

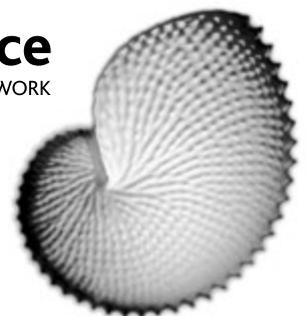


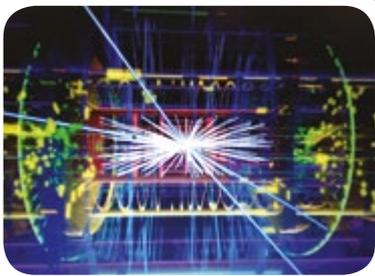
IMPACT SUMMARY 2015

**10 YEARS  
OF IMPACT**  
ON TEACHERS,  
PUPILS AND  
SCHOOLS

# Lessons in Excellent Science Education

**Science**  
LEARNING NETWORK





*“The Wellcome Trust has renewed its £10 million investment in Project ENTHUSE because we believe it drives improvements in student achievement and progression in science. A thorough review of the evidence found that ENTHUSE-funded professional development is outstanding, and should be an intrinsic part of all teachers’ careers.” Hilary Leever, Head of Education & Learning, Wellcome Trust*



The work of the National Science Learning Network is made possible through the support of a unique collaboration of government, charities, learned bodies and employers all committed to improving science teaching through the continuing professional development of teachers and technicians throughout the UK. This includes our partners in Project ENTHUSE—the Wellcome Trust, the Department for Education, BAE Systems, BP, the Institution of Engineering and Technology, the Institution of Mechanical Engineers, Rolls-Royce and the Royal Society of Chemistry.



# Summary

For the last ten years, the National Science Learning Network has provided teachers, technicians and other educators with high impact, subject-specific professional development in science and other STEM subjects (science, technology, engineering and mathematics). The Network includes the National Science Learning Centre, working initially with nine regional Centres, and since 2013 with 50 school-centred Science Learning Partnerships in England, and with partners in Scotland, Wales and Northern Ireland.



**T**he Network has learnt important lessons for itself, schools and colleges, policymakers and others about the nature, provision and impact of subject-specific professional development. Such support is particularly crucial for those teaching young people in the fast-moving areas of science, technology, engineering and mathematics (STEM).

We know that excellent professional development in science, such as that provided through the Network, improves subject and pedagogical content knowledge, develops science and understanding of science in relevant contexts, and provides opportunities for practical experiences. The Network makes such support accessible to all teachers, schools and colleges through an ongoing programme of professional learning accessed through a range of channels and media.

In this report we share five key lessons the Network has learnt about driving educational improvement through subject-specific support in its first ten years, namely:

- 1 | Sustained engagement of schools and colleges with Network support is associated with improved teaching and learning, and increased uptake and achievement in science
- 2 | Network professional development improves teachers' subject and pedagogical knowledge, skills and confidence, resulting in better outcomes for young people
- 3 | The Network develops strong leadership in science – from primary to post-16 – benefitting teachers, schools and young people
- 4 | Engagement with the Network helps schools and colleges recruit and retain excellent teachers
- 5 | Network professional development enriches teaching, supporting young people's engagement, progression and awareness of STEM careers

We share these lessons, along with supporting evaluation and independent research evidence, in order that together with teachers, school and college leaders, policymakers, funders, employers and others, we can achieve our vision of a world-leading STEM education for all young people across the UK.

**Yvonne Baker, Chief Executive,  
National Science Learning Network**

# The National Science Learning Network – a decade of support for science teaching

Improving lives through the excellent teaching of science, technology, engineering and mathematics.

Over this decade of improving student performance and progress in science the Network has:

- positively impacted the science education of over seven million young people across the UK through working with their teachers, technicians, schools and colleges
- worked directly with around 15,000 teachers and technicians across the UK every year, totalling more than 95% of secondary schools and 18% of primary schools
- enabled teachers and technicians to benefit from nearly 230,000 days worth of subject-specific professional development in a range of ways to suit them: residential, twilight sessions, bespoke in-school support, leading action research projects, scientific visits and placements, and online
- continually evaluated the impact of our activities, in order to improve, develop and adapt to the changing educational environment and teacher needs
- amassed an unrivalled body of evidence on the positive impacts of this support on the teachers, technicians and support staff themselves, and, crucially, on the young people they teach
- changed the expectations of those teaching science and other STEM subjects as to what good professional development looks like
- become an internationally recognised beacon of excellence in the provision of science education support



Our vision is a world-leading STEM education for all young people, across the UK

# Supporting teachers, schools and colleges across the UK

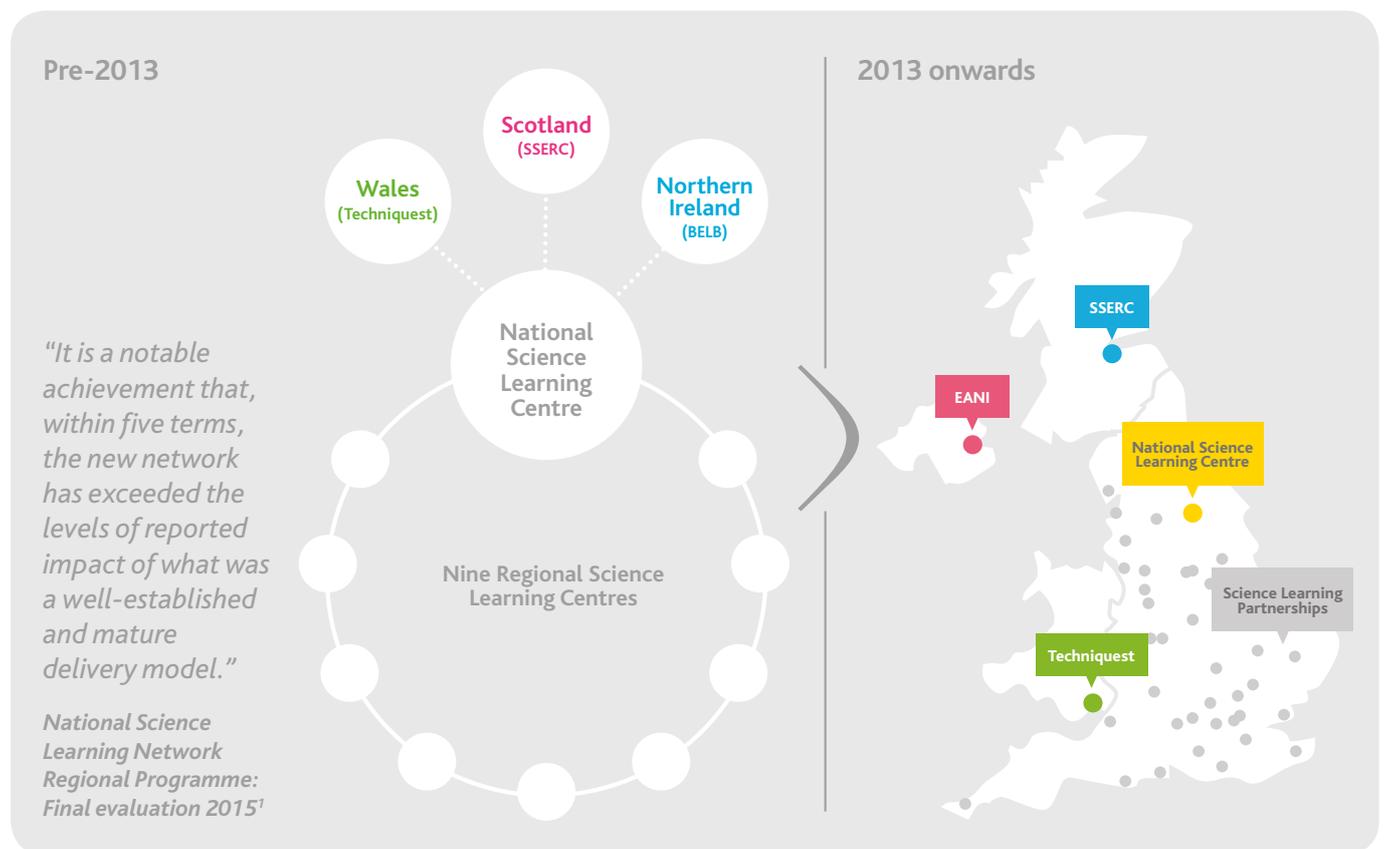
The National Science Learning Centre sits at the heart of a UK-wide network ensuring teachers of STEM subjects have career-long access to subject-specific professional development. Supported by Project ENTHUSE, with partners in Scotland, Wales and Northern Ireland, it enables all teachers and technicians to benefit from transformational professional development, including residential experiences, at York, or more locally through ENTHUSE Partnership Awards.

**A**cross England, teachers can also access DfE-funded, local, high impact support through the school-centred Science Learning Partnerships, established in 2013 to replace the previous nine Regional Science Learning Centres. The Science Learning Partnerships have quickly established themselves

as effective, working with over 14,500 teachers and technicians from 6,721 schools and colleges in their first five terms.

As well as face-to-face, residential opportunities and in-school mentoring and support, the Network also provides high impact, online professional development,

with nearly 10,000 UK teachers participating in three online courses during 2014 and 2015, led by education experts such as Professors Dylan William and Christine Harrison.



# Improving science teaching through a systematic, evidence-based approach

The National Science Learning Network's vision is a world-leading STEM education for all young people across the UK. It works towards this by making it easy for teachers and others involved in STEM education to access subject-specific, high impact professional development and quality-assured resources, so they can teach effectively and inspire the young people with whom they work.

**A**ll Network activities are grounded in appropriate education and scientific research. Outcomes for teachers, their students and the wider school environment are evidenced through a range of internal and external evaluations and independent research. Together this creates a robust, quality-assured process with which teachers, those leading STEM teaching, head teachers and others can confidently engage.

Seven key outcomes are the focus of Network support. For teachers, and school and college leaders, we seek to: improve subject and pedagogical knowledge as well as awareness of STEM careers; increase confidence, motivation and competence; encourage leadership within STEM; improve overall quality of teaching and to improve retention and career progression within STEM subjects. For pupils our key outcomes are improved student engagement, achievement and STEM literacy, and increased pursuit of STEM subjects and careers post-16.

Independent studies confirm the positive impact of Network support on each of these areas, as outlined in the next sections of this report. This is substantiated by direct feedback from teachers:

**86%**

of teachers confirm impacts on pupils, including better engagement, increased motivation to study science and improved progress and attainment

**94%**

of teachers report positive impacts on their own knowledge, skills, practice and confidence

**85%**

of school leaders agree that Network support has positive impacts on the quality of teaching in their schools



# Our model for effective CPD

## Who we work with



Teachers



Support staff



School and college leaders



Partners in government, employers and trusts

## What we do

### Face-to-face and online CPD

- school-based support
- mentoring and coaching
- networking opportunities
- thought leadership conferences
- study visits and employer placements



### Teaching resources



Physical and electronic library of teaching resources



- online groups and communities
- online cutting edge research

## Outcomes



### Improving teachers' and school and college leaders'...

- subject, pedagogical knowledge, and awareness of STEM careers
- confidence, motivation and competence
- leadership within STEM
- quality of teaching
- retention and career progression within STEM



### Leading to increased pupil...

- engagement, achievement and STEM literacy
- pursuit of STEM subjects and careers post-16

**Vision**  
a world-leading STEM education for all young people



### Network of STEM partners and supporters

- strategic direction for STEM education
- influence government and industry
- experts to enhance CPD
- funding for CPD

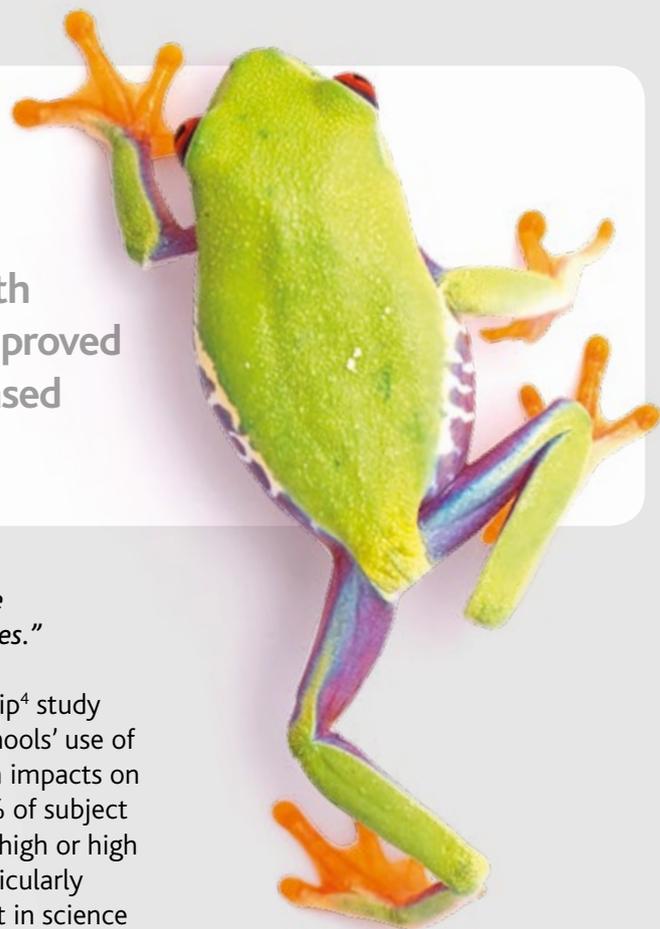


### Public engagement

- STEM activities for families and schools

# Lesson One

Sustained engagement of schools with Network support is associated with improved teaching and learning, as well as increased uptake and achievement in science.



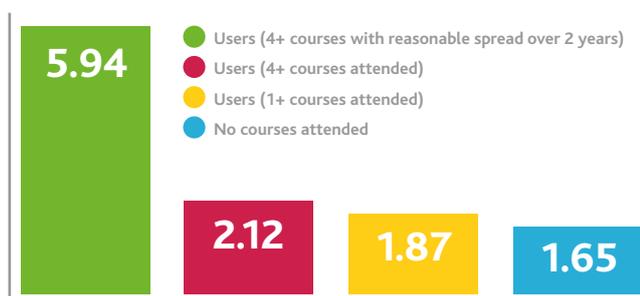
In 2010, the National Audit Office report 'Educating the Next Generation of Scientists'<sup>2</sup> found evidence that teachers' participation in National Science Learning Network programmes was "associated with improved teaching and learning, and higher take up and achievement in science at their school". A 2012 study by SQW<sup>3</sup> confirmed this: "Analysis of secondary data suggests improving performance amongst schools which

have accessed Science Learning Centre courses."

A 2015 Isos Partnership<sup>4</sup> study comparing English schools' use of Network support with impacts on pupils found that 82% of subject leaders reported very high or high impact on pupils, particularly increased engagement in science lessons, pupils' investigative skills, and enthusiasm for extra-curricular science activities.

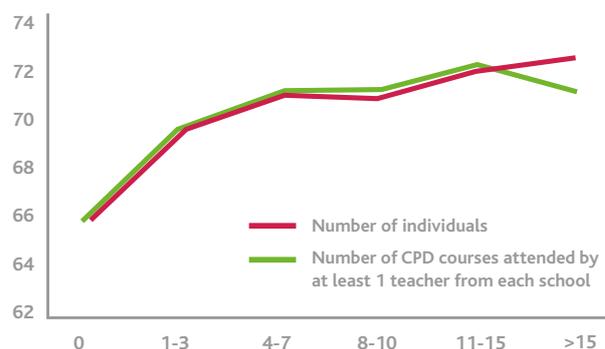
## The Isos study also confirmed impacts on pupil progress and attainment:

Improvements in percentage achieving L4+ at KS2 science, 2012-2014



Primary schools that have engaged with Network support start, on average, from a lower base of science attainment than other schools but improve more rapidly and show higher value added than other schools.

Percentage of pupils achieving EBacc 2 Science A\*-C in 2014



Secondary schools that engage moderately or highly with Network support achieve higher percentages of pupils attaining two or more science GCSEs and achieve a higher value added score in science.

Source: Evaluation of the Impact of National Science Learning Network CPD on Schools. Isos Partnership, 2015.

The key characteristics of all Network support are consistent with those identified as critical for effective CPD in the recent 'Developing Great Teaching'<sup>5</sup> report, specifically:

- emphasis on both subject knowledge and subject-specific pedagogy with clarity around identifying and assessing learners' progress
- tailoring of support to participants' needs through systematic needs analysis and the Impact Toolkit
- provision of clear pathways throughout an individual's career, with flexibility to meet their needs through a range of channels: face-to-face; in-school support and mentoring; school-led cluster projects; online; and professional networks
- practical approaches including hands-on science, workshops, discussions, networks and use of data embedded throughout
- sustained support, encouraging in-class experimentation and collaboration with colleagues back in school to embed learning and maximise impact
- ability of tutors and teacher presenters to challenge orthodoxies and address teachers' misconceptions and misunderstandings in a sensitive and appropriate way. Network support draws on a range of individuals, including practicing scientists and engineers, to provide these new perspectives and contexts, giving teachers opportunities to engage with a rich diversity of thought



Network support systematically enables teachers to become 'reflective practitioners' by embedding planning for impact across all its activities. Participants use the Impact Toolkit to help them identify their needs and intended learning outcomes, assess their practice before, during and after their participation in Network activities, describe the impact on themselves, their students and the wider school, and share learning with colleagues, school leaders and others.

Kudenko & Hoyle<sup>6</sup> (2014) found that this embedding of "*reflective and evaluative practices*" into Network

professional development "*has a definite beneficial effect on teachers' ability to plan for pupil-centred outcomes and to collect evidence of impact on pupils' achievement.*"

The Network utilises this impact evidence, along with participant feedback and independent research, to continually review, refine and develop its portfolio of support. It draws on relevant educational as well as scientific research to ensure its offer remains firmly rooted in evidence, and adds to this evidence base where appropriate through collaboration in research projects and by encouraging teachers to engage in research themselves.

# Case study

## IMPROVING STUDENT OUTCOMES IN SCIENCE WITH NETWORK SUPPORT

*"I can see the confidence the CPD gave 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 Network support has been."*



From

60% to  
88%

rise in pupils achieving  
A\*-C in science GCSEs

St Gabriel's Roman Catholic High School is a voluntary-aided secondary school with over 1,000 pupils in Bury, Greater Manchester. In summer 2014, 88% who entered core science GCSE achieved A\*-C, up from 60% in 2008.

### So, what has changed?

The school attributes the rise in science performance to strong leadership of the department, clear strategic priorities, a settled and reflective staff team, and the judicious use of science CPD; particularly from the National Science Learning Network.

The school has engaged with Network professional development in numerous ways over the last four years focussing on developing the science curriculum, building subject knowledge in physics, enhancing literacy skills in science and developing the school's technician team.

The science department maximises and embeds the impact of professional development by:

- linking CPD to departmental and individual needs
- making time for staff to reflect on their professional

development experiences and make changes to their practice

- planning how learning can be used and shared across the department and school

The school has clear expectations of the professional development with which it engages, so ensuring impact is identified and valued. For example:

- a teacher with a biology specialism attended Network professional development on teaching physics; so expanding capacity to teach triple science
- engagement with Network support led directly to an amended Key Stage 3 scheme of work
- as a result of a staff member participating in **Enhancing Literacy Skills in Science**, pupils are achieving better results in extended writing questions in science

Students speak positively about their science lessons, particularly the increased opportunities for practical work: *"We are more involved, which means you learn more, you take more in."*



# Lesson Two

Network professional development improves teachers' subject and pedagogical knowledge, skills and confidence – resulting in better outcomes for young people.

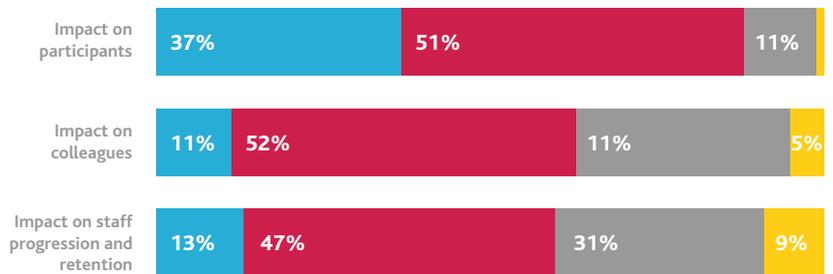
**E**vidence shows teachers who have the opportunity to update their science skills and knowledge through engagement with Network professional development are able to positively impact students, resulting in higher attainment and improved progression, increased engagement and excitement about science and a better understanding of STEM careers.

Isos Partnership<sup>4</sup> (2015) studied primary and secondary schools' engagement with Network support, and found:

- 88% of schools saw a very high or high level of impact on the staff who engaged with Network professional development and resources
- 63% of schools identified significant impacts on the colleagues of those who engaged and the wider school

A recent evaluation<sup>7</sup> of the Network's **Primary Science Specialist** support found teachers participating in a randomised control trial of Network CPD unanimous in identifying very significant impacts on their own knowledge and understanding of science subjects and pedagogies, on their ability to teach primary science in

## Schools' perceptions of the impact of CPD from the Network on staff



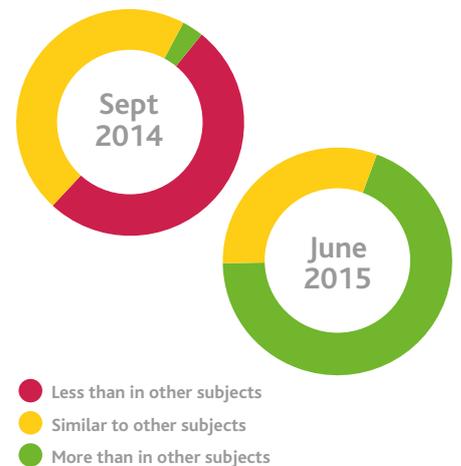
● Very high impact ● High impact ● Low impact ● Very low impact

Source: Evaluation of the Impact of National Science Learning Network CPD on Schools. Isos Partnership, 2015.

engaging and innovative ways and on their skills in supporting/leading colleagues' development of science teaching.

Participants confirmed significant positive benefits for pupils as well as themselves, with one pupil reported as saying: *"Miss, you have unlocked the mystery of science for me."*

## Primary pupil attainment in science before and after teacher CPD



Source: Primary Science Specialist (2013-14) and New and Aspiring Primary Science Specialist (2014-15) Impact Evaluation Report. Myscience, 2015.

*“Personally for me it’s made me get more excited, and look forward to [learning science].”*

Year 9 student



NFER’s evaluation of the National Science Learning Centre<sup>8</sup> in 2012 reported significant benefits for young people from their teachers’ engagement with Network support, including:

- increased enjoyment of, and engagement in, science lessons and extra-curricular activities
- increased confidence and understanding in learning science and security in their existing knowledge
- development of transferable and practical skills
- increased awareness of the importance and relevance of science to society
- increased knowledge of career opportunities in and from science
- improvements in progress and attainment
- increased interest in, and uptake of, science subjects and careers

OPM<sup>9</sup> (2014) investigated the impacts of Network support through ENTHUSE Clusters – groups of schools working together with Network support. The report found strong evidence to support students’ improved enjoyment and engagement with science as a result of more engaging teaching. In particular the students demonstrated improved thinking skills through greater use of enquiry-based learning: *“Children are being scientists rather than just completing the worksheet.”* Cluster lead.

Feedback collected from participants via the Network’s own Impact Toolkit shows 94% of teachers and technicians reporting positive impacts in terms of their subject and pedagogical content knowledge, skills and confidence.

This is particularly significant when compared to the 2014 OECD TALIS<sup>10</sup> teacher professional development report which comments: *“50% of teachers in England report ‘effective’ training over the previous year in their subject fields compared to an average of 71% for high performing countries.”*

# Case study

## INCREASED TEACHER CONFIDENCE LEADS TO A RICHER EXPERIENCE FOR PRIMARY PUPILS

*"The CPD I undertook with the National Science Learning Network was ideal. Every session was rooted in the context of improving my pupils' understanding and enjoyment of science and I left every day enthused and full of ideas for new lessons and schemes of work."*

**John Anderson**, Science lead, Hitherfield Primary



# 100%

of the teachers involved reporting positive changes in their abilities

# 94%

of teachers also reported improvement in pupils' attainment

As a result of the Network's **Coaching Primary Science Scholars to Success (CPSSS)** programme, teachers at Hitherfield Primary School in Lambeth have planned and implemented a new science curriculum based around the planting, cultivation and harvesting of fruit and vegetables. This context provides significantly enhanced opportunities for children to have practical, hands-on experiences, carry out their own investigations and develop skills in understanding and scientific enquiry.

Science leads John and Tim are clear that engagement with the Network support has enabled them to expand their subject knowledge, increasing their confidence to develop the new science curriculum and pass on their knowledge and skills to other teachers.

John now feels better able to calibrate the level of detail needed for a particular year group, as his ability to prioritise the most important areas of a science topic has significantly improved. Tim says that they had been able to demonstrate clearly the impact of their engagement with the Network by sharing new knowledge and skills

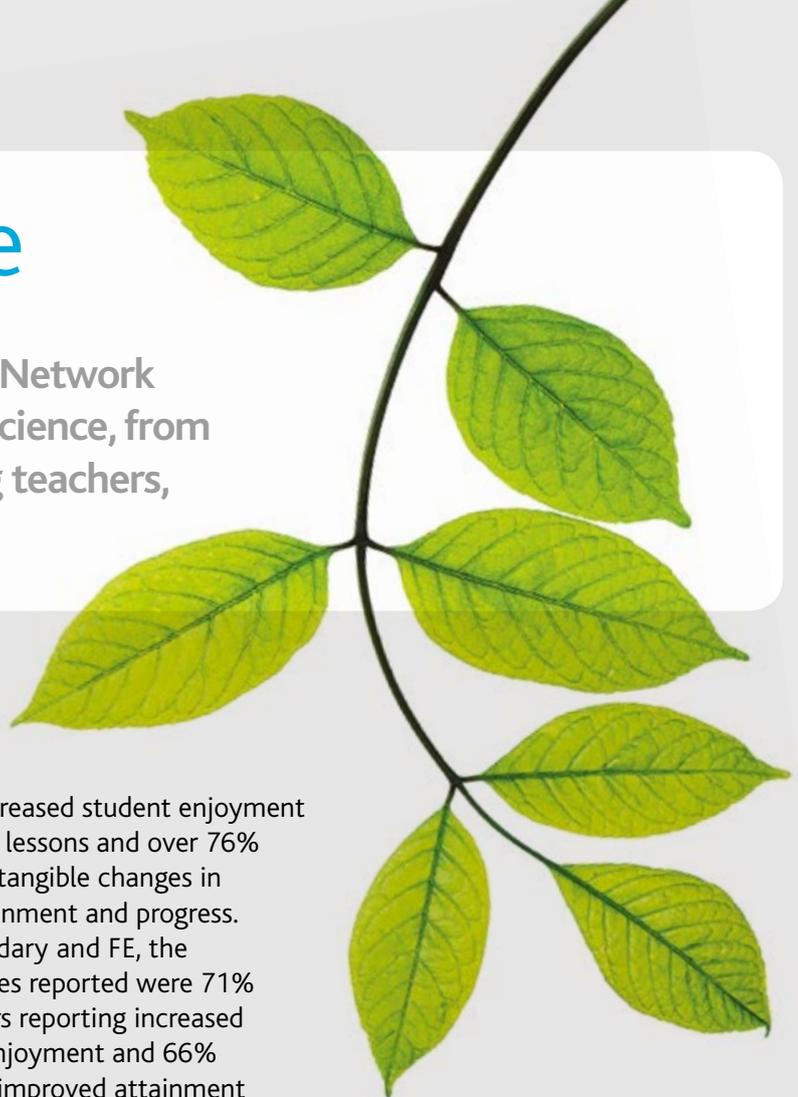
with other teachers, helping staff to plan an appropriate sequence of lessons and activities in science, and coaching and mentoring colleagues using the techniques and skills they have developed.

All participating teachers at Hitherfield reported improvements in their science subject knowledge, overall confidence and in particular their confidence and ability to teach the new science curriculum. This also reflected the views from other Lambeth schools involved in the CPSSS programme. 94% of teachers also report improvements in pupils' attainment and progress in science, along with increased motivation and interest in science learning.

*"Before in science we used to stay in class and just write down but now we go outside and try to experiment if something works."* Pupil

# Lesson Three

The National Science Learning Network develops strong leadership in science, from primary to post-16, benefitting teachers, schools and young people.



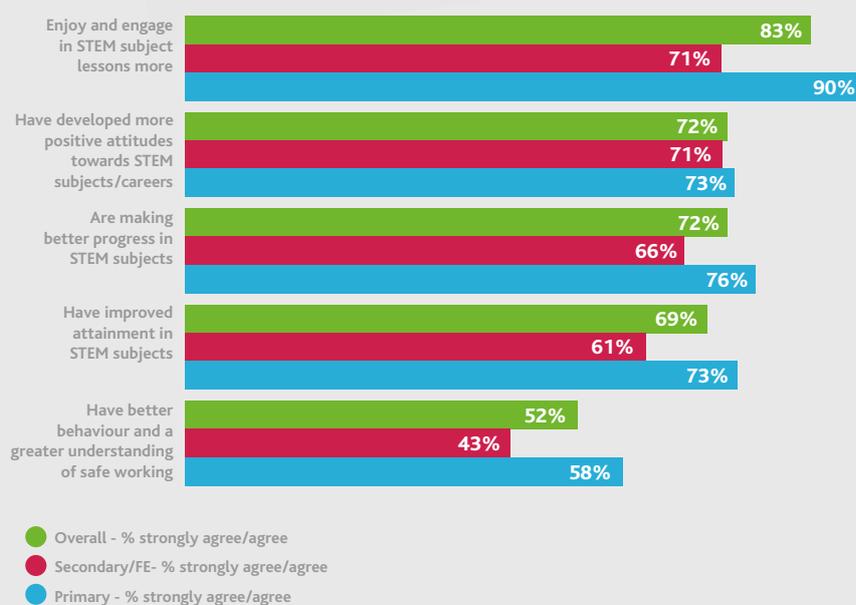
Studies show the Network's STEM-specific leadership development positively impacts teachers' subject leadership, the quality of their own teaching and learning, their confidence to transfer this learning to other staff, and their students' engagement, enthusiasm for and progress in STEM subjects.

noting increased student enjoyment of science lessons and over 76% reporting tangible changes in pupil attainment and progress. For secondary and FE, the percentages reported were 71% of teachers reporting increased student enjoyment and 66% reporting improved attainment and progress.

A leadership report<sup>11</sup> (2014) found that new and established teachers from primary and secondary schools across the UK who engaged with Network leadership CPD were extremely positive about their learning experience, with 93% reporting increases in their own confidence and competence as a science leader. The report also reported improvements in the quality and consistency of teaching and learning across their department/subject area within the school, with the strongest impacts being colleagues' confidence and effectiveness in STEM teaching and their willingness to be innovative in their teaching.

Pupils benefitted through improvements in science leadership in the schools studied, with over 90% of primary science leaders

As a result of the STEM leadership CPD, pupils in classes in my department/subject area:



Source: Report of Evaluation of the Impact of Myscience CPD Programmes in STEM Leadership on Primary and Secondary schools From original research conducted by NFER, 2014.

*"I have developed the confidence to support colleagues and have implemented a new scheme of work and assessment system for science. I have raised the profile of the subject because of my improved enthusiasm."*

Primary teacher, Primary Science Specialist participant 2013

Primary science leaders have a crucial role in helping teachers and others within their schools become confident in teaching science, since many primary teachers are not science subject specialists. The Network has strengthened its support for this important group in recent years.

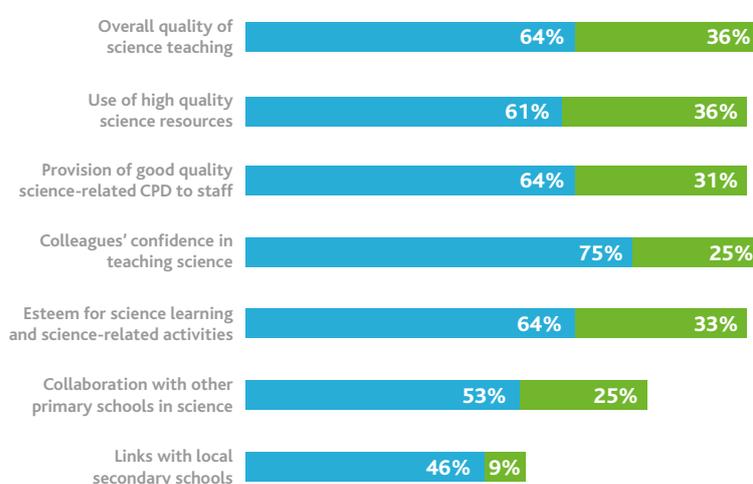
A 2015 review<sup>7</sup> of Network **Primary Science Specialist** (PSS) support found that teachers who had engaged with this CPD were confident in making an explicit connection between positive changes in pupil learning and the leadership development they participated in.

They were also clear that their participation in professional development has helped increase the quality of science teaching across their school and the profile of science school-wide.

Ofsted's "Maintaining Curiosity" science report<sup>12</sup> (2013) observed that *"Effective training for leadership [in primary science] rarely took place. Of the 91 coordinators in the primary schools [surveyed], 17 had received science-specific leadership training. Of these 17, six had received it from a regional or the National Science Learning centres... In six of the 17 schools in which the coordinators had received leadership training, science provision was outstanding, compared with only two of the 42 schools that provided no training for their coordinators."*

## Wider impact on school/colleagues

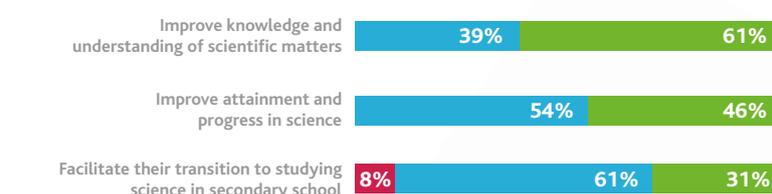
This CPD course has helped our school improve in the following areas:



● Agree ● Strongly agree

## Impact on pupils' learning

This CPD course has helped pupils in my school:



● Disagree ● Agree ● Strongly agree

Source: Primary Science Specialist (2013-14) and New and Aspiring Primary Science Specialist (2014-15) Impact Evaluation Report. Myscience, 2015.

# Case study

## RAISING ACHIEVEMENT THROUGH STRONG LEADERSHIP IN SCIENCE

*As new Head of Science at Balby Carr Community Academy in Doncaster, Ian McDaid regards the support provided by the National Science Learning Network as crucial in raising standards and aspirations for all students in a challenging environment.*

Eighteen months after being placed in special measures, Balby Carr is on a journey. The school faces severe challenges, drawing students from an area of high deprivation, with 40% free school meals and nearly 20% non-native English speakers.

With the support of his head teacher, Ian is drawing on the Network to grow the subject and pedagogical knowledge and practical and leadership skills of staff. In particular, he is encouraging newly and recently qualified teachers to engage with a wide range of support, and – with recruitment of specialist chemistry and physics teachers a particular challenge – he is drawing on the Network to raise these subject skills in non-specialist teachers so building capacity and capability across the team.

Ian starts the school year with an action plan developed with the help of the Network Self-Evaluation Tool.

He works with each member of staff to assess their needs and set performance management targets, using the Network's new Teacher Professional Learning Journey to match school priorities and their development requirements. As he says: *"Without the support of the NSLN and ENTHUSE, we would not be able to take advantage of Newly Qualified Teacher (NQT) support, build our Triple Science offering, get teachers comfortable teaching non-specialist areas and develop future leaders in science in our school."*

Ian is clear that his own ongoing engagement with Network support is a crucial factor both in his own development and his ability and confidence to take on this challenge. In particular, he points to the training he received in **Delivering Effective CPD** as critical in how he now plans to ensure effective interventions in his own department and the embedding of effective practice for sustainable change. As a Specialist

Leader of Education and Network course tutor, Ian now supports many other schools beyond his own, including primaries, enabling him to leverage the support he has received to the benefit of more teachers and young people.

Ian's advice is to use all the resources available from the Network to build critical bridges with local schools.



*"The National Science Learning Network is an essential tool for developing local connections within your network, and raising the overall science profile of your school."*



# Lesson Four

Engagement with the Network helps schools and colleges recruit and retain excellent teachers.

**R**esearch suggests that teachers who are re-enthusiased and upskilled in their subjects by Network professional development are more likely to remain in teaching and seek promotion, enabling them to influence more students positively in science.

The Centre for Education Inclusion and Research<sup>13</sup> (2012) found that most teachers participating in Network activities described their experience as increasing their likelihood of staying in teaching. This was particularly true of users with high levels of engagement over time and those engaged with subject-focussed CPD, support for non-specialists, or teaching and learning-focussed CPD.

CEIR reported that, as a result of engaging with Network support:

- teachers saw significant impacts on job satisfaction, taking on new responsibilities and moving into new areas of work
- secondary teachers also saw impacts on promotion
- teachers reported impacts on changes in their thinking about their future career plans, even where they saw no direct impacts on career progression

There was a strong correlation with the teachers' increased subject and pedagogical content knowledge, motivation and job satisfaction. This applied to all teachers, including those teaching outside their own specialism.

Perhaps most significantly, Network professional development was seen to have **a bigger impact on decisions to stay in teaching than other, similar CPD.**

*"I now have a Head of Science position and have vastly more confidence as a result of attending the course. The course and the job that followed came at a time when I was more than a little disillusioned with the way Science Education has been going. As such, it has had a very significant impact on keeping me in teaching."* Survey respondent.



A study of the Network's **Primary Science Specialist** support<sup>7</sup> provides further evidence of increased knowledge and confidence contributing to primary teachers' motivation and career aspirations.

*"It's only since I have been on these courses that I think I have something to offer and I can lead people to change the way [science is] taught across the school. Before I was in the dark because I had become science lead by default, but now I feel I have a level of expertise to pass on."*

**New and Aspiring Primary Science Specialist** (NAPSS) participant 2015.

Isos Partnership<sup>4</sup> (2015) found that 60% of schools surveyed felt that engaging in the Network's CPD had made a very strong or strong contribution to better career progression or retention for staff in their school.

Furthermore, Isos found that some subject leaders interviewed, who were new to head of department or science coordinator roles, spoke very convincingly about the contribution that the CPD they had accessed from the Network had made in enabling them to step into a position of higher responsibility and, importantly, to make a success of it when they got there.

Isos also identified the development of more local networking and collaborative opportunities,

such as participation in or with a Science Learning Partnership or an ENTHUSE Partnership, as important in providing opportunities to develop the leadership skills of their staff

and to build the leadership capacity of the school. For some schools, this was identified as part of a deliberate strategy enabling them to recruit and retain excellent science teachers.

*"It's only since I have been on these courses that I think I have something to offer and I can lead people to change the way it's taught across the school."*

**Primary teacher**



# Case study

## THE ROLE OF PROFESSIONAL DEVELOPMENT IN RECRUITING AND RETAINING EXCELLENT SCIENCE TEACHERS

*“High quality CPD makes staff feel valued and motivated to go the extra mile with their students. For us, it contributes to excellent student outcomes.”* **Nadine Payne**, Science Coordinator for Bury St Edmunds All-Through Trust



# 92%

**2015 A level science classes achieving A\*-C**

Bury St Edmunds County Upper is the secondary school within the Bury St Edmunds All-Through Trust, and for the past two years has been lead school in the local Science Learning Partnership (SLP). Head teacher Vicky Neale is adamant about the importance of supporting her staff with high quality professional development. As she puts it *“Our science department is fully staffed. Every week I get job applications... Teachers looking for their next placement see that our school demonstrates the value it places in its science teachers by investing in subject specific CPD and being part of the National Science Learning Network.”* Her approach is validated with a motivated staff, virtually no staff turnover and an extremely strong extra-curricular offering across the school. Student results support the overall picture with the latest A level science classes gaining 92% A\*-C grades.

In September 2014, newly qualified teachers in physics and chemistry joined County Upper, engaging with a broad range of

Network professional development via the SLP throughout the year. Subjects covered included time management, assessment for learning, behaviour management, tracking and progression, career progression and subject-specific practical sessions. Both teachers felt that the sessions were *“fantastically helpful”*, giving them immediate access to materials and approaches to try out with their classes. They also both commented they had deliberately applied to County Upper knowing it was a Network SLP and that therefore they would get a high level of support.

One year on, both teachers are very settled at the school and taking active roles in leading science and astronomy clubs. Joel Western, the Physics NQT, was recently recognised under the **Teacher and Support Staff Recognition Scheme** for the steps he has taken to apply his professional development learning for the benefit of his students and colleagues.

# Lesson Five

National Science Learning Network professional development enriches teaching, supporting young people's engagement, progression and awareness of STEM careers.



**E**valuation shows that teachers who have the opportunity to work with employers and researchers through Network-facilitated opportunities such as **Cutting Edge Science** and the **Teacher Industrial Partners' Scheme (TIPS)** are able to enhance the STEM curriculum and bring to life opportunities for young people. They are able to share with students their improved understanding of the breadth and diversity of STEM careers and people working in STEM.

NFER in 2012<sup>8</sup> identified one of the frequently reported benefits of teachers' engagement with Network support as "*new ideas, strategies and materials for delivering lessons in a more engaging and effective way.*" Schools studied were embedding examples, contexts and appropriate activities into lessons and placing a greater emphasis on delivering enrichment activities with the aim of raising attainment in class.

This included setting up or further developing Science and STEM Clubs, delivering science activities in breakfast clubs, arranging visits to science museums and becoming further involved in Science Week through, for example, providing competitions.

OPM's study of ENTHUSE clusters<sup>9</sup> (2014) found that Network support led to a range of school-wide innovations including introduction of STEM days or weeks, introduction of more 'real world' contexts and examples into teaching, and an increased emphasis on careers awareness for students resulting from new or improved links with industry. Crucially, these innovations were embedded into the schools' offer with teachers continuing to access resources and leverage links with employer and university partners long-term.

*"There is a lot more engagement of external support; teachers have invited individuals from business and*

*industry to demonstrate and articulate the subject area they have been teaching."*  
Cluster Lead

The Network's **Cutting Edge Science** programme, managed on behalf of Research Councils UK, gives teachers the opportunity to engage directly with active science research in universities and high profile facilities across the UK, such as CERN, Diamond Light Source and RAL.

94% of teachers engaging with the programme reported improved subject knowledge, improved skills and enhanced enthusiasm and confidence as a result of taking part. 84% reported positive impacts on their students' attainment, confidence, motivation and engagement in lessons.

*"I had forgotten how much I enjoy teaching around this topic and how much there was that you could do around it. I think enthusiasm is important especially when talking to students interested in a biology work role."*

Secondary teacher



**Teacher Industrial Partners' Scheme (TIPS)**, supported by Project ENTHUSE, takes teacher to the heart of industry, giving them the opportunity to spend up to two weeks with a STEM employer and gain an understanding of the range and depth of careers involved as well as the technologies and science applied.

King (2015)<sup>14</sup> and participant feedback shows teachers who take part in TIPS placements are significantly more confident in talking to students about careers in science

and engineering and using appropriate practical examples in lessons. They also report a significantly improved understanding of the breadth and depth of STEM careers. As a result they are more confident in discussing apprenticeships and vocational routes with young people, colleagues and parents and have a much better understanding of the diversity of people working in STEM careers.

Participant feedback<sup>7</sup> demonstrates that teachers engaging with the Network's **New and Aspiring**

**Primary Science Specialists** support often find that the ideas they gain for enriching the curriculum and encouraging enquiry based learning are particular highlights. One teacher commented: *"It has made me think harder in science lessons to make sure all children have practical experiences of science – moving away completely from using worksheets and taking opportunities whenever they occur, for example, the solar eclipse this year."*

*"This has been a fantastic course. My knowledge has improved immensely... I have used many of the activities in the classroom and have started a science club that has been over-subscribed since it began."*

**Secondary teacher**

# Case studies

## CERN TEACHER VISIT ENRICHES AND DEEPENS WHOLE SCHOOL STEM ENGAGEMENT

Network support connects teachers to ground-breaking science through trips to a range of scientific facilities, including the Large Hadron Collider at CERN. Over the 2014 school year, 78 secondary teachers from the UK visited CERN as part of Network professional development, complemented by sessions identifying how to use their experience back in school.

93% of teachers involved reported their visit had impacted teaching and activities within their school. Examples include:

- adding quality and depth to schemes of work, such as teaching particle physics at post-16 level
- CERN activities used to boost the profile of physics and encourage uptake of Alevel physics and mathematics
- whole school assemblies about CERN
- cloud chambers being built by students and used from primary to post-16
- integrating CERN into Alevel and BTEC L3 physics/engineering
- primary feeder liaison, using simple magnet and electricity experiments to engage young scientists
- support given to non-physics teachers to use "big science" in their teaching
- joint mathematics and physics activities, using data analysis from CERN materials as part of a whole-school activities

Feedback shows that each teacher who visited CERN worked directly with 145 students on average in that school year and supported a further 3.9 teachers, who, in turn, went on to use activities, resources and information about CERN with a further 146 students. This suggests that, in one year alone, up to 11,392 students have benefitted as a result of their teachers' experiences.

## LIFTING THE LID ON STEM CAREERS THROUGH TEACHER INDUSTRIAL PARTNERS' SCHEME

Science teacher David Sandell spent two weeks with Crossrail in 2014, experiencing a range of activities from project planning to tunnelling. As a result of the insights gained, he has rewritten schemes of work to incorporate engineering contexts into his and his colleagues' science lessons, developed engineering careers packs for all tutors to use with students and set up a series of engineering-focused trips and STEM days.

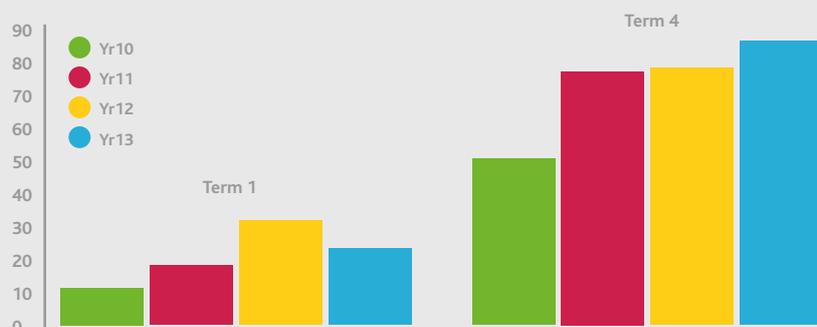
A survey of his students, before and after his experience, shows a significant change in their awareness of apprenticeships, a crucial area of careers where

many teachers feel their knowledge is lacking. David says: *"I learned so much about the range of opportunities in engineering for my students and the alternative*

*pathways like apprenticeships that they can take instead of standard university routes. This was one of the most useful CPD experiences I have undertaken."*

### Were students aware of STEM/Engineering opportunities such as apprenticeships?

Awareness of career opportunities



Source: Taken from TIPS participant feedback, David Sandall, 2014.



# Looking ahead – what next for science teaching and the National Science Learning Network?

The UK has an internationally-renowned science education support infrastructure, with the National Science Learning Network at its heart. Over the last ten years, the Network has been instrumental in helping the UK address concerns over the numbers of young people opting to study STEM subjects in the latter stages of their education and into STEM-related careers. It has also contributed to the growing public awareness of the importance of STEM skills and awareness for all young people in order that they can be active citizens in an increasingly technological world.

**T**he Network enters its second decade working ever more closely with and through schools and colleges to build capacity and capability for ongoing improvement. This includes the school-centred Science Learning Partnerships across England, which – in just 18 months – have established themselves as effective, forward-looking and driving improvements across the education system. Support is also being expanded to include professional development opportunities targeted at supply teachers, returners and those entering or in initial teacher training.

As the 2015/16 academic year begins, the Network is launching a Secondary Science Mark, along with an online version of the Impact Toolkit to make planning for and recording of impact even clearer for individuals and schools. It is also launching the Teacher Professional Learning Journey, in collaboration with ASE and the Wellcome Trust, enabling teachers to plan and track their own development in

collaboration with school and college leaders, and encouraging wider recognition of the professionalism of science teaching throughout schools and colleges across the UK.

Thanks to the continuing support of government, charitable trusts, employers and other supporters over the last ten years, the Network has been able to contribute significantly to a rise in the number of young people pursuing STEM subjects and being inspired to consider STEM careers. However, in the face of ever-growing global competition for talent, there is no room for complacency. The Network is moving ahead, drawing on the lessons it has learnt and continues to learn, determined to ensure that every young person across the UK should have the world-leading science education they deserve.



*“The future of science depends on the quality of science teaching today.”*

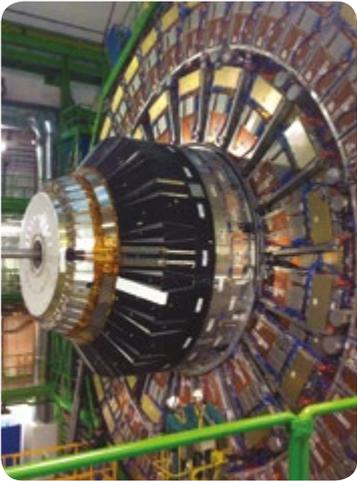
**Wellcome  
Trust**



# References

All listed reports are available at [www.slcs.ac.uk/research-reports](http://www.slcs.ac.uk/research-reports) unless otherwise stated.

1. Bryant, B., Dunford, R., Parish, N. & Rea, S. *National Science Learning Network Regional Programme: Final evaluation report*. Isos Partnership. 2015.
2. Clark, F., Epps, A., Hands, A., McKenzie, J. & Ormiston-Smith, N. *Educating the next generation of scientists*. National Audit Office. 2010. <http://stem.org.uk/rxajv>
3. Clarke, C. & Thom, G. *Evaluation of the Science Learning Centre Network*. SQW. 2012.
4. Bryant, B. & Parish, N. *Evaluation of the Impact of National Science Learning Network CPD on Schools*. Isos Partnership. 2015.
5. Cordingley, P., Higgins, S., Greany, T., Buckler, N., Coles-Jordan, D., Crisp, B., Saunders, L. & Coe, R. *Developing Great Teaching: Lessons from the international reviews into effective professional development*. Teacher Development Trust. 2015. <http://tdtrust.org/about/dgt/>
6. Kudenko, I. & Hoyle, P. *How to enhance CPD to maximise the measurable impact on students' achievement in science*. ESERA 2013 conference proceedings. 2014.
7. Kudenko, I. *Primary Science Specialist (2013-14) and New and Aspiring Primary Science Specialist (2014-15) Impact Evaluation Report*. Myscience. 2015. <http://stem.org.uk/rxc52>
8. Walker, M., Straw, S. & George, N. *Qualitative evaluation of the National Science Learning Centre*. NFER. 2012.
9. Dorrans, S., Cameron, G. & Ritchie, O. *Evaluation of the impact of the Cohort 3 ENTHUSE Clusters*. OPM. 2014.
10. *Teaching and Learning International Survey*. 2013. <http://www.oecd.org/edu/school/talis.htm>
11. Bentley, D. *Report of Evaluation of the Impact of Myscience CPD Programmes in STEM Leadership on Primary and Secondary Schools*. From original research conducted by NFER. 2014.
12. *Maintaining curiosity: science education in schools*. Ofsted. 2013.
13. Wolstenholme, C., Coldwell, M. & Stevens, A. *The Impact of Science Learning Centre continuing professional development on teachers' retention and careers*. Sheffield Hallam University: Centre for Education and Inclusion Research. 2012.
14. King, S. *Teacher Industrial Partners' Scheme Evaluation Full Report*. National Science Learning Network. 2015.



National Science Learning Centre  
University of York, Heslington,  
York YO10 5DD  
tel: 01904 328377  
email: [enquiries@slcs.ac.uk](mailto:enquiries@slcs.ac.uk)  
web: [www.slcs.ac.uk](http://www.slcs.ac.uk)  
follow us: [@sciencevoice](https://twitter.com/sciencevoice)

The National Science Learning Network is a joint initiative by the Department for Education and the Wellcome Trust.

Project ENTHUSE is a unique partnership of government, charities and employers that have come together to bring about inspired science teaching through the continuing professional development of teachers of science and technicians across the UK. The ENTHUSE Partners are the Wellcome Trust, the Department for Education, BAE Systems, BP, Institution of Engineering and Technology, Institution of Mechanical Engineers, Rolls-Royce and Royal Society of Chemistry.

