

Primary Science

Special Issue:
Primary Science
Quality Mark (PSQM)
January 2019



 The Association
for Science Education

The ASE's journal for primary science



University of
Hertfordshire **UH**

special issue:
PSQM



making physics matter

PRIMARY PHYSICS PROFESSIONAL LEARNING (P3L)

Join us for a packed day of professional learning delivered by physics and primary science specialists. Ideal for science co-ordinators.



Magnetic mathematics

This practical problem-solving workshop demonstrates how maths skills can be developed through teaching the primary science topic of forces and magnets.



Physics focus – light and sound

This interactive lecture will cover the key concepts of light and sound required by the Key Stage 2 curriculum.



Electrifying English

This workshop focuses on how English skills in reading and writing can be developed and practised through practical electricity projects.



Creative cosmos

This hands-on session shows how space can be used as a context within the broader curriculum.



Our confirmed 2019 dates so far are:

Kingston Grammar School – 25 Feb 2019

Eton College – 14 March 2019

Forest School, London – 12 June 2019

Keele University – 20 June 2019

Durham University – 19 September 2019

Book NOW!

www.ogdentrust.com/p3l

Courses available for just £20.00 including free resource pack for each delegate
Costs subsidised by the venue and The Ogden Trust



www.ogdentrust.com to download our **FREE** physics teaching resources

ogden trust

#P3L2019

Contents

4. Introducing the PSQM special issue

Jane Turner introduces PSQM and this special issue, which explores the far-reaching benefits of taking part in the PSQM through the experiences of the teachers.

5. Profile, professional development and purpose... making science more meaningful

Elizabeth Nally shares her PSQM experience and what it has done for her and her school.

8. From 'uninspiring science' to PSQM Gilt

Shaun Wingrove describes the transformation from dull to shiny science that is at the centre of the curriculum.

11. From island challenges to confidently leading the way...

Claire Burchell explains how the PSQM enabled her to make the transition to a new curriculum with confidence and also support others in doing so.

15. Reaching out to enrich science

Paul Tyler and **Jo McGregor** highlight the journey that they and their school took to achieving PSQM Outreach – going from great STEM education to even better!

19. A different view... the hub leaders' perspectives

Two PSQM hub leaders, **Alex Farrer** and **Julia Miller**, describe working with groups of local science subject leaders to encourage, advise and support them to achieve PSQM for their schools.

22. What is in your science holdall...?

Clare Warren, PSQM senior hub leader, explains why PSQM included 'science capital' in the criteria for the new Primary Science Quality Marks in 2017, and describes how schools have responded.

Cover photo(s) With thanks to Ed Walsh, Will Ferguson, Ian Scott and Paul Thomas.

Primary Science

Special issue

Editor *Dr Leigh Hoath*

Focus on... this PSQM special issue

This is the third special issue of *Primary Science* and it is one that offers primary school teachers an insight into an initiative that does wonders for primary science leadership, learning and teaching.

ASE was part of the original partnership behind Primary Science Quality Mark (PSQM), sharing and enabling a vision – for the quality of science education to be consistently engaging, interesting and supported by excellent leadership and confident teaching. For me, I sit in a very privileged position of working with ASE, and also as a PSQM Hub Leader. As I read the contributions to this issue, I have been amazed to read about the progress that has been made within these schools. It is astounding what the structure of PSQM can do for raising the profile of, commitment to and quality of science in the primary classroom and wider school community.

Jane Turner, Director of PSQM, has been a Guest Editor of this *Primary Science* and I would like to thank her, the rest of the PSQM team and the contributors for their efforts with this issue. It makes for an inspirational read. The only question left to ask is: if you have not signed up for your own PSQM journey...why not?

Executive Editor and ASE editorial contact
Jane Hanrott

Design/page makeup Colin Barker



The Association
for Science Education

Introducing the PSQM special issue of *Primary Science*

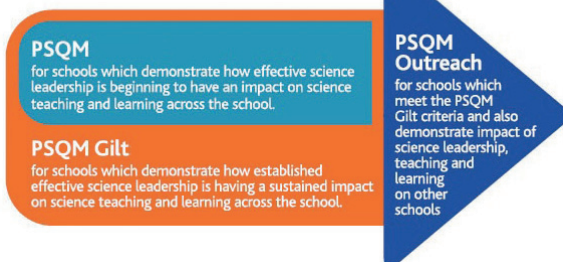
Jane Turner introduces PSQM and the contributors to this special issue, which explores the far-reaching benefits of taking part in PSQM through the experiences of the teachers



Meet the PSQM HQ team – Melissa Nice, Jane Turner, Norah O'Shea, Helen Sizer, Claire Harman (from left to right)

McGregor describe what happened when their schools embarked on the PSQM process and the impact that it has had on their schools and themselves. There are 13 criteria covering primary school science leadership, teaching, learning and enrichment, against which science subject leaders audit current practice and develop and implement a whole school improvement plan. Each

The PSQM Arrow



article by the subject leaders focuses on a selection of the 13 criteria, as well as exploring the impact of PSQM as a whole.

PSQM hub leaders play a crucial role in supporting subject leaders to achieve Primary Science Quality Marks through a year-long CPD programme. This includes 4 half-day face-to-face training sessions, which develop subject leaders' confidence and capacity to develop and operationalise an action plan that will transform science in their schools. There is a wide range of great online resources for subject leaders, plus PSQM provides links to all the major science education organisations and the support they offer. Throughout the year, the hub leaders mentor their subject leaders via the interactive e-portal, email and

face-to-face. Alex Farrer and Julia Miller describe what being a PSQM hub leader entails and the satisfaction that this role brings them.

At the end of the year, an evidence-based reflective PSQM submission, which analyses the impact of the actions on science teaching and learning across the whole school, is made by the subject leader. Clare Warren looks at what we have learned from 2018 submissions about how schools have met one of the 13 PSQM criteria, which focuses on developing children's science capital.

Schools achieve one of three Primary Science Quality Marks reflecting how embedded and extended the impact of effective science leadership is in the school and beyond.

Extensive feedback is given, ensuring that improvements to science teaching and learning are sustained through continued effective leadership. Head teacher Alison Richards from Hertingfordbury Cowper Primary School in Hertfordshire summed this up well when I spoke to her recently: 'As Headteacher I have seen the lasting impact of PSQM through both science teaching and learning in my school. The PSQM framework is embedded in our approach to science leadership, which ensures we continue

to be rigorous and evaluative. In particular, I am thrilled to see children who are able to articulate their science learning with a new depth of confidence and understanding, something noted by an inspector in our recent Ofsted inspection'.

We are sure that you will be inspired by these teachers' and hub leaders' stories. If you want your school to be part of the growing PSQM community of schools where there are confident science leaders and a real buzz for science, go to www.psqm.org.uk to register interest in your school achieving a Primary Science Quality Mark, or pick up the phone and give us a call on 01707 281034. We love talking about PSQM!

Associate Professor Jane Turner is the Director of PSQM and works in the School of Education at the University of Hertfordshire.
Email: j.turner@herts.ac.uk

Primary Science Quality Mark (PSQM) is a developmental accreditation programme enabling primary schools in the UK to improve science education through effective science leadership and school self-evaluation. It is supported by a collaboration of the University of Hertfordshire (where it is based) and the Primary Science Teaching Trust (PSTT). It began in 2009 and involved 12 schools, with the aim of raising the profile of science in primary schools by developing, sharing and celebrating good practice. Since then, over 3000 schools have achieved a Primary Science Quality Mark and there are now over 80 hub leaders delivering PSQM across all parts of the UK and beyond. PSQM training is focused on developing science subject leadership capacity, confidence and skills with the intention that all teachers and pupils benefit through raised standards.

So what is PSQM?

This special issue of *Primary Science* is designed to bring together a range of perspectives on PSQM. Subject leaders Elizabeth Nally, Shaun Winstone, Claire Burchell, Paul Tyler and Jo

SL1

Our Principles of teaching and learning are realised!

We are curious.



We are challenged.



We learn through questioning and explorations.



We use scientific vocabulary.



We experience a range of skills.



We enjoy enrichment events.



We can apply our learning.



We can learn outdoors about the real world.



Principles of science teaching and learning in action at William Westley

Profile, professional development and purpose... making science more meaningful

Elizabeth Nally shares her PSQM experience and what it has done for her and her school

'The profile of science has risen considerably since beginning PSQM. With a new confidence and a renewed passion, we have sought to inspire teachers, pupils and children.'

The outcomes that we have achieved through participation in the PSQM programme are scarcely imaginable compared to where we were 12 months ago. With a background as a chemistry research fellow for a number of years at various universities in the USA and England, I was confident that we provided good subject knowledge teaching in science and was pleased that we were drawing actively on many of the outside science organisations in the Cambridge area. In addition, we organised biennial science weeks comprising a balance of

in-house investigations and activities led by external science experts. Our last science week was a highlight of the school calendar, with over 15 businesses, groups and organisations, including Cambridge University, the Sanger Institute, MedImmune and TWI, taking part. The whole school community got involved in activities during the school day and at home.

Why PSQM?

However I knew that the nationally regarded position of science as the poor relation to English and maths was reflected to an extent at our school, with English and maths monitoring dominating staff meeting time. As a subject leader with a passionate interest in science, and with the complete support of the School Leadership Team (SLT), I proposed to raise the profile of our school's science teaching. Our main objectives were to implement a more robust assessment system and to improve our 'working scientifically' skills. Taking part in the PSQM, an 'award programme to evaluate, strengthen and celebrate science provision', was an obvious way to achieve these goals, and we joined our local PSQM hub in September 2017.

The PSQM programme

The programme provides year-long CPD for two members of staff. We took full advantage of this opportunity, as the Deputy Head and I both attended all the hub meetings. This was an excellent partnership, as sharing thoughts and actions always ensured that collaboration with the SLT was fulfilled. All the hub meetings were managed by our extremely competent hub leader, Charlotte Jackson. We quickly found the PSQM to be a comprehensive and invaluable auditing process for every aspect of the school's science provision.

Initially, we carried out pupil and staff questionnaires to determine their opinions of what makes science good. Using these responses, we established a set of science principles and a clear vision for the science in our school. The vision and principles make up a key component of our new whole-school science board and copies are also displayed in each classroom. As science leaders, and also for the rest of the staff, the clear vision and focus of the principles have brought confidence, cohesion and clarity to our understanding of teaching and learning throughout the school. The principles

are now referred to during lessons and underpin the development of science teaching and learning. As a result, the children are receiving more focused teaching with more opportunities for questioning and exploration. Work scrutiny has demonstrated a growing consistency in the approach and understanding about good science with increasing evidence of embedded principles. Governors and visitors to the school have also been interested to see the vision and principles as well as the current theme of the science display.

PSQM criterion T1:
There is engagement with professional development to improve science teaching and learning.

The PSQM has led me through a supportive pathway that has provided assurance and clarity in how to drive science forward in the school. Prior to the programme, the school was not a member of any science-based organisation and we rarely attended local science meetings. The school now has ASE membership and all the teachers are using resources from its website. In addition to the invaluable hub meetings, I attended numerous CPD courses, which were pivotal to the PSQM process being successful and to subsequently improving the science in the school. These courses included *Working Scientifically*, *Assessment and Progression*, *Connections between Literacy and Science*, *Working Scientifically through Photography* and a number of Local Network meetings. This was the part of the process that I enjoyed the most. Hub meetings and CPD allowed me to work alongside fellow subject leaders, sharing new ideas and good practice. I relished the challenge of imparting the information gleaned from the courses to colleagues, in order to offer them constructive advice and feedback, and to the children, to give them an exciting and engaging science curriculum.

Whole school pattern-seeking investigation

PSQM criterion SL2: There is a shared understanding of the importance and value of science.

Since beginning PSQM, I have led a number of whole-school science assemblies and they have become a feature of each school term. The first such assembly highlighted the science vision and principles, and introduced the staff and children to the unfamiliar concept of 'science capital'. Teachers have been encouraged to develop stronger links with parents who work in science. In addition, we have been more intent on sharing science-based competitions and challenges with appropriate year groups. We entered CLEAPSS' *No More Cabbage*, *The Great Bug Hunt 2018* and *The Laboratory of Molecular Biology* competitions. Subsequent assemblies were themed around upcoming whole-school investigations and activities. These included sinking and floating in a triphasic liquid, pH indicators and moon rocks.

The assemblies have become invaluable in introducing and preparing staff and pupils for whole-school investigations. They have generated excitement and interest from all stakeholders. As a result, there is a buzz about science from the playground to the staff room.

As part of the PSQM action plan, we initiated and led a very successful STEM club and covered chemistry, physics and biology topics. There was always great excitement on the day of the club as the pupils tried to anticipate what investigation was coming up. Our own passion for science was reignited as we shared the excitement

of the pupils, while developing their interest and knowledge in a more informal and fun environment.

PSQM criterion L1: There is a shared understanding of the purpose and process of science enquiry.

In addition to progressing 'working scientifically' skills in class, we have conducted a different enquiry-type, whole-school investigation each term. These investigations have then been moderated in staff meetings to ensure that there is progression in 'working scientifically' skills from Year R (age 5) to Year 6 (age 11).

PSQM criterion L2: There is a shared understanding of the purposes of science assessment and current best practice.

We devised and implemented an assessment tracking system incorporating all the curriculum objectives, for subject knowledge and 'working scientifically', for each year group. The hub leader made us aware of the PLAN (www.ase.org.uk/plan) exemplars of secure assessments for each year group on the ASE website. The assessment tracking system and the exemplars for assisting a secure assessment were disseminated to all staff during a staff training day. The combination of exemplars, regular whole-school 'working scientifically' investigations, routine investigations in class and a robust monitoring system has allowed all staff to demonstrate a much more positive and well-

T1, T2, L1, L2 Whole school investigations were only carried out during science week.

Whole school investigations are carried out termly. The front page of the lesson plans reminds teachers of enquiry types, key assessment points and question prompts.

Whole School Pattern Seeking Enquiry

Can larger hands pick up more beads?
We can see the progression in the presenting data criteria where Y1 have drawn a picture, Y3 have drawn a pictogram, Y4 have drawn a bar chart and Y6 have produced a computer generated scatter diagram.



Elizabeth and her colleague Lisa Pery receive the PSQM award from Dr Maggie Aderin Pocock at the 2018 London award event

and most importantly on the children. The science vision for the school has been achieved: children are engaged through scientific questioning and

informed attitude towards the purpose and process of scientific enquiry. Consequently, the teachers are able to provide an accurate picture of progress and attainment across the school. This of course has a direct impact on the pupils, who are more frequently achieving the learning objective first time, enabling learning to move on from knowledge and understanding, to using and analysing more quickly.

Impact of PSQM

PSQM has had a hugely positive impact on the whole school community

reasoning and their scientific skills are being developed through challenging learning and investigations. They are excited by science, with a heightened interest in class, and by wider science experiences in school and beyond, such as science fairs and exhibitions. Teachers have shared that they are more excited and confident about providing science opportunities to encourage the children's curiosity and to enable the children to understand the real-life value of science and scientists. Science displays and working walls are more engaging,

interactive and valued by children.

The most challenging aspect of the PSQM is quite simply time. A full-time teacher's life is already busy and PSQM makes it even busier! At the end of the process, writing the *Reflections on Impact* takes concentration, so make sure you are allocated time out of class, as I was by a fully supportive Headteacher. However, do not be discouraged in any way by the process: for us it has been overwhelmingly successful in raising the confidence of subject leaders and teachers, improving whole-school attitudes towards science and, most importantly, increasing interest, curiosity and enjoyment in children's science learning. I have no hesitation in recommending it as a initiative for improving the provision of primary school science, and providing a clear direction for the next steps.

.....
Dr. Elizabeth Nally is the Science Leader and Year 3 teacher at William Westley Primary School, Whittlesford, Cambs.

University of Hertfordshire UH School of Education

We have strong links to hundreds of organisations, including nursery, primary and secondary schools, giving you plenty of opportunities to gain practical experience and tackle professional challenges head on. As a result our graduates go on to successful careers and have a huge impact on the lives of thousands of learners.

We've achieved the top gold ranking in the Government's Teaching Excellence Framework (TEF) 2018 and our successful teacher training provision has been highlighted by the Department for Education in its review of the country's best performing providers of Initial Teacher Training (ITT).

Transforming lives through education.

Find out more about our undergraduate and postgraduate courses in education at www.herts.ac.uk/education

Shaun Wingrove describes the transformation from dull to shiny science that is at the centre of the curriculum



From 'uninspiring science' to PSQM Gilt

Shaun receiving his PSQM award

Taking on science leadership

'Inadequate' – a word that is guaranteed to silence any staff room. This was the situation in which we found ourselves at White Rock Primary School in July 2014. In the next year (my NQT year), Ofsted visited three times, each time seeing vast improvement. But the emphasis on raising maths and literacy standards meant that science was pushed to the back of the queue, with no plan and no one to drive it forward. The year finished with our school receiving a 'good' report. I was asked by the inspector 'What are your plans for the future?'. I told her that I would like to lead science. She smiled and said 'Good luck' and 'Make sure you read the report'. I already had: science at White Rock had been judged 'uninspiring'.

Although it didn't seem it at the time, I was in a fortunate position – starting to lead science with a clean slate. We had a dedicated and passionate staff who were willing to develop their science practice, but there was little guidance and a lack

of clarity about teaching science effectively.

PSQM provided the framework and support to improve standards in science across White Rock, as we had done for maths and literacy. As a new leader, it enabled me to systematically evaluate all aspects of our provision, and focus my activity. Most importantly, PSQM has a clever way of making you see where things need improving and how you might do this, without anyone explicitly telling you. My hub leader, Chris Banbury, guided me in a way that allowed me to identify needs and appropriate actions.

PSQM criterion SL4: There is a commitment to the professional development of subject leadership in science.

Investment in science leadership is vital. Many schools spend money on science resources, but my advice is to invest in people too. My Headteacher has supported my ambition for White Rock to achieve a PSQM and also provided opportunities for

me to attend further CPD. Equally importantly, she realised that, in order for real changes to be made, leadership needed allocated development time.

PSQM criterion SL5: There are monitoring processes to inform the development of science teaching and learning.

One of our initial challenges was tackling continuity in our science curriculum. We designed a curriculum map, which ensures curriculum coverage and a clear progression of science skills. As this has filtered through year groups, I am consistently seeing children with a greater understanding of their learning. It takes time, but the key message here is that every year group counts. All the building blocks need to be in place from an early age for a strong understanding of science to develop.

One of the biggest changes at White Rock is that science is now at the centre of the curriculum. PSQM has helped me to see that science is naturally engaging and, when science is used as a vehicle for teaching literacy,

An excerpt from the subject leader and CPD log from White Rock

| SL log and CPD Log | | | | | |
|--------------------|--|------------|--------------------------------------|--------------------|---|
| | Subject Leader action | Monitoring | Communication with SLT | Subject Leader CPD | Staff CPD |
| 5/01/18 | SL met with Teacher about setting up eco-committee. | | SL and Year 1 Teacher | | <ul style="list-style-type: none"> Eco-committee now in place in response to children's learning. Children are developing the idea of being responsible for the planet through Science learning. |
| January – Ongoing | Science Lead to Action Plan to develop science practise in the school. | | SL and HT | | <ul style="list-style-type: none"> Monitored what is already happening in relations to targets. Actions in place to develop areas of need. |
| 18/01/18 | Key stage 1 teachers to Pedagogy course | | SL and KS1 teachers. | | <ul style="list-style-type: none"> Teachers looked at the progression of the curriculum and identified how concepts taught in KS1 are essential to KS2 attainment. Teachers were motivated to ensure targets were met to raise attainment in Science. Teachers developed a greater subject knowledge of the Chemistry curriculum in order to develop teaching. |
| 12/02/18 | SL and HT meet to discuss plans for summer term. | | SL and HT | | <ul style="list-style-type: none"> Designed an engaging and exciting Science focused curriculum. Created opportunity for parents to be a part of children's Science learning. |
| 16/02/18 | Science learning walk | | SL and All teachers. | | <ul style="list-style-type: none"> Ensured principles of learning were evident of learning journey walls. Ensured that teachers were aware of the success criteria for a successful Science learning wall. Gave feedback and points for development to enhance learning. |
| 22/02/18 | Science Lead to Exeter consortium science hub | | SL and Exeter schools science leads. | | <ul style="list-style-type: none"> Good opportunity to network and meet a variety of different subject leaders. Learnt about project action as a tool for encouraging STEM skills in class. |
| 23/1/18 | SL met with members of Plymouth Aquarium to discuss visits. | | SL and National Marine Aquarium | | <ul style="list-style-type: none"> Organised an engaging trip for 150 children linked to learning on plastic. Identified areas to link to the Science curriculum and therefore trip was able to enrich Science learning. |
| 25/1/18 | Planned with Year 3 and 4 | | SL and middle years teachers. | | <ul style="list-style-type: none"> Planned session integrating project action into the curriculum. Children now taking part in engaging STEM activities which have a clear link to wider world. |
| 26/02/18 | Science Lead met with Head to discuss plans for a Science Club | | SL and HT | | <ul style="list-style-type: none"> Arranged KS1 and KS2 Science to increase wider opportunities for children in Science. |

maths and other curriculum subjects, the results are fantastic. Last year, we had a school-wide topic: 'Be Curious' . The whole idea was that children and teachers would learn about whatever fascinated them. The response was mind-blowing! It wasn't just the children either – each week, an adult would demonstrate an experiment in front of the school in assembly. As you can imagine, it became quite competitive!

PSQM criterion T3: There is a range of up-to-date, quality resources for teaching and learning science, which are used regularly and safely.

In the initial stages of leading science, I began by sorting the science equipment. There was a skipload of out-of-date and broken resources. My advice is to keep resources simple: the more you have, the harder something is to find. If it is not used regularly, do you need it? We went back to basics: a tidy, labelled area where teachers could easily see exactly what was available and how to use it constructively. In a busy curriculum, teachers are more likely to teach science when they can equip each lesson quickly and easily.

CLEAPSS
primary

EXCITING AND SAFE practical activities

Look out for our CLEAPSS Primary magazine **EXPLORE** in your school. With teaching ideas, safety advice and much more.

Our CLEAPSS Primary website is packed with practical activities & resources.



www.cleapss.org.uk



helpline 01895 251496



@CLEAPSS_Primary



The children experience some 'awe and wonder' in the playground

PSQM criterion SL1: There is a clear vision for the teaching and learning of science.

Throughout the PSQM process, I have found it essential to remember what inspires me to lead science. Science provides children with so much vital knowledge that it simply *must* be taught effectively and in an inspiring way. When you watch television and see marine biologists tackling the world's plastic problem, or amazing inventions that have changed lives, I feel determined that, one day, I will turn on the TV and see a White Rock pupil inventing a life-changing device or changing the world with their science passion. This is what motivates me. Just the other day, a child in my class told me that he would be the first person to land on Mars. Why not?

PSQM criterion WO2: There are appropriate links with families, other schools and communities and outside organisations to enrich science learning.

There have been countless trips: including to *We The Curious*, the Eden Project and the National Marine Aquarium. We have a wonderful initiative set up by our PE team to get children involved in the local environment and surroundings. We are very fortunate to have Dartmoor, the

beach and woodlands close by. As our PSQM journey progressed, Science Club became inundated. My one club in Key Stage 2 (ages 7-11) became two clubs with a waiting list as long as the club's register. It began with 20 children and soon became nearly 80 – I could have filled the club twice over!

PSQM criterion T2: There is a range of effective strategies for teaching and learning science, which challenge and support the learning needs of all children.

It's not just what you do outside the classroom that is important – it's about inspiring the children in each lesson. When promoting a school ethos of inspiring and engaging science, it's so important to practise what you preach. Staff meetings should be exactly that. Get the teachers doing engaging science activities and teach the pedagogical concepts through these activities. No teacher wants to sit through an hour of PowerPoints and preaching at 5 o'clock in the evening! I attend termly network meetings with fellow science leaders. Everything is practical and hands-on and I leave the meetings full of ideas and inspiration. I always try to pass this on when doing CPD at school because, when a teacher is passionate about science, the children are passionate too.

Science is a challenging subject

to teach, because enquiry requires teachers to relinquish control and hand it over to the children. The teacher is a guide. This is such a hard concept and one that takes years of practice. Not only this but, unlike any other subject, each lesson should contain two curriculum targets: science skills and knowledge. It's a challenge, but one that the staff at White Rock have risen to. I really couldn't thank them enough for all their efforts to achieve PSQM Gilt. They are a creative, passionate and hardworking team, share a vision for science – and the results speak for themselves.

PSQM criterion SL2: There is a shared understanding of the importance and value of science.

In order to engage parents in science, we ended last year with our own school-wide science museum. 800 parents and carers descended on the school and the children engaged them in science activities. The school was buzzing and all the teachers threw themselves into it. PSQM has made our whole school community see that science is as important as the other core subjects.

Another big change around school is the visibility of science. We have made sure that science is everywhere: it fills the corridors, library and hall. The change is remarkable and inspiring.

PSQM criterion SL3: There are appropriate and active goals for developing science.

PSQM has helped me to see 'what's next?' I now know the changes I would like to implement and what needs to happen next. This is the PSQM way. Never stop. Always look to the future.

And finally...

I can't recommend PSQM enough – it's just fantastic. It has a way of producing results in such a supportive and constructive way. You never feel judged or scrutinised – it's just helpful. I have met amazing and inspiring people and it has opened up pathways I never knew existed. It's enabled the transformation of science at my school.

Shaun Wingrove is a Year 2 teacher and science leader at White Rock Primary School in Paignton, Devon.

From island challenges to confidently leading the way...



Claire receiving the PSQM silver award from Richard Conder, representing Education for the Bailiwick

Claire Burchell explains how the PSQM enabled her to make the transition to a new curriculum with confidence and also to support others in doing so

Working at a primary school of 250 pupils in Guernsey, Channel Islands, presents challenges in terms of fresh ideas for CPD and resources to support curriculum development. When I became science leader, I began attending subject leader network meetings held on the island by SEERIH (www.fascinate.manchester.ac.uk). Although I had led subjects previously, I was unsure how to proceed with science. The network meetings gave me innovative ways to deliver science teaching and learning, which I was eager to implement in school, but I wanted to use them purposefully to engage the pupils and staff in a way that enthused them to develop the profile of science in school.

Working towards the Primary Science Quality Mark (PSQM) gave us that purpose. Through the tasks at the hub session, gap tasks and completing the initial self-assessment collaboratively with colleagues, parents and pupils, I

was able to make judgements about our strengths and identify areas for improvement. PSQM then supported us step-by-step to implement and evaluate these changes.

PSQM criterion SL4: There is a commitment to the professional development of subject leadership in science.

PSQM led me to realise that there was a vast difference between being 'the science co-ordinator' and becoming a 'leader of science'. I didn't just want to be responsible for sorting out the science cupboard and ordering resources. I wanted to make a lasting difference to the way that pupils learned science. To do this I needed to change our provision for learning, and teachers' feelings towards it. PSQM was the perfect tool with which to do this. Understanding that the award focuses on development, and not levels of achievement,

was a crucial realisation. It was refreshing changing focus from constantly levelling ourselves and children's attainment to focusing on developing teaching, learning and engagement.

It was important to work with the whole school to create an action plan and core principles. We identified priorities and simple wins to create lasting change to the teaching and learning of science. We found ways to develop science whilst working within the constraints that all schools face: a limited supply of funds, time and energy. PSQM gave an impetus to secure resources that, in the current education system, are harder to come by than a glue stick at the end of term! The PSQM contract requires support from the Senior Leaders, which means that there is a commitment to make changes. Staff meetings were allocated for CPD, action planning and reviews. School funds



Teachers creating principles for good science teaching and learning at Notre Dame

learning, I decided to try a whole-school Fish Week. We focused on child-led learning and cross-age-group activities, culminating in a whole-school celebration of learning.

The children arrived at school to discover fish and crustaceans in the outdoor learning areas. They could explore them, dissect them or simply observe from at a distance. They suggested investigations upon which they worked for two days, and then presented to class-sized groups. This engaged the children and

also Learning Support Assistants who actively led the activities, as they were so enthused by the topic.

PSQM criterion WO2: There are appropriate links with families, other schools, communities and outside organisations to enrich science learning.

Parental involvement in science increased astronomically during PSQM, as parents, pupils, PTFA and

were more readily available, time was allocated for monitoring science and the whole school community, including parents and outside agencies, became involved in activities.

PSQM criterion T4: There is a range of effective strategies for teaching and learning science.

From September 2017, the Bailiwick (government) of Guernsey implemented a new curriculum based on joyous and purposeful learning, which aims to develop skills and elements of learning rather than being content-driven. Although this may seem a dream curriculum, stepping away from assessment-focused learning was daunting. Using strategies learned from PSQM hub sessions, I felt confident that I could use science skills to support my colleagues through this period of uncertainty. This had a two-fold impact. Not only was I able to use PSQM to invest time and resources in developing science teaching and learning opportunities, but also the activities and resources gave staff ideas that they transferred across the curriculum. This increased their confidence and also supported them through the transition between curricula, which generated further commitment to trying my new ideas. Win-win for everyone!

Introducing new learning opportunities

PSQM provided the opportunities to try out many learning opportunities that we most probably wouldn't have had the courage or support to try without undertaking it. During a network session, we were introduced to the idea of using fish to engage learning by Toby Tyler and Lynne Bianchi from SEERIH. As the pupils and staff had requested more whole-school activities and more hands-on



Fish week at Notre Dame

staff worked together to transform unused spaces into Outdoor Learning Areas. Without a doubt, these developments have been one of the most important and enjoyable outcomes from PSQM, as it brought everyone together with a common purpose and enhanced our school facilities.

There is a range of socio-economic statuses and home languages within the school. Parents suggested creating voluntary, non-curriculum-based home-learning opportunities and so we created an annual science fair and termly STEM home-learning challenges, which were accessible for all ages and languages.



The jelly bean challenge

Children purchased resources from school for 50p and went home with basic instructions. Through providing the core resources, we removed the barrier to participation from home. It was encouraging to see parents becoming involved and using their knowledge and interests to work with the children. We celebrated children's participation in science displays around the school, whole-school assemblies and via the school's social media platforms.

Our first challenge to make a scribble bot was a huge success, with more than 130 children participating. This success continued with the jelly bean structure and science selfie challenges; over half of the school participated in both.

The children's newfound enthusiasm for science investigation was demonstrated through activities such as joining in the CLEAPSS (<http://primary.cleapss.org.uk/>)

marble run challenge to disprove a hypothesis that we could not build a marble run to transport a ball from our school into the harbour a mile way! We did it – and made the local TV news, which sent the buzz for science through the roof!

Accessing innovative training, resources and support on a small island is not easy, so links created through PSQM have provided previously unheard-of learning opportunities for Guernsey children. PSQM gave us the impetus to develop these links and integrate them into our provision within the new curriculum.

One of our most spectacular free resources was a 3-day visit from NASA Moon Rock. We facilitated Moon Rock viewing events for pupils, parents, other schools and even the Education Service themselves. Simply holding a piece of history triggered different emotions and questions in everyone who experienced it. This cemented our science vision for hands-on, discussion-based learning and discovery, rather than simply transferring knowledge.

Working with other science subject leaders

PSQM enabled me to forge relationships with other hub schools and the hub leaders. Discussions with them provided me with thinking time and expert guidance on how to structure monitoring activities, developmental processes and the actual award application itself. The training and support given by my PSQM hub leaders, Bryony Turford and Lynne Bianchi, was second to none. Attending sessions with clear objectives and gap tasks to complete focused my thoughts on the award's criteria and enabled me to target areas needing development. They also offered me the opportunity to consider how other schools approached PSQM and gave me time to magpie ideas and tweak them to fit my school.

Creating a buzz

Reflection on our PSQM journey highlights mixed emotions. It was hard work, but then nothing lasting and worthwhile ever falls into your lap! It involved commitment from everyone in school, but this buy-in is what created the energy to drive the science learning forwards. Most of all, I remember that Notre Dame was buzzing with science! As a result, science is still high in everyone's minds

rather than being slotted into the timetable as an add-on.

The energy generated by PSQM has undoubtedly changed the school. By raising the profile of science and changing how we create learning opportunities, we have begun to alter people's perception of learning across the curriculum. Science skills are being transferred to other subjects. Children who previously were 'labelled' as lower achievers in science are now demonstrating good levels of understanding and skills: we just weren't enabling them to do this before. Science is supporting children to develop their confidence in themselves as learners. It provides opportunities for parents to engage with learning and the school in new ways, thereby strengthening home-school links, which can only be a good thing!

Being a leader

PSQM has challenged and changed me as a leader – in a good way! The PSQM gap tasks helped me to gain clarity on what needed to be done, what I wanted to achieve and how to get there. I developed my skills to become more efficient and effective in leading my school to make long-lasting changes. PSQM has opened doors to achieve things that I have dreamt of doing, but was unsure how to get there. I led my school to achieve PSQM through expert mentoring from my hub leaders and Headteacher. I was able to use my newly developed skills to pass my NPQML Middle Leaders' qualification and now I am writing this article. [Editor's comment: *Claire is too modest to add here that she was recently awarded Guernsey Teacher of the Year!*]

Completing PSQM doesn't mean that we have finished improving teaching and learning in science; we've just been given a well-earned boost by achieving the award. We will continue with the improvements and use the feedback from undertaking PSQM to identify new targets, so that science at Notre Dame will continue to evolve.

Claire Burchell is the science leader and reception teacher at Notre Dame du Rosaire Catholic Primary School, St Peter Port, Guernsey.



Support | Consultancy | Teaching resources | Training

Herts for Learning's primary science consultancy and packages of support focus on building the capacity of science subject leaders. They are designed to meet specific needs, recent examples have included:

- developing working scientifically skills
- implementing child-led enquiry
- embedding effective science assessment
- designing an engaging science curriculum
- subject leader support and coaching



Herts for Learning primary science resources:

Developing young scientists - Part 1

An invaluable resource that provides primary teachers with practical advice, examples and activities that encourage children to ask questions and make decisions in enquiry.

Developing young scientists - Part 2, available from January 2019

Building on the ideas in Part 1, this resource supports teachers in developing conclusions, evaluations and writing in science.

The Herts for Learning Primary science package

A comprehensive suite of resources that includes a range of assessment tasks, tracking documents and a breakdown of knowledge required for each topic to support teachers to plan for progression and assessment.

Purchase online at: hertsforlearning.co.uk/shop

Please visit hertsforlearning.co.uk/booking to find out more about our complete range of CPD and training opportunities or contact the science team at science@hertsforlearning.co.uk or 01438 845111 for more information about our range of primary science consultancy and support packages.

Reaching out to enrich science

Paul Tyler and Jo McGregor highlight the journey that they and their school took to achieving PSQM Outreach – going from great STEM education to even better!



Paul and Jo with their PSQM Outreach certificate

'We are incredibly proud to have achieved the PSQM Outreach Award, and the recognition for the school will help to keep science, and STEM, high on the agenda for the future.'

Why PSQM?

Mearns Primary School has had a long-term commitment to excellence in science education, but a change of leadership in 2017 gave us the impetus to apply for a PSQM. Within weeks of arriving at the school, our new Headteacher had put PSQM on the School Improvement Plan and we had a working group of six teachers in place to manage the project.

Since 2012, when two teachers were trained as Science Champions with the Scottish Schools Education Resource Centre (SSERC) (www.sserc.org.uk), there had been a great deal of resource and time put into developing science provision in the school. New planners were written and implemented, resources had been purchased and organised, and training had been planned and delivered to teachers in key areas of the science curriculum.

Getting started

After a very positive meeting with our hub leader, Susan Burr, and completing the initial self-assessment process, we decided that effective

leadership in science in the school was already well established enough for us to challenge ourselves and go for the Outreach award. We are a school that shares our work and the aims of the Outreach award fitted closely with our ethos. It was clear that the three schools in our cluster, along with Cromarty Primary School, were going to work closely together, which turned out to be important as we all prepared to set out into new territory.

PSQM criterion SL1: There is a clear vision for the teaching and learning of science.

The action planning process was an excellent way of digging deep into our strengths and weaknesses and involved us consulting with all staff, pupils and parents. The resulting documents revealed exactly where we were on our STEM journey and our next steps to take the school forward. The main areas of focus were developing science capital and engaging with parents and

In Science at Mearns...

We do things that are strange and exciting.

We use science in maths, and other subjects.

We use technology to discover.

We work in groups and listen to others ideas.

We learn about scientists and what they do.

We want to learn more about our science topics.


Our minds are opened and we are inspired.

We get to learn about science outdoors and on trips.

We find out about the world around us.

You're doing it, not listening.

We do stuff and want to do it again.



We develop creative, independently thinking scientists with the motivation, knowledge and skills to succeed in a changing world.

Lessons are fully planned and researched, giving confidence in delivery.

Children are inquisitive and encouraged to ask questions (even if teachers don't know the answers).

Children can connect their existing knowledge with what they are learning and real life contexts.

Children are engaged, motivated and enthusiastic about their science learning.

Children apply their science knowledge to other areas of the curriculum.

Children are confident using a variety of science enquiry types to plan and carry out investigations.

We make full use of all our resources, indoors and outdoors. We use technology to enhance science

The Mearns' principles of good science

organisations to support our STEM programme.

Informed by the consultations, we drew up a set of principles for good science and a mission statement for the school. To ensure that this wasn't simply a 'poster' exercise, the principles were shared with pupils and staff by a group of pupils visiting every class, and with parents through the school website and Twitter. A copy is now displayed prominently in every classroom.

PSQM criterion L3: There is a commitment to developing all children's science capital.

We had started thinking about how we could adopt a science capital teaching approach before we signed up for PSQM and it became a key outcome of the process. We provided training and resources for staff to use in class adapted from the Science Capital Teaching

Approach¹, and produced a primary teacher-friendly handbook. We created a STEM careers resource, developed a new planning format and focused on planning a wide variety of opportunities and experiences for pupils and their families that would grow their science capital.

Sharing science at Mearns though #MPSSTEM



The STEM Showcase: a community celebration of all the amazing STEM work that pupils had done throughout the year.

Mearns Primary School

STEM Showcase

Wednesday 21st March

6pm – 7:30pm

Discovery Zone
Be stunned by science with...
Glasgow Warriors
VR Headsets
Glasgow Science Centre
Frog Life
Think Science

Showcase Zone
Come and see our pupils amazing STEM work from the last year.

No need to book – just turn up!

Exploration Zone
Get involved with some real science – led by our Primary 7 Lab Technicians.
Try coding with our Primary 5 experts.
Learn to be Plastic Clever with our Eco Reps.

STEM Careers Zone
Drop in and be inspired by Doctors, Engineers and Scientists talking about their STEM Careers.

glasgow science centre | think Science | Science ENGINEERING Technology MATHS | GLASGOW WARRIORS | froglife

PSQM criterion WO2:
There are appropriate links with families, other schools, communities and outside organisations to enrich science learning.

Parental engagement:

Before our initial parental survey, we were confident that parents would feel well informed about pupils’ learning in science, as it has been highlighted as a school strength for several years. The results showed otherwise and demonstrated that we needed to do more to engage parents in our science programme and inform them about what pupils were learning.

We updated the school website, adding an overview of our curriculum, the Science Principles and our monthly Topical Science Updates, as well as regular updates of science happenings in the school. We also launched #MPSSTEM and began tweeting about STEM learning daily. At parents’ evening, the pupil Lab Technicians gathered details of over 50 parents with an interest or career in STEM who said that they would be willing to come in to school to support us in delivering an exciting and engaging STEM programme. The impact of parent STEM visitors was significant throughout the

year: during Scottish Maths Week, a firefighter visited Primary 6 demonstrating how he uses maths every day; another parent, a STEM Ambassador, spoke to Primary 2 about renewable energy and then pupils collaborated to make wind turbines; parents who are civil and laser engineers, vets, doctors and dentists all visited the school to talk about their careers.

Building partnerships

The highlight of our annual STEM calendar was our STEM Fortnight, organised in March to coincide with British Science Week. The programme, which included at least ten workshops for each class and the nursery, was supported by the partnerships that we have built up with parents, businesses and STEM organisations.

Dr. Heather Reid OBE came along to our opening ceremony to share her STEM career story and talk about the importance of maths in meteorology. This was followed by a succession of STEM visitors throughout the school who gave their time freely to come and inspire our pupils.

Nursery pupils spent time with Country Park Rangers finding out how litter endangers animals on land and in the sea. Primary 3 pupils worked with Scottish Power to learn about climate change and rising sea levels. Primary 4 built and tested

flood defences with Scottish Water’s flood prevention model. Primary 4 and Primary 5 pupils interviewed several engineers as part of the Scottish Engineering Leaders Award and then designed solutions to underwater pollution.

Edinburgh Royal Observatory ran an Exoplanets workshop with Primary 7 and lent us a set of meteorites for the fortnight. Think Science visited the school with their mobile planetarium and there were workshops from the SSPCA, Glasgow Science Centre, Computer Xplorers, Royal Society of Biology and many parents with STEM backgrounds.

To end the fortnight, pupils organised a community STEM Showcase evening, which was attended by over 400 visitors. Families were invited to see work from every class.

In our Discovery Zone, pupils led workshops in coding, a Virtual Reality experience, and Glasgow Science Centre organised activities to show the workings of the human body. The sport science team from Glasgow Warriors demonstrated how sports science impacts their player’s performance.

In the Exploration Zone, our pupil Lab Technicians involved parents and families in hands-on science, pupils choosing their favourite science

investigations to demonstrate. Both parents and children were fully engaged exploring magnets, chemical reactions and even dissecting owl pellets.

Fifteen business and STEM partners were represented in the STEM Careers Zone, where they showcased their work and promoted the importance of STEM careers with pupils.

We have found that the science community has a huge willingness to work with schools and endless enthusiasm to talk about their work and inspire young people. The majority of our visitors are already signed up again for next year.

Opportunities for children

We looked at ways of growing science capital through increasing leadership opportunities for pupils. Primary 7 pupils applied for and were interviewed for the role of Lab Technicians. They organised the science room and delivered resources to classes, helped to set up lessons and supported teachers in class. At Parents' Evening, they showcased a selection of science investigations and talked to parents about things that they had been learning in school. They designed workshops about meteorites² and lunar rock samples³ and delivered them to every class in the school.

They provided training to teachers at a cluster event, sharing technologies they had used in class such as data loggers, microscopes and a range of measuring and recording apps. Some attended the Scottish Learning Festival to showcase their learning and one of our Lab Technicians delivered part of the keynote speech at the event talking about the importance of primary science in her STEM journey.

Giving pupils opportunities to lead learning is a practice that is embedded into the ethos of our school. For example, our Primary 4 to Primary 7 Eco Reps designed a Plastic Clever workshop, which they delivered to every class in the school and the nursery. They also visited our local shopping centre to talk to shoppers about ways that they could reduce their single-use plastic consumption.

One of our most successful projects was the Scottish Engineering Leaders Award, which involved engineers from a number of different companies visiting Primary 4 and 5 classes to be interviewed and help design projects. Two hundred pupils across Primary 4 and 5 went on to gain their Scottish Engineering Leaders Award this year.

Top tips for engaging parents and partners

- Start with your school community.
- Survey parents and staff to ask about any contacts they might have.
- Contact organisations and businesses directly to see what they can offer.
- Many national companies will have education outreach programmes.
- Contact your local STEM Ambassador hub – they're usually outstanding.
- Have a clear idea about what you're looking for.
- Be flexible about timings – often they're trying to run businesses.
- Contact high schools, colleges and universities – they are often happy to help.
- Use Twitter to connect with STEM businesses in the area.
- Think about what you can offer them: publicity, experience, training.
- Always let visitors know how much they're appreciated and the impact their visit will have on pupils.
- If you do follow up work after a visit then share it with them – they love it.

We run a wide range of STEM-based extracurricular clubs, including our multi-award winning Primary 7 Science Club, coding club and Computer Xplorers. These give pupils the opportunity to expand their knowledge and skills in areas in which they have a particular interest.

Pupils were also involved in the Great Science Share (www.greatscienceshare.org/) and the Young Engineers and Science Clubs Celebration of STEM, sharing their science work with schools from across Scotland.

Impact of PSQM

Completing the PSQM Outreach will have a lasting impact in our school. Staff have reinvigorated teaching science and have a better understanding of how to plan and deliver science capital-rich experiences for pupils. Our parents are more aware of the STEM work that goes on in the school and are actively seeking ways to get involved in our programmes of work. The pupils are getting a richer experience, which is giving them insights into the working world of STEM careers and a wider variety of hands-on experiences.

We have increased our outreach work, sharing our STEM experiences and resources with schools across the

UK. Members of staff have spoken at conferences, written articles and developed and shared resources to ensure that the best bits of our STEM programmes can be used by other schools.

It wasn't really until we sat down to put together our portfolio and write our reflections that we appreciated how much of an impact the PSQM had had on our school. It had been the driver for much of our work, many of the new initiatives we had tried and a huge motivation for staff. It led, directly, to Mearns Primary being shortlisted for the STEM category of the Education Scotland Awards and increased our profile in the world of primary science.

¹ Godec, S., King, H. & Archer, L. (2017) *The Science Capital Teaching Approach: engaging students with science, promoting social justice*. London: University College London.

² Meteorites borrowed from Edinburgh Royal Observatory <http://www.roe.ac.uk/>

³ Lunar rock samples borrowed from from the Science and Technologies Facilities Council <https://stfc.ukri.org/>

Paul Tyler and Jo McGregor are the STEM subject leaders at Mearns Primary School and Nursery, East Renfrewshire.



Julia's R14 hub members receiving their Primary Science Quality Marks at the 2018 PSQM London award event



Alex's R15 hub members receiving their Primary Science Quality Marks at the 2018 PSQM London award event

A different view... the hub leaders' perspectives

Hub leaders are the heart and expertise of PSQM, working with groups of local science subject leaders to encourage, advise and support them to achieve Primary Science

Quality Marks for their schools. Two PSQM hub leaders, **Alex Farrer** and **Julia Miller**, describe working with these groups to help them on their PSQM journey

Julia Miller, PSQM hub leader for South East London schools, describes her experience of supporting 145 schools to achieve Primary Science Quality Marks

Why PSQM?

In my view, PSQM is an imaginative programme that helps teachers to help themselves to become better teachers and more effective leaders. I discovered PSQM at the 2011 ASE Annual Conference in my previous role as a local authority science adviser. Whilst explaining the new scheme at a borough primary science meeting, I was inspired by the positive reaction of two young teachers. Suddenly I could see the potential of the award framework despite the hard work involved. The two teachers were hungry to find out ways in which they could help their schools to celebrate learning through science and, like so many primary teachers, were not daunted by the work involved.

Being a hub leader

Being a hub leader is a fantastic opportunity to learn new ideas and to have the privilege of seeing enthusiastic subject leaders make a real difference in their schools. My first hub in 2011 was with three schools in PSQM's third round and I have just met my 145th subject leader in cohort 17 in 2018! As a hub leader, the support I receive from the PSQM HQ team makes my job easy – regular conferences, constantly evaluated and updated resources, phonecall and email support and brilliant admin all make the job enjoyable. There is a real team spirit, which I am sure helps to promote continuous improvement.

The impact on teachers and schools

The PSQM award ceremonies are always held at prestigious venues with high profile speakers and so the impact of the changes in teaching and learning in science in each school is put into a wider national and international context – for example, the importance to our nation of developing science capital that depends on every teacher doing their bit to encourage children to think that 'science is for them'. It also results in exciting teaching and learning

ideas being shared in the process. The impact that my teachers have described in their final submissions is heart-warming.

The best bits!

It is a privilege as a hub leader to observe at close range the commitment, hard work and the innate desire of teachers to reach for excellence – both as teachers and leaders. I find the opportunity to read teachers' reflections and to listen to discussions at our meetings really encouraging – I am learning all the time and can quickly pass on ideas to others. I enjoy seeing the confidence of subject leaders developing in just a few months and hearing too that their Headteachers recognise the difference that they are making. I have also enjoyed organising additional science-specific CPD funded by Royal Society of Chemistry grants, allowing more time for the teachers to focus on current best practices in science education, e.g. assessment and 'working scientifically'.

The challenges

There are many challenges at all levels, but locally, in my area of London, there are still many schools that have not yet engaged with PSQM. Subject leaders already working towards an award often

find that there is insufficient time with all their other classroom responsibilities and they need access to more science-specific CPD and network opportunities. Many creative teachers are already engaged in using social media such as Facebook and Twitter to build new exciting networks through which to share ideas.

The impact on me

One subject leader said to me recently at the awards evening that *'we never have anything like this in our job'*. She was so proud of her achievement and so she should have been, with her Gold award for making a real difference not only in her school but in other schools as well. I felt proud too, although I had merely given feedback and checked the procedural aspects. I recommend PSQM because of its impact at all levels, from the senior leadership team, to the staff, pupils, parents and governors. I feel excited that, with PSQM, more children will understand more, ask more questions and keep us adults on our toes. The most enduring and rewarding aspect of the PSQM is that the real beneficiaries of the exercise continue to be the children.

Alex Farrer, PSQM hub leader for Kingston and Richmond schools, describes her experience of supporting 44 schools (10 of them twice!) to achieve Primary Science Quality Marks

Becoming a PSQM hub leader

I became a hub leader in 2013 when I was the science adviser for Kingston and Richmond schools, working with about 120 primary and secondary schools. I had been a chemistry teacher and Head of Science, so I needed to learn about primary science! I had read about the PSQM and thought it would support leadership in local primary schools and give me insight into excellence in primary science on a more national scale. But I wasn't sure what I had let myself in for!

Personal development

Following hub leader training I was asked to review the submissions from two schools. As soon as I started to look through these, I knew that I would be learning a great deal myself. I began to list all the great ideas I noticed.

Since my first hub of nine schools in 2013, I have had the opportunity to be the hub leader for 44 schools. Ten of those schools found PSQM so valuable that they



Julia meeting teachers from Irabia School in Pamplona at the 2018 London award event. Irabia joined the Barking hub in 2017, and is the first Spanish school to achieve PSQM, Julia is going to work with the subject leader to develop a larger Spanish hub.

have re-accredited their awards! I have also reviewed the submissions from over 40 schools, giving me tremendous insight into primary science in different settings. My ideas list has grown: national initiatives to be part of, resources to borrow, ways to carry out learning walks, use outdoor space and involve families in learning outside the classroom, plus fabulous resources for enquiry.

The development of the science leaders in my hubs has also been evident, firstly in the number of promotions those teachers received after their PSQM year! The leadership skills learned and the reflective nature of the process enabled them all to develop both the science in their schools, and personally. Everyone said that it was hard work, but such a worthwhile personal development and learning opportunity.

Providing opportunities

Through meeting fellow hub leaders, science leaders, or colleagues from organisations that are friends of PSQM, many doors have been opened. Speaking at the International Primary Science Teaching Trust (PSTT) Conference in Belfast in 2015 with one of my teachers, as well as attending and speaking at ASE Annual Conferences, again alongside members of my hub, were highlights. It is fantastic to be part of PSTT trial groups, an Ogden Trust Partnership, and to work with the Royal Society of Chemistry, all because of the people who I met via PSQM. The annual local science conference that I organised was also enriched by PSQM contacts who often went on to become both friends and future collaborators.

The opportunities for the subject leaders in my hubs have been vast. Through our collective contacts we have been able to work with the Kingston University outreach team, the National Physical Laboratory, St Mary's University, the IET, Thames Water, Holly Lodge, local secondary schools and countless others. Most of the

hub members have kept in touch after achieving the award. We get together for CPD events and new ventures, and to share ideas.

Rewards

Although there is a financial recompense for being a PSQM hub leader, the rewards have been so much more. The role has its challenges, but meeting these is satisfying. Each hub has consisted of a diverse group of teachers, all with different reasons for embarking on PSQM. There have been challenges in making the most of the meetings, online mentoring and encouraging some teachers to be much more reflective, plus simply working with people who are incredibly busy! The PSQM annual awards ceremony is such a wonderful celebration of each teacher's hard work, and I love to attend and congratulate them all.

I am now working with the Girls Day Schools Trust to champion STEAM. Being a PSQM hub leader is an essential part of my role: essential for me so that I continue to develop personally and am involved in exciting primary science initiatives; and essential for the schools with which I work to be part of a growing group of PSQM schools in the area, so they can establish links and all their pupils can have access to fantastic science teaching and learning. Again and again I am reminded that PSQM is an essential part of the work that I do to establish primary science excellence in our local area. Thank you PSQM – I love being a hub leader!



Julia Miller is a PSQM hub leader and ITT tutor.

Alex Farrer is PSQM hub leader and Head of STEAM at Wimbledon High School.

@STEAM_WHS





Spark your pupils' curiosity and develop their thinking skills. Explorify is a free digital resource of activities to help strengthen science teaching in primary schools.

- Explorify is inclusive and accessible to all your pupils
- It's a great way to aid assessment – as it can evidence progress in science
- Completely free – provided by Wellcome, a health research foundation
- It's easy to implement into your schedule, as it doesn't require expensive equipment or preparation.

Sign up at explorify.wellcome.ac.uk

What is in your science holdall...?

Clare Warren, PSQM senior hub leader, explains why PSQM included 'science capital' in the criteria for the new Primary Science Quality Marks in 2017, and describes how schools have responded



Clare introducing the new science capital criterion to PSQM hub leaders at the 2017 conference

Over the last year, schools participating in the PSQM have, for the first time, been learning about and promoting growth in science capital within their school communities.

A 2018 survey demonstrated that the shortage of workers in science, technology, engineering and mathematics (STEM) professions costs UK businesses an estimated £1.5 billion each year. The cause is insufficient young people studying STEM subjects. It is not just for economic reasons that it is important to address the shortage of STEM employees. The potential of science as a route to increase social mobility and STEM literacy, so that all citizens have a say in our increasingly technological world, indicates that science engagement is of benefit for individuals as well as the economy. For reasons of social justice we need to improve STEM participation with certain groups, including women, working class members of society and some ethnic groups¹.

The ASPIRES² project considered why these groups might be under-represented and why the STEM employment gap still exists, despite substantial funding to improve participation in STEM education and employment. They found that, while

the vast majority of young people aged between 11 and 15 enjoyed science and thought they learned interesting things, only around 15% thought that they would like to work as a scientist. A key factor that helped determine whether a young person might aspire to a STEM career was the amount of 'science capital' within the family.

Science capital encapsulates the science-related contacts, attitudes, experiences and knowledge within the family and only 5% of young people were found to have high levels of science capital. The students most likely to have low science capital were female, working class, in the bottom set and with low levels of cultural capital. Girls particularly saw science as 'not for me', especially those who saw themselves as 'girly'. They were more likely to consider caring or arts-based careers. Perceptions of scientists as 'brainy' also led students to believe that science is 'not for me'.

PSQM criterion L3: There is a commitment to developing all children's science capital.

Science capital is an important concept for primary schools to consider, because children aged 10 with low science capital, who also expressed no interest in STEM careers, were very unlikely to have changed their minds by the age of 14. It is for this very reason that, when the PSQM criteria

were amended in 2017, the new criterion, 'L3: There is a commitment to developing all children's science capital', was incorporated. When the evidence for the first schools where subject leaders and teachers had grappled with this new criterion was submitted in June 2018, we were delighted to see the extent to which schools had engaged with initiatives to increase the science capital of not just their pupils, but also staff and parents. From a sample of 111 out of 309 L3 reflections analysed, 65% of subject leaders had noted that the concept of science capital was completely new to the school, or staff had limited knowledge, yet every single school had found their own way to promote and try to develop science capital. It was great to read about the plethora of activities that innovative science subject leaders had implemented. The most popular are shown in Figure 1.

We never cease to be amazed at the creativity of our PSQM science subject leaders, and the diverse range of approaches they used included:

- Pupils 'speed dating' with STEM professionals
- Publishing a science capital article in the school magazine
- Using ReachOut Reporter³ to share science in the news with pupils
- Science film club
- 'We have been' posters where they

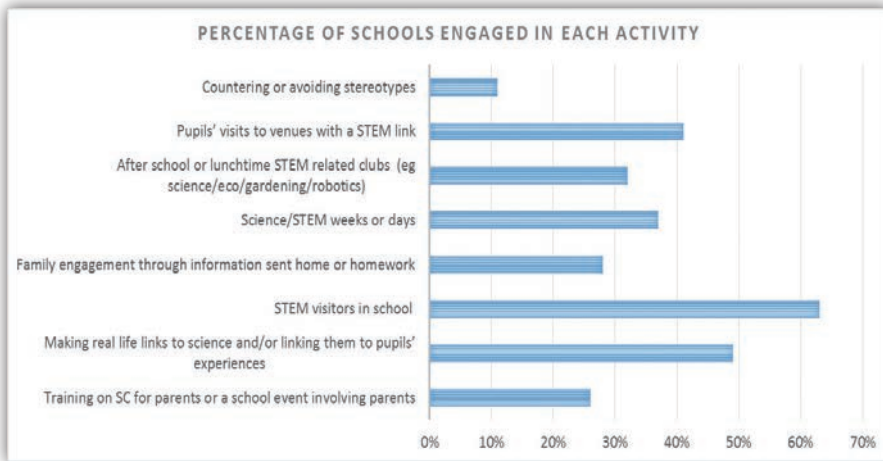


Figure 1 Activities undertaken to develop children's science capital

In their reflections, subject leaders were positive about this new addition to the PSQM criteria and had worked hard to raise awareness of science capital among their colleagues, with many going further to raise awareness with pupils, parents and governors. They clearly believed that the activities with which they had chosen to engage had helped children to change their views and that now, perhaps, science might be 'for them'.

1 WISE (2012) Women in science, technology, engineering and mathematics: from classroom to boardroom. Bedford: WISE

2 <https://www.kcl.ac.uk/sspp/departments/education/research/ASPIRES/ASPIRES-final-report-December-2013.pdf>

3 <https://www.reachoutreporter.com/>

4 <https://www.inspiringthefuture.org/redraw-the-balance/>

5 Smart Pickings 2016: No. 5, Bianchi, L., Millgate House Publishers

Clare Warren is a PSQM senior regional hub leader and PhD student at the University of Hertfordshire.

recorded the types of scientists the children had been during their science lessons (e.g. botanist, sound engineer, physiotherapist)

- Replicating the 'Redraw the Balance'⁴ activity with their children to heighten awareness of stereotypes and begin to counter them
- Working with staff at King's College London to develop primary approaches to increase science capital
- Using Smart Pickings⁵ as a way to start conversations about STEM careers

- Introducing a science playground box.

As ever, the PSQM science subject leaders never rest on their laurels and their planned next steps included:

- Improving transition arrangements
- Growing produce, and selling it at the local farmers' market
- Stemettes club
- Taking part in 'I'm a scientist, get me out of here'
- Project with the British Council
- Pupil and parent questionnaires to audit science capital

Supporting Primary Teachers Since 1997 THE PRIMARY SCIENCE TEACHING TRUST



Our FREE termly newsletter has been designed to offer practical support to teachers; with pull out resources and lesson ideas.

Access all issues and sign up to the mailing list at: www.pstt.org.uk/what-we-do/why-how-newsletter

The Primary Science Teacher Awards (PSTAs)

The PSTAs recognise the outstanding achievements of teachers who are going above and beyond to deliver fantastic primary science. Nominations for the 2019 awards will open in January 2019.

www.pstt.org.uk/what-we-do/primary-science-teacher-college

The 2019 Primary Science Education Conference



June 6 - 8
2019

Edinburgh International
Conference Centre (EICC)

PSEIC will offer three days of outstanding professional development delivered by world class experts.

The conference will offer a diverse mix of keynote talks, practical workshops, reflective practice seminars, interactive talks and science shows.

Find out about the competitive tickets and more, at: www.primaryscienceconference.org

0117 325 0499

info@pstt.org.uk

pstt.org.uk

primaryscienceconference.org

Collins



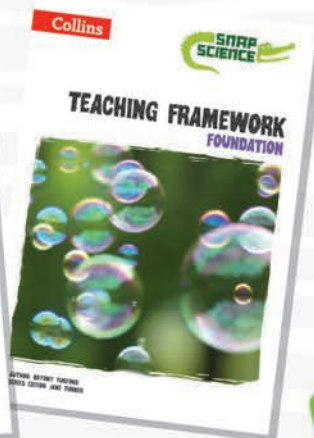
Discover the No.1 Primary Science programme used in UK schools!

Snap Science is a dynamic, comprehensive programme packed with inspirational, hands-on resources, designed to help you deliver outstanding science throughout your school, without breaking your budget.



"We've seen a new interest in science for the children and an excitement in their learning... I'm really thrilled for what it has done right the way across the school."

Alison Richards, Head Teacher,
Hertingfordbury Cowper Primary School



Try Snap Science with your class for free!

Simply contact your rep to sign-up for a free trial, findarep.collins.co.uk