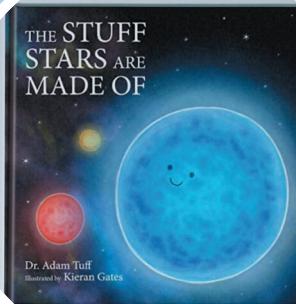
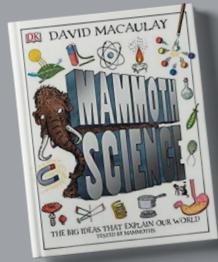
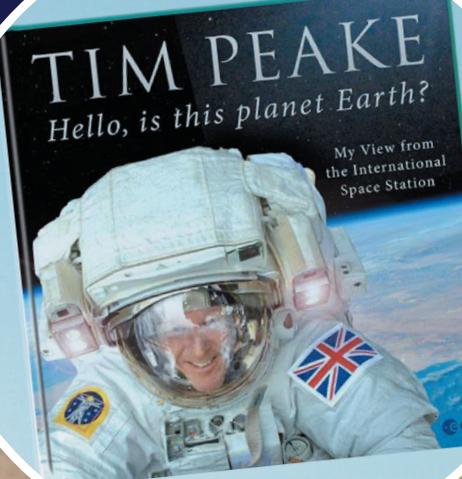


CONNECT

THE JOURNAL OF PRIMARY
SCIENCE DEVELOPMENT IN
STOKE-ON-TRENT

ISSUE 2: Better Reading Better Science

JULY 2021



**BETTER READING:
BETTER SCIENCE**



Looking ahead: Future issues are already in the making.

Contributions from local schools and teachers are always welcome. To find out more or express interest in contributing to future issues- Contact Olivia Stanyer ostanyer@moorparkjunior.co.uk

Issue 3	Learning Communities	From engaging with expertise, to embedding learning
Issue 4	Innovation from Stoke-on-Trent	Gifting and sharing new developments in science. Celebrating creative problem solving from teachers working collaboratively.
Issue 5	????	?????

This issue of **CONNECT**, along with previous issues, can be downloaded from
The Science Across the City website <https://www.scienceacrossthecity.co.uk/>
They can be located by clicking on the Impact tab.

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Deborah Campbell NPQH, NPQSL, has taught in the city of Stoke-on-Trent for 22 years in both secondary and primary phases. As a previous LA consultant and SLE of English and Leadership she has had the pleasure to work with many pupils, teachers and schools within the city. Debbie is proud to state, "**I have always wanted the best choices to be available for the children of this city because once, years ago, a teacher wanted that for me.**"



Context and Background



Tina Whittaker,
National Consultant
for Primary Science,
Co-lead of SATC.



Debbie Campbell,
Acting Curriculum
Leader
St Wilfrid's Catholic
Academy

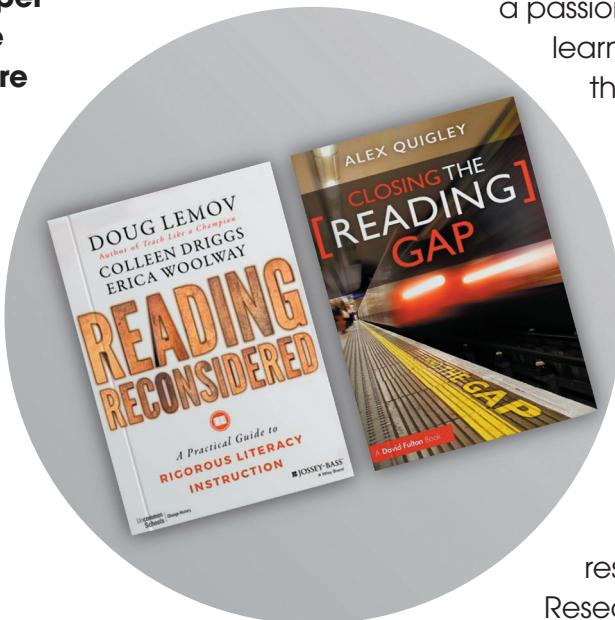


**BETTER READING:
BETTER SCIENCE**

This year Science Across the City has looked carefully at the impact of literacy upon the pupil's experience of Science. This has manifested itself as the Better Reading Better Science (BR:BS) learning community where members have shared training, discussion and debate in order to understand and apply research, regarding reading from the Education Endowment Foundation (EEF), Lemov and Quigley, to the subject of Science. Following this deeper thinking, as members of the learning community, we were challenged to reflect upon our own classroom and school practice. The 'voices' throughout this journal are the result of our enquiries, they seek to raise conversation and consideration of pedagogy. They also seek to spotlight the relentless, dedicated work of teachers within our city. Better never stops

BR:BS was designed as a 'co-create' CPD model to support teacher development. The co-create theme extends to the leaders of this learning community, Debbie Campbell and Tina Whittaker.

They have much in common including a passion for learning and being learners, dedication to enabling the best quality classroom experiences for all children and a commitment to our local community, Stoke-on-Trent. The difference simply being the lens of specialism, immersion in their own subject perspectives and the research underpinning current best practice in English and Science respectively. The recent Ofsted Research Review¹ states, that 'any





THE JOURNAL OF PRIMARY SCIENCE DEVELOPMENT: SUMMARY STATEMENT

•

school approach that improves pupils' reading will, in turn, help pupils to learn science and vice versa'.

Scientists often claim that enquiry is great when it leads to more questions than answers.

This, therefore, infers this project is an excellent piece of enquiry with the teachers' findings

stimulating new and exciting hunches to explore further. Deepening and embedding reading to learn through action research has enabled light bulb moments that perhaps now seem such easy wins and has stimulated the symbiotic relationship between better reading improving science and better science improving reading.

The project's ultimate aim is to address what it means to read like a scientist within the primary curriculum, known as disciplinary literacy. This is different to literacy across the curriculum and without doubt, for cohort 1 there is much improved reading about science as a body of knowledge, but for phase 2 taking the development further will mean designing and piloting new approaches and resources to better support the explicit teaching of reading like a scientist! And so, yet more new learning from this 'co-create' learning community is eagerly anticipated.

This year has been so very different for both pupils and teachers. The Better Reading Better



Science team met virtually, discussed, and debated with one another for the betterment of science teaching and learning. It has been a privilege to work together and we look forward to meeting face to face to continue this deeply thought provoking journey.

Given the success in classrooms a new 'co-create' learning community of Science Influencers and English specialists are invited to express interest to join the next BR:BS group (cohort 2) (Sept 2021-May 2022). To register your interest please email Olivia Stanyer ostanyer@moorparkjunior.co.uk

Debbie Campbell and Tina Whittaker

VOCABULARY

CO CREATE, remaining open to one's own learning whilst being engaged in another's. Recognising that learning evolves via discussion of experience and honest collaboration.

DISCIPLINARY LITERACY, having the ability to produce, interpret, and understand language whether spoken or written, which is appropriate to different subjects.

¹<https://www.gov.uk/government/publications/research-review-series-science>



Reflections from the Editor

Inspired by the articles in this journal I have been reading 'Closing the reading gap' by Alex Quigley. What a remarkable book. I have been reflecting on just how much I take reading for granted. To use some of Alex's vocabulary it is magical that I am able to plunder a vast store of knowledge accrued over a lifetime to unlock the meaning of black marks on a page. Sadly, so many children are not lucky enough to have the same access to books and reading that I did as I grew up and do not have a wide variety of experience to help them make sense of their reading.

The great news is that in Stoke-on-Trent a team of teachers is grasping the thorny issue of using complementary approaches of reading to support the teaching of science and science contexts to teach reading. This issue of CONNECT celebrates their successes, so far, on this fascinating journey and looks to the future with a second phase for cohort 1 and new opportunities for science leads to join cohort 2. I'm sure the ten places will be filled faster than I can say knife, but, if not, count me in!

Ofsted¹ note the strong correlation between achievement in reading and science and infer this link is causal in both directions. They claim that through reading pupils become familiar with scientific vocabulary, scientific concepts and the links between those concepts. Before this report was even published, teachers in Stoke-on-Trent were already investigating these links in their own classrooms. Their learning and experiences are shared through this issue of CONNECT. As the journal name suggests, many of their initiatives connect the different areas explored in the five main articles.

The articles are topped and tailed by Debbie Campbell, a local English teacher. She has opened up a whole new world to the teachers involved in the project, sharing her specialist knowledge and



Clare Warren

understanding to help them translate theory of best practice in the teaching of English to support learning before, during and beyond science lessons. Research shows that it is difficult to translate theory learned on courses into classroom practice, but the teachers who have engaged with the BR:BS project make it look like falling off a log!

The first article considers the ways in which some teachers have tested strategies to support the acquisition of scientific vocabulary. Three different approaches are described that aim to ensure pupils are familiar with the scientific vocabulary before the teaching of scientific concepts begins. Read about Sinead, Julie, Janine and Lucy's thoughts on their approaches on pages 8 and 9.

In this first article the importance of the choice of text becomes clear, so, 'which books and why?' is the important subject of the second article. Teachers from across the City share their experiences of text selection and explain why it is so difficult to choose when so many books are available claiming links to the science curriculum. As ever, in teaching, there isn't one right answer, but their recommendations and those in the centrefold



THE JOURNAL OF PRIMARY SCIENCE DEVELOPMENT: REFLECTIONS FROM THE EDITOR



might be a good starting point for anyone wishing to try some of the approaches advocated

Texts that might be useful in the teaching of primary science are shared and reviewed across the centrefold thanks to the BR:BS team and the pupils of Ellison Primary School. As a bonus Jenny Watson, who like myself, is a guest in the SATC community, has provided her suggestions for reading that supports the primary science curriculum as a double sided pull out. She also usefully signposts other sources providing book suggestions to support both primary reading and science. What a wonderful gift to the City!

Vicky, Julie, Sharon, Adam and Dawn feature in the following article and they explain their experiences of experimenting with guided or shared reading of science books to develop reading comprehension skills. They too note the choice of texts is crucial.

Any primary teacher who has ever read aloud to a class knows about the power of books to engage, motivate, prompt questions, explore new worlds and so much more. Books as Hooks, the next article, discusses the ways stories can provide motivating scenarios for pupils to investigate as

part of their science lessons. The teachers featured in these articles have discovered the strength of combining fiction, non-fiction and other genres to inspire and engage their pupils.

Our final article explores just what it means to Read as a scientist. Scientists ask questions – it's in their DNA! This conflicts with the way that school science is often taught as a body of facts. If we are to encourage pupils to be scientifically literate citizens able to make informed decisions about wide ranging topics, for example, vaccinations and climate change, developing the crucial ability to question should be an entitlement for all pupils. The teachers of Stoke-on-Trent are clearly working to support children to develop those higher order thinking skills. What a great place to experience primary science education!

For my concluding thought I return to Alex Quigley who states, "The ideal scenario is that every teacher and teaching assistant would be highly trained, with time to support one another, but often this isn't the case."² Teachers-in-Stoke on Trent are so fortunate to have access to training through the BR:BS project. It is clear to me that, unlike my ability to read, they are taking none of that for granted.

Clare Warren

*“The more you **read**
the more **things** you will know.
The more that you **learn**
the more **places** you'll go.”*
Dr Seuss

¹Research review series: science (2021) Available at <https://www.gov.uk/government/publications/research-review-series-science>

²Alex Quigley (2020) Closing the reading gap. Routledge



BETTER READING: BETTER SCIENCE

Vocabulary Acquisition

Featuring contributions from Moorpark, Ellison and Our Lady and St Benedicts Primary Schools

1



Develop pupils' language capability to support their reading and writing

EVIDENCE STRENGTH:
EXTENSIVE

Purposeful speaking and listening activities support the development of pupils' language capability and provides a foundation for thinking and communication.

Purposeful activities include:

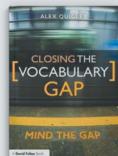
- reading books aloud and discussing them;
- activities that extend pupils' expressive and receptive vocabulary;
- collaborative learning activities where pupils can share their thought processes;
- structured questioning to develop reading comprehension;
- teachers modelling inference-making by thinking aloud; and
- pupils articulating their ideas verbally before they start writing.



Excerpt from the 'Improving Literacy in Key Stage 2 – Recommendations Summary'

Vocabulary is key to reading comprehension. A group of innovative Science Influencers within the city of Stoke-on-Trent, when faced with the challenge of improving pupils' scientific vocabulary, responded in innovative ways.

Alex Quigley in his book 'Closing the Vocabulary Gap' suggests that narrowing the gap 'between a child's personal word-hoard and the academic language of school is an achievable and realistic goal'. The BRBS team agree with this statement and set forth with a particular focus upon making this happen within science.



Hu and Nation (2000) reported that learners needed to know around 98% of the vocabulary in a fiction text to gain unassisted comprehension.

Having been exposed to the science knowledge and vocabulary in detail during shared reading sessions, I found that the children were given a head start during their weekly science lessons

Dawn McCann



Lucy Holdcroft of Moorpark Primary School seeks to ensure

that the careful teaching of selected vocabulary leads pupils into a text with confidence rather than misconception. The improvement of pupil vocabulary and therefore their ability to explain their thinking is the intention behind Moorpark's focus on text use in science. Recognising that there was a need to develop children's scientific vocabulary took the school on an interesting and productive journey into the world of choosing new science texts to support different units and developing specific vocabulary lessons to 'prepare' for learning.

Thus the 'Reading Squad' was created. This is a whole class intervention aimed at improving reading comprehension skills via clear modelling and explanation using specific science text. The session, led by an adult, focuses upon one of the comprehension strategies from the EEF KS2 Literacy Guidance Report utilizing a science text to practice these skills with.

The appraisal and selection of effective scientific text is a time investment that Lucy and the school feel is well worthwhile. Texts, both fiction and non-fiction, are identified to support each of the science units throughout the school. This creates opportunities to model the reading of a multimodal text and to provide an emotional link to an objective subject via a fictional choice.



BETTER READING: BETTER SCIENCE



At **Ellison Primary School**, Science Influencer **Janine Carpenter** developed a highly effective method to ensure pupils hear the fluent reading of a non-fiction or fictional science based text. The teachers recorded themselves reading aloud from a science text related to the current unit of study. Published on the school website, this allows pupils to access modelled fluent reading with its inherent prosody at any time of the day. These benefits are supported by careful pre-teaching of vocabulary which begins a pupil's understanding of a word before the science lesson.

When combined with the practice of guided oral reading and repeated reading techniques this allows pupils to recognise the sound of fluent reading and to aspire to achieve it themselves. Teachers at Ellison Primary School have engaged with the EEF research to deliver excellent practice and have aligned this with their own context.

The Ellison teachers have skilfully supported one another. Janine writes, 'although as teachers we stand in front of large groups of children and adults every day, if you point a video camera at us we become nervous, twitching, unsure individuals who begin to doubt whether they have a reading voice that is acceptable.' The sharing of their initial, and then increasingly polished efforts enabled the teachers to see that publicly revealing their fluency skills took courage. This honest recognition reminds us of the anticipatory nervousness that is a feature of many pupils reading experiences.

This approach also ensures that the benefits of remote learning are recognised and built upon. The blending of both in school and home instruction generates advantages for the whole school community.

VOCABULARY

SCHEMA A cognitive framework that helps organise and interpret information. Pupils build increasingly complex frameworks as they link and join information from different subjects and experiences.

LONG TERM MEMORY refers to the storing of knowledge for an extended time. Long-term memories require learning and repetition to become fixed..

PROSODY the rhythm, stress, and intonation of speech. Prosody provides the skills which enable fluency in reading to be achieved.

PEDAGOGICAL This refers to the practice of teaching and the methods that we as teachers use within our classrooms..

TIERS 2 & 3 are commonly used terms when describing ambitious or subject-specific vocabulary

Pupils hear words used in several ways in a variety of contexts. This helps them to really 'know' the word and to practise using it correctly within a sentence

Sinead Carroll-Knight



Vocabulary taught with a shared pedagogy is the focus of **Our Lady and St Benedict's Primary School** where Science Influencer **Sinead Carroll-Knight** leads the science curriculum. The teachers are developing a cohesive pedagogical approach to use from the Early Years to Year 6 that is consistent across all curriculum areas. Sinead is particularly focussed upon pupils' scientific vocabulary and will capture pupil voice evidence regarding their understanding and use of new words within context.

The success and quality of the vocabulary instruction began with Sinead's careful consideration, in collaboration with each year group teacher, to identify the most useful and powerful Tier 2 and Tier 3 words to teach. This has impacted upon pupils who say that they are 'intrigued' by scientific text.

The Ofsted Research Review of Science states that the EYFS provides opportunities to learn a 'wide range of vocabulary' and that 'these words form the beginnings of scientific concepts which will be built on in Year 1 and beyond'. Hence Sinead's careful planning of vocabulary from EYFS to Year 6.

Julie Rowe of **Alexandra Junior School**, recognised an improvement in pupils' vocabulary use when using a blend of fiction and non-fiction science texts to support explicit vocabulary instruction. She writes, 'There are definitely more opportunities for reading with a purpose; maximising opportunities within the curriculum, retaining and applying knowledge and increasing fluency. The focus is on talking about the text, the new vocabulary, what the words and sentences mean and how pupils know what might be happening and why.' The improvement in reading fluency, as noted by Julie, leads to greater comprehension allowing science specific questions and ideas to be formed and considered.



Which Books and Why?

Featuring contributions from Alexandra Junior School, Abbey Hulton Primary School, Ellison Primary, and St Wilfrid's Catholic Academy

2



Support pupils to develop fluent reading capabilities

Fluent readers can read quickly, accurately, and with appropriate stress and intonation.

Fluent reading supports comprehension because pupils' cognitive resources are freed from focusing on word recognition and can be redirected towards comprehending the text.

This can be developed through:

- guided oral reading instruction—teachers model fluent reading of a text, then pupils read the same text aloud with appropriate feedback; and
- repeated reading—pupils re-read a short and meaningful passage a set number of times or until they reach a suitable level of fluency.

It is important to understand pupils' current capabilities and teach accordingly. Most pupils will need an emphasis on developing reading fluency, but some pupils may need a focus on more basic skills, such as decoding and phonological awareness.



EVIDENCE STRENGTH:
MODERATE

Excerpt from the 'Improving Literacy in Key Stage 2 – Recommendations Summary'

All of the teachers and schools involved with this project have highlighted the importance of choosing the correct text in order to support scientific knowledge. During one of the BR:BS sessions we considered the books currently on the market which describe themselves as science based. What we found was that the depth of subject content varied greatly.

I would definitely recommend completing an audit of the science books within school. You might find you have fewer than you think.

Gemma Coward

Science Influencer Julie Rowe

of **Alexandra Junior School**

commented that 'Many books declare themselves to be 'science filled' however, when a specific unit or kernel of knowledge is required, do they all deliver?' So, she set about selecting books that 'delivered', to use within Guided Reading sessions to teach pupils, through careful modelling and instruction, how to 'read like a scientist'.

Alexandra Junior School's teachers are also developing their pupil's ability to question text with a range of strategies linked to De Bono's Thinking Hats. Recognising that as scientists' pupils need to be taught to question evidence and to approach 'fact' with an awareness of authenticity. Beginning and succeeding in 'Reading like a scientist' requires pupils to become critical consumers, to question, challenge and explore information.

Within these classes (using specifically resourced science fiction and non-fiction text) we found a greater engagement, enjoyment and understanding of the complex topics covered
Gemma Coward

At **Abbey Hulton Primary School**,

Science Leader **Gemma Coward** has developed an interesting question for her research. Which text type is most purposeful for scientific understanding; fiction, or non-fiction? to begin with she completed an audit of science books in the main library and in each of classroom libraries and found that there was only a limited amount of quality science texts available for the children to choose from. This meant that the children were not always able to be immersed in science texts as she would have liked them to be, as well as not always being able to select texts related to the topics that they were learning about during free reading times..



BETTER READING: BETTER SCIENCE

An exciting array of text has now entered the school, these include: The Molliebird by Jules Pottle, The Bacteria Book by Steve Mould, and Hair in Funny Places, by Babette Cole. When reading these books as part of their science lessons Gemma recognised that pupils 'found a greater engagement, enjoyment and understanding in the complex topics covered. Children were enthusiastic to use high quality texts within their science lessons.' The books intentionally include a range of fiction options which may create an emotional involvement for children.

Moving forwards, this exciting project will involve the pupil led 'Abbey Hulton Science Council' directly in the appraisal and selection of books. Gemma will achieve not only an adult led answer to her hypothesis but one which is completely owned and driven by her pupils, 'having children make the choice will ensure that the books are going to be read and enjoyed and not just sit on a shelf and never looked at.'

Having being exposed to the science knowledge and vocabulary in detail during shared reading sessions, I found that the children were given a head start during their weekly science lessons

Dawn McCann

Teachers at **Ellison Primary**, upon recognising that pupils need to hear fluent readers in order to become fluent themselves, rose to the challenge of selecting, reading and recording a book for the school website. The Subject Leader's expertise was needed in supporting colleagues to find books which delivered the quality of science required. These text are used as home readers as well as utilised within the lesson.

The joy of collaborative working is evident in the excitement that this approach has created, 'One member of staff stated that she was most looking forward to listening to all of her colleagues, she listens to 'Audible' every night and she intends to listen to the school recordings with her young daughter instead!'

As SENCO I could see that the use of exciting and engaging books was beneficial for every pupil in the class.

Emma Catchpole



Astronaut Tim Peake enthused and challenged the ambitions of pupils at **St Wilfrid's Catholic Academy** as astonishing photographs and the first person prose within 'Hello, is this planet Earth?' encouraged them to dare to dream. Class teacher and Science Influencer **Emma Catchpole** recognised the need to share this present day aspirational figure with pupils from our city. The reality that in 2016 he became the first official British astronaut to walk in space brought science into the time frame of their own lives.

During the Evolution and Inheritance topic this time, pupil engagement improved as a result of linking learning to a book. It enabled pupils to build on their scientific vocabulary and knowledge.

Julie Riddell



Mrs Julie Riddell of St Gregory's Catholic Academy, on being gifted her Closing the Reading Gap gift text from SATC noted that: Alex Quigley (2020) also promotes disciplinary reading: combining the use of background knowledge, general reading strategies and those that are subject specific... "We should find, devise, curate and share such reading lists so that our pupils gain access to the breadth and depth of reading that is required to flourish in school and far beyond the school gates". The collation of Year 6 pupil voice upholds the use of narrative to support the understanding of fact. "The story helped me to understand how animals have to learn to survive in different habitats. I didn't know what evolve meant. I do now."

Pupil excitement when visiting the school library is palpable and many of our local primary schools have developed welcoming, well stocked, accessible areas. When selecting text, we need to consider subject knowledge, the development of reading strategies and the gift of a love of reading. Making sure that every child opens this gift, often relies upon one book, one day, one teacher, one school.

Must have books

Tried and tested by the SATC team and pupils from Ellison Primary School



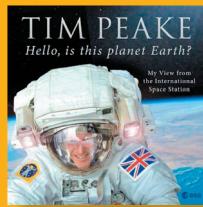
The Matilda Effect - By Ellie Irving

“About a girl who loves science, she enters the school science fair and doesn't win because she is a girl. A book designed to empower budding female scientists”



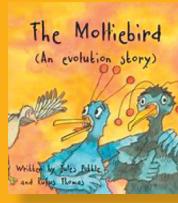
Science through stories - By Jules Pottle and Chris Smith PhD

“Honestly, I wouldn't be without it. It ticks so many boxes and the children love the drama that goes with each story. It's a no brainer or me”



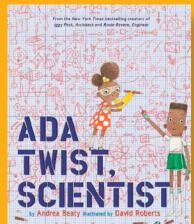
Hello, Is this planet earth? - By Tim Peake

“Brilliant for Science and Geography because the images are so beautiful, full of great quotes too”



The Molliebird - By Jules Pottle

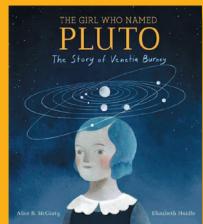
“I love the Molliebird because it's been amazing to see the improvement in my classes understanding of evolution since using it”



Ada Twist, Scientist - By Andrea Beaty

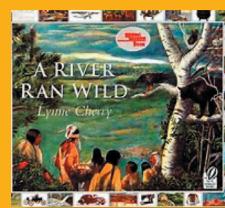
“Lovely fiction book with a female main character. Lovely for encouraging questions, curiosity and demonstrating perseverance”

I love Ada Twist, from not speaking to asking question after question. What, how, why, when? She just wants to know everything about the world. From being frazzled, her parents soon embrace her passion and help her sort ‘fiction from fact’. A real story of what it takes to be a fabulous young scientist; the excitement of asking and answering questions; how we should follow our thirst for knowledge”



The girl who named Pluto - By Alice B. McGinty

“Another fab book for increasing the visibility of girls/women in Science, we shared it on international women in science day. It tells the story of how Pluto came to be named through the actions of a girl who was fascinated by the planets and in a similar way to Ada Twist she asks a lot of questions like an enthusiastic young scientist. It is a lovely picture book that works well for KS2 (Year 5 especially)”



The river ran wild - By Lynne Cherry

“I really liked teaching ‘the river ran wild’. It was great for science, geography and history all interlinked”

BETTER READING: BETTER SCIENCE



A big thank you to pupils at
Ellison Primary School for their reviews
Janine Carpenter



Here we Are: notes for living on Planet Earth - by Oliver Jeffers.

Reviewed by Noah Johnson

“I like how it talks about everything that relates to me and how it is an introduction to the world and all of its wonder.”



The Street beneath my feet - by Charlotte Guilan

Reviewed by Finley Davenport

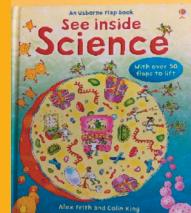
“It’s really interesting. I like the design of the book as it opens up and this helps me understand how much is under our feet.”



If - by David Smith

Reviewed by Emily Anderson

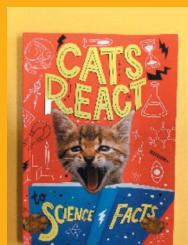
“I find the book intriguing because it has lots of facts and you get to compare them. It makes you think and ask more questions.”



See Inside Science - by Alex Frith and Colin King

Reviewed by Laila Davenport

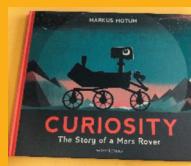
“I like the detail and lifting the flaps to find more information. It is bright and busy. It gives you a lot of facts on one page.”



Cats React to Science Facts - by Izzi Howell

Reviewed by Isabelle Connor

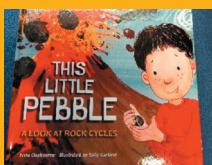
“This has so many key facts about everything that is scientific. The cats are cute and funny, but the facts make you think more.”



Curiosity: The story of a Mars Rover - by Markus Motum

Reviewed by Emily Anderson

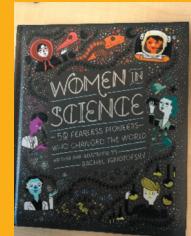
“It is mind blowing because it tells you how hard it is to get to Mars and everything that is involved. The detailed images help you understand.”



**This little Pebble:
A look at rock cycles - by Anna Claybourne**

Reviewed by Isabelle Connor

“I didn’t know there were so many rocks in the world. It was interesting to see how rocks develop. I think it would be suitable for LKS2.”



Women In Science - by Rachel Ignotofsky

Reviewed by Keira Woodall

“This is an inspiring book because it tells us all about women who have done things that they were told weren’t possible in Science. I want to be as good as they were.”



BETTER READING: BETTER SCIENCE

Science and Guided Reading

Featuring contributions from Burnwood Primary School, Hillside Primary School, St Paul's Primary School, Alexandra Junior School and Maple Court Primary School

3



Teach reading comprehension strategies through modelling and supported practice

Reading comprehension can be improved by teaching specific strategies that pupils can apply both to monitor and overcome barriers to comprehension. These include::

- prediction;
- questioning;
- clarifying;
- summarising;
- inference; and
- activating prior knowledge.

The potential impact of these strategies is very high, but can be hard to achieve, since pupils are required to take greater responsibility for their own learning.

The strategies should be described and modelled before pupils practise the strategies with feedback. Support should then be gradually reduced as pupils take increasing responsibility.

Texts should be carefully selected to support the teaching of these strategies.



EVIDENCE STRENGTH:
VERY EXTENSIVE

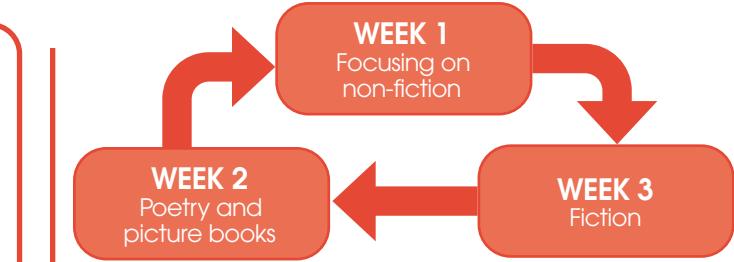
Excerpt from the 'Improving Literacy in Key Stage 2 – Recommendations Summary'

Reading is vital if pupils are to access and understand our increasingly complex world. Following the BR:BS meetings, our interest in Guided or Shared Reading sessions to develop pupils' comprehension of science, began. Inspired by the EEF Literacy Guidance Reports, we sought to develop pupils' comprehension of scientific text and therefore scientific knowledge.



Burnwood Primary School, Science Influencer Adam Lowell

brings these reading strategies directly to the science curriculum. His model of science promoting Guided Reading sessions also draw on Lemov's work by establishing a broad knowledge base in order to support understanding.

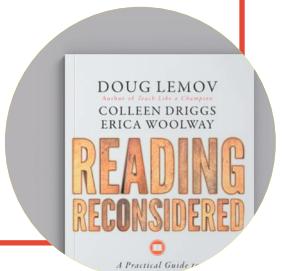


Focussing on science non-fiction during week one ensures pupils are exposed to the information and vocabulary needed to visualise the scientific fiction text in week two, which builds towards the complex scientific poetic imagery of week three.

This pre-teaching cycle leads to greater comprehension when the subject matter is subsequently explored within the science lesson. Adam's innovative aim is distilled to a sentence. He 'wanted to bring reading into science rather than adding science into reading.' The use of narrative and poetry in combination with the non-fiction of science leads to an emotional and objective understanding of the content matter.

Adam's innovative idea is that by pre-teaching the contents of a science unit via the Guided Reading sessions, he will then teach the science lesson to pupils with a 'preloaded' knowledge base. This idea, explored by Lemov in Reading Rediscovered, is that once fluency of reading is established the greatest impact on pupil's comprehension will be their previous experiences.

Using a three-week cycle to 'pre-load' pupils' knowledge of electricity Adam exposed pupils to subject content and vocabulary. This enabled greater access to subsequent learning. Adam writes that 'during the first electricity science lesson, children had already met and could explain, the difference between 'voltage, current, and early discoveries of electricity.' When listening to children working collaboratively during their first experiment, he noted discussions which used this vocabulary correctly and within context



BETTER READING: BETTER SCIENCE

Having been exposed to the science knowledge and vocabulary in detail during shared reading sessions, I found that the children were given a head start during their weekly science lessons

Dawn McCann



Science Lead Dawn McCann of **Hillside Primary School**'s desire to 'create' time within the school day will be familiar to all teachers. As Dawn states, 'I felt there must be a way that we could use other areas of learning to support the acquisition of science knowledge and vocabulary outside of the allocated science time.' Dawn's solution was to consider the EEF Guidance Report on Literacy at KS1 and KS2 and to explore the substantive knowledge of science through 'Shared or Guided Reading time'. A range of fiction and non-fiction texts were carefully chosen by Dawn, to teach specific scientific knowledge, and as the text was visited daily, this enabled pupils to become immersed in the text, understand the science knowledge, and explore scientific vocabulary.

The texts, which are specifically selected, will add breadth and depth to the children's studies in the foundation curriculum, while giving them further exposure to the technical tier 3 vocabulary introduced during lessons.

Sharon Brown

At **St Paul's Primary School** Science Influencer **Sharon Brown**'s study is ongoing but the careful purchase of differentiated

non-fiction text for use within Guided Reading time, points to an important factor as noted by Lemov in *Reading Reconsidered*. This is that pupils frequently hear the fluent reading of fiction throughout their school life.

These read aloud texts, as seen in BR:BS school book audits, are largely fictional. There is, we feel, a difference in the skill required to read fiction or non-fiction, multi modal text. Where to begin reading? At what point to note the information supplied by graphs or tables and how to read them? What do images contribute to the meaning of the text? St Paul's teachers carefully model the reading of non-fiction science specific text. The teachers also model the use of the comprehension strategies as identified by the EEF in reading multi-modal text. In this way pupils observe the strategies and are challenged to adopt and practise them as they progress with their own reading.



"Quantitative and qualitative data analysis showed that narrative information was retained for lengthier periods than factual information in long-term memory. Moreover, the analysis of the performance of the narrative group showed that individuals were more likely to remember scientific information when that was central to the development of the story."

L Avraamidou & J Osborne (International Journal of Science Education, 2009)



Science and Guided Reading Continued

The approach taken by **Alexandra Junior School** has led to teachers reporting ‘an almost lightbulb moment where pupils recognise that they know this or have learnt about this before.’ This recall of Long Term Memory is vital in the building of schemata and relates to the organisation of the curriculum. As Ofsted² state ‘An ambitious curriculum needs to identify the most important concepts for pupils to learn’ and ‘how the concepts are related so that over time, the logical structure of each scientific subject is made explicit’, to enable pupil’s ‘lightbulb’ moments.

In her case study **Julie** noted that the impact of the BR:BS science reading project ‘promoted an environment where pupils challenge or support each other in discussion about the scientific learning in the story, with catchphrases being used such as ‘remember when we...’ or ‘I know what’s going to happen because...’ The facilitation of the discussion not only comes from the teacher but from the pupils themselves. Additionally, a new range of questions to investigate or learning to revisit or consolidate could come from the discussion.’ The Research Review agrees with Julie’s view as it states ‘Young pupils need opportunities in lessons to recap and to orally rehearse and structure their thoughts using scientific language.

Collating teacher voice suggests to Julie that ‘teachers value the discursive interactions which now occur within their classrooms. In terms of impact, she found ‘positive correlations on promoting discussion, challenging thinking, improving retention, further assessment opportunities and building teacher confidence to reinforce scientific learning.’



As the class teacher I really enjoyed teaching in this term and the progress in reading and science were plain to see.
Vicky Peake

Vicky Peake of Maple Court Primary School

similarly recognised that ‘an interesting and unexpected bonus’ to her project of using fiction, non-fiction and guided reading to develop subject knowledge, was that one member of the staff team commented that teaching the guided reading first had made her far more confident when teaching the science lessons that followed.





BETTER READING: BETTER SCIENCE

The words were coming out of the children with ease as if they had been using them for years and were part of their everyday vocabulary
Adam



The careful modelling of reading is reflected upon by **Adam**, he comments; 'It is already clear to see that this is making a difference to the quality and particularly the fluency of reading. Children feel more confident in tackling scientific vocabulary. Words like 'atrium' and 'ventricle' are easily read and explained. There has been a clear increase in the number of children in my class reading science texts for pleasure, particularly among traditionally less enthusiastic readers. Modelling reading of non-fiction texts is also helping with fluency and comprehension, and children are beginning to see the difference in terms of how fiction and non-fiction should be read and how it should flow.'

Using time effectively is vital for every teacher. The Ofsted Research Review¹ of Science recognises that at 'primary, a shortage of curriculum time for teaching science has been identified as a particular concern'. Bringing the innovative approaches of BR:BS, to the school day and more specifically the exposure of pupils to scientific text throughout the day, term and year, is beneficial not just to learning but to planning and delivery too. When faced with the need for extra time and an increase in the knowledge base of pupils, the Science Influencers have implemented a wider range of pedagogies and used more science texts, resulting in positive impact.

VOCABULARY

SCHEMA Schemas help people organize their knowledge of the world and understand new information

GUIDED READING Gives pupils the opportunity to practise their reading skills in a group or whole class situation. It is a method which is designed to lead to independence of reading

MULTIMODAL TEXTS can be picture books, text books, non-fiction, comics and posters where meaning is conveyed to the reader through varying combinations of visual images, written language, and data presentation

¹ Research review series: science (2021) Available at <https://www.gov.uk/government/publications/research-review-series-science>

Teachers have reported 'lightbulb moments' where pupils recognise that they know this or have learnt it before
Julie Rowe



BETTER READING:
BETTER SCIENCE





Books as Hooks

Featuring contributions from Maple Court Academy Jules Pottle, author of 'The Molliebird' and Burnwood Primary School

With the incredibly wide range of 'science' curriculum supporting books available for teachers to choose from it is difficult to select the one that will: contain the necessary subject knowledge, the appropriate vocabulary, appeal to both pupil and teacher, and be memorable for pupils. The importance of text selection can be both expensive and time consuming.

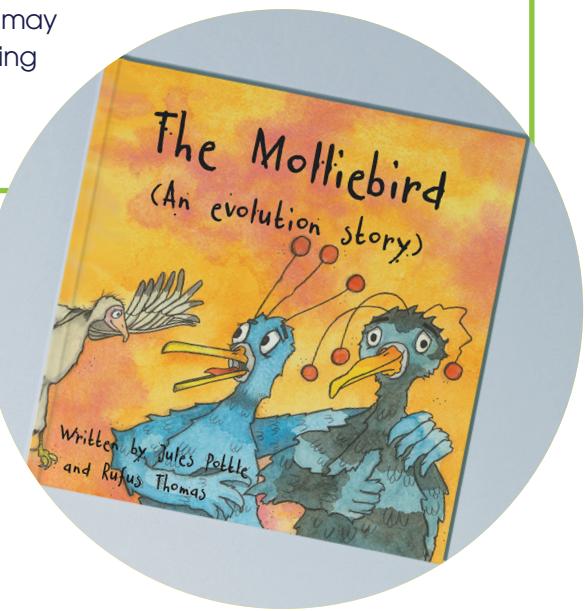


At Maple Court Academy, Science Influencer **Vicky Peake** was tasked to establish stronger links between all curriculum subjects and English. Recognising that many textual links were Historical or Geographical in nature she recognised a need for Science.

Vicky personally selected the text *Pig Heart Boy* by Malorie Blackman to support her teaching of The Circulatory System with Year 5. The text is engrossing and the story challenging not least in its vocabulary use. Vicky demystified the scientific vocabulary within the text with explicit vocabulary teaching and by supporting this fictional story with the study of circulatory non-fiction text. Vicky commented that 'the novel facilitated the introduction of topics such as heart structure and circulation'. Hence, pupils meeting aortas and valves within the narrative had already met these body parts within non-fiction multi-modal text and vice versa. They knew what an aorta looked like, they recognised its place within their own body, they could discern the fiction of the narrative from the non-fiction of scientific fact.

In addition to the reading of this novel during English lessons, pupils were also introduced to the scientific concept of the circulatory system through the use of non-fiction texts within their Guided Reading lessons, this shared the key scientific vocabulary that pupils needed prior to the science lesson.

Jules Pottle, author of 'The Molliebird' supported teachers with professional development sessions. The first introduced the idea and the value of using fictional stories to teach factual science. The second session allowed teachers time to reflect on their learning. The impact of this text upon pupils' learning is acknowledged in the teachers' voice regarding: the appeal of the text; 'Fiction is more inclusive'; the emotive intelligence of the text; 'Diagrams might not mean anything to them, but a story does'; and the way that, 'The story introduces complex ideas in a simple format.' Thus *The Molliebird*, in its narrative format delivers fact so that pupils may enjoy thinking deeply.



I feel that teaching science through the children's love of the class text made learning meaningful to the children and really impacted positively upon their understanding of scientific concepts.
Vicky Peake



BETTER READING: BETTER SCIENCE

The impact of pupil's increased familiarity with non-fiction text is expressed in **Adam Lowell's** observations and experiences within his own classroom. 'We looked at three texts: a non-fiction text about the heart, a sci-fi fiction text about a heart transplant, and finally a poem based on the heart. The knowledge gained from these three texts was incredible! Children were using and explaining terms such as 'cephalopod' and could even explain why their blood is blue compared to ours which is red. Performing the poem in week three, using and pronouncing correctly words like 'superior vena cava' made understanding the meaning of the poem much easier. Complex terms such as 'pulmonary artery' were discussed and explained, so that when it came to explaining how blood is pumped around the body a couple of weeks later in a science lesson, many children could write in their own words. In the past, the activity had involved cutting and sticking the information in the correct order.' The impact upon pupils, understanding, articulation and confidence within Science is clear. The experience of exposure to the three-point cycle allowed the pupils to 'read like scientists' able to articulate their scientific knowledge.



The contributions the Science Across the City Science Influencers are able to share is quite simply huge. Many of the texts featured are on our 'Must have books' pages and have all been used within the twelve schools featured.

The list of text recommendations relating to different science units of all genres and modes is an important piece of work which will continue into Cohort 2 as we select text to develop pupils' critical consumer skills, their ability to remain inquisitive and curious when presented with facts. We continue our quest to support every child to read like a scientist....

"Discussing big ideas is more important than finding the right answer and it will obviously be important to establish a classroom atmosphere in which all ideas and responses will be valued."

Coates and Wilson (UK: NACE/Fulton, 2003)





Reading as a Scientist

Featuring contributions from St John's Primary School, Moorpark Primary School and St Paul's Primary School

What does it mean to 'Read like a Scientist' and how can we help pupils develop these skills in busy primary or secondary schools? Science begins with questioning and the art of asking good questions constitutes an important skill to foster for developing scientists.

Our last section looks carefully at this idea; how do we teach pupils to engage fully with the ethos of discovery, to question and make sense of their surroundings? How can we use text to engender the disciplinary knowledge of a scientist?



Science Lead Karen Chapman from St John's Primary School is thinking about the impact of children learning to read with heightened scientific awareness. In order to develop this Karen is working closely with the English lead in the school to ensure a text based, cohesive and cross curricular approach.

Each science lesson begins with a question which is generated by the pupils. 'What would we like to be able to answer?' This close focus upon the consideration and creation of questions is the impact that will ultimately be measured. Pupils' ability to question science that is presented as fact; to question conceptual understanding; to question the very world that they live in, is the end point of this quest.

Just as each science lesson begins with a question so each English lesson begins with a reference to the science text. This reciprocal approach visually and physically reinforces the sharing of reading skills between the two subjects. The importance of reading in science is established and reinforced.

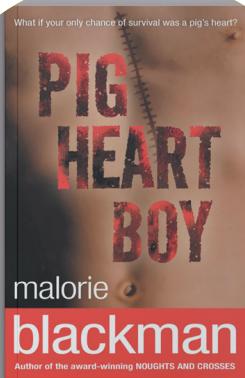
Working with the English lead, we narrowed our objective to one specific aspect of what scientists do – they ask questions.

Karen Chapman

Lucy Holdcroft (Moorpark primary School) also uses this enquiry based approach. When studying the circulatory system pupils suggest their own questions:

- Here are some example questions:
1. What is the urinary system?
 2. What is meant by 'the heart is at the heart of the circulatory system'?
 3. What are the two main parts of the body that help the heart pump blood?
 4. What does the phrase 'oxygen-rich blood' mean?

With a range of non-fiction and fiction texts a detailed and multi-faceted approach to answering these questions is enabled. Not only do pupils explore the anatomy and physiology of the heart. They discuss and debate the moral dilemma of transplantation when reading 'Pig Heart Boy'. In small steps they are developing a view of the dilemmas that face science and that lead to humans striving to reframe what we believe to be true.



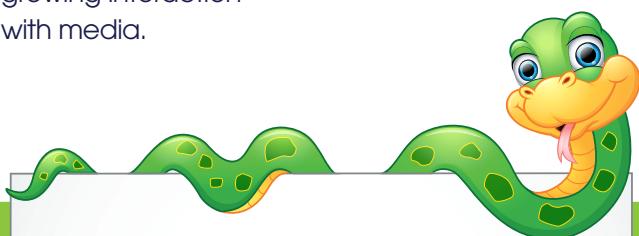
We knew the intervention had been successful because when we used the word circulatory, the children said, "This is how the blood goes round the body, as if it's going in a circle."

Lucy Holdcroft



BETTER READING: BETTER SCIENCE

The subject knowledge needed to support the development of higher order thinking questions that deepen understanding was considered by **Sharon Brown** at **St Paul's Primary**. To develop the skills of both teachers and support staff oral questioning is based upon on the VIPERS comprehension strategies which have evolved from the EEF Guidance Report and the need to explicitly teach these skills. Pupils' development of questioning skills has led to a growing recognition that pupils should be taught to recognise and respond to the truth of the information that they read and receive. They therefore become critical consumers of evidence. This not only impacts upon their science lesson but also upon their engagement with the wider world and their growing interaction with media.



VIPERS:

VOCABULARY, INFERENCE,
PREDICTION, EXPLANATION,
RETRIEVAL AND
SEQUENCING/SUMMARISING

In order to support this ability to question and consider the balance of evidence presented, the BR:BS team will be involved in producing a resource in 2021-22 which supports the development of these skills using primary texts. With better reading comes greater exposure to ideas which must be counterbalanced with critical reading skills.

The BR:BS project has resulted in all of the actions and ideas discussed above, linking the vital skill of reading to science. Blending these core subjects now feels entirely natural and the discussions that have taken place this year have developed the process of reading within science and science within reading.

The evolution of the BR:BS team and our practice does not end with the publication of this journal. We have become a learning community committed to our own co-education and impact upon the pupils we teach. To become involved and join our community please do join us on Cohort 2 or on one of our other exciting projects. Excellence across the city is the destination. The journey is ours to map. Better never stops.





BETTER READING: BETTER SCIENCE

The STUFF STARS are MADE of

A Science across the City collaborative project now known as Better Reading: Better Science set out to explore the symbiotic relationship between reading and science. Could being better at one support being better at the other and vice-versa? In the spirit of interconnectivity join us as we compare a story with the vision and practice developed during our project.

Dr Adam Tuff in his book: The Stuff Stars are made of tells us, 'Scientists look at lots of stars through telescopes, stars of different ages, different sizes and even different colours. Scientists keep track of data and consider how stars have grown over time.'

The aims of the book are to inspire children (KS1) about exciting ideas in space and to encourage children to ask questions about the universe we live in.

At the heart of the SATC strategy is a deliberate policy of seeking out stars, developing and identifying primary school practitioners with a passion for science teaching and learning. Those nominated by a senior leader as going above and beyond expectations, engaging with STEM organisations or learned bodies, enhancing and seeking curriculum depth, have become our SATC Stars. They are invited to join the SATC team as recognised 'Science Influencers'. Science Influencers share enthusiastically and collaboratively,

and seek to problem solve and innovate. They aim to influence science teaching and learning in other schools in a way that is honest, positive and kind. In Stoke-on-Trent we are very proud of our Science Influencers who collectively achieve far more than the sum of the individual parts. SATC is a community made up of many different stars with their own strengths and areas of interest, and at different stages of growth in their leadership.

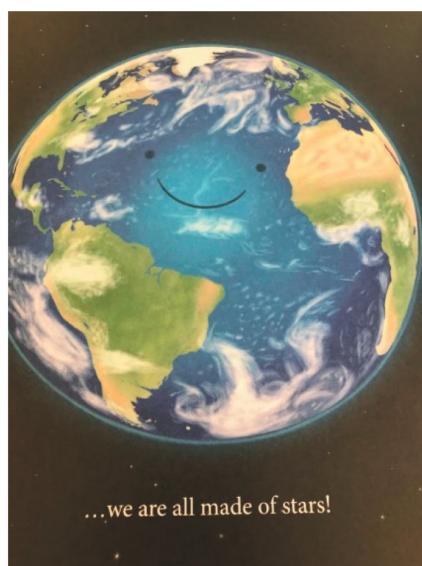
Meet our Science Influencers featured within and through this and



other issues of CONNECT, or alternatively visit <https://www.scienceacrossthecity.co.uk/our-team/> to check out their top tips.. Please take a moment to 'stargaze' at this amazing group of Science Influencers; we hope it brings you as much joy as it does to us as the project leaders.

The final page of the beautifully told story reveals the scientific fact that we are all made of stars! And so, to a couple of ponders -What is it that enables great science teaching and learning? What enables all teachers to know they are, or can be, stars? Both the book's author and the SATC strategy intend to

inspire question asking. SATC seeks to empower dialogue that is rooted in question asking, reflective practice that articulates each pedagogical decision with why this approach to develop this scientific knowledge for this child's learning? When every teacher can consider with depth the 'So what?' of their busy teaching lives then the night sky above Stoke-on-Trent will twinkle with a galaxy of Science Influencing Stars!



Tina Whittaker & Karen Peters
Proud to be co-leads of the OA
(SATC) project

The BR:BS team



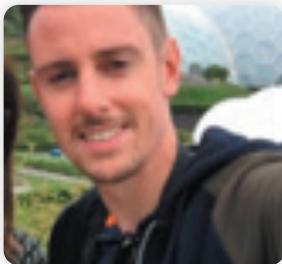
Debbie Campbell
Acting Curriculum Leader, St Wilfrid's Catholic Academy



Tina Whittaker
National Consultant for Primary Science, Co-lead of SATC.



Sharon Brown
St Paul's Primary School



Adam Lowell
Burnwood Community Primary School, Burnwood



Dawn McCann, Hillside Primary School, Stockton Brook



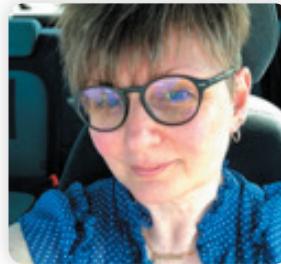
Emma Catchpole
St Wilfrid's Catholic Academy, Tunstall



Gemma Coward
Abbey Hulton Primary School, Abbey Hulton



Julie Riddell
St Gregory's Catholic Academy, Longton



Janine Carpenter
Ellison Primary School, Wolstanton



Jules Pottle
(Guest to the City)



Julie Rowe
Alexandra Junior School, Normacot



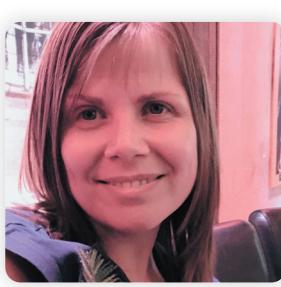
Karen Chapman
St John's CE Primary School, Trent Vale



Lucy Holdcroft
Moorpark Junior School, Burslem



Sinead Carroll-Knight
Our Lady & St Benedict Catholic Academy, Abbey Hulton



Vicky Peake
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