



Evaluator's Report: The impact of Science Across the City (SATC)

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Introduction

The aim of this report is to support the evaluation of the Science Across the City (**SATC**) project, funded by Stoke-on-Trent Department for Education Opportunities Area (2019-2020) to close the attainment gap between science assessment data for Stoke primary schools and national data. The project encouraged school leaders to consider working towards the **Primary Science Quality Mark (PSQM)** for effective self-review purposes, and to increase the profile and quality of science teaching and learning. The strategy envisaged that the number of participant schools taking part in **PSQM** would increase during the timeline of the project. Indeed, four schools registered in the early stage of the project for round 18 (April 2019 start), a further ten schools started in round 19 (September 2020) and a further six schools were due to start in round 20 (April 2020); however the start date has been delayed until October 2020. Stoke schools involved in the project self-selected to work towards a **PSQM**. This report is based on an examination of the documents submitted to the **PSQM** for review for the four Stoke schools who submitted their evidence in spring 2020.

A glossary is provided to explain terms that those not familiar with primary science education may require. Terms described in the glossary are denoted in **bold** font in the main text. Headline summaries are included in blue boxes for easy reference.

It should be noted that schools closed at short notice on Friday 20th March because of the Covid-19 pandemic, causing cancellation of some of the planned activities, including **PSQM** CPD and school based events and activities. It also resulted in some science subject leaders being unable to gain access to their schools to complete the collection of evidence. Round 19 schools, due to submit their **PSQM** evidence at the end of March 2020, were given an extension until the end of April 2020. The deadline for round 20 **PSQM** submissions has been moved from June 2020 to February 2021 to allow subject leaders additional time to implement their action plans. As a result of these extensions, at the time of writing, only four **SATC** schools have submitted their evidence, whereas it was anticipated significantly more schools would have completed the process and their data would be available for analysis.

The aims of the Primary Science Quality Mark (**PSQM**) include raising the profile of science in primary schools and providing schools with a framework and professional support for developing science leadership, teaching and learning. Science subject leaders work in local hubs supported by a **PSQM** hub leader. They attend four half day (or equivalent) training sessions. The year long process starts with a self-evaluation of the school's provision for science teaching and learning, a decision as to which of the three quality marks to aim for (**PSQM**, **PSQM** Gilt or **PSQM** Outreach) and the creation of an action plan to enable them to meet the criteria at the end of the year. For most of the year the focus in schools is on activities to raise the profile and quality of science teaching and learning with a process of evidence collection at the end of the year. The evidence consists of written reflections and **core documents** that are subsequently reviewed by a **PSQM** hub

leader from a different region. In the majority of cases the quality mark is agreed, but in a small minority of cases, further evidence is requested, or a different quality mark is awarded.

To collect data to evaluate the **SATC** project, while minimising the impact on the science subject leaders, the researcher downloaded all the **core documents** that had been uploaded to the **PSQM** website. This includes a substantial, wide range of qualitative data, such as pupil work, stakeholder voice and teacher reflective comments. Thus, having worked hard to compile their submission evidence in unprecedented circumstances, the science subject leaders were not asked to take part in other data collection methods.

Full ethical approval for the study was granted by the University of Hertfordshire social sciences, arts and humanities ethics committee. All participants were given a participant information sheet to keep and signed a consent form. To maintain the confidentiality of the participants and others in their schools, the school names have been changed to colours; red, blue, green and purple.

All documents submitted to the **PSQM** for review have been examined to identify incidences related to three themes:

- **Engage** – members of the school community doing something they were not doing before; becoming part of a city-wide vision for change.
- **Enable** – school leadership takes ownership of change. School planning choices and initiatives driven by the vision.
- **Empower** – continuation of development and connections initiated by **SATC** reflecting the confidence to 'go it alone'. School culture embraces the wider STEM landscape.

This report is structured around the above three themes. Photographs from the schools' supporting power point presentations have been included to provide examples of what has happened in schools. Each photograph has a border to match the colour of the school where it was taken. One other factor of note has been identified and further research questions and themes are provided.

Engage

The evidence submitted to the **PSQM** for review shows increasing engagement with the teaching and learning of science across each school's community and beyond. This includes pupils, staff in school, school leaders including governors, parents, other organisations and primarily the science subject leaders themselves. Engagement beyond the school includes other local schools and local industries. It also includes other organisations involved in the promotion and development of primary science education.

The impact includes increased pupil engagement, enjoyment and attainment, pupils thinking more like scientists, raised pupil aspirations, and pupils better able to articulate their scientific knowledge and understanding. Science activities and displays became more prominent in all schools. Teachers' confidence, science pedagogy and curriculum coverage improved as a result of more regular **CPD** opportunities, predominantly provided by the science subject leader. Lessons included more opportunities for practical work and child-led investigations, and children's science enquiry skills improved as a result. Learning outdoors occurred more frequently and the supply of science reading books in school increased. Improvements in assessment, based on accepted best practice, were also evident. Parents were increasingly invited to schools for science events and more science learning took place at home. Links were made with external organisations including other local schools, scientists based at local businesses, and organisations supporting the development of primary science (e.g. **CLEAPPS, TAPS, Ogden Trust, STEM Learning, Primary Science Capital Project**)

The increasing engagement and its impact, related to these different groups will now be explored in more detail, including specific examples from the four schools.

Pupils

There is evidence of pupils having a greater influence on their experiences of science teaching and learning. At Blue School children's views were incorporated in the **principles** of science teaching and learning. The science subject leader also instigated termly meetings with pupil representatives from each class. As a result, pupils believed their views made a difference. At Green School, an area on their website entitled, 'You said it; we did it', recorded how the pupils' views had been responded to.

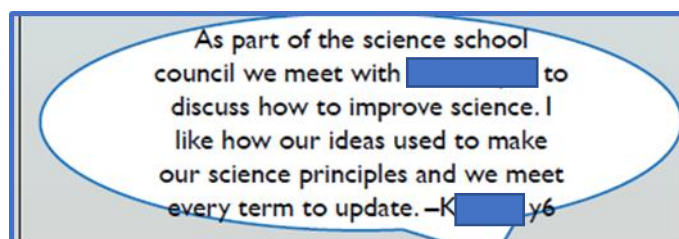


Figure 1 - Pupil quote

During an autumn review at Red School the children responded emphatically that they enjoyed increased opportunities for practical work. Children's increasing engagement and enjoyment of science lessons were also reflected in an **Ofsted** report for the Red School. The science subject leader restated information from the report. 'Teachers make learning more exciting' in science, which means 'pupils succeed'. 'Pupils enjoy thinking like scientists through practical experiments.' Children also became better at articulating their scientific knowledge and explained their

understanding of topics such as evolution and electricity, as well as commenting on the numerous experiments they carried out.

The science subject leader at Blue School also reported pupils were now more positive about science lessons and were enjoying them more. In addition, a few pupils at this school were engaged with organising and maintaining resources and supported teachers with equipment for practical lessons. The science subject leader also claimed pupils who were typically disengaged became more interested when teachers related discussions to their home lives.

In addition, improvements in pupil attainment were signposted, with data analysis for Red School showing increasing numbers of pupils achieving or exceeding age-related expectations. The Green School also reported raised pupil attainment.

Children's science learning experiences extended beyond normal science lessons into extra-curricular activities. A science fair at Red School included an experiment presented by the best group in each class to the whole school and parents. This gave the children immense pride in being able to showcase their scientific understanding. Some of the school's pupils participated in an **Ogden Trust** Solar Scrap Heap Challenge creating a solar powered car from scrap materials. They felt a sense of pride in competing against other teams as well as working within their own teams in their classes. Because of this positive feedback, Year 5 were chosen to lead a 'Physics Escape Room' activity where they again competed against the other schools in the partnership. The feedback from the staff and children was overwhelmingly positive and the profile of science related activities has been raised. Children's self-esteem grew when they were chosen to demonstrate their experiment from the school's science fair at Keele University's 'The Great Science Share' in summer 2020.

The science subject leader at the Blue School reported participation in this same opportunity had led to raised pupil aspirations.

Staff in school

The science subject leader at Red School commented that at the start of the year some classes in the same year groups were teaching to different objectives and that opportunities for science enquiry were missed. Weaknesses in curriculum coverage and pedagogy were also evident at other schools in the sample, but a range of improvements occurred over the year.

In all schools the science subject leaders involved their colleagues in the development of the **principles** of science teaching and learning, and Red School's science subject leader recalled lesson observations showing teachers adhering to the **principles**, making science lessons hands-on, investigative and fun.

The science subject leaders instigated a range of activities to support and develop their colleagues' knowledge and skills. At Green School termly staff meetings included continuing professional development (**CPD**) opportunities resulting in a wider range of strategies to support the needs of all learners. Purple School staff also received regular science **CPD** in staff meetings and the subject

leader reported that, as a result, colleagues more confidently linked science enquiry types to science activities. The science subject leader at Blue School targeted **CPD** at need and was pleased to see evidence of the impact of local **CPD** in lessons and in improving staff confidence. She also provided individual support in the form of an induction for new and returning staff to outline new science teaching and learning practices.

The science subject leader at Red School provided individual support with planning and reported, ‘I sat with the teachers from every year group to plan their science lessons for 2019/20. This ensured all National Curriculum objectives were being met, all enquiry types were being revisited and appropriately planned for during all topics throughout the year, and, where possible, links to other subjects could be made. For example, ‘Year 1 have linked their ‘Where in the world’ topic to their science objectives.’

There was also evidence of impact on teaching assistants (TAs) who ran extra-curricular activities at Blue School alongside high school science teachers. These TAs reported developing confidence to run a science club as well as a greater feeling they were respected.

Pedagogy

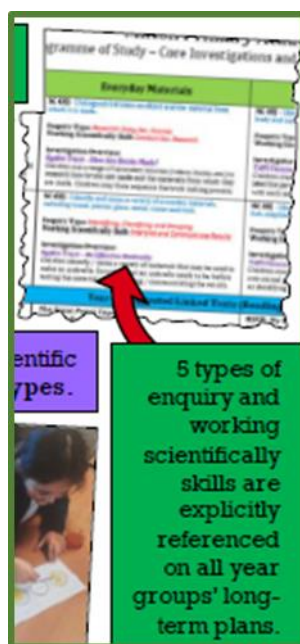


Figure 2 - Science enquiry now explicit in planning

As a result of the support provided to their colleagues, the science subject leaders noted improvements in science pedagogy. One of the ways this was evident was through an increase in the quality and quantity of science enquiry. At the Green School lessons became more practical and enquiry-based with the five enquiry types and enquiry skills now being included systematically in planning, leading to improvements in children’s knowledge and skills. Staff at Red School focused on improving attainment in science through an enquiry-led and child-led approach, and the science subject leader at Blue School confirmed that all lessons now have an enquiry focus with evidence of teachers’ greater confidence when teaching enquiry. More practical lessons were happening at the Purple School, and children were deciding which enquiry types are appropriate for answering different scientific questions. Teachers at Purple School also became more confident. ‘As a new teacher to the school, I wasn’t sure what was meant by ‘working scientifically’. Thanks to the **TAPS** working scientifically cycle and a meeting with Mrs W I feel much more confident about what this means for both me and for the pupils in my class.’ (Mrs K – Year 4 teacher).

The National Curriculum requires children to be asking and answering their own scientific questions and children at Red School were given the opportunity to develop their own questions for investigations. For example, a Year 4 unit was devised by the children to explore plastic pollution and they then carried out their independent investigations. Mr W, a Year 3 teacher at the Purple School was quoted. ‘My lessons were very worksheet-based, and I lacked the practical element of science. With Mrs W’s help and support I have taken chances and planned more practical lessons.

Using the **TAPS** assessment has meant that my **AfL** is more effective and the children are enjoying science more’.

Without the appropriate equipment it is difficult, if not impossible, for pupils to engage in practical work. The resources available for practical lessons increased. The Purple School was successful with an application for a grant of £300 to purchase more equipment. Blue school was grateful for additional resources from the **Ogden Trust** which supplemented the previously installed, regularly used Phizlab. As a result, the children thought science was better because they were now using what they regarded as ‘proper equipment’. At the Green School staff were making good use of equipment in lessons and increasingly discussing health and safety implications of practical activities.

Although the **SATC** project did not specifically focus on outdoor learning, this is referred to in the **PSQM** framework and in some of the schools outdoor learning became more prevalent, resulting in children engaging more regularly in science outdoors. The science subject leader at the Red School described how their vast outdoor area was the site for many of the children’s investigations and gave an example of a Year 1 pattern-seeking lesson where children established which of the outdoor areas best supported the growth of moss. At Blue School the outdoor area was developed as trees and flowers were planted, and bird boxes and bug houses were installed to increase biodiversity.



Figure 4 - Year 1 pupils investigating where moss grows

Figure 3 - Pupils developing their outdoor spaces



Figure 5 - Reorganised and new resources

Science reading books were another addition in some schools. A science section in the new Blue School library made science books more accessible to pupils and the Green School also increased the number of science books (fiction and non-fiction) in the library. Red School took a slightly different approach, ordering and distributing science books to reading areas for each year group.

Teacher questioning is another area in which pedagogy strengthened. Blue School used opening questions for topics to stimulate the children’s curiosity, and the science subject leader stated, ‘More open questions from teachers in both lessons and marking has encouraged deeper thinking and higher quality responses from pupils.’ The science subject leader at Purple School noted improved questioning skills of teachers and how these were used to identify gaps and misconceptions in the children’s knowledge. These were then addressed. The science subject leader at Green School considered higher order questioning was leading to teaching better meeting the needs of the children. Improving pupil discussions and high-quality work in science books were also evident at Blue School.

Linked to questioning and talk for learning, an increase in the use of science vocabulary was a focus at Red School. Tailor-made vocabulary lists were developed for each year group, for each unit, and this enabled the children to use more technical vocabulary in their responses. ‘A book scrutiny showed the children were implementing the agreed areas for focus [science vocabulary and independently using science equipment]. Children’s work regularly demonstrates accurate use of scientific vocabulary in write ups and evaluations. In addition, children are producing quality graphs as a result of a focus on using equipment and measuring accurately. ‘The quality of verbal and written responses has seen a big improvement because of the use of Concept Cartoons, and this is clearly evident in **‘purple pen’** work in a number of year groups.’

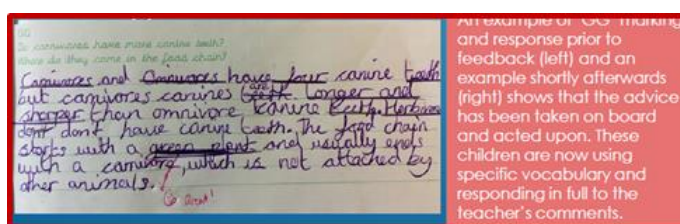


Figure 6 - Children's use of scientific vocabulary

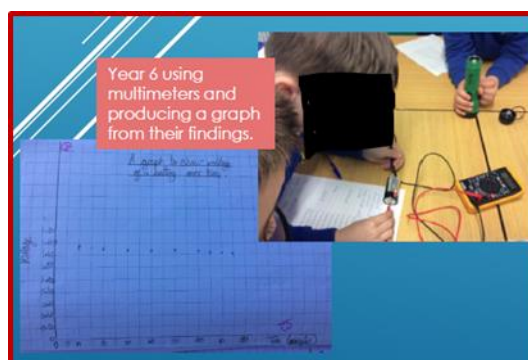


Figure 7 - An example of graph work

To ensure children engaged with cross-curricular learning, links were made between learning in science and learning in other subjects. At both Blue and Green Schools, new long-term plans linked science with other subjects. Information technology (IT) was used to record work in science at the Blue School and science links were also made in Forest School sessions.

Assessment

At the outset, the science subject leader at Red School acknowledged that teachers’ judgements about pupils’ learning in science were not as robust as they could have been. Weaknesses in assessment were also apparent in other schools, but over the year, as a result of engaging with training, actions were taken, to improve the situation in each school.

The science subject leader from the Green School took part in Teacher Assessment in Primary Science (**TAPS**) training, transforming science assessment at the school as a result. One of the school’s ‘Outstanding science **principles**’ became, ‘Teachers use a range of effective assessment

strategies to inform the planning and teaching of Science. There is a focus on active assessment strategies and embedded formative assessment practices inform summative judgements.'

Both Purple and Blue Schools adopted the **TAPS** focused assessment tasks, improving the confidence of teachers to assess pupils' learning. Teachers began to use observation of pupils to assess prior knowledge and misconceptions, then targeted teaching to 'close the gap' at Blue School. At Purple School, focused assessment tasks were used in combination with Floorbooks and teachers' comments as an, 'excellent way to prove a child's progress over the year.'

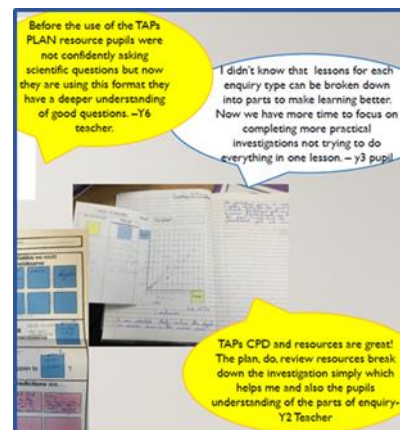


Figure 8 - Influence of TAPS resources

Outcomes of other CPD opportunities

Overall, the science subject leaders were pleased with the outcomes of the **CPD** opportunities they attended and then cascaded to their colleagues. Red School's science subject leader wrote, 'There has been on-going discussion and reflection with colleagues regarding their increased confidence and passion towards the subject.' The children's scientific explanations, written in **purple pen** at the end of a piece of work, demonstrate a deeper understanding which has clearly come from teachers having deeper subject knowledge and more confidence to teach that particular area. The Green School's science subject leader explained, 'Every single member of staff now says that they enjoy teaching science and do a better job of it as a result of the initiatives that have taken place in the last 18 months.'

A greater understanding of **science capital** led to pedagogy and curriculum enhancement across the schools. The science subject leader at the Red School reflected staff and children were previously unaware of the term **science capital** and there was a lack of good role models for children. Previous science weeks had focused on 'fun' rather than on how science concepts relate to real life. There were also plans in place to invite more scientist from industry to make further real-world links with science.

The Blue School participated in the **Primary Science Capital Project** at Key Stage One with



Figure 9 - Pupil voice activity showing increasing links to careers

strategies now being shared across the whole school. Careers links, visitors, family engagement and trips were all included on the long-term plans. At Purple School the purpose of science became more prominent in lessons and increasing links to careers in science were being made.

The Green School staff also organised a range of educational visits, visitors, career workshops, themed assemblies and regular communication with families, resulting in children making links between science and their everyday lives.

School Leaders and Governors

Mentions of engagement with senior leaders and governors occurred less frequently than engagement with pupils and other colleagues, but a couple of examples follow. At Blue School the greater involvement of the science governor was noted, in addition to termly meetings between the science subject leader and the senior leadership team. The School Development Plan at the Purple School explicitly included targets related to science.

One of the ways in which the schools' leaders supported the science subject leaders was to allow them time out of class to carry out monitoring activities. At Blue School the frequency of science monitoring increased so that it was monitored termly, like English and maths, and outcomes informed next steps. As an example, monitoring indicated some National Curriculum objectives were not being covered and this resulted to changes in planning.

The science subject leader at the Green School confirmed a monitoring timetable was in place and stated this indicated the school's rigorous approach to improvement. Furthermore, he saw the wider picture and noted the staff, 'now have a clear and robust framework to plan, deliver and monitor science teaching and learning.'

Other organisations

Links were made with a range of outside organisations. Some of these were organisations where an introduction was made through **SATC** while others were unique to the school and initiated by the science subject leaders or one of their colleagues.

The science subject leader at Blue School leads an **Ogden Trust** partnership; organising events for other teachers and science subject leaders; and managing the budget. She also involved the school (one of only 15 schools across the country) in the **Primary Science Capital Project**, led by King's College London and reported positive results in Key Stage One so far, additionally she is a facilitator for **CPD** organised by **STEM Learning**.

The science subject leader at Green School recognised that he had become part of the wider primary science education community; contributing to a professional learning community as a Science Influencer (**TAPS**) supporting other schools to develop science teaching and learning. Both he and his colleagues engaged with **TAPS** focused assessments, **PLAN** resources and **Ogden Trust** resources. This resulted in improved teaching and raised attainment for pupils. Purple School's science subject leader mentioned **CLEAPSS** training resulting in increased confidence to train colleagues on health and safety.

Now consideration will be given to engagement with other organisations where the science subject leaders made their own links. For example, Blue School is part of an academy chain that ran a STEM event enabling pupils to engage and share science with pupils from other schools. Blue School also invited local high school science teachers to run a STEM club for the children. Green school stated they established links with other schools. At the Purple School lessons began to be linked to science careers and people from industry were invited to speak to the children during science week. The science subject leader at Red School was in the process of completing a whole school **NPQSL** project based around science and Working Scientifically. The project will run over the next two terms and it focuses on closing the gap between boys' and girls' attainment at the end of Key Stages One and Two.

Parents

At each of the schools, engagement with parents was increased in several ways. At the Red School science fair, the best group from each class was chosen to present their experiment to the rest of the school and parents. The feedback from parents was incredibly positive. Blue School teachers were proud of increasing parental engagement. They invited parents to visit classes, suggested science activities to do at home in weekly newsletters and included science tasks to be completed at home in learning logs. Parents were also involved in the career's week. The impact of this increased engagement with parents resulted in a parent voice activity showing a greater understanding of ways in which science might be relevant to their children and greater engagement with science activities at home.



Figure 11 - Blue School evidence of learning at home (taken from their portfolio)

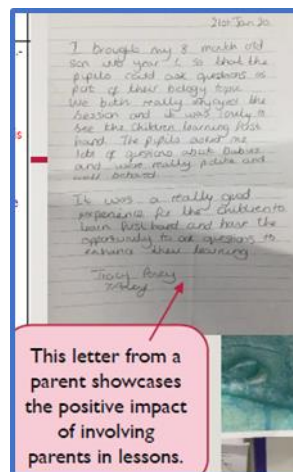


Figure 10 - Positive feedback from a parent

Purple School's children and parents took part in the Great Bird Watch in their gardens, which also led to parents becoming increasingly involved in children's science learning. The science subject leader at Green School also noted the improving quality of science related homework.

Science subject leaders

Many of the activities the science subject leaders engaged with involved children, colleagues in school, parents or other organisations and so have already been included above. However, there are a few additional statements from science subject leaders that are worthy of note. For example, the science subject leader at Green School commented on his own and his colleagues' engagement with **CPD**, emphasising the sustained nature of this engagement and the extent to which he now belonged and contributed to a professional learning community. He explicitly stated, 'both **PSQM** and **SATC**, and the opportunities that have arisen as a result of these initiatives, have played a significant role in my wider development as a leader, and in particular, supported me in securing a post as assistant head teacher in my current setting.'

The Red School's science subject leader referred to the recent **Ofsted** report. 'Following their deep dive into science, [they] commented on the 'high quality' leadership in science. It was also suggested in the report that the 'high quality science curriculum' should be used as an exemplar to improve the foundation subjects in school, thus highlighting the impact that I, as a subject leader, have made.'

The Purple School's science subject leader also confirmed **CPD**, 'has made me more confident in my own teaching and in giving advice and support to others.' Research shows lack of confidence is a barrier to science teaching, so, teachers' increasing confidence is likely to increase the amount of time devoted to science teaching, in addition to raising the quality of the teaching.

Other outcomes - Profile of science

Many of the benefits of the increased engagement of the whole school community with science teaching and learning have been explored above. However, it is important to capture the extent to which science has become increasingly visible in each of the four schools.

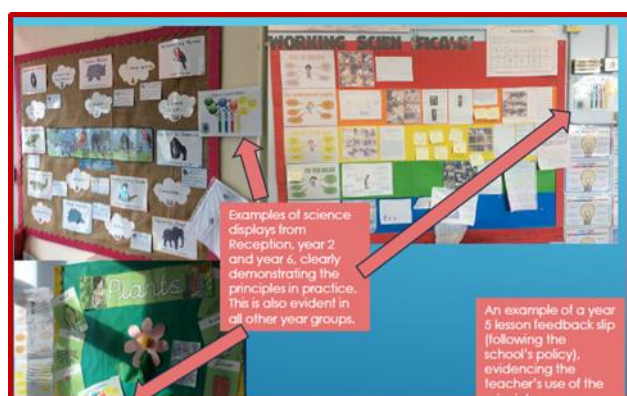


Figure 12 – Science Displays

Where previously science had not been prominent, science displays began to appear. At the Red School a prominent 'Working Scientifically' corridor display shows the **principles** in action and similar ones appeared in classrooms. An example of the display in Year 6 confirmed displays enable teachers to see which objectives have been taught and identify areas to cover in the future. The Red School also ran a science fair for the first time ever.

Science became visible at the Green School's appearing on the school's website, Facebook and Twitter accounts; science displays and working walls appeared in classrooms and communal areas; science staff meetings became a termly event; and, extensive engagement in a range of activities and events occurred, including clubs and residential visits.

Across all four schools the number and range of the science activities was impressive compared to the researcher's substantial experience of typical **PSQM** schools. The activities recorded in the logs exceeded what might be expected for similar schools elsewhere aiming for the same quality marks.

Enable

In this context enable means to take ownership of change and drive forward initiatives based on a vision for science teaching and learning.

Enablement, as defined above, was evident in all four schools. Each of the science subject leaders finished the **PSQM** year with plans to continue to develop science teaching and learning in their own schools, as well as to support other local schools in a range of different ways. The legacy of the project is evident as, even with no expectation there would be any further project funding, the subject leaders' plans included continuing to improve subject pedagogy, in addition to increasing and strengthening links with other organisations (e.g. on-going work with the **Primary Science Capital project**.)

The commitment to the continuing development of science teaching and learning was clearly expressed by the science subject leader of Green School who stated a desire for a lasting legacy. As evidence this was supported, he mentioned budget and resources for science had already been allocated for the next academic year. He aspired to move towards a model of joint-professional development to make greater use of capacity within school for a sustained approach to professional development. One example being to share effective pedagogical strategies among teachers. He also believed colleagues were now able to articulate the ways their science teaching had improved and had become enabled to identify their own development needs. He planned to extend professional development opportunities to include support staff.

For children the next step he identified was to increase opportunities to ask their own scientific questions and he planned to increase links with other local schools. The School Development Plan included the objectives of making more cross-curricular links and promoting a range of scientific careers. Considering how engagement with **SATC** and the **PSQM** had positioned him to continue to

develop science teaching and learning, he stated, “[Participation in the **PSQM & SATC**] has enabled opportunities for me to support and develop others as a leader beyond our own setting and make links that we are able to maintain into the future.”

Plans at Blue School focused on the second year of the **Primary Science Capital Teaching Approach**. The science subject leader planned to further develop parental involvement and introduce new classroom practices to increase the **science capital** of pupils. These will include coaching colleagues to annotate and edit planning with a focus on increasing **science capital**.

At Red School the science subject leader included a next step focussing on the principle ‘Science is good when I know how it works in the real world’, and stated the intention to forge links with local businesses, building on the events already undertaken over the last few months.

When considering the **PSQM** year the science subject leader at Purple School said, “I can’t wait for school to get back to normal and we can realise this opportunity, which I’m sure will be a valuable activity for the children.”

Empower

Empowerment refers to the continuation of development of connections initiated by **SATC** and reflecting the confidence to ‘go it alone’. It considers next steps that are related to **SATC** or other organisations or schools they became involved with as part of the project.

Relationships with organisations involved in developing primary science education strengthened over the course of the year with science subject leaders becoming more confident to take on outreach roles such as ‘Science Influencer’. The science subject leaders are committed to the sustainability of the project and are grateful for the support they have had through the year and the opportunities that have arisen from the project, for example, an on-going relationship with the **Ogden Trust** and membership of the **ASE**.

The science subject leader at Red School became part of a programme called ‘Nurture to SLE’ with **SATC**. ‘My current outreach role is ‘Science Influencer’ which involves going into other schools to provide advice on their own science delivery. This role will allow me to stay at the forefront of current pedagogical thinking in science and to continue to develop links with other schools.’

He mentions the school is now a full member of the **ASE** and he has been able to work much more closely with the **Ogden Trust** as the year has progressed, and through this, to tailor **CPD** events to

more closely meet the needs of staff. He has also made colleagues aware of 'Reach Out CPD' on-line CPD units. One member of staff successfully completed a unit on magnets and her improved use of vocabulary was evident when she was observed teaching. A colleague of the science subject leader at Red School reported an improved scientific understanding and the success of the Year 5 class in the Solar Scrap Heap Challenge empowered him to volunteer to lead future events.

Other future plans included developing further links with the **Ogden Trust**, to provide a family learning day during the summer term involving parents learning about the solar system alongside their children. (The researcher assumes this was cancelled because of the Covid-19 pandemic.)

The Blue School's science subject leader has plans for the future including sharing the **Primary Science Capital Teaching Approach** within her own school and across other local schools. Based on some classes' success in improving group work using role cards, she has plans to introduce them more widely across the school. Other future developments include more outdoor learning to improve pupils' attitudes, mental health and opportunities to link learning, and greater use of Concept Cartoons to enhance pupil discussions and increase pupils' enthusiasm for science.

Two quotations from the science subject leader at Green School speak for themselves:

"What's important though is the school's commitment to ensuring that we retain the capacity for this to be sustained beyond the **PSQM** and **SATC**, in order to ensure that there is lasting impact."

"Both **PSQM** and **SATC** have opened doors, enabled us to make connections, and it is this that we believe to be the legacy of our participation, as we know that the impact of this will continue to be enjoyed for many years to come."

In summary, the science subject leader at Purple School expresses how she and her school community have benefited from engagement with **SATC** and the **PSQM**. "Thanks to the superb mentoring both in school and especially of my hub leader, with whom I had many thought-provoking discussions. I now have a clear vision of how to progress both my own subject knowledge and how to develop the teaching of others in order to have the best outcomes for the pupils."

Pride

As a **PSQM** Hub Leader since 2012 the researcher has seen many **PSQM** submissions both from subject leaders she has mentored through the **PSQM** process, and from school submissions she has reviewed. What she finds remarkable about these four schools is the sense of pride that became apparent reading the evidence submitted. This came through more strongly than in many submissions from schools elsewhere.

"Staff children, parents, leaders are proud of what we offer at (Green School)"

"Pupils have a high regard for science and are proud of our Phizlab" (Blue school)

“Children felt a sense of pride in competing against other schools as well as working within their own teams in their own class.” The science fair, “gave the children immense pride in being able to showcase their scientific understanding.” (Red School)

I am, “proud of more parental involvement in learning – parents visiting KS1 classes, family learning sessions in class, suggested science activities in weekly newsletters, learning logs.” (Blue School)

Our school is particularly proud of the impact of being involved in Science Across the City and the opportunities it has provided in the development of staff knowledge in pedagogy and strategies to support learners such as **TAPS CPD**. (Blue School)

This sense of subject leaders’ pride in their own schools, and in the **SATC** project more generally indicates a sense of self-belief and esteem which exceeds a typical **PSQM** subject leader in the researcher’s experience and warrants further exploration.

Conclusions

There is substantial evidence of engagement with the development of science teaching and learning in each school, yet each science subject leader and school community’s experience of **SATC** has been unique. In addition to being engaged themselves, the science subject leaders have engaged the children, their colleagues, parents, senior leaders and governors. Outside of their school communities they have engaged with other local schools and industry. Their links with organisations providing training and support for primary science teaching and learning have provided information about best practice subsequently adopted in the schools. For example, there is evidence of improvements in pupils’ science enquiry skills, and teacher questioning, promoting high-quality discussions among pupils.

There is more limited evidence of empowerment and enablement, however the sources of data limited the information available and the extent of enablement and empowerment may be understated in this report.

Limitations of the research

As with any other research it is important to acknowledge the limitations. It should be remembered the data is self-reported by the science subject leaders as evidence to gain a **PSQM**. It was therefore written in such a way as to present the improvements in science teaching and learning in a positive light. There is secondary evidence in the form of photographs in the portfolio and logs of science events that have taken place, and this supports some of the claims made. The

Hub Leader was also closely involved in the **SATC** project and would be aware if any of the claims were untrue and would not have accepted inaccurate evidence. However, the researcher has not been able to independently verify the accuracy of claims made. Because of the nature of the evidence presented it has not been possible to identify any weaknesses in the process.

The Covid-19 pandemic resulted in an extended deadline to February 2021 for the schools that should have submitted their **PSQM** evidence at the end of June 2020. Therefore, the number of submissions it has been possible to examine has been reduced from the original fourteen to the four that submitted in spring 2020. There is no claim that these four schools provide a representative sample of all Stoke schools participating in the **SATC** project, however, the results so far indicate how this research might be developed in the future.

Further questions to be considered

1. The four schools completing the **PSQM** programme in the spring of 2020 have a disproportionately high number of PSQM Gilt schools compared to the wider population of PSQM schools. See table 1. When more schools complete **PSQM** in February 2021 it will be interesting to see if, once again, there are a disproportionately high number of Gilt schools and, if so, consider the reasons why.

PSQM Round 18 (Spring 2020) results at 29.7.20	National results actual	National results percentage	Stoke results actual	Stoke results percentage
PSQM	127	72%	1	25%
PSQM Gilt	43	24%	3	75%
PSQM Outreach	5	3%		
No award	1	1%		
Total	176	100%	4	100%

Table 1. Number of schools completing each type of quality mark in Stoke compared to national data for round 18.

2. Use of the **PSQM** data for this analysis provides many opportunities to identify engagement of members of the school communities and the impact of this engagement. Unfortunately, the limited focus on next steps provides less data on enablement and empowerment. With future rounds of the **PSQM**, other research instruments, such as teacher interviews or questionnaires for senior leaders, might be considered to gain more information about the extent to which the project has empowered and enabled science subject leaders.

3. Retention of teachers is currently an issue¹ and it would be interesting to consider the retention, within the teaching profession, of those science subject leaders who participated in the project. Based on the Green School's science subject leader's comments about his promotion, it would also be interesting to consider how **SATC** supports career progression.
4. The sense of pride, both in the project, in the schools, and in individuals involved in the project has been mentioned above, and a deeper exploration of whether this pervades the whole Stoke **SATC** community as well as other schools involved in **SATC** would be of interest. If so, it would be useful to identify what it is about the project that has created this sense of pride.

The focus of this report has been on the science subject leaders, but there is tentative evidence of other school staff and volunteers, for example, senior leaders and governors, becoming involved in the development of science teaching and learning. It would be interesting to explore the impact of the **SATC** project on wider science leadership.

¹ Teacher Recruitment and Retention Strategy Department for Education (2019)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/786856/DFE_Teacher_Retention_Strategy_Report.pdf

As Director of the Primary Science Quality Mark programme, I was delighted that PSQM was invited to play an instrumental role in the Science Across the City (SATC) project. I have had the privilege of receiving regular, lively updates on progress from project leaders and of meeting many of the subject leaders taking part in the PSQM programme. I have heard about the increased engagement of the school communities with science teaching and learning, witnessed at first hand the confidence and purpose of the enabled science leaders and am confident that whole schools now feel empowered to continue the developments and connections initiated by SATC.

This report's detailed analysis of the impact of SATC and the role of PSQM confirms my confidence. It is an inspirational read. Despite the unprecedented challenges that subject leaders faced as this project neared the end of the first stage, the enthusiasm and commitment they demonstrated was impressive and their enhanced leadership skills and capacity evident. I look forward to seeing these teachers receive their schools' well-deserved PSQM certificates and to celebrating with them at a PSQM award event as soon as this is possible.

SATC has empowered school communities across Stoke to improve science leadership, teaching and learning, the primary aim of PSQM, and for that the project leaders and PSQM hub leader should be congratulated, alongside the visionary head teachers and outstanding subject leaders.

The report both identifies the limitations of the data set and poses five further areas for investigation. As the Director of PSQM I am interested to extend this evaluation:

1. to research the impact of SATC and the role of PSQM on current and ensuing PSQM cohorts in Stoke using the thematic framework that has been used in this report, but focusing more on enable and empower;
2. to collect further data for analysis, to answer the questions posed about impact on teacher retention, subject leader pride and school leadership, and the role of the PSQM programme in these.

The success of the SATC project shows clearly that PSQM can support school improvement in science on a city-wide scale and I am proud to share this report widely with all PSQM stakeholders and other interested funders; and look forward to discussing with them both how this model can be extended, and further evaluated.



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Glossary

AfL	Assessment for learning, also known as formative assessment.
ASE	Association for Science Education – A registered charity supporting all those involved in science education.
CLEAPSS	Supports practical activities in science, D&T and art, including health and safety advice.
Core Documents	The PSQM requires subject leaders to upload a wide range of qualitative data in the form of specific core documents to the website for review. This includes the principles (see below), logs of CPD and activities undertaken by staff and children, the School Development Plan, written reflections covering 13 criteria statements and a portfolio in the form of a Power point presentation of about 20 slides containing examples of planning documents, children’s work, children engaging in various science related activities and other supporting information.
CPD	Continuous Professional Development or Continuing Professional Development
Enquiry types	The National Curriculum in England specifies five types of science enquiry that primary children should engage with. These are research using secondary sources; identifying, grouping and classifying; pattern seeking; observation over time; and comparative and fair testing.
NPQSL	National Professional Qualification in Senior Leadership
Ofsted	Office for Standards in Education – inspectors of services providing education and skills for learners of all ages
Ogden Trust	The Ogden Trust aims to increase the uptake of physics for all at post-16, particularly for those from under-represented groups. The Trust supports schools, projects and programmes that are committed to enhancing physics teaching and learning.
Primary Science Quality Mark	The Primary Science Quality Mark is a national, CPD supported, accreditation programme aimed at improving science leadership, teaching and learning and raising the profile of science in primary schools. It is based at the University of Hertfordshire where it is supported by partnership with the Primary Science Teaching Trust (PSTT).
Primary Science Capital Project (also known as the Primary Science Capital Teaching Approach)	The Primary Science Capital Project is a piece of applied action research, working in partnership with teachers to develop a science capital informed pedagogical approach for use in primary schools, from Reception to Year 6. This is a two-year project (2019-2021) funded by Primary Science Teaching Trust (PSTT) and Ogden Trust.
Principles	A set of statements to describe ‘good science teaching and learning’, devised collaboratively by teachers and sometimes other members of the school community. Usually presented as a single A4 sheet and often used as a standard against which to evaluate progress in improving science teaching and learning. This is one of the PSQM core documents uploaded for review.
Purple pen	Children at the Red School use a purple pen to write their scientific explanations.
Reach Out CPD	30 on-line courses for teachers of 5 to 11 year-olds, covering the primary curriculum. Each one provides teachers with concise topic knowledge and resources to use in class, including short videos, practical activities and experiments, and whiteboard visuals
Round 19	Numbering system used by the PSQM to denote when a school started and completed the PSQM. Schools in Round 19 started the PSQM in spring 2019 and were due to complete and submit their evidence by the end of March 2020.

	However, because of the Covid-19 pandemic this deadline was extended to the end of April 2020.
Round 20	Numbering system used by the PSQM to denote when a school started and completed the PSQM. Schools in Round 20 started the PSQM in autumn 2019 and were due to complete and submit their evidence by the end of June 2020. However, because of the Covid-19 pandemic this deadline was extended to February 2021.
SATC	Science Across the City
Science Capital	The concept of science capital is a way of encapsulating all the science-related knowledge, attitudes, experiences and social contacts that an individual may have. Those with higher science capital are most likely to choose to continue studying science.
STEM Learning	Provider of education and careers support in science, technology, engineering and mathematics (STEM). Working with schools, colleges and others working with young people across the UK. Supported by a partnership of Government, charitable trusts and employers. Aiming to raise young people's engagement and achievement in STEM subjects and careers.
TAPS	The Teacher Assessment in Primary Science (TAPS) project is a 3-year project based at Bath Spa University and funded by the Primary Science Teaching Trust (PSTT). It aims to develop support for a valid, reliable and manageable system of science assessment which will have a positive impact on children's learning.