of the spinner dropped and Miss Smith let me!'* There was a buzz – pure excitement (see Figure 2).

I felt as if my enquiry question was being unequivocally answered: *Yes, science would be more interesting to children if it was child-led.* At the next staff meeting, I asked staff how the day had gone, and it was reported as an overwhelming success. All the staff had enjoyed the day and, more importantly, they saw the benefit of letting children lead their own learning. One staff member said *'I have never seen every child in my class so engaged with science and want to be involved in the discussions'.* Children said that they had enjoyed sharing their findings and investigations with their peers, teachers, Headteacher and parents, as well as seeing other children's projects.

Figure 2 Primary pupils investigating paper spinners.

This enquiry and these findings have changed the culture in our school. Staff now have less fear in allowing children the opportunity to lead their learning. Just as importantly, we now see the importance of linking our science with the community, our family and friends. I have seen classes working together and swapping findings, and a class present their STEM topic work to a younger class to excite them for what they have in store next year.

Final thoughts

This two-year project has been an appreciative enquiry, with a legacy of change in the curriculum and pedagogical bridges for the teachers and schools involved. The final word is from one of the secondary teachers, who has been teaching for 18 years, and who spoke about her transformation during the Celebration event at the end of the project:

'I feel like less of a teacher and a bit more of a researcher in my classroom because I'm going, right, how did the kids respond to this question? What are their misconceptions? Why did you think that, even though it's the wrong answer? So, I say, "Why? Why are you thinking that?" So, I'm collecting that information and then teaching from that, rather than assuming what they know'.

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Dr. Zoe Crompton is a science consultant and senior lecturer at Manchester Metropolitan University.
E-mail: z.crompton@mmu.ac.uk

Zoe Hulme is a secondary science teacher.
Christine Siddall is a secondary science teacher.
Zoe Tarry is a primary science subject leader.
Josh Harper is a primary science subject leader.
Professor Lynne Bianchi is Director of Science and Engineering Education Research and Innovation Hub (SEERIH), University of Manchester.
Grace Marson is SEERIH Specialist Lead, University of Manchester.