EVALUATION OF THE IMPACT OF NATIONAL SCIENCE LEARNING NETWORK CPD ON SCHOOLS

Case studies

Ben Bryant and Natalie Parish – Isos Partnership
www.isospartnership.com

Science
LEARNING NETWORK

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PRIMARY SCHOOLS

Duddon St Peter's Church of England Primary School

Duddon St Peter's is a 3-11 voluntary-controlled primary school in Cheshire West and Chester, attended by 136 pupils. In November 2013, Ofsted judged the school to be good. Three years ago, according to one member of staff, 'science had lost its way'. It was a subject that was not seen with enthusiasm by pupils or by staff. Then, the school appointed two new Science Co-ordinators, for KS1 and KS2 respectively. The appointment of new subject leaders who were passionate about science, and the use of CPD from the National Science Learning Network aimed at developing primary subject specialists, has played a key role in transforming science teaching and learning at the school. During this time, the school has seen the proportion of pupils achieving expected attainment levels in science teacher assessments rise from 56% in 2012 to 88% in 2014.

A key focus during this time has been on implementing new principles of science – pupils were consulted on what they wanted from their science lessons, and said that they wanted science to be fun, challenging, hands-on, experimental and relevant to real life.

As well as the Science Co-ordinators taking part in the *primary science specialism* CPD, they have also been trained to deliver CPD through their local science learning partnership, and have used this training to deliver CPD to local primary schools about assessment in science. The school's approach to CPD has three distinctive aspects.

1. **Developing subject leadership** – the focus of the CPD that the school has accessed from the Network has been on developing the subject-expertise of the Science Co-ordinators, who then have a role in spreading their knowledge across the school and sharing this with other local primary schools.

2. **Sharing knowledge through focused, internal, subject-specific CPD** – there are regular subject-specific staff meetings, where each subject co-ordinator can plan and share new ideas with all staff. This creates not only a regular opportunity to share new ideas, but also establishes a routine for staff to reflect on their pedagogy and refresh their subject-knowledge.

3. **Embedding effective practice through collaborative practice** – not only is CPD shared in regular, practice-focused sessions, but the Science Co-ordinators also support individual teachers by planning and teaching lessons with them, observing pupils' learning, and then reflecting on and refining teaching practices. The Science Co-ordinators plan to implement a lesson study approach from September 2015.

As a result, pupils are enjoying science much more, and there is burgeoning interest in science in the classroom, in extra-curricular activities such as science clubs and science week, and at home – parents report how their children have come home talking about what they have learned in science. Parents themselves are also more engaged in what their children are learning in science – the school has drawn on parents to give pupils ideas about what sort of jobs science can lead to. Among the pupils to whom we spoke, there were several budding engineers, chemists and sports scientists.

School and subject leaders have also seen a significant impact on staff confidence in teaching science and in facilitating more experiment-based, outdoor learning for their pupils, as well as on the quality of teaching. The school has sought to celebrate the success they have enjoyed in science by highlighting this to governors and in the school newsletter. Other subject areas are now interested in what they can learn from science, including how they can develop pupils' investigative and problem-solving skills. Work to plan and evaluate science teaching for the primary science quality mark has also led to ideas from science being applied in other subjects, such as mathematics.

What three things make the biggest different to maximising the impact of science CPD?

1. **Be brave and let people explore** – this goes not only for pupils, but also for staff and leaders within the school – pick the right people to champion new ideas and enthuse other staff and pupils.
2. **Create the conditions for this to be shared and embedded** – create the time for regular opportunities to share learning from CPD, not just in a "chalk-and-talk" information session, but through hands-on, practical staff training.
3. **Get everyone on board** – engage staff, give them practical things they can use, work alongside them to plan new lessons and activities, and co-teach and observe learning in order to build their skills and gather feedback to refine and improve new approaches.

What did the school say?

'Because of all the changes we have made, all of the pupils now love science. They find science really exciting and interesting.' (KS2 Science Co-ordinator)

'I like doing experiments because you are not just given the answer, but you can experiment and find out the answer for yourself.' (Year 5 pupil)

Exeter Road Community Primary School

Exeter Road is a 5-11 foundation school in Exmouth, Devon. Just over 200 pupils attend the school. In January 2012, the school was judged to be good by Ofsted. Over the past three years, the school has seen the proportion of pupils achieving expected levels in KS2 science teacher assessments rise from 68% in 2012 to 93% in 2014.

During the same period, the school has made significant use of science CPD from the National Science Learning Network. The science leader, class teachers, a higher-level teaching assistant and school leaders have all participated in Network CPD, which has included CPD focusing on developing the school's science curriculum, leading science in the early years, role-specific CPD focusing on the role of the subject leader and teaching assistants, and the course *From good to outstanding: Making learning visible*.

The school's approach to science CPD is characterised by three things.

1. **Systematic planning and prioritisation** – the school's leadership invests time in establishing clear development priorities for the school in consultation with subject leaders. The overarching school priorities are informed by annual action plans, developed by subject leaders, which in turn are informed by an annual audit and staff appraisals. This enables school and subject leaders to consider science CPD opportunities and select those that meet school, subject and staff development priorities.

2. **Selecting CPD that is directly relevant to the day-job** – the school have found that CPD activities that include gap-tasks, which need to be undertaken back at school and reflected on, have been effective in promoting new ideas and collaborative work among staff, and are more likely to lead to action being taken after the CPD has been completed.

3. **Collaborative professional development with partner schools** – the school is one of four schools that make up the Avocet Learning Trust. Exeter Road's science leader has played an influential role in developing a shared approach to planning science CPD within the trust. Although in its early stages, the science leader is encouraged by the early signs of how science learning is being shared within the trust.

As described above, the school has seen a significant increase in the pupils achieving expected levels of attainment in science. Leaders attribute this to the more interesting science curriculum that the school has developed, particularly through more practical approaches to science. The pupils to whom we spoke were not only enthusiastic about science, but also described what they were studying in terms of hypotheses and fair tests. It is telling that the membership of the school's STEM club had to be determined by drawing lots: the number of children who wanted to join far exceeded the numbers the club could accommodate. Likewise, leaders have seen staff grow in confidence and generate creative ideas for teaching science, which are having an impact in the classroom. The school has also seen an impact on the career progression of individual members of staff, including a former teaching assistant who has now become a qualified teacher as well as in the skills of members of the school's leadership team.

What three things make the biggest different to maximising the impact of science CPD?

1. **Opportunities to collaborate** – enable colleagues to access CPD or work on implementing CPD learning together, so that implications specific to the school and follow-up can be discussed at the time.

2. **Opportunities to meet and work with your peers** – provide opportunities to learn from the practice of science leaders and teachers across the country and from other jurisdictions.

3. **Built-in activities that have to be followed up back at school** – select CPD that is relevant to the day-job, and make it happen back at school.

What did the school say?

'The Network CPD gave me confidence to teach science in a more interesting way and to lead discussions about it with my colleagues.' (Science leader)

'The *From good to outstanding* course has had a positive impact on the whole school and curriculum ... not just science.' (School leader)

Hampden Gurney Church of England Primary School

Hampden Gurney is a 3-11 voluntary-aided primary school. Located in Westminster, the school is single-form entry and is attended by over 230 pupils. In its last Ofsted inspection, the school was judged to be outstanding.

Four years ago, the school decided that their science curriculum was not enthusing their pupils, nor stretching their most able. They wanted to develop a new approach to teaching science that harnessed their pupils' knowledge of technology and curiosity about the world around them, and encouraged them to "think like scientists". They found this was very much in line with changes to the curriculum at national level, and used CPD from the National Science Learning Network to embed a new, more investigative approach to science teaching and learning in the school. During this time, the school has accessed CPD focused on scientific enquiry and working scientifically, as well as a programme for newly-qualified teachers led by the local science learning partnership. In 2014, 100% of pupils made expected progress and achieved expected levels of attainment, including in science teacher assessments.

Hampden Gurney's approach to science CPD has three key components.

1. **Clear planning informed by having a clear vision and ethos that aligns whole-school and subject priorities** – the school had a clear vision for a more investigative approach to science teaching and learning. This was linked to the school's overall priorities and informed by consultation with staff. Science CPD was then carefully chosen, focusing specifically on CPD that would help to achieve this vision.

2. **Practical sharing of new ideas to give teachers confidence to try new things in the classroom** – most of the CPD that the school has accessed from the Network has been attended by the school's Science Co-ordinator. He then leads science-specific training sessions for all staff. These focus both on the overall vision, which provides staff with a clear framework for teaching science, and on demonstrating and trying out specific practical ideas and resources to give teachers the confidence to take those into the classroom.

3. **Routine follow-up and support for teachers to ensure there is an impact on pupils' learning** – what is vital, according to the school's Science Co-ordinator, is having routines for following-up to see how the learning from science CPD is being used in the classroom. Each week, the Science Co-ordinator spends time looking at how science teaching is being planned, observing lessons, and going over pupils' books. This allows him to identify classes where this is working well and areas where he can provide further support, for example working with teachers 1-to-1 to co-plan science lessons.

As a result, teachers at Hampden Gurney have greater confidence in facilitating scientific investigations. Teachers are able to plan and deliver lessons that harness the curiosity and enthusiasm of pupils to help them develop their critical-thinking and team-working skills. This is not only the case in science: teachers described how they were using some of the approaches from science to encourage pupils' higher-level critical-thinking skills in other subjects, such as literacy and numeracy. Teachers describe how pupils are visibly more engaged and enthusiastic about their science lessons, are working together and helping their peers to learn, which in turn is having an impact on their learning.

Pupils themselves spoke excitedly about the different experiments they had done in class, at home, and that take place in the school's popular weekly science club. They also spoke animatedly about some of the ways they had thought about the experiments they had done, how this had prompted them to think of other scientific ideas they would like to investigate, and topics they would like to study at secondary school.

The school has invested time in developing a new approach to assessing pupils' progress in science, and is planning to work with a number of local partner schools to share and develop this approach.

What three things make the biggest different to maximising the impact of science CPD?

1. **Have a clear vision for science teaching and learning** – be clear what sort of pedagogy and culture you want to create across the school and instil in all teachers and pupils. Align this with whole-school priorities and with staff development needs, and use this to select the right CPD for the school.
2. **Give staff the initial impetus and tools they need** – do not simply tell staff how to facilitate scientific investigations in their class, but give them the opportunities to see ideas for experiments and try them out for themselves. This will give them the impetus not only to use these in their classrooms, but also the confidence to extend and develop their own experiments.
3. **Keep the focus on learning** – use regular routines to look for evidence that new ideas are being used to plan lessons and are having an impact on pupils' learning, which in turn enables subject leaders to highlight good practice and provide additional support.

What did the school say?

'Some things in science are not controllable. The key is giving staff the confidence to facilitate learning in science in a different way. Experimenting and thinking like scientists, these are the things that children remember. If we want children to go on to study science in higher education, this is what we need to be preparing them for.' (Deputy Headteacher and Science Co-ordinator)

'I really like experimenting with different things and the tension of seeing the result.' (Year 6 pupil)

Hutton Rudby Primary School

Hutton Rudby is a 4-11 maintained primary school in North Yorkshire attended by just over 200 pupils. The school is a high-performing school and has been judged 'outstanding' by Ofsted, who have commented on the excellent teaching, pupils' enjoyment and motivation to learn, and the rich variety of stimulating activities on offer at Hutton Rudby. In 2014, all pupils achieved the expected levels of attainment in reading, writing and mathematics at KS2, as well as in teacher assessments in science, while the school was in the top 10% nationally for the progress made by pupils.

Following the end of standardised KS2 science tests, the school developed a new approach to ensure that they continued to offer the highest-quality, cutting-edge science teaching. The role of the Science Co-ordinator was divided between KS1 and KS2, and the school used CPD to develop the Science Co-ordinators' specialist subject-knowledge and embed new ideas in science teaching. Both the KS1 and KS2 Science Co-ordinators participated in the *Primary Science Specialist* course at the National Science Learning Centre. There have been three key aspects of the school's approach to enhancing science teaching and learning through the use of science CPD.

1. **Systematic, evidence-based, strategic planning in each subject area** – each subject area, including science, undertakes an annual review of teaching and learning. The evidence gathered, combined with overarching school priorities and needs identified through staff performance appraisal, is used to plan the school's CPD needs for the year.

2. **Combining routines for embedding CPD learning with rapid sharing of new ideas** – dedicated slots at staff meetings are used to share and model new ideas gleaned from CPD. Those approaches that have applicability across the school are considered by the senior leadership team, who then support its roll-out. This is complemented by an established culture of team-working and ongoing, informal sharing of ideas between staff so that new ideas can be tried and adopted rapidly.

3. **In-depth evaluation of impact on pupils and staff** – the school evaluates the difference made by implementing new approaches taken from CPD activities through each subject area's annual review and staff performance appraisal. Surveys are used to gather feedback from pupils and staff, which provide baselines for tracking the difference made by new approaches.

From what was already a high level (90%), in the past two years, 100% of children achieved the expected level of attainment in KS2 teacher assessments in science. The pupils themselves speak with great enthusiasm about what they are learning in science, particularly experimenting, and staff have noticed how much more positive students are about their science lessons. Pupils also described how they have used what they have learned in science in other subjects, such as mathematics and creative-writing. They spoke about how what they have learned in science at Hutton Rudby has influenced what they would like to study at secondary school and even their future careers – there were budding marine engineers and paediatricians, and even an alchemist!

Staff described the positive impact of the Network CPD on their confidence and practice. Senior leaders have seen staff become more confident in facilitating hands-on, pupil-led science investigations. Staff also thought the encouragement to keep pace with cutting-edge developments in science teaching was good for staff retention and development. One said, 'you are always aiming for and working towards something new.'

In the future, the school is planning to access science CPD focusing on new approaches to assessment, to build the subject-knowledge of new staff, and to keep pace with and incorporate cutting-edge developments in science.

What three things make the biggest different to maximising the impact of science CPD?

1. **Encouragement to share learning (and the time to do it)** – combining regular, formal routines for embedding learning from CPD, open communication to share new ideas, and the encouragement to "have a go" in your own classroom.
2. **Modelling effective new approaches** – showing how one member of staff has used what they have learned from science CPD in their classroom to give other staff the confidence to try it themselves, having seen what good looks like.
3. **Celebrating success** – giving students the opportunity to showcase what they have learned in science through sharing assemblies and displays, to foster enthusiasm and curiosity about science throughout the school.

What did the school say?

'Through the CPD, my knowledge in the delivery of science has been enhanced, I am more confident and enthused. And if teachers have that enthusiasm, that love of the subject, the pupils pick up on that. They just love science!' (Science Co-ordinator)

'What I like most about science is experimenting. I like it when you try to predict what is going to happen, and it can turn out that you are completely right or completely wrong.' (Year 5 pupil)

Richmond Methodist Primary School

Richmond Methodist Primary School is a 5-11 voluntary-controlled school in Richmond, North Yorkshire. Over 300 pupils attend the school. The school is a member of the Swaledale Teaching Alliance, a partnership of 56 schools from across North Yorkshire. In its most recent Ofsted inspection, the school was judged to be good.

The school has focused on developing more investigative, enquiry-based approaches to science across all year-groups. Staff described how they wanted to get away from an "information-delivery" approach to one where students were able to think for themselves and learn through their investigations, and where what they were learning about in science was linked to other areas of the curriculum. In this, the role of the school's Science Co-ordinator has been crucial – she has accessed CPD from the National Science Learning Network on extending the role of the subject leader and on leading science in the early years. The Science Co-ordinator has been able to use the learning from the CPD, as well as the resources from the National STEM Centre, to work with teachers in individual year-groups and key stages to embed new investigative approaches in their planning and teaching. There are two core aspects to how the school seeks to maximise the impact of science CPD.

1. **The role of Science Co-ordinator** – the Science Co-ordinator plays a key role in science teaching and learning within the school, acting as a champion for investigative approaches and as a conduit for new ideas. A key part of her role, she says, is having lots of new, practical ideas at her fingertips and supporting staff to implement these in their classrooms, and then reinforcing these through whole-school activities like science week. As one teacher at the school said, the subject leader is 'a gateway to new ideas, she takes a barrier down. We are expert learners together.'

2. **Dedicated time to co-plan with individual members of staff** – the school has set aside time for the Science Co-ordinator to work closely with staff in individual year-groups or key stages to co-plan the science curriculum, embed more investigative approaches, and integrate this with pupils' work in other areas of the curriculum. The Science Co-ordinator has done in-depth work with teachers in Year 6, KS1 and now in the early years.

Teachers report that they have greater confidence is seeking new ideas and implementing them in their classrooms. As a result, they have seen pupils become more engaged and excited about what they are learning in science. The pupils to whom we spoke certainly confirmed this. They described how they enjoyed their investigations, particularly the opportunity to ask questions and find out things for themselves.

Teachers also describe how they have been able to link science investigations to literacy. For example, in one instance, pupils had to create a rap about what they had found in a science investigation, which saw some students who were not usually keen on literacy debating the finer points of alliteration. Over the past three years, the school has seen a rise of 16% in the proportion of pupils achieving expected levels of attainment in science at KS2 – now, nine in 10 students achieve this level.

The impact has not been confined to the school, however. The school's Science Co-ordinator is heavily involved in initial teacher training within the Swaledale Teaching Alliance, and has worked with new science teachers to share ideas for lessons and investigations, which has helped to build their knowledge and confidence to facilitate pupils' own enquiries.

Looking ahead, the school is continuing to focus on supporting newly-qualified teachers in the school and within the Swaledale Teaching Alliance, encouraging hands-on and outdoor investigations for the children, and developing new approaches to assessment in science.

What three things make the biggest different to maximising the impact of science CPD?

1. **Make time to share and embed new ideas** – having time set aside time and regular routines provides time to co-plan and embed new ideas in planning and teaching.
2. **What difference has the CPD made to science teaching and learning?** – there is an important role for school leaders to ask this question regularly about any external CPD, including science CPD, that the school has accessed.
3. **Find opportunities to try new ideas with pupils as well as staff** – get pupils and staff engaged in trying out new ideas in class and through whole-school activities such as science week, and use their feedback to adapt and improve science teaching and learning.

What did the school say?

'I like how we get to be more independent, to do experiments and find out interesting things for ourselves.' (Year 6 pupil)

'I have a lot more information and practical ideas at my fingertips that I can work through with my colleagues and for them to have a go – they now have the confidence to ask for ideas and implement them in their classrooms.' (Science Co-ordinator)

South Farnham School

South Farnham is a 4-11 primary academy in Surrey. Operating across two separate infant and junior school sites, the school has more than 750 pupils. Ofsted have judged the school outstanding four times consecutively, and identified it as one of the country's top schools. One hundred per cent of pupils achieve expected levels of attainment at the end of KS2 in reading, writing and mathematics, and also in teacher assessments in science. South Farnham was also among the first 100 schools to be designated as teaching schools by the National College, and is also actively engaged in a confederation with 10 local primary schools.

Over the past three years, the school have accessed a range of CPD from the National Science Learning Network, focusing on developing a new science curriculum, fostering investigations, and developing assessment. Focused collaborative-working is at the heart of everything the school does, including its use of CPD. There are two ways in which this manifests itself.

1. **Systematic routines for embedding new ideas** – there is an established, systematic cycle for embedding learning across the school. First, a member of staff will provide a short presentation to their subject group, including a pack with action-points and resources relevant for each year-group. The subject group has representatives from each year-group, who then take this back to their year-group meetings. Teachers then try out the new approach in their classroom, evaluate its effectiveness and provide feedback. This cycle informs both ongoing planning and end-of-year subject evaluation and planning, including annual reports to governors by subject leaders.

2. **Spreading learning with partner schools** – once a new approach has been embedded, the school looks for opportunities to share this with other schools in their networks and beyond. By sharing new ideas with other schools, South Farnham seeks not only to increase the impact of CPD by spreading learning to other schools, but also to develop the pedagogical and leadership skills of its own staff.

The development of a more investigative, pupil-led and hands-on approach to science has clearly enthused pupils at South Farnham. Pupils across the year-groups spoke of their interest in finding out how things work, how much they were learning because they were able to discover things for themselves, and how this made them want to share what they had learned with other students and their families. As one Year 6 pupil said, 'I like it when we get to do things, not just get told. It makes you want to learn, helps you to remember, and implants it in your brain.'

Pupils spoke excitedly about what they wanted to learn about and how this might influence their future study and career choices. There was at least one budding science teacher, with very clear ideas about how to maximise learning. This Year 5 pupil said: 'I would like to teach science. I really enjoy it as a subject. I think other people would enjoy it too if it was taught the right way – when you don't just sit on the carpet and get told things, but you get to investigate and experiment.'

The Science Leader and the school's senior leaders have also seen a demonstrable impact on staff confidence and mastery of the subject. As the Science Leader said, 'you can see it, you can hear it: they have mastery of scientific concepts and topics, they have brought it to life.' Having the opportunity to teach new topics and with different year-groups, supported by regular CPD, is also helping to develop multi-talented educators and leaders, who want to stay at South Farnham and in the profession more broadly. As one senior leader said, 'we want teachers to be experts in every area of the science curriculum. That is the impact: they become highly-skilled, expert teachers.'

What three things make the biggest different to maximising the impact of science CPD?

1. **Share it** – through established routines and practical suggestions so that the learning from CPD is shared across all year-groups in the school.
2. **Evaluate it** – through ongoing feedback loops, systematic annual reviews and planning processes to maximise the impact and identify what makes the biggest difference to pupils' learning.
3. **Link it** – share it with other partner schools to spread new ideas, influence learning across more and more schools, and to develop the skills of all staff and help them become expert teachers and leaders.

What did the school say?

'Take a normal science lesson, like making a fact-file: that is fun. But when you do things like pond-dipping or raising butterflies, you get to actually experience it. You hear and see it. It is much more fun, and really makes you want to learn.' (Year 6 pupil)

Stephenson Memorial Primary School

Stephenson is a foundation primary school for pupils aged 3-11 in North Tyneside. Almost 400 pupils attend the school, of whom more than half have been eligible for free school meals. Three years ago, the school decided to develop a new, project-based STEM curriculum. This was done specifically to equip pupils with an understanding of opportunities for STEM-related careers and the skills they would need to pursue these opportunities. Over the past three years, the school have achieved significant improvements in pupils' progress and attainment in science. Key to achieving this has been a strategic and innovative approach to accessing science CPD to improve STEM teaching and learning across the school. There are three key aspects of the school's approach.

1. **Regular engagement with staff to identify opportunities to enhance science teaching and learning.** The school fosters a culture in which staff are encouraged to work together to identify areas where the school could benefit from external CPD. This ensures not only that CPD is aligned to school priorities, but also that staff are engaged, motivated and empowered to use the learning gained from CPD to enhance their practice and that of their colleagues.

2. **Providing dedicated time for staff to reflect, share and embed learning collaboratively**. Every three weeks, subject-based, cross-phase working groups come together to plan activities and share learning and good practice across the school. Every two weeks, all staff meet for "light-bulb moments" – 20 minutes of "speed CPD-sharing". These provide regular, dedicated opportunities to share learning and effective practice.

3. **Clear processes to check the CPD is making a difference in the classroom** – this has not involved inventing new systems, but rather being clear in advance about what staff will do differently as a result of the CPD and using existing routines (book scrutiny, learning walks, progress assessments) to check this is happening. The school uses regular surveys to gather feedback from pupils and teachers.

Staff report that the project-based approach to STEM has brought many benefits. It has enabled them to link STEM projects with other areas of the curriculum, particularly literacy and numeracy. Teachers say how they have seen pupils excel who are not usually enthusiastic about literacy and numeracy because their project is building towards a particular product that is relevant to them, like a car or a volcano. School leaders also described how the way in which the school values CPD, invests in its staff and enables them to progress has been key to retaining and developing key staff: 'we have low staff turnover, but high leadership capacity', said one school leader.

It is not only the staff who are empowered to be leaders – pupils act as STEM ambassadors, which involves supporting younger pupils to perform experiments during STEM activities and demonstrating experiments to other pupils and parents during the annual STEM fair.

The school has also been active in sharing the learning with local schools. They have worked with other schools to support them in developing their science curriculum and a more project-based approach to science teaching and learning.

What three things make the biggest different to maximising the impact of science CPD?

1. **Building in time to share learning and practice** – dedicated time to reflect, share and collaborate are key to enhancing science teaching across the whole school.

2. **Engaging staff regularly** – this vital to gathering evidence of development needs, building confidence, and retaining talented staff. It also ensures they are motivated to share learning and adopt new ideas, which is key to maximising the impact of CPD across the school.

3. **Monitoring impact** – maximising the impact of CPD requires schools to be clear about the difference they expect to see as a result of accessing CPD and to use existing monitoring processes to ensure it is making a difference in the classroom.

What did the school say?

'We like *actually doing things*, getting messy, getting involved, and then learning the science behind it.' (Year 5 pupil)

'Our school makes it so science is fun, so we get involved. We don't just write about science, we don't just watch experiments: *we do experiments*. You can ask for help from the teacher, but they won't tell you the answer – they might ask you a question or give you a hint.' (Year 6 pupil)

Tower Road Academy

Tower Road Academy is a 5-11 primary converter academy in Boston, Lincolnshire. More than 600 pupils attend the school. In 2014, Ofsted judged the school to be good. Over the past three years, the school has seen a significant increase in the proportion of pupils achieving expected levels in KS2 science teacher assessments: in 2012, 76% of pupils achieved level 4, while this rose to 83% in 2013 and 92% in 2014.

The process of transforming science at Tower Road started seven years ago. At the time, science focused heavily on theoretical learning to prepare pupils for national tests. In a pupil survey, science was among pupils' least favourite subject. Led by a newly-qualified teacher with a science specialism, later the school's Science Lead, Tower Road shifted the focus in science 'from factual to practical', with an emphasis on developing investigative skills. The school has complemented internal CPD with high-quality external CPD, including CPD from the National Science Learning Network. This has focused on developing science in the early years, preparing for curriculum changes, and working with local schools to develop assessment in science. To embed and evaluate their practice, the school undertook the primary science quality mark, achieving the silver and gold awards within twelve months of one another. Three things characterise their approach to science CPD.

1. **Strategic planning of external CPD** – science CPD is used to enhance teachers' expertise, 'to continually fill staff with new ideas and opportunities'. It is informed by school priorities, subject leaders' strategic planning, staff feedback, and individual development priorities.

2. **Practical sharing and developmental support to build teachers' skills** – science leaders see their role as giving teachers the confidence to try new ideas in their classroom. A small core team of science leaders share key principles and practical pointers from CPD in regular all-staff meetings so that staff get the chance to try out and become comfortable using them. Subsequent staff meetings are used to check how teachers have used these new ideas, and gather feedback. Science leaders also provide direct support to teachers in their classrooms, through team-teach, coaching and lesson observations. Given the size of the school, this is crucial to ensuring consistently high-quality science teaching across the school.

3. **Identifying leaders and fostering leadership** – the school recognise the importance of sustaining and developing their work in science. Central to their approach is identifying and training individual teachers to be science ambassadors and leaders, giving them specific responsibilities and empowering them to develop their skills through CPD. The school also fosters pupils' leadership capabilities, using their questions to guide science lessons and consulting the pupil-led Science Council to plan the science curriculum.

According to the Science Lead, 'the profile of science has gone through the roof.' Children are enthused by what they are learning in science, with some taking their new-found investigative skills home and getting their parents involved in their science learning. The school's results in science have been increasing year-on-year, and leaders have seen clear evidence that the new approaches in science are changing staff practice, and that teachers now have the confidence to follow pupils' questions rather than sticking rigidly to their lesson-plans.

Access to high-quality, subject-specific CPD has had a huge impact on the career progression of staff, including the Science Lead and those who have been identified and trained as science leaders. The school's approach to planning and assessment has also had a beneficial effect in other subject areas, such as literacy. The next stage of the school's work is to develop a local network of science

leaders to share and refine Tower Road's good practice, and to develop collaborative approaches to moderation and assessment in science.

What three things make the biggest different to maximising the impact of science CPD?

1. **Identify and train key staff, empowering them to become leaders** – this builds capacity and sustainability, and supports succession-planning. Not only does it create a 'ripple effect' effect, maximising the impact of new ideas throughout the school, but also enables the school to work with other local schools to develop their science practice.
2. **Empower teachers to try new things** – share learning and provide practical support to give staff the confidence to try new things in their science lessons, including those suggested by their pupils.
3. **Ensuring assessment and evaluation is built into curriculum planning** – be clear what good looks like, and how quality and impact will be assessed when planning, rather than it being an add-on and an afterthought.

What did the school say?

'If I say to my class that we have science this afternoon, they all cheer. Children are really enthusiastic. I now have children stopping me in the corridor to tell me about experiments they have done at home. If they are taking what they are learning in science on, going home, then doing it themselves, this is powerful, this is the impact.' (Science Leader)

'I love science.' (Year 2 pupil)

Winterbourne Earls Church of England Primary School

Winterbourne Earls is a 4-11 voluntary-controlled primary school in Salisbury, Wiltshire. The school is attended by just under 200 pupils. Ofsted inspected the school in 2014 and judged it good. In 2014 94% of pupils achieved the expected level of attainment in KS2 science teacher assessments.

The school has made use of a range of CPD from the National Science Learning Network, including CPD focusing on planning cross-curricular science, fostering scientific enquiry, and developing staff subject-knowledge. The school is also part of the East Salisbury primary cluster, and Winterbourne Earl's Science Leader has played an influential role in sharing his expertise and disseminating learning from science CPD to improve science teaching and learning across the cluster. There are three important elements to the school's approach to science CPD.

1. **Systematic planning of school and subject development priorities** – this analyses the school's strengths and areas for development, including through use of data on pupil learning and staff appraisals, and is used to develop a robust improvement plan. This then provides a set of guiding principles that inform the choice of CPD across the school, including science CPD.

2. **The role of the subject leader** – the school's Subject Leader is a former deputy headteacher at the school, recognised by his peers as an outstanding science teacher and professional tutor. The Subject Leader's role has changed significantly, and the leadership aspect of the role is now focused firmly on leading the development of science teaching and learning not only within the school but also across the East Salisbury primary cluster.

3. **Evaluating impact and gathering practical feedback from staff to inform future science CPD priorities** – in addition to gathering evidence of impact on staff practice and pupil learning, the school runs a regular science staff development survey to gather ideas for a wide range of practical improvements in science. The survey provides not only valuable suggestions of new ideas, but also provides a useful "temperature check" of how confident staff are feeling in teaching science and how learning from CPD is helping them to plan and teach science lessons to their pupils.

The science staff development survey has provided evidence that teachers in the school are now more confident in teaching science and are able to use a wider range of teaching techniques, resources, and extension tasks to enhance pupils' learning. As one teacher commented, 'we are now offering children more opportunities to explore.'

In addition to the very high proportion of pupils achieving expected levels of attainment in science at KS2, described above, pupils themselves spoke with enthusiasm and understanding about what they were learning in science. They were particularly animated when describing the recent WOW festival, in which pupils and staff from schools in the East Salisbury primary cluster had the opportunity to interact with working scientists. Staff received training for this event from the local science learning partnership in Bristol.

Furthermore, there has been positive feedback from the leaders of schools across the cluster about the growing effectiveness of the science leaders within their schools, and from teachers about the quality of the CPD on offer within the cluster.

What three things make the biggest different to maximising the impact of science CPD?

1. **Focusing on the role of the subject leader** – providing regular, high-quality inputs from external experts can be an effective way to enable subject leaders to keep up with current

developments and ensure the school's curriculum is relevant and engaging. This approach has already proved beneficial to Winterbourne Earls and its partner schools.

2. **Choosing the right science CPD to access** – accessing current CPD that has relevance to school and has in-built resources and support to implement changes in classroom practice and assess impact.

3. **Subject-based school-to-school collaboration is key** – smaller primary schools can achieve significant benefits in terms of science CPD by pooling resources, planning science CPD collectively, and sharing expertise among partner schools.

What did the school say?

'Our aims for science in the school are to improve the confidence and competence of teachers, and enhance the enthusiasm and excitement of children.' (Science Leader)

Woodthorpe Community Primary School

Woodthorpe is a community primary school for just over 400 pupils aged 3-11 in York. Over the past three years, the school has accessed several CPD activities from the National Science Learning Network, including CPD focused on extending gifted and more able children in science, the new science curriculum, and maintaining curiosity in science. There are three key components of the school's use of science CPD.

1. **Clear science CPD priorities** – the school has a clear sense of their science CPD priorities and how these linked with the school's priorities overall. The focus has been on embedding a more enquiry-led approach to science in the school, focusing on developing pupils' investigative skills. In order to ensure that this new approach was implemented consistently, the school's leadership decided that the Science Co-ordinator would participate in the CPD and then lead the dissemination to all staff in the school.

2. **Initial collaborative work to test the impact of the CPD in school** – after staff access science CPD, they then work with relevant colleagues in the school, for example through a small study group of year-group co-ordinators, to implement what they have learned in their classrooms.

3. **CPD learning, specific to the school, is shared with all staff** – once the learning has been implemented, reviewed and the impact monitored, then it is shared with a wider group of staff through structured presentations at staff meetings. The reason for implementing first is to enable other staff to see how the CPD learning has worked in their school, which has proved very powerful.

Staff feel empowered by this approach, and see the past three years as the freeing up of science teachers and teaching in the school to adopt a more creative, dynamic, investigative approach. The approach has been 'brilliant', according to one teacher. As a result, pupils spoke animatedly and enthusiastically about what they were learning in science and the investigations they had undertaken. As one pupil put it, 'I really like science, I like everything about it.' A consequence of this has been that pupils have made improved progress in science and the school's science results have improved. Currently 81% of pupils achieves the expected levels of attainment in KS2 science teacher assessments.

A good example of this is the school's work to extend gifted and more able students in science. Having accessed CPD from the Network on this topic, the Science Co-ordinator then worked with the school's Gifted and Talented Co-ordinator to implement what she had learned in their classrooms. They took a base-line of where their pupils were at the outset, and then tracked their progress. Since the school is a two-form entry, they were able to compare the progress made by their class against the other class in the same year-group. They found that pupils in their class had made significantly greater progress over a term and a half. Once they had clear evidence of impact, they then shared their learning with the wider group of staff, and have worked with them to embed these new approaches in the school.

In the next stage of developing science in the school, the plan is for individual members of staff to access science CPD, based on the school's strategic priorities for science, the performance management process, and staff feedback. A key focus will be on continuing to embed investigative approaches and extended more able pupils. The school plans to continue using the Network to access CPD as they feel the CPD it offers is consistently high-quality, current and practical.

What three things make the biggest different to maximising the impact of science CPD?

1. **Working with a colleague to implement what you have learned, gathering evidence of impact, and then sharing with other colleagues** – showing how it works in this school.
2. **Having access to and identifying practical techniques that you can use in your classroom immediately** – get started with something that does not require lots of extra resources.
3. **Keeping what you are doing under regular review** – and gathering systematic feedback from staff and pupils.

What did the school say?

'I really like science, I like everything about it.' (Pupil)

'I think the Subject Leader's approach to science is brilliant. For example, I found that last year, the children got really excited whenever we were doing science. As a result of the CPD the school had accessed through the Subject Leader, I was able to say to my class, 'There's your equipment, here's what I want you to test, do it.' Their engagement and understanding came across in lesson observations, and we saw the progress the pupils were making every half term.' (Year 6 teacher)

SECONDARY SCHOOLS

Altrincham Grammar School for Girls

Altrincham Grammar School for Girls is a selective converter academy for almost 1,300 students aged 11-18 in Trafford. Ofsted judged the school to be outstanding in 2008. The school leads a large teaching school alliance.

All students achieve 5 A*-C grades at GCSE including English and mathematics, and, for the past two years, all students have achieved A*-C grades in two sciences. In science, the challenge for the school is to stay ahead of cutting-edge developments, broaden students' horizons, and enthuse them about further study and careers in science. A key aspect of this is encouraging staff to access high-quality, subject-specific CPD to enhance their pedagogical skills and subject-knowledge.

In science, the school has worked with the National Science Learning Centre to access CPD and, more recently, has worked within the Network as a science learning partnership with a role to co-ordinate and lead science CPD for local schools. Over the past three years, more than 12 members of staff have accessed over 20 different CPD activities, including those aimed at newly-qualified teachers, technicians, teachers responsible for planning the science curriculum, as well as those who want to lead CPD for their peers.

There are three key components of the school's approach to science CPD, and subject-specific CPD more broadly.

1. **Expecting all staff to strive constantly to enhance their knowledge and skills** – school leaders provide encouragement and set an expectation that all staff will make use of new CPD opportunities to enhance their teaching and subject-knowledge.
2. **Ensure there is a range of ways for staff to share learning from CPD** – the school uses a combination of regular routines for sharing new ideas – bi-weekly science CPD cascades and 60-second-shares – as well as opportunities for staff to incorporate new ideas into subject schemes of work and to lead whole-school training. What is consistent is the expectation that CPD will be shared and there will be a measurable impact.
3. **Tracking impact, subject by subject** – at the end of each year, school leaders work with subject leaders to evaluate the impact of the CPD staff in each department have accessed on staff practice and students' learning.

The school has seen a significant impact from the CPD they have accessed from the National Science Learning Network. Staff talk of receiving 'a regular boost' of new ideas that they can use in their teaching. School and subject leaders report that staff are able to talk with confidence and credibility to students about cutting-edge developments in science and to engage them in a range of creative activities, which in turn spark students' interest in and enjoyment of science. The school has sustained extremely high rates of progress and attainment in science, but they have also seen an increase in the numbers of students going on to study the sciences at KS5. In 2013 to 2014, the school saw their largest-ever cohort of students going on to do sciences at AS Level.

The school's role as a science learning partnership is also having a knock-on effect on staff who are leading CPD, since it is enhancing their practice and giving them opportunities to learn from others. Furthermore, it is also making a difference to other subject-areas in the school, which are now adopting ideas that have been shared across the whole school by science staff.

What three things make the biggest different to maximising the impact of science CPD?

1. **Ensure there are opportunities (and an expectation) to share new teaching ideas** – combine rapid feedback to staff with opportunities for in-depth work with colleagues to implement new ideas and for leading CPD for one's peers.

2. **Set a target of something you will do that term** – identify something that will be done differently and as soon after the CPD as possible. This goes both for individual staff who access CPD and departments as a whole.

3. **Create a school ethos that values staff developing themselves and bring new ideas into the school** – investing in CPD is crucial to showing both prospective and current staff that the school values their long-term professional development and progression. It will help the school to recruit and retain talented staff.

What did the school say?

'Subject-knowledge is what makes the great teacher and what adds real value to students.' (Principal)

'There is a genuine feeling of excitement in science lessons. I hear students coming out of lessons saying, 'I didn't expect to do that today.' You know teachers are planning lessons with great confidence and variety.' (Head of Science)

Kendrick School

Kendrick School in Reading is an 11-18 selective academy for girls. Over 700 students attend the school. In its most recent Ofsted inspection, the school was judged outstanding. Kendrick has an established reputation as a local hub of expertise and excellence in science – the school previously had specialist status in science, and has led local subject leader, technicians, and triple science networks for neighbouring schools. The school saw engagement in these networks as a way of supporting high-quality science teaching and learning across all local schools, both primary and secondary, as well as giving their own teachers ongoing access to new ideas through which to reflect on and enhance their teaching practice. In 2013, the school became a science learning partnership within the National Science Learning Network, through which Kendrick has continued to play a role in shaping high-quality science CPD available locally to schools. During that time, Kendrick has accessed a range of CPD from the Network, including CPD focused on bringing cutting-edge science into the classroom, opening up careers in STEM for students, improving exam skills in science, and supporting the development of the school's team of technicians.

Kendrick's successful approach to science CPD is built upon three pillars.

1. **Strategic planning that links school and subject priorities** – the "extended senior leadership team", which includes the Heads of English, Maths and Science, construct the school development plan, which includes priorities specific to individual subjects. One of the Assistant Headteachers has overall responsibility for CPD and works with Heads of Department to put both whole school and subject development priorities into action. This helps to ensure that the school invests in the right CPD that is going to meet the school's needs.

2. **Dedicated time for staff to share and reflect on CPD learning, and co-plan how it will be embedded in their classrooms** – through regular staff and department meetings, staff who have accessed CPD, including Heads of Department, will not only feedback what they have learned from CPD, but also facilitate in-depth discussions so that staff can work through and plan together how they adapt and implement what has been taken from the CPD. Additionally, each subject area has one day set aside each year for all staff in the department to work and plan together on curriculum changes.

3. **Following-up to identify evidence of impact in the classroom** – in their planning of new approaches to science teaching, subject leaders and staff agree how they will identify evidence of impact in the classroom, and how to ensure this is consistent across the school. This is then followed-up through focused lesson observations, moderations of students' work, and specific, systematically-collected feedback from students.

The school has a highly-skilled and engaged staff team in the science department – according to one of the school's leaders, CPD plays a vital role in sustaining teachers' enthusiasm for their subject and encouraging them to be 'reflective practitioners'. Subject leaders describe the way in which CPD has played a role in helping teachers to feel confident in preparing for changes to the curriculum and assessment, and to adapt their practice and incorporate new ideas. Technicians describe the way that CPD has given them access to new ideas and approaches, and the support they receive to adapt and use these at Kendrick.

The nature of the school and its reputation in science means that Kendrick's students are interested and engaged in studying science. Nevertheless, the A Level students to whom we spoke described passionately the way in which their studies enable them to experiment and develop their understanding of scientific concepts through their own work. As one school leader put it, 'we have been able to develop better thinkers and better scientists.' Already a school of choice for studying science at A Level, school leaders have seen growing numbers of students studying chemistry and

sciences across the board at A Level. Students described that one of the things they valued most about science teaching at Kendrick was that it encouraged them to use their judgement and think scientifically.

Looking ahead, the school plans to continue accessing CPD that will enable staff to reflect on their practice and draw on cutting-edge developments in their fields. In their role within the science learning partnership, Kendrick plans to continue to focus on giving teachers, particularly in primary schools, the skills and confidence to teach science in an engaging way.

What three things make the biggest different to maximising the impact of science CPD?

1. **Identify the right CPD priorities** – plan CPD so that it brings together priorities for developing the subject and the school's overall development plans.
2. **Set aside dedicated time to share, discuss and embed CPD learning** – ensure staff have time to work collectively to consider the implications of new developments and learning from CPD and how it can be adapted and implemented across the school.
3. **Be clear in advance how you will assess impact and follow this up systematically** – this is the key to ensuring that new ideas are implemented consistently across the school and that all students receive the benefits of great science teaching.

What did the school say?

'It's not really rocket science. If you don't build in time to follow-up CPD, and crucially to give staff time to discuss, plan and embed the learning from CPD, the knowledge, the learning and the impact is lost.' (Head of Science)

'I think one of the things this school does well is put a lot of emphasis on developing our understanding. We don't just get taught the facts: we get taught how to use our judgement so that we can apply that to unfamiliar questions or new areas of work.' (Year 12 student)

Maria Fidelis Roman Catholic Convent School FCJ

Maria Fidelis is a voluntary-aided secondary school for almost 700 pupils aged 11-18 in Camden, London. It In its most recent Ofsted inspection, the school was judged good. In 2014, 95% of pupils entered for EBacc science achieved 2A*-C grades.

Four years ago, science teaching and learning in the school was very different to how it is now. There had been significant turnover of staff, with many relatively inexperienced staff new to the school, and results were not where the school wanted them to be. As a result, with the support of a number of impact bursaries from the National Science Learning Network, the school embarked on a programme of structured CPD to improve science teaching and learning, specifically to make science more accessible and engaging for students and teachers alike.

Over the past three years, the school has accessed a wide range of science CPD activities from the National Science Learning Network. These have included learning skills for science, a number of CPD activities focusing on physics teaching and learning, the triple science support programme, and a conference on Ofsted's *Maintaining curiosity* report. Most recently, the school has accessed CPD from the Network focusing on bringing cutting-edge science from the field of biodiversity into the classroom. There are two central planks to the school's approach to science CPD.

1. **Strategic planning in the science department** – the school's approach to CPD is driven by the school development plan. Within that, science CPD is informed by the science department's strategic plan for science, and a robust performance management system, the hallmark of which is a commitment that any CPD needs identified through staff appraisal are treated as department and school priorities. As one teacher said, 'if it is on your appraisal form, it will happen.'

2. **Collective CPD experiences to enable collaborative reflection and implementation** – the school uses a range of different types of CPD, but each year the department has a department-wide INSET day, so that all staff experience the same CPD. The learning from this and from other CPD activities is then brought back into school and shared in a structured way: an hour is set aside each for the department to share knowledge, and staff are supported and given time to reflect on their learning, present what they have done, and prepare resources to share with their colleagues.

Overall, the school has been delighted by the impact the CPD it has accessed from the Network has had on science teaching and learning. Teachers spoke about their enthusiasm for the subject, and about how the science CPD they had accessed had enabled them to explain and teach more complex scientific concepts in a way that was accessible to all students.

For example, two years ago, all staff went on the *learning skills for science* CPD offered by the Network. They reported on the impact this had on improving the revision, academic writing and research skills of A Level students. One revision exercise enabled students to test their own understanding of particular concepts by having to present them to others and then critique the work of their peers. The Head of Science was able to put questions to the leading Ofsted science HMI at the *Maintaining curiosity* conference about how the school could further improve A Level science at the school. To take another example, three years ago, no students at Maria Fidelis took triple science. Now, 100% of pupils who take triple science achieve three good science GCSEs, and there is growing interest from students, senior leaders and governors in this success in the science department.

Looking ahead, the school plans to continue to use CPD to keep abreast of the latest developments in science and incorporate this into science teaching in the school. They are thinking particularly about A Level biology practical work, linear assessment, and computer science and coding.

What three things make the biggest different to maximising the impact of science CPD?

1. **Match the right people to the right CPD** – ensure that the CPD is relevant to their development and that of the school community.
2. **Build in dedicated, focused, structured time for reflection, implementation and sharing** – and work hard to maintain an open, collegiate culture of sharing resources and giving advice within the department.
3. **Focus on CPD that can yield a practical and achievable end-result**, and use this to secure buy-in from and demonstrate support to senior leaders within the school.

What did the school say?

'The Network CPD was really valuable, and the resources were great. We got to see examples of how other people had done things, and try them for ourselves. The way we reflect on and share science CPD at the school helps me to reflect on what I teach, apply new ideas in my lessons, and make changes to my practice.' (Science teacher)

'The triple science support programme has been a huge success for us. The CPD, plus the impact bursary, really helped us. We started at zero, yet now the results are amazing – 100% success for those pupils doing triple science. This has raised the profile of the work we are doing in the science department with the Headteacher, and also helped science gain status with the students.' (Head of Science)

Millais School

Millais is an 11-16 community school for girls in Horsham, West Sussex. Over 1500 pupils attend the school. In its most recent Ofsted inspection in 2014, the school was judged to be outstanding. Millais is a hub of inter-school collaboration. The school leads the Millais Alliance, a teaching school alliance, the leadership of which also inspired e-PD (enabling professional development), which is an innovative way in which almost 200 schools can exchange their expertise and development opportunities. Science is key to the networks of which Millais is part: the school leads a science learning partnership within the National Science Learning Network. As well as Ofsted and the National College, the quality of Millais' collaborative work was recognised through the granting of an enthuse award to work with primary schools around working scientifically, an important focus of science teaching and learning.

Over the past three years, Millais has made significant use of CPD from the National Science Learning Network. This has included CPD focused on improving attainment in science, developing subject leadership, developing the science curriculum, literacy in science, working towards linear assessment, and bringing cutting-edge and inspiring science into the classroom. In 2013, Millais moved into a leadership role within the Network, becoming the lead partner in the Sussex science learning partnership. In this role, members of staff at Millais and partner schools have been trained to facilitate CPD, and the science learning partnership plans to use this cadre of aspiring and enthusiastic science leaders to roll-out further CPD to teachers and technicians in their network.

Three elements are at the heart of the school's approach to science CPD, and indeed subject-specific CPD more broadly.

1. **Robust planning** – the school conducts a regular audit of development needs and priorities to ensure that CPD opportunities overall and in particular subject areas are closely linked to the needs of the whole school and staff team, as well as individuals. Requests for CPD must also include an assessment of the expected impact on teaching and learning in that subject area.

2. **An ethos and expectation that all staff participate in and benefit from subject-specific CPD** – there is a strong expectation, as well as encouragement, that staff at Millais will take advantage of the CPD that is on offer, including that related specifically to their subject, in order to enhance their subject-knowledge and pedagogy. Taking part in CPD, disseminating learning through dedicated workshops, and then spreading the learning through collaborative networks with other schools is at the heart of the Millais approach.

3. **Empowering subject leaders** – while an Assistant Headteacher has overall responsibility for co-ordinating the school's development priorities and CPD strategy, considerable responsibility is delegated to individual subject leads (called Directors of Learning), along with a dedicated budget to support subject-specific CPD.

The school has seen significant impact from the science CPD they have accessed from the Network. School and subject leaders reported the difference the Network's CPD had made on staff confidence and subject-knowledge. The school's recent Ofsted report corroborates this, referring to teachers' outstanding pedagogy and subject-knowledge. The school has also seen how the CPD has helped staff to progress in their careers, particularly where science CPD has been chosen with an explicit focus on developing leadership skills.

Staff have seen an impact on pupils' curiosity and motivation to learn in science, as well as in the way CPD has given teachers strategies to improve pupils' literacy skills in science. The pupils to whom we spoke were well-informed, thoughtful and positive about what they were learning in

science, and highlighted the importance of the subject not only to them, but also to the country's economy and wellbeing.

What three things make the biggest different to maximising the impact of science CPD?

1. **Plan and select the right CPD** – focus specifically on science CPD that will improve teaching, provide practical ideas and resources that can be applied straightaway in the classroom, and help staff to develop their skills and progress in their careers.
2. **Be strategic** – consider the way the education system and national policy is changing, and plan CPD pro-activity to equip the school to meet those needs. Work with a range of partners, such as members of the science learning partnership, and other national bodies (the Institute of Physics, Royal Society of Chemistry) to access and offer CPD that keeps pace with new developments.
3. **Be practical** – ensure that in planning, implementing, embedding and evaluating science CPD, there is a clear focus on how it is helping the school to provide solutions to identified development needs and new challenges so that pupils improve their learning. Measuring the impact is essential and how this will be done is integral to the planning.

Ormiston Maritime Academy

Ormiston Maritime is an 11-16 converter academy in Grimsby, North-East Lincolnshire, attended by almost 900 pupils. The academy is part of the Ormiston Trust. In 2012, the academy was judged inadequate. By 2014, the academy had affected a rapid transformation and was judged to be good. In their report, Ofsted commented that 'the strong focus on professional development of staff has been a key factor in developing better quality teaching and learning.'

The strategic use of CPD to enhance teaching and learning has been central to the development of science within the academy. Initially the focus was on enhancing staff and departmental subject-knowledge. The academy has accessed CPD from the National Science Learning Network, including subject-knowledge enhancement in physics and chemistry, and raising attainment in triple science. Looking ahead, the academy is planning CPD to ensure staff are confident about the implications of national changes to the curriculum and accountability measures for the teaching of science in the academy.

The science department's approach to CPD is characterised by three features.

1. **Regular, flexible strategic planning of CPD** – this involves analysing staff subject-knowledge and student test data to identify any areas or types of questions where students are doing less well. This informs the departmental CPD priorities, so that these can be reflected in both the departmental plan and staff appraisals.
2. **Ensuring staff have dedicated time to share learning and develop practice collectively** – 12 months ago, the academy changed their timetable so that staff in each department had two periods per week of non-teaching time to share learning and reflect on their practice. Teaching staff have responsibility for how this time is used.
3. **Using both hard and soft indicators to track impact in the classroom** – as well as regular scrutiny of progress and attainment data, academy leaders use "soft" indicators, such as student voice surveys and subject-level data on students being out of the classroom, to track levels of student engagement. Leaders use learning walks to see how learning from CPD is being used in the classroom. To complete the evaluation cycle, student assessment data is used to look at how students are doing on certain types of questions compared to how they were doing before staff accessed the CPD.

Academy leaders and teaching staff have reported that, as a result of the CPD, staff are more confident in their knowledge of the subject, and are planning better, creative lessons in which students are engaged and learning more. This is evinced not only by the data on student progress and attainment – the academy's science data has risen from the bottom 5% nationally to catch up with the national average in two years – but also by increased student take-up of triple science and STEM-related enrichment activities. Older students spoke in glowing terms about how what they had learned in science, particularly being able to undertake their own experiments, had influenced their choices for further study and potential career-paths. In 2015, the school saw the highest proportion of girls who went on to study KS5 physics at college after they left the academy.

Not only has there been an impact on staff and their students, but leaders also highlighted that the academy's commitment to CPD has led to better recruitment, retention and progression of science staff. The academy is involved in a number of emerging networks to share good practice in science, including the local science learning partnership and a new science leaders network within the Ormiston Trust.

What three things make the biggest different to maximising the impact of science CPD?

1. **Ensure staff have quality time together to share learning and reflect on their practice** – empower staff to take responsibility for both their professional development and that of the department, and provide dedicated time in the timetable for this to take place.
2. **Identify the "movers and shakers"** – match the right people to identified CPD priorities, empowering them to become ambassadors, advocates and beacons of good practice.
3. **Track, measure, share and celebrate** – capture evidence of impact in the classroom and use that to build momentum and foster a departmental culture that is open to trying new ideas.

What did the school say?

'Some of my students said to me, 'We can tell this course is working for you. You are more confident.' This is the nicest – but harshest – feedback I've ever had from a student.' (Science teacher)

'Getting into a subject in depth, it makes you want to work, it makes you want to learn, it helps to get things into your brain, and it helps to get a grasp of what you want to do where you get older.' (Year 10 student)

St Gabriel's Roman Catholic High School

St Gabriel's is a voluntary-aided secondary school for over 1,000 pupils in Bury, Greater Manchester. In the summer of 2014, the school achieved their best ever results in science (88% achieving A*-C in core science, up from 60% in 2008). They put this down to strong leadership of the department, clear strategic priorities, a settled and reflective staff team, and the judicious use of science CPD.

Over the past four years, the school has accessed almost 20 different CPD activities from the National Science Learning Network. The use of CPD has focused around four main themes: developing the science curriculum, building subject-knowledge in physics, enhancing literacy skills in science, and developing the knowledge and resources of the school's technician team. Most recently, the school has also accessed CPD on developing outstanding learning in science and preparing students for careers in STEM.

The science department does three things to ensure science CPD is used to best effect in the school.

1. **Identifying key departmental priorities for developing science teaching** – this is done through a robust process, led by the head of department, drawing on strategic priorities, pro-active analysis of future policy changes, analysis of pupil progress and achievement data, and the staff appraisal cycle.
2. **Providing time for staff to reflect on the CPD** and make changes to their practice or develop outputs to be shared across the department. Staff are given five hours planning each week: 'we build in time for our staff to be reflective practitioners', says the Headteacher.
3. **Planning how the CPD learning can be used and shared** – the Head of Science meets staff that have accessed CPD to plan how the learning will be used and how it will be shared across the department.

These enable the Head of Science to match the CPD activities the school needs to access to the staff who will be in the best position to take that forward back in school. 'I want all staff to be our local expert in something', he says.

The school is very clear about what they expect to see happen as a result of the CPD they access. For example, a teacher with a biology specialism accessed a range of CPD activities on teaching physics; they are now teaching triple science. The school accessed the *Outstanding schemes of work* CPD, and has now developed a KS3 scheme of work. The staff member who accessed *Enhancing literacy skills in science* is now co-ordinator of the school's literacy strategy, which has helped pupils to achieve better results in extended writing questions in science. The school has seen improving results in science, culminating in the summer's outcomes. Students speak positively about their science lessons, particularly the opportunity to experiment – 'we are more involved, which means you learn more, you take more in' – and uptake of triple science has increased fourfold to almost half of a year-group.

Looking ahead, the school plans to access CPD to develop a new KS4 curriculum and to support a new member of staff to become an expert in numeracy in science.

What three things make the biggest different to maximising the impact of science CPD?

1. **Honest self-evaluation** – focus CPD on the department's and staff development needs.

2. **Pick your people** – match CPD priorities to the people who are best-placed to embed the learning and lead change within the department.

3. **Create space to reflect and embed learning** – give staff the time and support when they return to school to reflect on their practice, try out new things with a buddy, and develop outputs for sharing with colleagues. This does not need to be a huge amount of time, but the school will not see the benefit of the CPD without reflection and planning.

What did the school say?

'I can see the confidence the CPD gives me, the enthusiasm it gives to others, and the satisfaction of seeing it used by teachers and pupils in the classroom. I cannot tell you how valuable the courses have been.' (Senior technician)

'I had the subject-knowledge, but wanted to know more about how to put it across. The course was fantastic in helping me to do this. There were lots of practical experiments, and ideas about how to explain this to pupils. It really helped to make me a more confident physics teacher.' (Physics teacher)

Southend High School for Boys

Southend High School for Boys is a selective converter academy located in the Prittlewell area of Southend. In 2014, the school was judged to be outstanding in all aspects. The school currently caters for around 1,000 pupils aged 11-18 and is growing. Despite being selective, the school describes itself as 'not super-selective' and draws pupils from the upper quartile of the ability-range from its local area. A high proportion of their sixth form students study at least one STEM A Level and many go on to study medicine, pharmacy or engineering at university.

Over the last three years, the percentage of pupils achieving two sciences at grades A*-C GCSE has never been lower than 95%, and this year was 100%. The school, therefore, set itself a three-year development goal across all subjects, including science, to increase significantly the proportion of pupils achieving A* or A grades at GCSE. Five years ago 48% of pupils achieved A* or A grades in science subjects; this year 71% did so. The Headteacher and Head of Science are clear that the judicious use of science-specific CPD has contributed to this very significant rise in performance. Over the last three years the school has accessed nine courses through the National Science Learning Network, distributing the learning among six different members of staff. The CPD has included a focus on new science leadership, leading professional development in science education, assessment for learning, and bringing science to life through forensics, as well as keeping abreast of curriculum changes and skilling-up technicians.

The Headteacher is clear that the strength of the learning community within the school is one of the factors that has enabled the school to capitalise on the CPD that they have undertaken. The Headteacher describes a thriving science faculty as one in which:

1. **colleagues routinely engage in casual conversation about subject content** – this may be the latest, cutting-edge developments in science or deeper understanding of familiar topics;
2. **colleagues exchange ideas routinely and without judgement about science pedagogy** – this needs to be reinforced by an open-door policy in which it becomes the norm for staff to visit each other's classrooms for the purpose of learning from each other and sharing ideas; and
3. **staff are 'sustaining an enquiring mind' –** in other words they remain eager to learn, to stretch themselves, to innovate and to be open to new ideas and content.

When these characteristics are in place, the Headteacher's view is that science-specific CPD will have a catalytic effect because individual members of staff are accessing CPD to update their knowledge or enhance their skills *on behalf of the whole team*. This sense of collegiate learning runs like a golden thread through the school. The Head of Science described how the outcomes of any CPD undertaken 'start to spread out immediately' because sharing ideas and having conversations about learning is commonplace. Teaching staff said that they have all developed particular areas of expertise and also know each other's strengths. They said the open-door teaching policy means that they share strategies and go and see new ways of teaching in action in the classroom, rather than just relying on presentations in a staff meeting to disseminate the outcomes of CPD.

Senior leaders and teaching staff alike are clear about the impact that they have seen from the Network CPD that has been undertaken. Staff are more confident and enjoy their work more. There has been a shift towards a more enquiry-driven approach to teaching and learning. They have improved the effective giving of feedback in the classroom, the use of group work and the role of dialogue. All this had led to many more pupils being really engaged by their science lessons. In

addition to the massive growth in A* and A grades described above, the school has also seen a doubling in the percentage of pupils choosing separate sciences rather than double science at GCSE, an 'explosion' in the take-up of A Level science, and students going on to study 50 or more different science-based courses at university. Pupils attest to a science experience which is fun, practical and enquiry-based. Some contrasted their positive experience at Southend High School for Boys with much less engaging science teaching that they had received at previous schools.

Network CPD has also contributed to the flourishing extra-curricular science offer at the school. Attending a Network course on forensics has led to the establishment of a very popular 'spy science' club with year 7s, and sixth formers currently help run a well-attended science society. The Headteacher said that it is not uncommon to have two or three labs open after school, buzzing with activity, and the Head of Science described how the extra-curricular offer had made science 'cool'. Teachers value the after-school clubs as a low-risk environment in which they can try out new techniques or delve more deeply into particular topics. Younger pupils describe it as 'science, but also playing'.

What three things make the biggest different to maximising the impact of science CPD?

1. **Set a clear vision for what you want to achieve through the CPD based on pupils' learning.** Be honest in your evaluation of areas for improvement and then target CPD at those areas where you still have further to go, as well as undertaking CPD that allows quality to flourish.
2. **Give individual members of staff responsibility for their own development, within a supportive and accountable framework.** The contrast in the impact of CPD which is *chosen*, versus CPD which is *imposed*, is massive.
3. **Nurture an active community of learning** so that is becomes second nature to share ideas, skills and techniques for science teaching, alongside content knowledge.

What did the school say?

'It is quite challenging stuff – it pushes you further than you think you could go.' (A Level science student)

'Practical lessons are fun. But you also have to think about the concepts behind them. We have to think about the problem first.' (Year 7 pupil)