



STEM Learning Limited

Triple Science Support Programme

Final evaluation summary (extension period)

October 2016

Summary

STEM Learning Ltd conducted an evaluation of the Triple Science Support Programme (TSSP) extension period from 1 April to 31 July to supplement the external evaluation of years 1 and 2 of the programme conducted by OPM (published in April 2016). The evaluation comprised of two parts; an online survey to a sample of schools engaged with the programme (n=36) and five case studies. The aim of the evaluation was to provide evidence impact of the programme and highlight achievements from schools that received support during the extension period.

Key findings:

1. This evaluation found that the TSSP was successful in meeting school needs to improve triple science provision. This is similar to the findings from the evaluation of years one and two of the programme (conducted by OPM and reported in April 2016).
2. An increased proportion of schools reported high impact on teacher development (78%) and student outcomes (50%) compared with the figures in the previous evaluation (47% and 27% respectively). Many schools reported that the programme facilitated positive changes that are being embedded in the school and will be sustained in the longer term (98%). They also report that the impact would not have occurred or would not have occurred so well without support from the TSSP (97%).
3. Through participating in the TSSP, many schools reported improvements in the quality of teaching (67%) and leadership (67%) and/or are expecting improvements in the future (42% and 47% respectively). Almost all of the schools (92%) expected to see an increase in the number of students wishing to study science subjects post 16 in the future. Forty percent expressed confidence that the number of students opting to study triple science will increase in the future and three quarters (78%) expected increased engagement in triple science of pupil premium and other vulnerable groups in the future.
4. The case studies provided additional evidence that the extended programme increased impact on student outcomes as well as teacher development. For example, one of the case studies came from Farnborough Academy, a state comprehensive school in challenging circumstances with 50% of students qualifying for the pupil premium, the school has had been engaged with the programme for the last two years. According the school head of science,



- a. “The last two years has seen a vast increase [in students taking triple science] from 10 to 30 to now 75...” Moreover, thanks to the continuing availability of the programme, this number is expected to rise further with the size of the TS cohort in the current academic year (2016-17) reaching half the year group.”

The future:

1. The evidence from both the previous external and this extension evaluation clearly demonstrates that the programme has been a benefit to schools. The benefit from longer term engagement and a more integrated approach with the Science Learning Partnerships is reiterated by this extension evaluation. Consequently, from August 2016, the TSSP is being integrated into the provision from Science Learning Partnerships to targeted schools to improve their uptake of triple science at GCSE over the next three years.



1. Introduction

The Triple Science Support Programme (TSSP) is a programme of professional development support funded by the Department for Education. The current phase of the programme started in July 2014 and finished in July 2016. Its aims were to improve the provision of triple science and increase the number of students in England studying GCSE triple science, including those eligible for funding from pupil premium (formerly free school meals) as well as building capacity in the teaching profession to improve the teaching of triple science in the future.

This evaluation report builds on the previous external evaluation report conducted by OPM and focuses on the extension period from 1 April 2016 to 31 July 2016. This evaluation supplements the previous external evaluation findings, which found that schools engaged in the programme improved their triple science provision with positive impact on the outcomes for students.

2. Extension evaluation

STEM Learning Ltd has evaluated the extension period activity of the TSSP programme from April – July 2016. The aim of this evaluation is to highlight further achievements and provide additional evidence of impact from schools that had continued to receive programme support. The evaluation methodology included:

- Online survey – of schools that continued to receive TSSP support during the extension period; 36 schools participated in the survey.
- Case studies – Four in-depth school-based case studies and one case study from a network of schools that benefited from the TSSP support. These case studies (included in the second part of this report) were used to triangulate and expand the findings from the online survey.

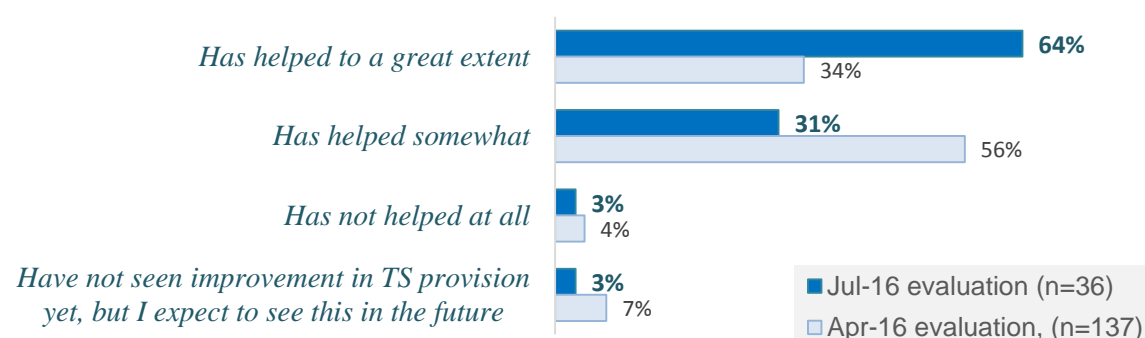
3. Main findings (online survey)

Overall impact

Overall the findings from the previous external evaluation of the programme (April 2016) were corroborated: TSSP has had a positive impact on a wide range of outcomes. The evaluation of the extension programme confirmed that the quality of the TSSP support to schools remains consistently high and is appreciated by science teachers and leaders. It also showed continued impact on teachers, students and schools.

Nearly all respondents reported that TSSP improved the triple science provision in their schools with nearly two-thirds (64%) considering this help to be of **great extent**. As illustrated in Figure 1 below, this is a significant increase from the previous evaluation of the programme, which asked schools a similar question in February 2016. Previously, around a third (34%) of survey participants reported that the programme helped 'to a great extent' with more than a half (56%) describing it as 'somewhat helpful'.

Figure 1: Overall, how successful was the TSSP in helping to improve TS provision in your school?



This comparison of evaluation findings indicates that it takes time for the impact of the programme to be embedded in schools and shows that with time the impact is being sustained and expanded. This was predicted by the previous external evaluation and substantiated by this extension evaluation.

Quality and range of CPD within the TSSP

The quality and range of CPD provided by TSSP has been rated highly and shown to bring a wide range of benefits for teachers and subsequently for students. All of the schools responding to the extension survey (36) agreed that 'TSSP support was useful and relevant to school needs' with 78% strongly agreeing. Nearly all survey respondents 97% considered TSSP CPD to be of high quality, and viewed it as the key success ingredient of the programme.

The highest quality of professional support needs to be tailored to participants needs, be delivered effectively and needs to promote high impact and sustainability. This was the second key element of the programme success and many participants acknowledged the

relevance and usefulness of the school-focused delivery and the flexibility of the TSSP bespoke programme,

“The expert advice is open and honest. The needs analysis ensures CPD is focused and training is very productive. The convenience of venues including in-house is extremely useful to ensure all staff can attend. The resources and links to other websites enhance teachers practice immensely and a trusting relationship has developed between science staff and the two lead advisers; Lynn Henfield and Debbie Roberts. This enables staff to contact them to ask questions when in doubt and the service we receive from both advisers is outstanding. Overall the impact is confident teachers, happy to teach outside specialism and students that receive quality first time teaching so that they make expected progress and above.” Subject leader (North Lincolnshire)

Another respondent praised the programme support, which combined external training opportunities and in-school support:

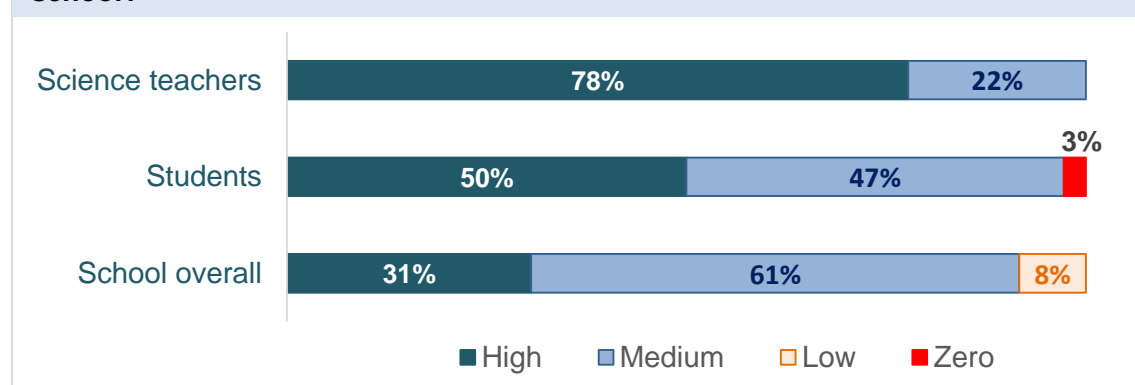
“The external training sessions attended were key in highlighting the demands of the linear courses and how to best support teachers and students in meeting those demands, so allowing greater progress. The 1 to 1 sessions were hugely informative and introduced new ideas and concepts which will be useful for all stages of science.” Teachers (Worcestershire)

Impact of the programme

Science teachers:

In line with the earlier findings from the previous external evaluation report, this evaluation also found evidence of a strong impact on science teachers, such as improved subject and pedagogical knowledge, increased confidence in teaching new areas, awareness of planning and teaching the new curriculum, particularly for new and inexperienced teachers. More than three quarters of responding schools (78%) rated the impact on teachers as ‘high’ while the remaining 22% reported medium level of impact (see Figure 2 below). This is a substantial increase in impact compared with the previous evaluation period (April 2016), when only 47% of participants rated it as ‘high’ while 49% considered it to be of ‘medium’ strength.

Figure 2: What is the overall impact of the TSSP on teachers, students and school?





Participants provide evidence of how the TSSP helped improve teachers' subject and curriculum knowledge, skills and confidence:

- ✓ Better deeper and broader knowledge of maths in science stronger understanding of how to use test scores/data to support learning progress (Newham)
- ✓ Improved Physics skills of specific teachers and maths skills improved across the dept. (Rochdale)
- ✓ Really helped the non-physicists with the additional maths required for physics in the context of the new course (Wiltshire)
- ✓ Provision of high quality schemes of work and useful tips to make this most effective for us (Oxfordshire)
- ✓ Raising confidence, thorough understanding and open and honest dialogue (North Lincolnshire)
- ✓ Confidence for teachers who are new to teaching or new to triple science, especially with the literacy and numeracy content. (Wandsworth)
- ✓ Staff increase awareness of new requirements for practical skills and maths content (Rochdale)
- ✓ The pressures of teaching triple award for us is with the time constraints and the TSSP has given us great ideas to try and get around having only 5hrs a week (Calderdale)
- ✓ [The programme has helped us with] the planning and practise of the required GCSE practicals in the new science GCSEs. Also [with] any issues that have been encountered and how to avoid them with some of the more tricky ones; pacing of the new curriculum and the expected knowledge students should have coming from key stage 2 (Swindon)
- ✓ Inexperienced science teachers who were struggling with consistency in planning for, marking and moderating CAU were greatly improved in proficiency (Newham)

Improvements in teachers' knowledge and skills enabled positive changes in classroom practice:

- ✓ Development of enquiry based learning... has led to our highest ever predicted Year11 TS results (100% A* - B) (Leeds)
- ✓ Increased understanding of specification changes has enabled us to make changes to KS3 SOW to help prepare students from the start [of secondary school] (Hackney)
- ✓ The challenge in lessons has been improved (Thurrock)
- ✓ [Improved] use of probing questions and deeper learning (Bradford)



Impact on students:

A considerable increase in the impact on students was reported in the extension period particularly in terms of enthusiasm, interest, improvement in enquiry skills, increased attainment and progress with subsequent increase in take up of triple science and progression to sciences post16.

Fifty percent of the respondents (compared with 14% in April 2016) reported high impact on students with a further 47% reporting medium impact (63% in April 2016). A growing number of schools registering stronger impact on students during the extension period supports the conclusion from the previous evaluation that the impact of the programme on student outcomes takes a longer time to become established and evident.

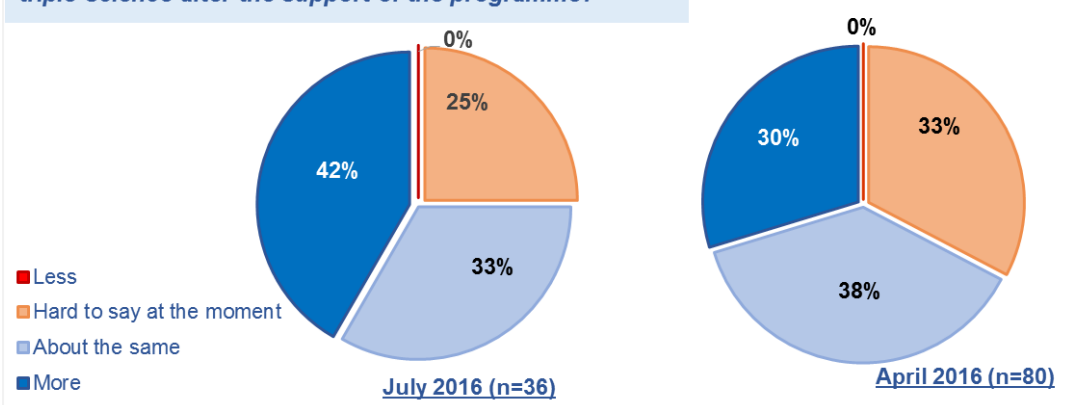
- ✓ The triple award programme has helped students to be enthused by Science and push them on to higher grades, particularly A*-A (Calderdale)
- ✓ ...improved physics results and improved pupil attitude towards physics especially girls (Birmingham)
- ✓ Development of scientific enquiry skills in students. This in turn is promoting their curiosity in science. (North East Lincolnshire)

The respondents confidently pointed to a direct causal link between the increase in teacher confidence and competence following TSSP CPD, and noticeable improvements in such student outcomes as enjoyment of and engagement in science lessons as well as improved attainment and progress:

- ✓ [students] benefit from teacher's feelings of confidence (Hackney)
- ✓ Better preparation for exams and the heavier working scientifically content (Leeds)
- ✓ better understanding - more engagement due to better activities done in lessons (Birmingham)
- ✓ If teachers have good quality schemes to follow this improves confidence then this impacts on the delivery to the students (Oxfordshire)
- ✓ Teaching students to understand and then apply to situations. Addressing misconceptions. Linking practical to theory and relating equations to real life examples (North Lincolnshire).

The programme has impacted on the number of students taking triple science. Around 40% of schools were confident that the number of students studying triple science would increase as the result of the programme, while another third of schools estimated the number of students to, at least, remain the same. This is a moderate increase on the previous evaluation findings when only 30% of schools expected the number of TS students to go up (Figure 3).

Figure 3. Will more or less pupils in your school study triple science after the support of the programme?



- ✓ We have predicted to achieve our highest ever Triple Science results with our current year 11 pupils following the enquiry based learning activities and working scientifically skills we have looked at developing in our lessons. The KS3 curriculum has had a complete overhaul which has meant that we have increased our numbers opting to take Triple Science due to the enjoyment and engagement within lessons. Our Triple Science pupils will all make better than expected progress against their target grades this year (Leeds)
- ✓ Students are enjoying their science curriculum more and science staff are more motivated. The numbers of students opting to take triple science next year has almost doubled to nearly 60 students (East Sussex)
- ✓ Introduced triple science in Sept 2015 in Y9 with one group of 22 students as an indirect result of the work of the TSA. This year we have two groups opted for triple science to start in Sept 2016. We also have A level courses starting up in all 3 areas in Sept 2016 in addition to BTEC which we have run for several years (Oxfordshire)

Schools have also reported increased likelihood of students selecting STEM subjects at post-16 level:

- ✓ It has allowed for the opportunity to share good practice, it has helped colleagues to develop their subject knowledge of specific topics, particularly if they are teaching outside their own subject specialism. It has helped us to prepare for the new GCSE Science specifications. Through improving the teaching and delivery of the subject, through the sharing of good practice and opportunities for collaboration, it has encouraged more pupils to opt for the subject (Wigan)

Wider impact on school:

The programme has delivered high quality support for the teaching of triple science options, which has generated many additional benefits for schools including improvements in the quality of science teaching across all key stages, raised confidence of science leaders, sharing of best practice and new pedagogies with colleagues in other departments and across schools. There has been an increase in the proportion of schools reporting high or medium levels of impact on school from 81% (April 2016) to 91% (July 2016)

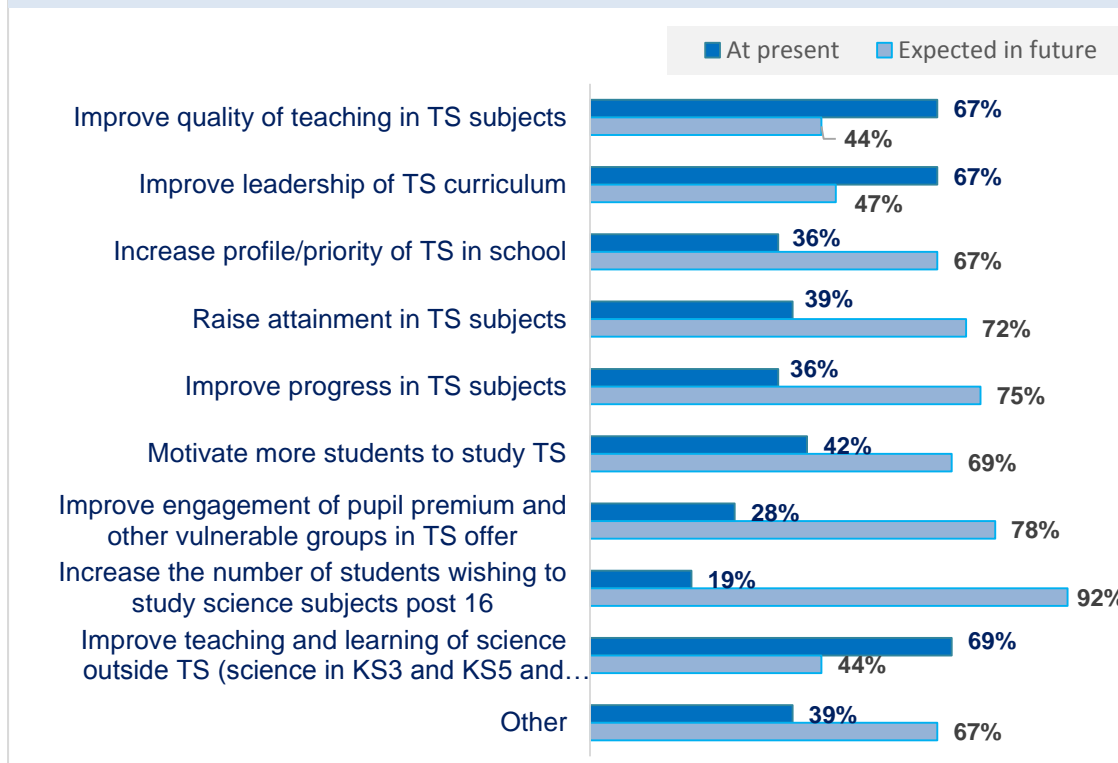


- ✓ Above national average results for Triple science A*-C and A*-A over the past three years. More students choosing to study the sciences at post-16 (North Lincolnshire)
- ✓ We found the work done [of the TSSP] not only improves the triple science subjects but all of them [i.e. other subject]. Our students are not the traditionally triple science cohorts and this scheme has helped to plan more effectively for our groups. It has also assisted staff in their preparations and clarified some misconceptions. The sharing of practice with other middle leaders in science departments was particularly good for our newly appointed Second in Department (Rochdale)
- ✓ Improved quality of teaching both inside and outside of triple science. Increased confidence with delivery of physics following CPD and bespoke coaching in Physics (Buckinghamshire)
- ✓ Definitely improved engagement of students and profile of science within the school (Kent)
- ✓ Improve the leadership of triple science - having had my CPD sessions I feel more confident in my leadership skills and style and am able to better lead this area of the curriculum (Wiltshire)

Present and future impact

Schools have reported that TSSP has had a range of positive developments to date and they expect more in the near future (Figure 4).

Figure 4: Which of the following outcomes have been achieved/will be achieved in your school through your participation in the TSSP?



For instance, over two thirds of schools evidenced improvements in quality of teaching in triple science subjects, leadership of triple science curriculum and teaching and learning of science in key stage 3 & 5. However, as a result of the programme, schools expect an increase in the number of pupils studying science post16: from 19% currently to 93% in the future. Similarly, just over a third of schools reported improved student progress in triple science subjects with three quarters of schools expecting an improvement in student progress in the future.

- ✓ TSSP support will impact considerably on the assessment of pupils' progress prior to KS4 to identify the most suitable students to engage with Triple Science (Dudley)
- ✓ As a new head of Science the CPD received will greatly improve the assessment and tracking of our students and allow a greater level of specific intervention for students to take place. Also, the monitoring of staff will be improved following the CPD (Durham)
- ✓ Cohorts of pupils in current 9 and 10 on triple pathway. Further raising profile of subject in school (Manchester)

Impact attribution and sustainability

Schools are clear that the TSSP has enhanced, speeded up or made possible a majority of positive changes i.e. 56% (20) considered that only some of the improvements noted in science teaching would have been possible without the TSSP. Moreover, 4 participants (11%) said that these changes would never have occurred without the TSSP. A further 11



respondents (31%) considered that changes would have happened anyway, but the programme helped to speed them up (Figure 5).

Figure 5: Would the changes identified in the last few questions have happened without the TSSP?

No, only some of these changes would have occurred without the TSSP	20	56%
No, these changes would not have occurred without the TSSP	4	11%
Yes, but these changes would have taken longer to implement than through the TSSP	11	31%
Yes, these changes would have occurred without the TSSP	1	3%
Total	36	

This positive impact of TSSP is expected to be sustained in the future with 42% (15) of respondents strongly agreeing and 56% (20) agreeing with the following statement:

“I expect the impact of the programme to be sustained or increase in the future”.

All schools that responded to the survey are interested in receiving similar support and/or CPD for science and other STEM subjects in future: 72% (26) strongly agreed and 28% (10) agreed that

“In future our school would very much like to receive similar support and CPD for science and other STEM (science, technology, engineering and maths) subjects”.



4. Case studies

The following case studies triangulate and verify the impact of the programme discussed so far. The four school-based case studies provide evidence of impact on teachers participating in the programme, their students colleagues in their own school and across schools as well as information about their future plans for the teaching and learning of triple science. Case Study 2 is an example of how a regional triple science network of teachers, technician and schools has benefited from the TSSP, facilitating significant improvements in teacher and student outcomes among its member schools.

Case study 1: The Farnborough Academy, Nottingham, Central Region (p.10 – p.11)

Case study 2: Blueprint Alliance Network (p.12 – p.14)

Case study 3: Malton School, North Yorkshire (p.15 – p.16)

Case study 4: Liverpool Life Sciences UTC, North West (p.17 – p.19)

Case study 5: Blackburn Central High School, North West (p.20 – p.21)

The case studies support the survey findings and provide evidence of the impact on the uptake of triple science at key stage 4; outcomes for pupil premium students; building capacity and sustainability within school; outcomes for students and teachers and the uptake of STEM subjects at key stage 5.



Case Study One: The Farnborough Academy, Nottingham, Central Region

Overview

The Farnborough Academy is a state comprehensive school in challenging circumstances, where 50% of students qualify for the pupil premium (PP). It is located on the edge of Nottingham City in the suburb of Clifton and became part of Trent Academies Group in January 2015. It has a relatively long history of triple science implementation that started in 2007. The first groups were taught out of schools hours with only 10 pupils participating. In 2016/17, the school will have three groups of 75 pupils taking triple science. Support from the Triple Science Support Programme (TSSP) started in 2012, and has included whole team CPD on triple science subject content and pedagogical knowledge, strategies for raising attainment and bespoke advice on curriculum planning and whole school issues. The developments have been driven by the head of science, with the support of the triple science adviser. They have improved opportunities for students to increase the 'science capital' particularly for students with limited 'science capital'.

"The last two years has seen a vast increase from 10 to 30 to now 75 students a year taking it up. Next year's cohort is half the year group" Head of science

Impact on students

The science leader has a strong commitment to tracking students' progress. Advice from triple science adviser confirmed their excellent practice and introduced some new tools. For example, the triple science students had input about STEM careers from a chemistry teacher, a junior doctor and a mechanical engineer.

"We are working hard to positively identify students that can benefit from taking triple science. Within our present cohort, student in receipt of pupil premium are making more progress than those without pupil premium in biology and chemistry. They are matching progress in physics." Science leader

The large growth in numbers for triple science has been partly as a result of the high status of science in school as well as the using bespoke support from the Triple Science Support Programme to develop and extend strategies to engage students and maintain their curiosity. In addition, triple science CPD courses 'Identifying and Inspiring' and 'Linear assessment' have supported these developments.

"CPD from both TSSP and within school has got students engaging more with the science specification and the language of science." Head of Science

"Inspiring our pupils is important to us - we have taken many triple science pupils to 'GCSE Science Live', participated and won prizes at the Institute of Physics 'Extreme Physics' residential... We often have engineers in to school to talk to triple science pupils." Head of Key Stage 4 Science

"Pupils taking triple science that took chemistry and physics at A Level completed the course compared pupils who did double science many of whom dropped out at AS Level." Head of Science

"In recent Year 10 pupil voice, feedback from the pupils was that they enjoyed science lessons and were happy with teaching of the subjects." Head of Science



Impact on teaching staff

Staff have reported that continuing professional development on linear assessment, raising attainment and managing effective practical work have improved the quality of teaching and addressed student underperformance. For example, early results from triple science indicated underperformance in aspects of physics. The strategies from the linear assessment CPD helped staff improve preparation and teaching of 'revision'

"Resources from the TSSP CPD revision session were shared across the school and used on a weekend revision residential with Year 11 pupils." Senior Leadership Team member

Impact on colleagues and schools

The TSSP 'Curriculum modelling' CPD was used to improve provision for triple science delivery and to improve pupils' knowledge of the curriculum options

"Having a larger triple science cohort in school means that those in key stage 3 are hearing about it and staff are talking to classes about triple science in Y7 onwards." Head of Science

The provision of triple science has changed from a small group being taught triple science in out-of-school hours, to a 'top set' of pupils taking triple science in double science curriculum time, and now to triple science being a popular option block with a more appropriate amount of time.

"This has further increased this year by the Academy moving to a two week timetable giving a further hour a fortnight to triple science - each subject now getting five hours a fortnight." Senior Leadership Team Member

Future plans

The school will continue to learn and build capacity to ensure Farnborough students have opportunities to take triple science. The online platform will be used to share the legacy from the current triple science CPD with present and future staff.

"[We will] continue to maintain the higher profile within school option blocks and make further links with sixth forms within the schools academy group (Trent Academies Group - Rushcliffe School and Arnold Hill Academy along with The Farnborough Academy) to get more pupils involved with the sciences in key stage 5." Head of Science

Case Study Two: Blueprint Alliance Network

Overview

The relationship between Blueprint Alliance and STEM Learning has evolved from the support for triple science from the STEM Learning Network for Sirius Academy over the last four years. During this time, Sirius has improved its Ofsted rating from 'good' (2011) to 'outstanding' (2014) and received high praise for their engagement with the local authority to provide support for science subject leaders in Hull. Sirius Academy is now part of Blueprint Alliance Teaching School in Hull, which is a local partnership of schools and institutions working collaboratively to train the next generation of outstanding teachers for the benefit of local communities. The support from the Triple Science Support Programme (TSSP) in 2014-15 allowed the alliance to form a regional network of science technicians and teachers



aimed at fostering their collaboration and enabling a forum where they can share good practice, ideas and resources that enhance science teaching.

The overall objective of the Blueprint Alliance triple science network was to encourage technicians, science teachers and heads of science to collaborate on preparing for the changes in GCSE curriculum, especially regarding the teaching of triple science. Teachers and technicians were invited initially from the Humber region but as the network grew, schools from south of the Humber and North Yorkshire opted in. Building some of the travel costs into the network plan helped the initial engagement and once the momentum and value of the meeting was recognised, more people attended regularly. The network meetings included expert speakers and opportunities for teachers and technicians to work together to develop materials to support the new science GCSE. It was particularly successful in helping participants become confident with the requirements of the new GCSEs.

The network is now self-sustaining as a result of the planning and support from the Blueprint Alliance Triple Science Team, the STEM Learning Triple Science adviser and enthusiastic teachers and technicians. The impact on STEM Learning Network is also evident: Blueprint Alliance have been offered the opportunity to become its regional Science Learning Partner. The Network leaders' confidence in the Alliance's capacity to deliver a CPD programme developed through strong needs analysis is the legacy of excellent planning, organisation, admin support and marketing. The evidence of impact of the Triple Science Network is outstanding and provides a strong evidence base for high aspirations for the partnership in future years.

Overall Impact of the network

The intention of the network was to support the needs of the attendees in an ever changing educational environment and to raise the profile of the technicians especially using and developing their skills for supporting practical work of the students.

One of the main areas of work for the network was the development of new practical activities, which are part of the new GCSE science curriculum. An AQA adviser attended one of the network meetings to update the attendees about the practical work and how it would be assessed. The collaborative effort of technicians and teachers working together to review the proposed compulsory practical activities resulted in a booklet that was distributed to all attendees. This contained pictures of the set-up of the practicals and basic advice on how to successfully run these activities. The purpose of the booklet was not only to create a catalogue of activities for the new GCSE, but, using participants' vast expertise and experience in teaching practical science, to highlight possible difficulties and problematic areas as well as to give advice on how to deal with such issues.

The technicians found this collaborative work very useful as evidenced by the large numbers attending regularly and the emails of thanks from less experience technicians who found the meetings very helpful. The impact was to support staff in the delivery of the practical aspect of the new GCSE and to ensure that all students to successfully access the practical aspect. Overall, the triple science network helped participating schools/teachers to address issues, which in turn would impact on students' attainment:

- supporting schools which did not offer triple science to prepare for the teaching



- addressing the needs of vulnerable and less able students
- addressing the content for the new GCSE

Impact on teachers and technicians

Teachers attending the network reported that they were more confident and less threatened by the changes to triple science, were well-resourced and more equipped to teach the new GCSEs.

Since the network meetings had clearly set outcomes and these outcomes were shared with the department before the writing of new resources began, teaching staff became more efficient and consistent in their approach to the writing and sharing of new triple science materials.

Marie Seaman from the Axeholme Academy said that her participation in the network meetings saved her valuable time and gave her confidence that she was addressing the new GCSE schemes correctly. Hana Standing of the Ormiston Academy said that she had learned so much from the meetings over the past year and that her confidence grew tremendously, so she was able to write and develop a number of additional resources, which later were shared with colleagues in her school and the network. A PE specialist, who is also teaching science, reported that she had learned an extensive amount from the TSSP and the network and this had significantly improved her curriculum and subject knowledge.

The Maths Network day was developed as a direct response to the feedback from attendees of the network. Teachers felt poorly equipped for the increased mathematics content in the triple science curriculum. Heads of Science were also concerned that their staff were not trained to deliver this content and this was having a negative impact on morale. One attendee stressed that they would not offer triple science because she did not have the staff to deliver it. By the end of the day she was more positive and was considering this decision. The morning session was hands on with attendees focusing on the maths content and how this could be delivered to students. In the afternoon a maths teacher trainer delivered a session to demonstrate the skills taught in maths. The feedback was very positive and there were a number of requests to offer further training in this area.

Attendees were keen to share their ideas with colleagues back in their schools. They were all inspired to work closely with the maths faculty to ensure that their teaching would be consistent with the techniques and skills taught. One attendee stated that he had always thought about working with maths colleagues but had never had the resources to organise this. He appreciated the opportunity to work with the maths specialists.

Impact on schools

Some of the schools, who attended on regular basis, sent more than one staff member, which facilitated dissemination to colleagues. Schools reported that they had used faculty time to disseminate effective practice from the meetings, which has had a positive impact on the teaching of colleagues.



One school in the network, which previously was selective in offering triple science to its students, is now teaching triple science to every student. A newly appointed lead in science commented:

“Meetings and sharing has been vital in my role to plan for the future changes. This has been a good opportunity to share the workload.”

For example, thanks to the triple science expertise provided by the TSSP and an opportunity for ongoing collaboration with other teachers, which was brought by the network, participating teachers developed a set of stimulating and engaging work sheets to support students in accessing the practical assignments. These were supportive and intended to be used only to give guidance not to be a list of instructions. These were shared with the network on line. The feedback from using these resources was extremely positive.

“The department have appreciated the feedback from these meetings.” Teacher

Chris Fletcher of the Sirius chain said that he had had extremely positive feedback from several heads of faculty in the region about the meetings. They felt confident in the delivery of the new curriculum and that the sharing of resources had saved valuable time and resulted in high quality products.

Future plans

The network is proactive and is determined to continue its work to help meet the changing needs of the Blueprint Alliance partners. This vision is supported by the leadership of Blueprint Alliance, who are also keen to see the meetings continue.

Case Study three: Malton School, North Yorkshire

Overview

The science department at Malton School has many strengths and is well staffed with a spread of specialist teachers: biology (four); chemistry (three); physics (three). There is high performance at key stage 3, and 30% of curriculum time is used to teach triple science. Malton School was targeted for the triple science support programme because data analysis showed a positive trend in students' GCSE A*-C including English and mathematics results, but a negative trend in triple science entry, and a negative trend A*-C triple science results. The subject leader wanted to improve consistency of achievement for the 'higher starters', and so a focus on suitable strategies for higher ability students was established. The department know their students well, and were also keen to narrow the progress and attainment gap between pupil premium students and the rest of the cohort. They use monitoring impact as a key to accelerating progress.

A bespoke package of support was used with the whole science team to maximise benefits of working together. It focused on the planning of progression using SOLO taxonomy, structuring learning with visual tools and effective feedback to improve student learning. The professional development was undertaken over several months in 2015 and each session started with reporting back on monitoring of impact.

Impact on students

Uptake and attainment in triple science at key stage 4



The science department reported their highest GCSE results to date against the measure of levels of progress (LOP), and were emphatic that the triple science professional development had been crucial in securing this, in particular the focus on improving their feedback to students, and structuring learning. In all the triple science subjects, more than half the groups achieved better than expected LOP from key stage 2 and above the national figure. Chemistry in particular had 27.3% of students made 5+ LOP compared to the 18% nationally. Female students made significantly better progress (85.7% 3+ LOP) compared to male students (50% 3+LOP). The additional science cohort had excellent results, 100% achieved A*-C with 42.9% A*-A and 23.8% scored 5+ LOP. The two pupil premium students achieved 3+ LOP, and there were no obvious differences for disadvantaged students.

Improved students' progress in science knowledge, skills and/or understanding improved confidence, motivation and engagement in lessons

Teachers involved in professional development used all the ideas and strategies with other years and classes beyond their triple science groups to practice and embed the approaches. Triple science will be offered to two groups next academic year, entirely due to more students wanting to take it as an option. A recent Ofsted inspection raised the school's status from requiring improvement to good, and a student voice survey conducted prior to Ofsted's visit was extremely positive regarding science.

Impact on teaching staff

The teaching team really embraced the triple science support offered, and included their teacher trainees. There was positive feedback from each session, and they appreciated both the subject-specific CPD and the sound evidence-informed pedagogical focus to all the sessions. Actionable next steps made a difference to implementing the strategies from the CPD; using language of learning consistently with each other and their students, building and referring to posters and displays, and regular discussion in departmental development time. The teachers reported that their own improved enthusiasm and confidence had a positive impact on the students' learning.

Teachers have been increasingly thoughtful in their pedagogical practice – recognising that there are different ways of doing things, and developing professional practice, based on research and evidence-led practice. The introduction of new pedagogies –visual tools and SOLO has resulted in differentiated learning outcomes and learning conversations between teacher and student:

“It is far more about ownership of one's own practice, and that outstanding is not so much a measure of what we do, but what they [students] do, and ways in which they can show it.”
Subject leader

Impact on colleagues and schools

There has been an increase in progress and attainment of students in triple science which has improved the status of science in the school. It has also increased the capacity of the department to teach triple science, so as a result triple science will now be offered to two groups rather than one.

The support has proved useful to colleagues in other departments – a lead practitioner based within science has cascaded training into other subject areas, and the science leader has delivered SOLO CPD at local subject leaders' meetings.

The learning gained from professional development on triple science has been used to further extend the use of SOLO and graphic organisers and has been embedded into the department development plan, and training of new staff members. The teachers use the SOLO principles in the assessment objectives of the new GCSEs and have developed student-friendly SOLO rubrics to guide students in different assessment objective areas. There has been focus on bringing active learning approaches into post-16 teaching to enable A-level students to be more responsible for their own learning.

Future plans

Following discussions around the 'Big Ideas in Science Education'^{1 2}, the subject leader is building more synoptic teaching and learning into the new key stage 4 scheme of learning. The science team is working in specialist groups to create progression-based learning pathways so that the students can see links between the science disciplines. They are mapping the cognitive, conceptual and procedural (working scientifically) demands so they can obtain evidence from assessments instruments that can be used to inform future planning and teaching.

Case Study four: Liverpool Life Sciences UTC, North West

Overview

Liverpool Life Sciences UTC was established in 2013. It is the first school in the UK specialising in science and health care for 14 to 19 year olds. The UTC is sponsored by local businesses and the University of Liverpool and offers both academic and vocational routes of education. Liverpool Life Sciences UTC is based in Toxteth, one of the most deprived areas of the North West. The intake has mixed levels of attainments at key stage 3 and a wide geographical intake. The majority of pupils are white British, with just over a quarter from other ethnic heritages.

The UTC was involved with the Triple Science Support Programme from 2014-2016, before they had students entered for triple science examinations. The continuing professional development (CPD) included consultant support in external verification of standards and in planning strategically for the subject leader; bespoke whole department or small group CPD and attendance by individual staff at external, locally delivered CPD. This mix of consultancy and departmental CPD helped to develop the department more effectively.

"For a new school [or] new subject leader, the opportunity to have consultancy support which is external to the school acting as a critical friend is a real opportunity and should be available to all. It was a very supportive model." Subject Leader

The bespoke in-school support included subject-specific CPD physics and strategies to improve student progress and using SOLO Taxonomy as a planning and learning tool. External CPD focused on stretching and challenging students within all classrooms and the development of maths skills for the new GCSEs. A local Triple Science Network of Excellence was used for sharing effective practice.

"Effective partnerships have been forged...for example, links have been established with examination boards, Liverpool John Moore's University and science advisors to check judgments made by teachers and leaders across the UTC." (Ofsted Inspection report,

¹ Principles and Big Ideas of Science Education, 2010, Harlen,W. (ed.) ASE

² Working with Big Ideas of Science Education, 2015, Harlen,W. (ed.) ASE

January 2016)

Impact on students

Students enter the UTC in Year 10 so choosing the most suitable pathway is not always easy as staff do not always have access to accurate information on pupils' prior attainment. The UTC used expert support from the Triple Science Advisor to secure accurate judgements of pupils' attainment at the start of key stage 4

Both numbers and proportions of students studying triple science have increased over time. In 2015 51% of the cohort completed triple science. In 2016, that increased to 63% and for 2017 the cohort size has increased again with similar or more proportions studying triple science.

One part of the triple science support was on stretch and challenge of higher-attainers. This has improved outcomes for students studying triple science, particularly at higher grades, as shown in the table, below.

Year	A*-C (% of total cohort)	A*/A (% of total cohort)
2015 (actual)	72	4.9
2016 (actual)	85	22

Ofsted recently commented positively on the improvements made for the higher-attaining students:

"Some of the most-able pupils did not make consistently good progress in 2015 across the UTC. However, information relating to current pupils (2016) displays a rise in the success of the most-able across a wide range of subjects. Stretch and challenge in lessons have improved and learning experiences for the most able are of good quality". Ofsted Inspection report, January 2016

Uptake of Science A Levels post-16 has also increased, as has student retention from Year 12 to Year 13. The table below shows numbers of students at A Level.

Year	Biology	Chemistry	Physics
2015	28	17	7
2016	52	41	14
2017	66	56	33

The school has above average proportions of disadvantaged pupils. The department have remained focused on improving outcomes for these students, including attending a Triple Science Network focused on supporting pupil premium pupils.

"All groups of pupils are now making good progress, including those pupils who are disadvantaged. Gaps in attainment between disadvantaged pupils and their peers are closing". Ofsted Inspection report, January 2016

Pupil voice surveys also indicate more engagement and interest in science and science pathways.

Impact on teaching staff

Staff reported that the quality of CPD linked with the Triple Science Support Programme was excellent and met the outcomes identified at the outset. Many staff implemented strategies immediately following CPD and one newly qualified teacher stated that "because I included



resources and ideas immediately in my teaching, they have become embedded, they are now just what I do”.

Another trainee teacher worked with a department member to incorporate ideas from the SOLO training in a lesson observation after the CPD session; mentor feedback from that lesson was very encouraging. Students reported that they felt that they could see the progress that they had made throughout the lesson and found the materials engaging. The teacher mentor reported this new way of planning also helped him to refocus his own planning to promote deeper learning. He now describes that students are more aware of making progress as they move from recalling individual ideas to making connections and applying these to other learning.

One teacher who attended external CPD reported impact on his teaching and pupil learning:

“This is one of the only CPD courses I have attended that will affect my practice in the long term. I have already given some of the strategies a go with my Year 10 students. We used the ‘Thinker’s Keys’ and data from ‘Information is Beautiful’ to practice talking and questioning about science and dispelling misconceptions in preparation for work with command words and using them to devise questions about the data next lesson. Ninety minutes flew by and they were all engaged.” CPD Participant

Lesson observations across the department provide evidence that the ideas from the CPD have been embedded including practical strategies from the support for triple science physics.

Impact on colleagues and schools

Strategies and resources from all CPD are shared during science department meetings and as a result colleagues have introduced new strategies and resources into their own teaching. For example, ideas from the Triple Science Network meetings on preparing for new GCSEs have been used by all of the department. The science subject leader reports that increased creativity and confidence to trial new strategies has led to a dynamic new approach to A Level teaching.

Triple science at the UTC has traditionally been taught in the same curriculum time as core and additional science. However, from 2016, triple science students will receive additional curriculum time across key stage 4 more in line with three GCSEs.

Future plans

The delivery of new GCSEs is currently being planned to include accurate assessments using external verification.

The department is aiming high and planning to deliver triple science to all students as a starting point. Support will then be positioned where required and students transferred to a combined science route where necessary.

The department will engage in future Triple Science Networks and will provide core physics practicals in new GCSEs for their teachers.



Case Study Five: Blackburn Central High School, North West

Overview

Blackburn Central High School (BCHS) was formed in 2012 following the merger of two existing schools and relocation to a new campus. The school serves an area of high social deprivation and students entering the school have below average prior attainment. There is a mixed ethnic intake with high numbers having English as an additional language (75.5% in 2015). There is also a high turnover of students. The science subject leader was appointed two and half years ago and took over a department facing a number of challenges including poor GCSE results following an over-reliance on vocational qualifications.

The first aim was to establish a well-functioning department that could give students a good experience of science. More specific aims were to raise the profile of science, increase the knowledge and skills of staff for teaching of triple science and to promote further study of science post-16.

The Subject Leader and Science Technician attended Triple Science Networks year 1 (2014-15); and the school joined year 2 of the programme and the year 2 extension. They attended external courses on physics for the non-specialist and maths in science and Networks covering a range of themes including teaching the 'Big Ideas' in science and developing STEM. They had two in-school sessions and had bespoke sessions on:

- techniques to help embed learning when aiming for terminal assessment
- investigative approaches to improve working scientifically in the new GCSEs

Impact on students

Triple science is now established and is at the forefront of pupil achievement and progress in science and the school as a whole.

	2014 Year 11	2015 Year 11	2016 Year 11
Biology GCSE A* - C	76%	91%	65.5% (97% predicted)
Chemistry GCSE A* - C	85%	82%	92%
Physics GCSE A* - C	85%	91%	72.4% (97% predicted)

Progress this year has shown a downward trend in biology and physics. The Director of Learning for Science is analysing results to try to find an understanding for the decline. The B3 and P3 papers seem to be the most obvious reason for the lower grades. Students were sitting exams during the month of Ramadan and may have been feeling the effects of fasting, whilst sitting a 2 hour exam in the afternoon, having had a short amount of sleep.

Early evidence suggests, for Year 11, an increase in numbers of students intending to go on to further study or training in science related fields.

Increased motivation of students in science lessons is evident and supported by very positive comments during pupil interviews.

"We now have a regular teacher who always makes science interesting." Year 10 student



More students are taking triple science at GCSE - for the first time in September 2015 the school had two groups of students studying triple science (50 out of 130).

Impact on teachers

The development of triple science has provided a vehicle for high expectations of students and has contributed to a determined, sustained effort by the department. The teachers appreciated the opportunities they have been given to attend CPD out of school and receive additional science specific CPD in-school. They are given opportunities to share their learning and are regularly reminded to use the ideas

The Triple Science Network support on using the 'Big Ideas' in science has helped the department develop a five year curriculum plan for teaching science. A spiral curriculum model has been adopted so that pupils will meet the key ideas several times and have opportunities to consolidate and apply the skills and knowledge.

Impact on colleagues and school

Following the department CPD on techniques to embed students' learning, throughout the GCSE courses and be better prepared for terminal assessment the department has developed its assessment for learning practice and developed a set of bookmark prompts for peer and self-assessment which has been adopted across the school.

The profile of science across the school is now high, not least because the Senior Leadership Team (SLT) recognise the big contribution that science is making to student progress and attainment, motivation and ambition. Science is treated on a par with maths and English. The continued backing from SLT and significant investment in new resources and equipment has meant that the department are well prepared to continue improving student achievement

Future plans

The future plans will include embedding a new system of assessment and reporting for the new GCSE grade system. New practical requirements of the courses at GCSE will require new techniques and equipment, especially for physics investigations where staff are non-specialists.

The involvement of the department in education and science research is very important as it helps to shape the future of science learning. It is the SLT's intention to continue to develop links with Universities and industry with a view to further enhance teaching, student learning and science in the wider community.

The school sees STEM careers as key priority both for its students and for, for the sake of society. The science department at BCHS will continue to develop links across the school curriculum areas. STEM days, extra-curricular activities, competitions (in-school, local and national) and recognised awards will all help to raise the profile of STEM.