

CONNECT

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

ISSUE 7: GENDER, EQUALITY
AND OPPORTUNITY.

JUNE 2022



CONTENTS



A huge thank you to the OA board in supporting and committing to the investment in primary science. Science makes a difference to life chances in so many ways; the way we think, the way we tackle a challenge, the way we understand the changing world around us as well as broadening career aspirations.

Looking Back: Previous issues to enjoy

There are seven Connect Journals to explore, with each having a different theme and focus. Impact narrative reflects teacher voice, headteacher voice and pupil voice and critically comments on resulting changing values, attitudes and quality experiences.

The full series can be found at www.scienceacrossthecity.co.uk/impact

There is one further issue to look forward to: the conference papers from the final event of the year. If you haven't already done so please book your place at

<https://www.eventbrite.co.uk/e/science-influencers-conference-tickets-316608292927>



Issue 1	Seven Stories of success	Teacher Voice reflecting upon the personal narrative of professional development impact
Issue 2	Better Reading -Better Science	Practitioner research, I tried and the difference I saw, or heard was...
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	Senior Leaders reflect on policy influencing practice.	Senior Leaders relate their experiences of the SATC project to informative publications related to primary education
Issue 6	Change over time	Science subject leaders reflect on just how far they have come since they submitted their PSQM evidence in the spring of 2019
Issue 7	Gender, equality and opportunity	Legacy for children from enriched wider experiences.

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.

	Context and Background. A subject refreshed Tina Whittaker and Karen Peters	4
	Editorial	5
	Adopt a Scientist Becki Price	6
	Sutherland theatre visit Pupils from Sutherland Primary meet Jina and the STEM Sisters	8
	Combining strategies for maximum impact! Gladstone Primary	12
	Superhero Scientists. Abbey Hulton	16
	Career aspirations of the children of Stoke-on-Trent	18
	Science Rocks. Julie Clarke Priory Academy,	20
	Teaching to tackle inequalities. Dr Jenny Watson	24
	High quality experiences along with wide ranging variety make for meaningful science memories	28

Context and Background



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



Karen Peters,
PSTT Fellow, Headteacher
Moorpark Junior School,
CEO New Guild Trust.
Co-lead of SATC

through the enriched experiences that children in the city have enjoyed as part of their science education. Experiences that will quite literally remain as memories forever. Whether it was a Space Camp under the stars, a first visit to the theatre, meeting a scientist that could answer your questions, or just tackling a new challenge in a different way.

Our aim is to make you as a reader smile too! In CONNECT issue one we stated that success breeds success, if that is true then surely smiles can also breed more smiles.

A city working together

Science Across the City being true to its name sets out to work with as many schools as possible across the city of Stoke-on-Trent. Our challenge to the reader is not to simply spot the smile, but to also play spot the difference as we ask you to notice the variety of uniforms and range of settings. Our pride in this journal is not simply the joy that it represents but also that it reflects the reach of that inspiration too.

This is the shortest context setting of all the SATC journals and that is deliberate as fewer words mean more space for the images that matter.

Enjoy

Tina Whittaker and Karen Peters



A subject refreshed

For most families every now and again the old photo albums come out for a browse and the backlog of e files are sent to print ready for the next scrapbook collection. The joy of seeing smiles and reflecting on the back story behind those smiles is both timeless and priceless.

Smiles, smiles and yet more smiles are our promise in this issue. Whether you take a flick through the pages browsing the photos, or read the articles, the impact is evident



Reflections from the Editor

This issue of CONNECT explores the themes of Gender, Equality and Opportunity. Equality and Opportunity are perhaps obvious given that Stoke-on-Trent was identified as one of 12 Opportunity Areas (OAs) targeted to improve social mobility. But how do these themes link to gender and science (as in Science Across the City)? For me, the answer to this question lies in the ASPIRES research¹.

Many young people might ask why they should consider a STEM² career and the answer has two facets: economic and social. Those who study STEM subjects are better paid, make a greater contribution to the nation's economy and competitiveness, plus they are also more scientifically literate citizens, able to make informed decisions about so many things in life, including the health of themselves and the planet. Yet the ASPIRES research discovered that fewer than 15% of young people in the age range 10-14, aspired to be a scientist. This seems disproportionately low given the positive views they hold about science and scientists. The research identified 'science capital' as the key factor affecting the likelihood a student will aspire to a science career.

Those least likely to see science as 'for me' were found to be 'female, white, have low/very low levels of cultural capital, in the bottom set and not have any family members who use science in their jobs'. 'Girly' girls, those who regard themselves as highly feminine, were least likely to aspire to a STEM career, and the few who did were prone to change these aspirations over time. Hence, a focus on gender and careers is clearly relevant and important. The word clouds on pages 18 and 19 were completed by Stoke-on-Trent children from years 5 and 6 as a baseline measure at the start of the GEO project. They demonstrate that the national issues with gender and aspirations, are also present locally. In this edition of CONNECT you can read about some of the initiatives that have been implemented in primary schools across Stoke-on-Trent aimed at raising aspirations, especially for girls.



Clare Warren

Along with the word clouds, the top three career choices of a sample of pupils shown on the sticky notes on page 10 serve to demonstrate how gendered career aspiration are. (I think I could guess whether they were written by a boy or girl with a high level of accuracy.) But while we have teachers like Chris Wemyss asking whether his school has enough science books by female authors, Dr Jenny Watson acting as a role model for aspiring female scientists, the STEM Sisters HDMT production which was attended by over 2000 pupils in Stoke-on-Trent, Julie Clarke introducing Priory's science club members to female scientists on screen, or Abbey Hulton's year 6 pupils taking a scientific approach to reviewing a book showing a diverse range of STEM professionals, Stoke-on-Trent primary schools are embarking on an important journey. The changes will take time, but the city's young people are clearly in a place where the teachers care enough to learn more and do their very best to raise aspirations for all.



¹https://discovery.ucl.ac.uk/id/eprint/10092041/6/Moote_9538%20UCL%20Aspires%202022%20report%20online%20version.pdf

²Science, Technology, Engineering and Mathematics

ADOPT A SCIENTIST



Becki Price.

A special thank you to Fran Gale and all the scientists, from the Wellcome Genome Campus that we have adopted!

Following on from a highly successful cross city science club focussed on unconscious bias, including 20 schools and over 250 children, we wanted to capitalise on the relationships built, and passion fired up by creating an opportunity to meet and adopt a real life Scientist.

For too long children have positively embraced virtual visitors who have enhanced their learning experiences greatly, but with the offer of a minibus full of scientists, this was a chance we couldn't pass up. Having an abundance of schools who had engaged in the unconscious bias training with Fran from 'Science for all', we had the potential to reach a huge audience with teachers who were clued up and enthused about making a difference in inspiring children.

So, SATC and Fran made it happen.

On Thursday 19th May 2022 we hosted 8 Scientists from Wellcome into our city. They travelled 3 hours to meet child representatives of a matched school. Stepping off their bus, the buzz and excitement were tangible; they were excited about the prospect of working with a school and were brandishing an adoption gift for each one. Class representatives, teachers and Scientists had a professional lunch and discussion together with the chance to introduce themselves to all involved and talk about why Science is important to them. Topics were discussed at the roll of dice; 'what if we had magnets for fingers?' 'What inspired you to be a Scientist?' 'What makes a good scientist?' Scientists were then whisked away with their matched schools to meet the rest of the class. Children were responsible for introducing them, and integrating them into their own class.

Once back at schools, children engaged in a workshop with their adopted scientist and had the chance to ask them about their jobs and how they came to be in their position. Value was lifted even further when Headteachers then took part in certificate presentations with their gifts being exchanged. Children couldn't believe that they were not only meeting a real life Scientist, but could continue to ask questions and meet virtually into their next year. Many were shocked by the gender and appearance of the Scientist and felt that they could now achieve more with a scientist involved in their school lives.

Following on from the day's events, the Subject leaders and teachers from the attending schools were highly enthused, positive and grateful for the opportunity given. We've already had glimpses into displayed adoption certificates and Zoom calls being set up with the scientists; children were so keen to see their workspaces!

Running this event has had a wide impact on all stakeholders:

- Inspired classes with new aspirations**
- Valued children and scientists**
- Purposeful relationships built**
- Opportunities for all to share**
- Confidence building in children and Scientists**
- Outreach opportunities for Wellcome**

14 child science ambassadors were able to sit alongside their teachers and scientists to discuss science questions, their lives, their aspirations and were given the chance to 'sell' their schools to the scientists. All additional 232 children have met, in person, a young scientist (6 female and 2 male) who is actively engaging in enquiry based work; covid data analyst, entomologist, biologists to name a few. All classes have been given a chance to enrich their science units for the next year with links to external supporters who are actively passionate about working with their adopted classes beyond this event.

A scientist is for life, not just adoption day.



SUTHERLAND THEATRE VISIT

Pupils from Sutherland Primary meet Jina and the STEM Sisters

As part of a series of activities and events to focus on girls into STEM careers, children from schools across Stoke-on-Trent were able to watch one of nine shows of HMDT Music's stunning Jina and the STEM Sisters production at the Mitchell Memorial Theatre, Hanley. Thanks to funding from the Opportunities Area (Government Equality Office), the Arts Council England, The Royal Society of Chemistry and the Ogden Trust, over 2000 pupils from 32 different primary schools and their teachers were delighted by an exciting performance and finding out about what it takes to be a great scientist. The SATC team knew from the reactions at the events that the show had been very much enjoyed by all, but I was invited to evaluate the impact by listening to some of the year 6 pupils from Sutherland Primary to hear pupils' voices around what resided with them a week after the event, beyond the wow of an engaging trip.



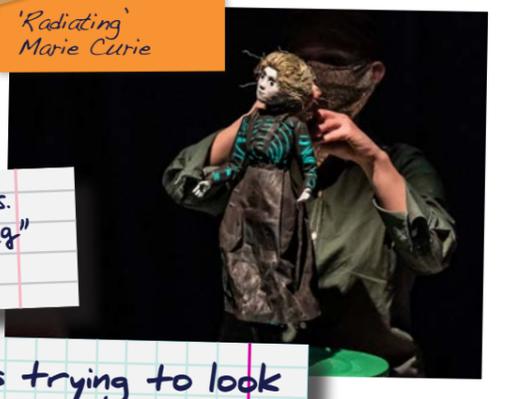
"They explained some of the information in music"

What surprised you most about the production?

"We were surprised that it was all puppets"

"We weren't expecting it to be puppets. We thought it would be people acting"

'Radiating' Marie Curie



"Someone was trying to look for a new species of beetle"

"There were only two people to do all the puppets"

In the show they spoke about scientists needing the qualities of open mindedness, persistence, curiosity and question-asking. What other qualities do you think are important for scientists?



"They need to be resilient, so they don't give up"

"Intelligent, so they understand how to make rockets"

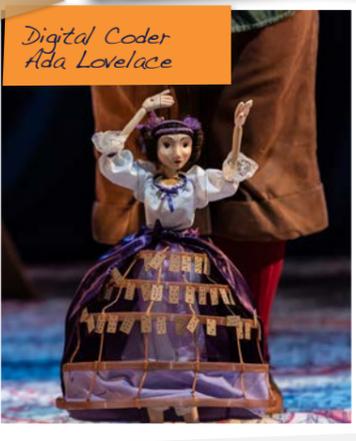
"Adventurous, so if they study insects they might need to go on an expedition."



"Creative, so they can come up with solution's"

"Maths, so they can calculate how long it takes to get from earth to the ISS."

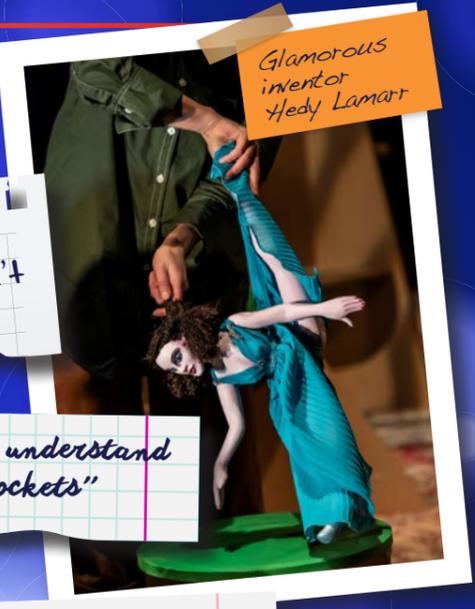
"Never give up. If an experiment goes wrong, try again until you get it right"



Digital Coder Ada Lovelace

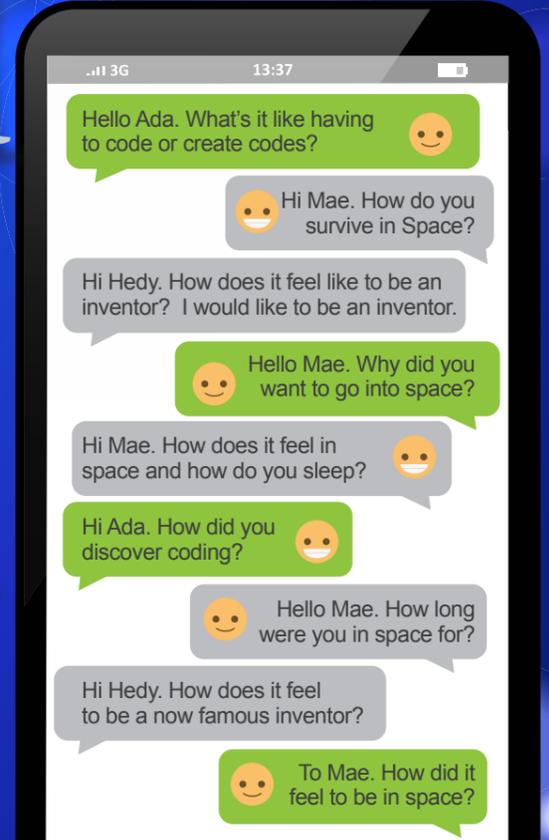
"Creative, if you get stuck you need to find a solution"

"Exploing because you can go into a forest and test different plants"



Glamorous inventor Hedy Lamar

If you could send a text message to one of the scientists in the show, who would you send it to and what would it say?



SUTHERLAND THEATRE VISIT

Pupils from Sutherland Primary meet Jina and the STEM Sisters

What would be your top three career choices?

- I would take over my dad's company
- Engineer
- Pro Fortnite player
- Car engineer
- Pro-swimmer
- lifeguard
- car designer
- POLICE OFFICER
- CHEF
- ARTIST
- Teacher
- Archaeologist
- Doctor
- Plumber
- Roofer
- footballer
- Maths teacher
- Inventor
- hairdresser
- RAF pilot
- F1 pit stop crew
- Car engineer
- Engineer
- Police
- Car dealership owner
- Acting
- Interior designer
- Fashion designer



What was the most interesting thing about being in a theatre?

- Lots of lights and colours of lights
- I wasn't expecting it to be dolls. I wasn't expecting a glow in the dark doll or all the songs
- Lots of lights in the background
- The amount of good lighting
- How they could do different voices
- It was puppets



Astronomer Hypatia

The stage light and the songs were great

I wasn't expecting to have multiple schools there

Clearly you are all great scientists, but how would you finish the sentence, 'I am a great scientist because ...'

- I am creative and sort of intelligent
- I am patient and curious
- I don't give up easily and I try hard.
- I am good at maths and I never give up
- I am curious and fascinated by science. I also like engineering.
- I like inventing and experimenting with all different stuff
- I'm good at developing new skills and I'm intelligent
- I am good at maths
- I am very curious and great at asking questions.



"Science Across the City have been fantastic partners in this project thanks to their strong relationships with Stoke schools. Their work in ensuring schools' participation, including them all receiving STEM Sisters workshops, enabled the science and our resources to be embedded within curricula, thus maximising the learning potential of the STEM Sisters project for all participating schools. I wish every city we're touring to was lucky enough to have such an organisation to bring the project to life."

Tertia Sefton-Green, Creative Director HMDT Music

After more than two years where school trips had been severely curtailed, the children had clearly experienced an inspiring and educational visit. Their perceptions of the attributes required to be successful scientists showed maturity beyond their years, and their intended career choices showed that STEM careers may well feature in their futures.

Combining strategies for maximum impact!

Gladstone Primary

Overall impact

"We aim to make science accessible to all pupils. We want to plant a seed of love for science"

"Children now have more opportunities to talk and they are less fearful because they don't always have to show their learning in writing. The belief that I'm not very good at science because I can't write it down is now gone. They feel less stressed about science lessons."

"Science is now so much more enjoyable. If there is an Explorify Odd One Out on the board when they come in they want to talk about it before they've even taken their coats off."



Science Club

Molly Wells, a Newly Qualified Teacher of year 4 pupils, runs the science club for 9 girls and 6 boys. That gender balance has been chosen because we want to encourage girls into science.

The video calls with female scientists have been great success. Many hadn't realised that forensics was science because they aren't wearing white coats. Girls are realising there's more to science and it's changing their minds that science might be for them.

The children have loved science club. There have been some real moments of awe. For example when crabs started growing.



Jules Pottle visited the school dressed as Mary Anning in the morning, then made an appearance as Jules Pottle, author, later the same day.

Phil Bloor, year 6 teacher tells us about the visit.

As part of the day the children took part in a hands-on, practical lesson on fossils with no other than Mary Anning.

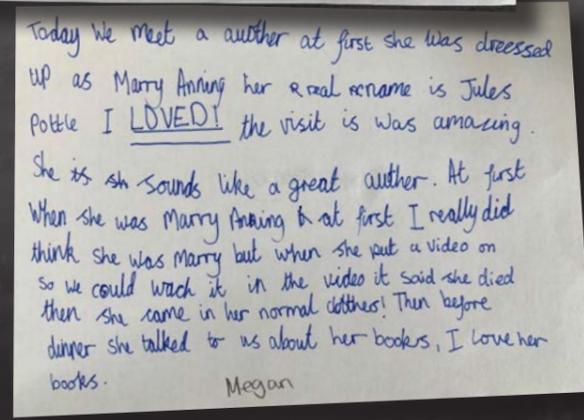
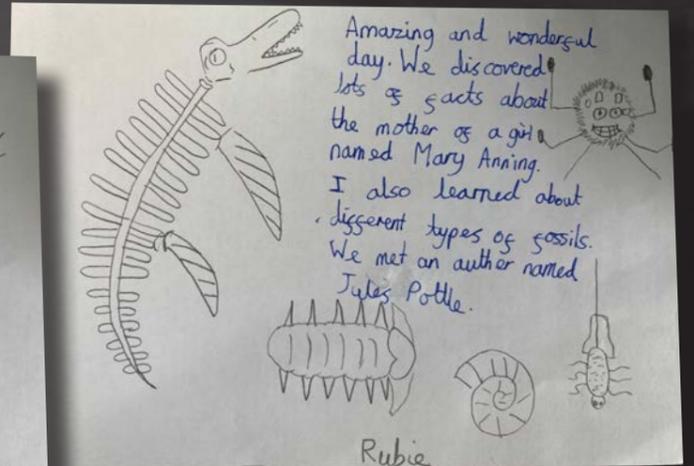
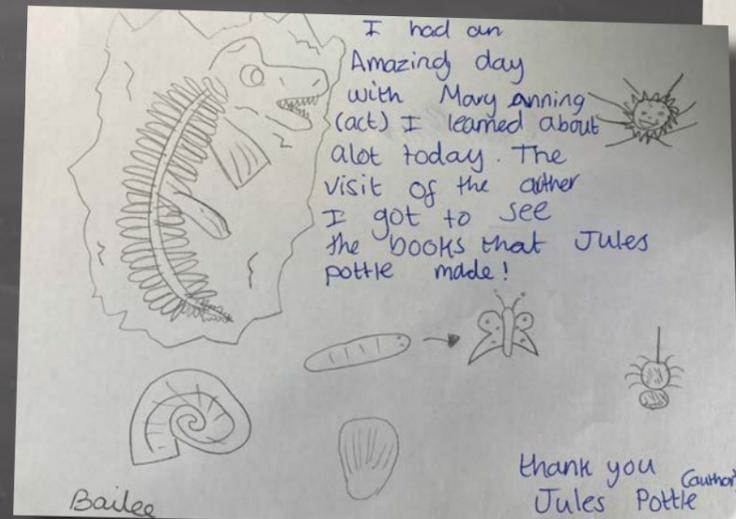


The children felt it was real because she dressed up as Mary Anning

Some of the children were perplexed when Mary Anning told them 'I can't do that because I'm a woman' and they couldn't understand why she was saying that

Torrie and Faith were outraged that Mary Anning was ignored by the scientific community of the time. They couldn't understand why she got no credit for her work. This led to a great debate in the class between the boys and girls. The girls were really cross!

After the session the children produced written and illustrated reflections on the day. A few examples are shown below.

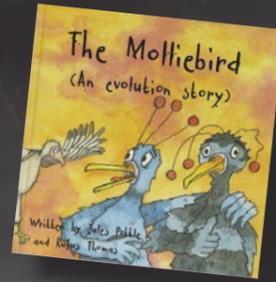


Their enjoyment and learning both came through really clearly

Combining strategies for maximum impact!

Gladstone Primary

Later the same day Jules read her book, *The Mollybird*, and used pictures of women doing scientific jobs, for example polar scientist, as prompts for discussion. This opened the eyes of children to different areas of science.

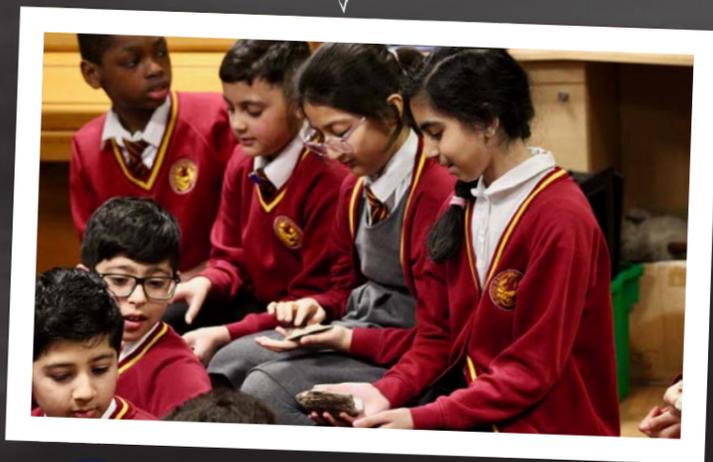


Many of the children were so proud that they'd met a real author and asked for her autograph.

This event also provided good CPD for teachers who thought that next time they would teach the topic differently.



The event also raised children's cultural capital because it's not every day that they get to meet an author and that was really special for many of them.



Researching the new Jules Pottle book

Chris Wemyss leads the group of pupils who have been reading and critiquing Jules Pottle's forthcoming book.

Chris is very keen to increase the children's vocabulary through using texts.



They have been inspired by the project to read more non-fiction scientific texts

We know our children need the scientific words and if these books can raise the level of vocabulary that will be amazing

It has been a fascinating project to be involved in; considering how a book might be used improve children's vocabulary

The project has made me question whether we have enough science books by female authors in school

Thanks to science across the city we now have the equipment we need and children are very excited. For example one child found it hard to believe that she had her own magnet to use for the whole lesson

Science Ambassadors

Chris Wemyss also supports the school's Science Ambassadors.

A number of pupil Science Ambassadors have been appointed. It is important to Staff at Gladstone Primary that science careers are seen by all pupils as something they might aspire to. To try to address gender imbalance there are more girls than boys and the ambassadors come from a range of academic abilities. At play times they are easy to spot in their orange Hi-Viz jackets, demonstrating science activities. They choose which activities they want to present and Chris organises the equipment they need. For example, in Science Club they did some chromatography, so now the Science Ambassadors are doing chromatography with other children in the playground.



SUPERHERO SCIENTISTS

Abbey Hulton

An analytical review of the opinions of Abbey Hulton pupils (KS2 year 6) regarding the text Superhero scientists by Allen and Sinclair

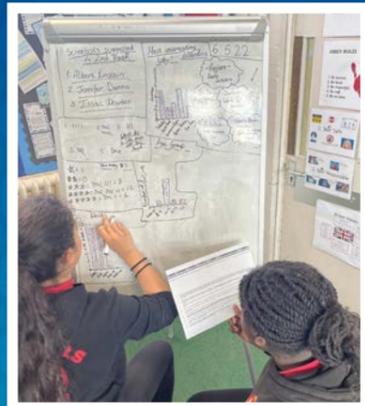
Introduction

Issue 3 of CONNECT considered Learning Communities, and Gemma Coward, science leader at Abbey Hulton Primary, and her pupils contributed to that issue with their reviews of both fiction and non-fiction science books. They formed their own Learning Community known as The Science School Council who worked together to nominate their favourite science texts. The children wrote about which were their favourite books and why. Because of the enthusiasm of Gemma and her class they were invited to review Superhero Scientists through a scientific lens. With the expectation that they would communicate their findings through a formal scientific poster, there was an increased need to consider and collect appropriate evidence.

Methodology

Superhero Scientists is designed to increase children's awareness the diversity of those pursuing a range of scientific careers. A class set of the books was provided (generously funded by Government Equalities Office.) and the pupils were given time to read and reflect on the contents. They also met one of the authors on Zoom to find out more.

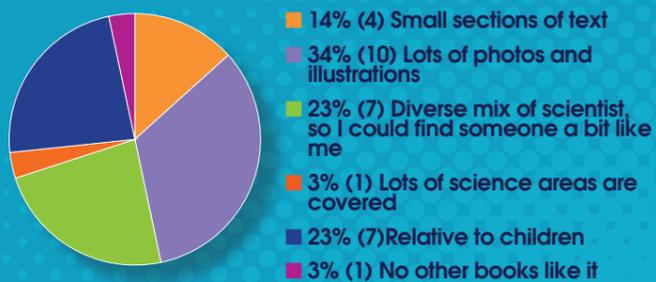
Following a meeting with Dr Clare Warren to discuss how they might ask and answer questions about the book using a scientific approach, they selected their questions, collected their data, and presented their findings using a variety of graph and charts.



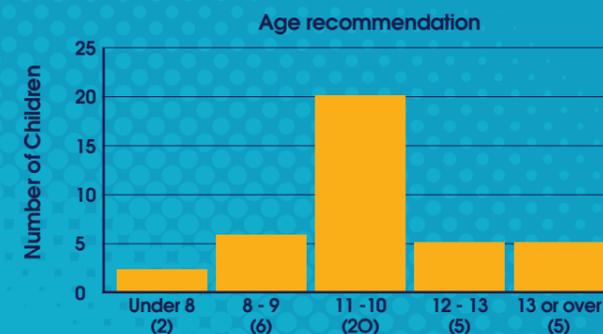
The results

The results of their data collection are presented here and are intended to inform the authors should they consider Superhero Scientists – the sequel!

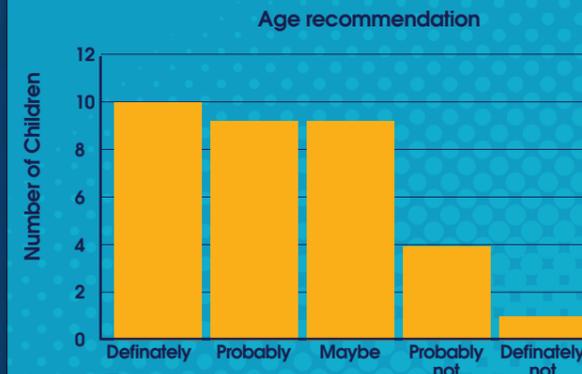
What did you like best about the book?



What age group is the book most suitable for?



Would you recommend the book?



THERE IS A WIDE RANGE OF SCIENTISTS TO INSPIRE EVERYONE!

IT'S VERY INTERESTING, BUT SOME OF THE SCIENCE WAS DIFFICULT.

THE BOOK WOULD NOT BE SUITABLE FOR YOUNGER CHILDREN.

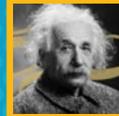
I LIKED THE MIX OF SCIENTISTS. SOME WERE YOUNGER AND MORE RELATABLE TO US.

IT IS AN INTERESTING, INSPIRING, FUN AND ENTERTAINING BOOK - AND IT'S NON FICTION!

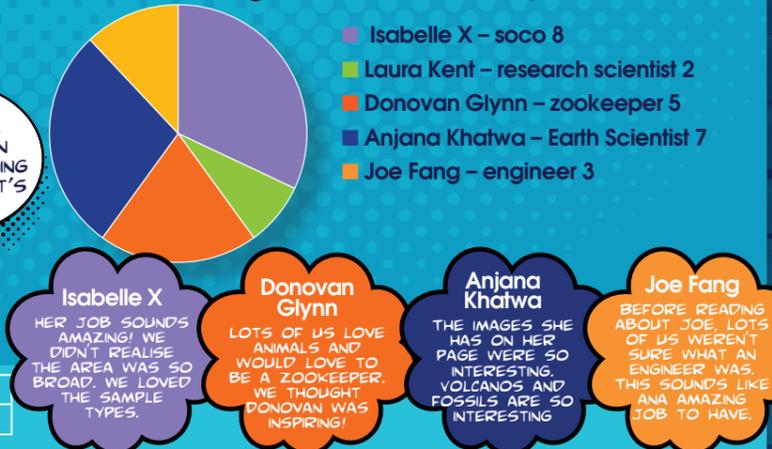
How many stars would you give this book?

★	★★	★★★	★★★★	★★★★★
1	0	8	12	9

Scientists for a follow up book

 <p>ALBERT EINSTEIN We thought he was a scientist from the distant past and it would be useful to learn how current he was. His science and ideas are very important.</p>	 <p>NOEL FITZPATRICK Noel isn't just a vet he is a super vet. Some children will already know him from the television show. He would inspire people to be compassionate and have a career as a vet.</p>
 <p>ISSAC NEWTON He is a scientist that most of us had heard of. He is included in our science lessons, so it would be good to recognize the scientists in the new book.</p>	 <p>JENNIFER DOUDNA We want to see more female scientists represented. She seems very interesting and we don't really know much about the area of science that she covers: biochemistry and genetics</p>

Most Interesting Scientist and Why?



The Findings

The children gained a broader understanding of what it might mean to work as scientists. From an expectation that all book reviews are in the traditional form of text, they now have an understanding that it is possible to ask questions, collect data, present results, and share their findings with an audience. A shift to more child-led scientific enquiry. When comparing the written reviews in issue 3 with their current data gathering, analysis and presentation, this shows impressive development in working scientifically skills.

In addition, children know more and remember more about the about the diversity of those with scientific careers. Stereotypical ideas of men in white coats with wacky hair are being dispelled.

Future Research

Having created this poster, the pupils might now consider if pupils in other schools or other year groups might share their opinions or have different views. They could evaluate their poster and think about how they would do it differently if they were to do it again. Would they ask different questions if they were invited to review another book in a

similar way? They could consider the validity and reliability of their results.

As a result of their efforts, every school library in Stoke-on-Trent will receive a copy of the book to encourage them to set up inter-school reflective book clubs. Perhaps other schools could compare their own school results with the ones shared on these pages. Comparisons of this type are only possible once data have been collected and analysed.

Further Reading

The Art and Science of Teaching Primary Reading. Christopher Such, Corwin Ltd

Closing the Reading Gap. Alex Quigley, Routledge

ASPIRES 2: Young people's science and career aspirations age 10 – 19 available at <https://www.ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/aspires-research>

Improving Literacy in Key Stage 2 Education Endowment Foundation. Available at <https://educationendowmentfoundation.org.uk/education-evidence/guidance-reports/literacy-ks2>

Science Club Rocks

Julie Clarke Priory Academy,

Additional Opportunity Area funding from the Government Equalities Office (part of the Cabinet Office) saw the Science Across the City (SATC) team pondering what more could be done to help teachers whilst not bringing the stress of additional workload. Other pedagogical CPD offers, with which so many of the teachers and science leaders have engaged, already require commitment, thoughtfulness and changes in planning and classroom practices. As a school-based teacher, Becki Price, one of the SATC Science Coaches, empathises with other teachers and to make their lives easier, suggested and took on the challenge to co-ordinate a collective city-wide curriculum enrichment offer. Becki provided much passion and enthusiasm; the planning and pre-club information; and even organised opportunities for children to meet inspirational female scientists via Zoom. Alongside kit providers, she procured the resources for newly launched 'Curiosity Clubs' to run at different schools, at the same time each week, and on the same problem or theme. This offer was taken up by 20 schools in Stoke-on-Trent.

Julie Clarke from Priory Academy, one of the science subject leaders running a SATC Science Club, told me about her experience.

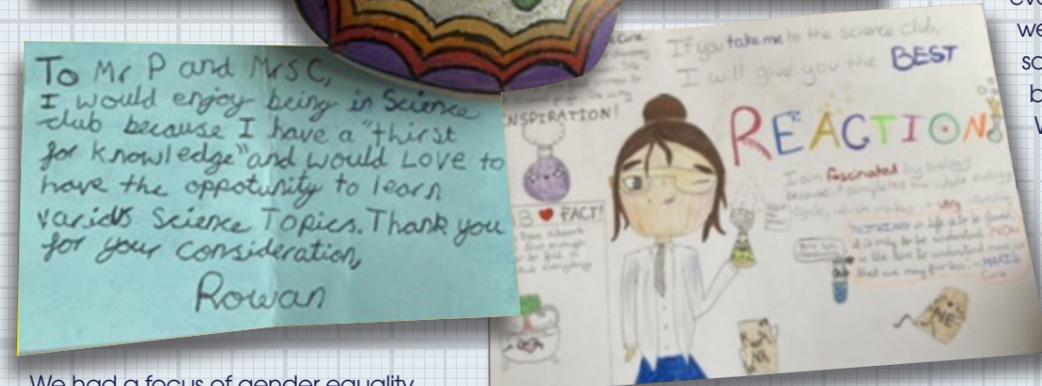
When we were offered the opportunity to run the Science Across the City Science Club it was the first club we'd run, other than a sports club, for about two years. The children haven't had anything extra-curricular, so they were really excited to be part of the SATC Science Club. Initially we were unsure how to target the children and we listened to other teachers across the City to get some ideas. Then several of us met at school and talked about the best way forward for us.

Previously when we had taken children on a visit to Birmingham Airport, we asked them to apply and that worked well so we decided to employ the same strategy. To ensure we got the right children, we asked them to do something for us to show their interest in science. We left it really open ended. They could draw, or they could write, whatever they wanted. We were absolutely overwhelmed with applicants, about 40, so we chose an initial 15. We were looking to be actively inclusive, reaching out to children who might not previously have considered a science club was for them. Because of the high quality of the work, and rather than disappoint the children, we will run the club a second time once the



first cohort have finished. We have just completed the first 12-week cycle and now we're ready to do exactly the same again for the next group which is really exciting.

So, I have a few examples of what the children produced and things they made for us. The effort that some of them had put in was impressive. Some of them had gone home to work on it; they were just so keen to be involved.



We had a focus of gender equality, so I think we ended up with nine girls and five boys from years five and six. We spent a long time considering whether we should just have year five or just have year six, and eventually we decided to mix the children because nobody had been working together for such a long time. It had been many months since some of the children had seen children in other year groups. We have been so isolated for so long. We hadn't even had whole school worship at this point, so it was quite a big step to have 15 children from different classes. To start with we had to work really hard on collaborative skills. During lockdowns, the children became used to working alone, they would have their own pens, their own equipment, and they weren't allowed to share. Now, all of a sudden, we're saying you learn better, you build your learning power through sharing and collaborating, so it was a really good experience.

What did you do to try and give them messages about gender equality?

We talked a lot about what it is to be a scientist, but the scientists they could name were all male. I don't think the children realise they are, and they can be scientists because aspirations are low at our school.

Everybody has a voice, everybody has to share, everyone has to listen

able to finish practical activities and solve the problem before the children they may have predicted would finish first. It has been very inclusive and a lot of children with diverse needs have come. Being one of 15 rather than one of 30 for a full hour after school with two teachers provides a supportive environment. We also have a high school student who is doing his Duke of Edinburgh award who comes and helps out so staff to pupil ratio is really high.

Tell me about the impact on the children

Each week we see the children grow in confidence and become more independent. To begin with the whole idea was very foreign,

What has been really important about a group of 15 is that everybody has a voice, everybody has to share, everyone has to listen. Most weeks we've met female scientists on screen and that's been amazing for the children. We have written questions for these scientists and a lot of the conversations have often been around, 'did you find it difficult to get to this point in your career?' and 'what were the barriers?'. The scientists told us, 'other people are better than me', or 'I didn't feel I was as good as the boys', or 'I'm not as good at maths as the boys'. We've been able to address those issues. Sometimes it's been lovely to see the girls being

Each week we see the children grow in confidence and become more independent

Science Club Rocks

Julie Clarke Priory Academy

they weren't in a class with a teacher and classmates and a massive tray of equipment. We've provided some instructions and said, 'let's see how we do?' Initially some children didn't read the instructions properly and made a lot of mistakes, so we asked, 'what are we going to do now we've made these mistakes?' 'What do you think?' We put the onus very much back on them and they became much better at solving problems on their own. They soon realised there are lots of teachers here, but they are not going to give us the answer. They're not going to tell us

what to do, it's our club. I think that's very important. So, they learnt very quickly that they had to read the instructions carefully and they have become very resourceful so they can fix the mistakes.

They became much better at solving problems on their own

At the beginning we noticed the children had forgotten how to be resourceful, as a result, at the start the independent skills were very low, but they have come on and now their confidence is really high. The children now choose their own equipment, or they are asking to go to different places. For example, this week they made an anemometer to measure wind speed and straight away the children said, 'can we go outside?' They also have the confidence to talk about what they think might happen. It's just collaborative learning really, all the things you would expect to see in the classroom that we've lost along the way.

It's just collaborative learning really, all the things you would expect to see in the classroom that we've lost along the way

We have spoken to some of their class teachers who have seen a massive rise in confidence of the children who come to Science Club. One of the boys was sitting behind me at the theatre and I heard a member of staff asking if he was OK. He said, 'Yes. I'm OK. I'm just a bit nervous.' I turned round to him and said, 'you'll be fine. It's science and you love science.' Then I heard him saying Science Club is the only club I've ever been to and stuck at. When he was asked why, he said, 'because the other older children are so nice to me. I've never done anything with the older children before and they were so nice to me from the beginning. That made such a difference and I wanted to come each week.' So, for a child like him it's not just about science, it's about those social interactions, building relationships and working together.

Every week, either together or separately, we've found

a solution to the problem we were trying to solve. Sometimes we had to leave it until next week and come back and think again.

it's about those social interactions, building relationships and working together

Every week ... we've found a solution

'Why didn't this work?' Again, lots of communication and that's the other thing, as time has gone on, we have noticed they are kind to each other. Maybe that's where the confidence has come from because they feel they can say whatever they want.

To begin with some children wouldn't speak and it took about four weeks before they would put some ideas forward. Now I would say the children involved in the club take a really big part in the running of the club; so, it's been fantastic

The children involved in the club take a really big part in the running of the club

Have you tried to measure the impact in terms of gender equality?

In the first week of the Science Club we asked the children if they could name a scientist and most of them couldn't. I think in the end they could just about remember Einstein but not why, and David Attenborough's name cropped up, but they were quite vague. Now you hear the children talk regularly about the people they've met on screen and the jobs that they do. Some of the careers are totally new to them. They were particularly impressed with the lady they've just met who is an inventor. She saw a gap in the market for biodegradable paper towels. I think they were really taken with that. It's not always about following a scientific path, you can create your own path and you can invent something brand new, market it and sell it. They've now planned an investigation to find out how long different materials take to degrade overtime.

They were particularly impressed with the lady they've just met who is an inventor

With the STEM Sisters theatre show we chose to take year five students because we didn't have enough tickets to take both year five and year six. We were given 15 extra tickets, so we asked the year six children from the Science Club if they would like to go with their parents. Some of the year six children went with their families and they will

be able to tell us all about the female scientists and the discoveries that they made.

We believe Science Clubs are important for the children, and as teachers it's lovely not to have to be tied to the national curriculum. In the past we've always found that boys want to come to Science Club. Therefore, we've worked really hard to try and address that. In their science lessons some of the children that have been to Science Club are modelling skills like independence and they are more vocal than they might have been. They are leading their peers by example, and I think other children are remembering and thinking I used to be more resourceful like that. Other children are watching and learning from them.

Other children are watching and learning from them

Some of the girls who come along are quite quiet and it's great to see them change in the classroom environment. We've talked about giving one of the girls who comes to Science Club the Scientist of the Year award because she goes above and beyond and puts so much effort in. She goes home and she thinks about things. Her level of confidence now is amazing.

Some of the students have asked if they can come along too when we next run the club and mentor the children in the next cohort and I don't ever like to say no. If the children in our school really want to do something, we try our hardest to let them do that unless there's a safety issue. We will sit down and talk about how we can help those children and move the club forward at the same time, because it can't just end for these children.

One of our children, Millie, was so taken with the club that

she was talking about it to her mum who works for the police. Her mum then messaged me and said I've asked my

Some of the students have asked if they can come along when we next run the club

colleagues if there is anything we do linked to science that would help. Then the forensic police unit got in touch and offered to have a Zoom meeting where the children can ask questions and find out about what a police forensic scientist does. This was for a whole year group rather than just the Science Club. On the day some of the Covid restrictions had changed and they were able to actually come into school. They sent the manager, who was male, and the young female who had only been there for a year so. Again, it was very good gender equality for the children to see not just a male but a female as well. She talked at length about how she got to that role which was very inspiring. Had Millie not come to Science Club we may not have had that opportunity, so that's an unexpected impact.

Finally, is there something special about the way that Becki has set up Science Club that makes it so impactful?

It's very organised. You know what to do in advance, where to find the information, and you've got the WhatsApp group so you can just check if you are not sure. Becki is very good at emailing us and reminding us. I think part of that is because she's still a teacher herself. She sits where we sit, and she understands the pressures. She'll have done a lot of work beforehand, so everything is in place, and Olivia helps keep us all on track.

Becki Price concludes:

When we came up with the idea of Science Clubs the objectives were to:

- Get schools to work together on clubs
- To think more about which children would benefit the most from clubs
- To increase the links with real and current scientists in the workplace

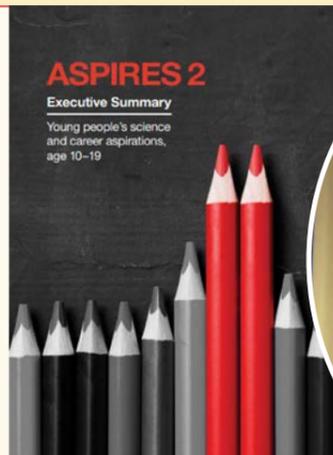
Julie's experience shows that the Science Club at Priory Academy has been successful in achieving these objectives. However, what has surprised and delighted me is the unintended consequences of the project. I am especially impressed with the way Julie has enabled the children involved to develop their confidence, problem solving, independence and relationships. It is marvellous that these skills and attributes are then being demonstrated to their peers during science lessons. To have such outstanding impact beyond our clubs has truly exceeded our expectations.

Teaching to tackle inequalities

In conversation with Dr Jenny Watson

A discussion focusing on science capital, the ASPIRES 2 report, and the workshops Jenny has facilitated for schools as part of the SATC initiative

ASPIRES 2 was an influential study that recognised inequalities in young peoples' science identities and the key factors influencing these identities and students' aspirations. Factors such as class, gender, and ethnicity were discovered to be influential and perpetuated existing inequalities. The report recommends that building the science capital of young people, starting as early as possible, is key in addressing these inequities. Before our discussion Jenny and I both read the ASPIRES 2 Executive Summary with a view to discussing how the virtual science workshops Jenny has been running for pupils in Stoke-on-Trent primary schools have been building their science capital.



To begin, I was interested to understand more about Jenny's background and her own levels of science capital

I grew up in a very 'sciency' household. Two of my grandparents studied chemistry at London University and both my mother and my father also studied science at university. My mother trained as a teacher then taught from home, and my father worked with biochemists to connect their research experiments with computers back in the 1960s and 70s when computers were the size of a room. From my mother came my love of nature and my father provided my inspiration to become a scientist. My sisters and I used to watch my father mending the car and I still have my childhood drawings of crankshafts and spark plugs! He explained about how computers work using binary when I was seven or eight years old. I saw my father as an inventor and an engineer of magic when I was growing up. I agree with the research on science capital that shows much of it comes from the home. When my daughter went to school her friends were under the impression that as a family everything we spoke about included science. Actually, I think that's true.

Girls tend to have lower science capital than boys, yet this doesn't seem to have been a barrier to you.

I went to a girls' school and I think that's relevant because there wasn't the competition in science lessons that some girls experience. The disadvantage for me, however was that we could only do 'physical sciences' rather than physics. Later, as a woman studying physics at university, I was very much in a minority. I felt I had to prove myself, by working harder, probably more so than if I'd been a young man.

So what sort of work did you do when you left university?

I did a PhD in low temperature physics, then did various jobs in computing, technical authoring and software support. Some years later I trained as a secondary science teacher and worked for the Physics Factory in Birmingham on an initiative to provide CPD to non-specialist physics teachers in the Birmingham secondary schools. Then I began doing science outreach to primary schools through the Ogden Trust. With each primary school, I made sure there was sustained interaction – giving pupil workshops at their school, providing teacher CPD and inviting pupils to multi-school science events.

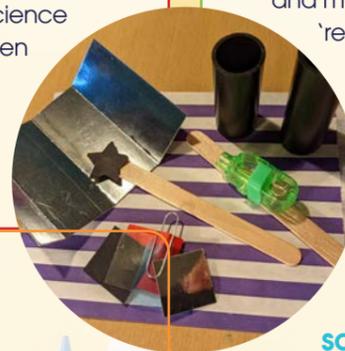
Because you have a degree in physics do people say 'you must be so clever'? And if so, how do you react to that?

The ASPIRES report says, "The pervasive dominant association with 'cleverness' and 'masculinity' is detrimental and makes many young people feel that science is not 'for me'." When people find out I am a doctor of physics they do say, "You must be really clever", but I explain that I just wear science goggles! This means I see the world in terms of science, for example I see a child dropping a ball or walking with 'giant' steps as doing science experiments. That's what I want to pass on to the children I teach – how to see the world as a scientist. If you have science goggles you don't have to be clever, but without them, however clever you are, it is much harder to see how the science you learn fits together.



Can you teach children to wear science goggles or is it innate?

I have borrowed the idea of science goggles from the Institute of Physics who talk about forces goggles and seeing the world in terms of forces. I would expand on that and use the analogy of science goggles to explain 'seeing the world as a scientist'. Getting science goggles is a light bulb moment that I've seen many young people have; suddenly, for example, they don't have to remember the equation linking speed, distance and time, it clicks that this is just the everyday science of 'miles per hour'!



Do you think primary children are more easily able to discover they have a pair of science goggles?

Absolutely. In my experience younger children are more malleable and there isn't as much peer pressure. That's why it's important to talk about and do good science in primary schools because of that openness to new ideas that aren't shut down by peer pressure. They are less worried about being wrong as well, and ideas are still developing in their minds.

So, what do you do in your workshops for pupils in Stoke-on-Trent to help them find their science goggles?

I start my workshops by listening to the children's questions and answering them positively. So, for example, if I'm working with year six pupils studying light, I ask them for their questions about light or about scientists. Allowing the children to ask about scientists means they often ask me how long I've been a scientist. I tell them that it started when I was younger than them. If they have younger brothers and sisters, their siblings are doing science experiments by dropping a ball; checking it always falls downwards; listening to the sound it makes when it lands; and seeing how high it bounces. I tell children that every day, even though you don't always know it, we're all doing science experiments and once you recognise that, you understand that we are all scientists. Children sometimes ask me "Are you a real scientist?" I reply "Yes I am, and so are you!" which also leads me on to talking about other scientists they know. I usually ask "Do you know anyone who's a nurse or a carer... or works in the garage fixing cars... or is a plumber or an electrician?", and gradually there's hands going up and most of them conclude that they know several 'real' scientists. We know that seeing science in our own lives and those around us helps build that science capital.

ASPIRES talks about not trying to change young people but changing STEM education. You seem to be trying to change their perceptions of what science is.

I feel indignant that we often put children off science in secondary school: We have all these bright young people who love science whether they consider themselves as scientists or not, then we put them off science by making it academic and hard work and implying that they have to be clever to do well in the subject. It makes me very sad that young peoples' love of science quite often doesn't survive what we do to them in secondary schools. I have seen for myself the structural inequalities discussed in the ASPIRES report and how easily disadvantaged pupils can turn away from science. The flame of that exciting, engaging

In conversation with Dr Jenny Watson

science is snuffed out. However, the great thing about the primary workshops is that we are igniting those flames, so they burn more brightly and are hopefully more resilient.

What are the things you do to light those flames?

By being enthusiastic about science; that's what lights the flames. I tell people that a job in science is one where you are problem solving every day. It's exciting and if you follow a science track in school you are likely to be paid better because it keeps doors open. Many of my university physics friends went to work in finance in the City of London earning very large salaries.

I also like to focus on stories of a diverse range of scientists (from books and real life) and I believe that this is a particularly good way to engage girls. In my opinion, boys are often more focused on the 'doing' of science, whereas girls tend to see things in a more holistic way, and are interested in people as well as what they do.

Do you have a couple of examples of scientists you tell the children about?

Helen Sharman, prior to becoming the first British astronaut, worked as a food scientist, creating the flavours of chocolate ice cream. Children can see that's a truly wonderful science job that they've never even considered.

I also think it is important that children have role models from their own communities and, for example, when

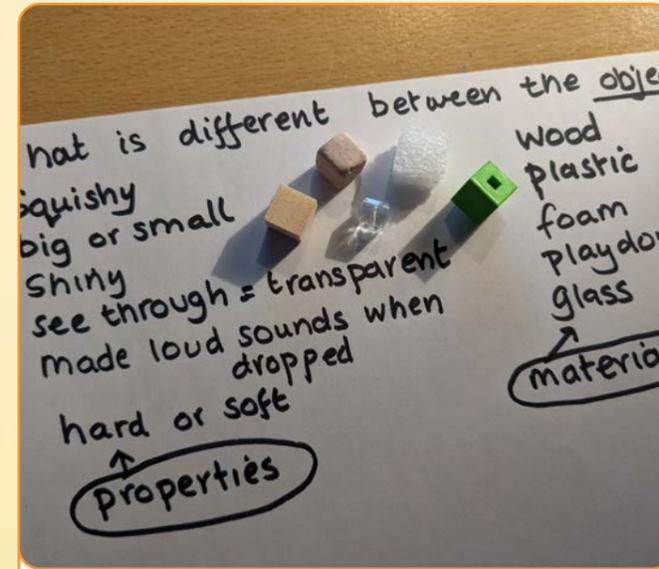
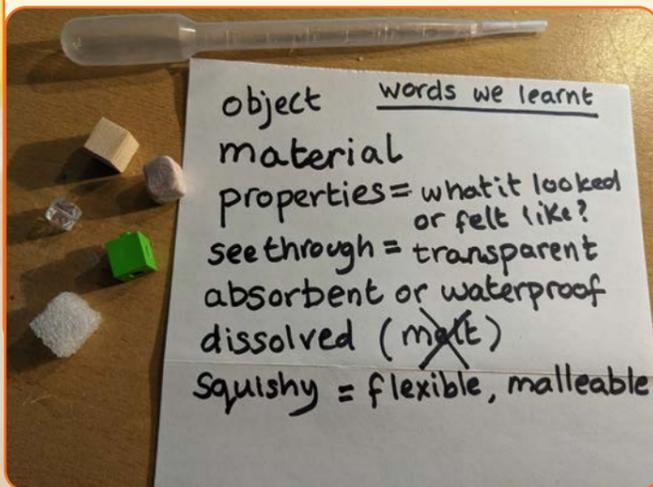
I taught about science in polar regions at King's Norton primary school in Birmingham, the children were excited when I shared that the doctor on Ernest Shackleton's expedition also went to school in King's Norton. So, what I'm saying to the pupils is these are people like you, and you could do this too.

To increase perceptions of scientist coming from diverse backgrounds, I have also spoken about Alhazen. He was born in Iraq in the 10th century AD. While under house arrest, he experimented with light and was the first person to recognise that light travels in straight lines. He also invented the pin-hole camera.



What do the children do during your workshops? And why are they structured in the way they are?

Quite often the 10 minutes of questions at the start of a children's workshop comes round to talking about the Big Bang. This leads to questions that scientists don't yet know the answers to, for example a child might ask "What was there before The Big Bang?" In response I ask them their name and say "So, in 20 years' time when I'm watching my hologram (because we won't have televisions then) and they're interviewing the scientist who has won the biggest prize in science because they answered that very question, I will remember you asking that." Sometimes I ask the class who would like to be that person making discoveries and answering questions that nobody's been able to answer before, and most would. After questions, we go on to do practical activities. For example, with my light workshop for year 6, each pupil gets a bag containing a tube, a kaleidoscope (simply a piece of folder mirror card) for them to make then take home, a finger torch and some materials. The children look at light sources (e.g. the classroom lights) through the tubes, seeing them because of the direction they are pointing in and light travelling in straight lines. They then use the torch in pairs to investigate which of the materials produces the darkest shadow and rank them from lightest to darkest shadows. We always stop and talk about all the vocabulary used so far. Finally, they are challenged to find two ways to make a shadow larger: One is to move the torch closer to the object making a shadow and the second is to move both the object and torch further from the screen. The shadows shape and size are explained by light travelling in straight lines (the year 6 National Curriculum learning).



Where possible I encourage children to take the bags home and share their learning with their parents, because we want homes to be places where science is valued and discussed.

My year 1 materials workshop pack includes: two small kitchen foil packages, a pipette and five small cubes of plasticine, wood, plastic, foam packing and a transparent plastic. After children's questions, we talk about what we mean by an object (a thing) and a material (what it's made of), and how the materials differ, which leads on to talking about properties. The children, working in pairs, group the cubes according to their properties, for example whether or not they are hard, squishy or shiny. We then use pipettes to put a drop of water on each and talk about whether they are 'waterproof' or 'absorbent' (the wood is absorbent; the rest are waterproof).

Next, the children open the two foil packages - one contains a dark powder and the other, three sugar cubes. They put the powder in a bowl, make a tower of sugar cubes on top, and predict what will happen when they pour water into the bowl. Some children think the sugar cubes will melt but I explain that melting only happens when something is heated. We discuss absorbing and dissolving and whether they think things will happen fast or slowly. Then they try it and the water goes blue straight away because the 'mystery' powder is food colouring. It is then absorbed up the sugar cube tower, the sugar dissolves and their towers collapse. We finish by considering what would make it all happen faster and what they've learnt.

Thank you so much for the session this morning - our class of yr1s absolutely loved it! We are having our Science week next so we will definitely be using some of the ideas from today to build on

Do you think teachers are benefiting from your workshops?

Following the workshops, teachers have told me how easy they now think it is to do good science with the key stage one children. I very clearly point out to the teachers that we have been working scientifically; classifying materials and observing over time. Children have also been making predictions, and I have modelled for both the teachers and the children how to use the scientific vocabulary with a focus on the curriculum. The children are not just seeing it done they are doing it for themselves.

How would you like to conclude this interview?

I aim to build science capital by showing children the science in the world around them; in their everyday lives. Breaking down the 'them and us' barriers that children and their parents often hold about scientists is so important to me. The little paper bags contain items that the children are already familiar with and can relate to. I hope I have been successful in explaining to pupils across Stoke-on-Trent how science is in their everyday lives and communities and through these approaches have raised their science capital.

'A big thank you for the workshop you provided on materials. The feedback from staff and pupils has been very positive. The kids really enjoyed the experience and it has helped staff develop their ideas for teaching using scientific enquiry.'

High quality experiences along with wide ranging variety make for meaningful science memories



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