London Schools Excellence Fund

Self-Evaluation Toolkit

Final report

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Evaluation Final Report Template

Introduction

The London Schools Excellence Fund (LSEF) is based on the hypothesis that investing in teaching, subject knowledge and subject-specific teaching methods and pedagogy will lead to improved outcomes for pupils in terms of attainment, subject participation and aspiration. The GLA is supporting London schools to continue to be the best in the country, with the best teachers and securing the best results for young Londoners. The evaluation will gather information on the impact of the Fund on teachers, students and the wider system.

This report is designed for you to demonstrate the impact of your project on teachers, pupils and the wider school system and reflect on lessons learnt. It allows you to highlight the strengths and weaknesses of your project methodology and could be used to secure future funding to sustain the project from other sources. All final reports will feed into the programme wide meta-evaluation of the LSEF being undertaken by SQW. Please read in conjunction with Project Oracle's **'Guidance to completing the Evaluation Final Report'**.

Project Oracle: Level 2
Report Submission Deadline: 30 September 2015
Report Submission: Final Report to the GLA for approval and then through the Project Oracle website

Project Name: **Stretch and Challenge: accelerated achievement in science at Key Stage 4**
Lead Delivery Organisation: **Seven Kings High School, in partnership with UCL IOE**
London Schools Excellence Fund Reference: **LSEF 145**
Author of the Self-Evaluation: **Karen Spence – Thomas (UCL IOE) and Nick O'Brien (Seven Kings High School)**
Total LSEF grant funding for project: **£69772**
Total Lifetime cost of the project (including match funding): **£69772**
Actual Project Start Date: **May 2014**
Actual Project End Date: **July 2015**

1. Executive Summary

This report summarises the findings of the Stretch and Challenge programme that aimed to improve teachers' subject knowledge and understanding of pedagogy to enable higher attaining pupils to reach their potential by achieving A/A* grades in science. The report covers the period from the start of the project in May 2014 up to the final celebration event in June 2015 and includes an analysis of the summer 2015 exam results for participating pupils. In summary the findings are as follows.

- The project recruited and retained the planned number of schools. Learning and findings were shared at a celebration event attended by all participating schools in June 2015.

- The initial project plan, including three subject knowledge development days led by University College London, Institute of Education (UCL IOE) specialists, three phases of lesson observations with learning conversations and a final celebration event, was adhered to.

- Benefitting teachers used the UCL IOE baseline impact framework to vision the desired impact on pupil learning and outcomes and establish a baseline picture from which the impact of strategies on pupil progress could be evaluated.

- The workshops and celebration event enabled teachers to share and develop good practice through joint lesson planning and the discussion of alternative strategies which they found useful, inspirational and exciting. The workshops also facilitated the dissemination of skills and knowledge across the schools, with colleagues sharing ideas and working collaboratively.

- Lesson observations and learning conversations followed a coaching model with the emphasis on supporting improvements in teaching and learning. This approach promoted a sense of trust between the participant teachers and UCL IOE subject experts.

- Data from observation records and the subject knowledge audits indicate that teachers gained new knowledge and understanding of a range of strategies to stretch and challenge the most able learners. These strategies are detailed in **section 9** of this report.

- Analysis of lesson observations shows that, where progress was at its best, there was an increased level of emotional engagement and motivation on the part of targeted pupils who worked well independently of the teacher and collaboratively in structured groups, supporting their peers and accepting the support of others.

- Teachers have created new lesson plans and resources in the light of new methods learned which will be shared more widely in the dissemination phase of the project (autumn 2015).

- Final analysis of GCSE results shows that 82.5% of targeted pupils achieved A* - B grades, (43.8% at A* or A) compared to 68.6% in the mock examination (35.3% at A* – A).

- Importantly, pupils made increased progress from mock to final exam results in relation to their minimum target grades established from baseline data (Fisher Family Trust). In the final GCSE exam, 65.5% of pupils achieved their target grades with 18.8% exceeding them. This represents an increase from 48.3% and 19.1% respectively in the mock exam.

2. Project Description

The lead school, a secondary teaching school, in partnership with the University College London, Institute of Education (UCL IOE) , worked with teachers from schools in Redbridge, Waltham Forest and Newham with the aim of increasing their science subject knowledge (SK) and improving pedagogy so that pupils on GCSE courses capable of achieving A/A* grades in science met their potential.

The lead school had already worked closely with the UCL IOE on a number of other projects and with several of the other participant schools, some of whom are now members of their teaching school alliance. The lead school is committed to developing networks for professional development and research as a teaching school.

UCL IOE provided a professional development facilitator and science subject specialists. They worked in collaboration with a project lead from the lead school to design a programme focused on professional development for teachers to support their science subject knowledge and skills. To improve and embed this level of subject knowledge and to ensure 'new' knowledge' resulted in improved practice, the professional learning model included:

- a baseline audit of teachers' science subject knowledge and confidence and a follow up audit to evaluate change
- subject knowledge (SK) workshops led by subject experts from the UCL IOE designed to address the identified subject knowledge gaps
- collaborative lesson planning between teachers and UCL IOE subject experts to apply new subject knowledge and pedagogy
- development of better subject resources and lesson plans
- lesson observations and learning conversations with subject experts to develop and embed changed practice
- teachers evaluating the impact of their teaching through the use of the IOE's impact evaluation framework so that they could better identify successful strategies for dissemination
- impact team meetings for heads of science so they could support teachers to move subject knowledge into practice and collate and track its impact on pupil progress

- a celebration event to share learning and plan for the dissemination of the project findings (see Appendix 3 project plan with dates).

2.1 Changes to the GCSE science curriculum in 2011 for chemistry, physics and biology were designed to ensure more challenging curricula. In 2013, the national proportion of A/A* grades decreased 'largely due to the more challenging science subjects' (Ofqual). This project set out to address the specific and more rigorous subject knowledge that Key Stage 4 (KS4) science teachers now need to support more pupils to achieve A/A* grades in science. It aimed to enable teachers to plan sophisticated lesson sequences to support this increased rigour and challenge for more able pupils in biology, chemistry and physics. The structure and a timeline for the project is shown in Appendix 3.

Participant teachers were drawn from five schools across Newham, Waltham Forest and Redbridge teaching a target group of pupils on GCSE science courses identified as being capable of achieving A/A* grades.

2.2 Final outcomes were shared at a celebration event at the UCL Institute of Education in June 2015. Schools presented their findings in poster form (see Appendix 5 for two examples). The event was videoed and now features on London Centre for Leadership in Learning area of the IOE website.

. It is intended that findings and learnings from the project will be made available via the Seven Kings teaching school website during the autumn term of 2015. As and when teacher interviews are completed, these will provide further feedback to inform the planning of future similar projects at the UCL IOE and / or across the teaching school alliance.

3. Theory of Change and Evaluation Methodology

The project Theory of Change and Evaluation Framework are included as Appendices 1 and 2.

3.1 Table 1- Outcomes

Description	Original Target Outcomes	Revised Target Outcomes	Reason for change
Teacher Outcome 1	Increased subject knowledge and greater awareness of subject specific teaching methods in KS4 science		
Teacher Outcome 2	Increased teacher confidence to effectively deliver KS4 stretch and challenge in science		

Teacher Outcome 3	Delivery of higher quality teaching including science-focused teaching methods		
Teacher Outcome 4	Use of better science-specific resources co-constructed as a result of participating in the project		
Pupil outcome 1	Increased science attainment for high ability KS4 science students.		
Pupil outcome 2	Greater than expected progress towards GCSE target grades seen in Year 10 teacher assessments / unit tests and end of Year 10 mock exams in Biology, Chemistry and Physics	Focus groups also in year 9 and 11	Some schools within the project begin GCSE courses in year 9
Wider system outcome 1	Use of better resources by teachers/ schools outside the intervention group		
Wider system outcome 2	Teachers/ schools outside the intervention group have the opportunity to increase their subject knowledge through the programme		

3.2 Did you make any changes to your project's activities after your Theory of Change was validated? No

3.3 Did you change your curriculum subject/s focus or key stage? No

3.4 Did you evaluate your project in the way you had originally planned to, as reflected in your validated evaluation plan? Yes with caveats below.

The evaluation methodology remained largely as planned. A range of tools were developed to enable project leads and participating teachers to monitor and evaluate teacher development and pupil progress at the outset (baseline) and impact stages (outcomes). These included an initial audit of teachers' subject knowledge and confidence to identify priorities and to form a baseline from which to monitor improvements. The analysis of the audit enabled the prioritisation of areas for professional development for the teachers on the project and also to evaluate changes in teacher confidence and science subject knowledge and pedagogy during and at the end of the project in the summer term 2015. The audit was repeated at the end of the project to assess improvements. A number of staff interviews are due to take place in the autumn term 2015 as a follow up to the project and to inform the organisation and delivery of similar projects within the participant schools and elsewhere in the future.

At the initial launch event, teachers established a baseline picture of pupil learning and their own current teaching methods, including qualitative evidence as well as quantitative data using the UCL IOE impact evaluation framework. The reflective data was triangulated by observations carried out by UCL IOE science specialists.

From this first round of observations a baseline was established indicating effective strategies observed and areas for further action and development.

Three subject knowledge (SK) workshops facilitated the development of strategies to stretch and challenge pupils and provide a forum for the co-planning of lessons. Teachers were asked to give feedback on the first and second SK sessions so that facilitators could review and hone the relevance of content and delivery. An online resource which summarises the pedagogy and strategies developed during the project is to be produced in the autumn term 2015.

Three rounds of lesson observations, together with learning conversations were put in place to track, develop and embed changed practice. In line with new OfSTED guidance in approaches to lesson observation, the quality of teaching in individual lessons was not given a score as had been planned in the original evaluation schedule. Rather, the observer commented specifically on the effectiveness of strategies to promote learning which provided stretch and challenge. This qualitative data was then used to track changes in practice impacting on pupil learning.

In order to assess the impact of the project on pupil attainment, progress data was collected at intervals. Initially, to establish a baseline, target grade data was analysed for the target cohorts to establish those pupils within selected groups who fitted the study's criteria of having a B grade or higher as a target. Progress was then tracked through teacher assessments, mock examinations and final exams.
Due to the nature of option pathways and setting it was anticipated that some pupils within the study groups would not fit the initial focus. The data for these pupils has been included and has been used to measure overall impact comparing target pupils to those within control groups where possible.

4. Evaluation Methodological Limitations

4.1 With regard to both the initial and final knowledge and confidence audits, not all benefitting teachers submitted a response. One school joined the project slightly after the others so 9 of the 13 participant teachers completed the initial audit. 10 of the 13 completed the final audit. Though relatively small, the sample size was sufficiently representative to identify changes in teachers' knowledge and confidence from the beginning to the end of the project.

As previously mentioned and in line with new OfSTED guidance in approaches to lesson observation, the quality of teaching in individual lessons was not graded as had been planned in the original evaluation schedule. A coaching model of lesson observation was adopted. This featured follow-up learning conversations during which the success of strategies trialled were explored and areas for further development to provide stretch and challenge agreed. These were detailed on anonymised feedback forms and summarised in a tabular format devised to qualitatively track changes in teacher practices over the duration of the project (see Appendix 4).

With regard to the analysis of pupil data, there were considerable variations in the delivery of the GCSE science curriculum between the participating schools. Some

chose to target the delivery of core science only for the project, others also focussed on the additional and further science. Furthermore, some schools now begin GCSE science in year 9 while others adhere to the more traditional model of beginning exam courses in year 10. Consequently, a school to school comparison of pupil data is less informative than an analysis within each school of the progress of the pupils within their focus groups from baseline to final result.

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5. Project Costs and Funding

Table 2 - Project Income

	Original[1] Budget	Additional Funding	Revised Budget [Original + any Additional Funding]	Actual Spend	Variance [Revised budget – Actual]
Total LSEF Funding	69772			64987.50	-4784.50
Other Public Funding					
Other Private Funding					
In-kind support (e.g. by schools)	16000				
Total Project Funding	85772			64987.50	-4784.50

Table 3 - Project Expenditure

	Original Budget	Additional Funding	Revised Budget [Original + any Additional Funding]	Actual Spend	Variance Revised budget – Actual]
Direct Staff Costs (salaries/on costs)	15000	0.00	15000	16562.50	+1562.50
Direct delivery costs e.g. consultants/HE (specify)					
Management and Administration Costs	13800	0.00	13800	13800	0.00
Training Costs	27147		27147	22565	-4582.00
Participant Costs (e.g. Expenses for travelling to venues, etc.)					
Publicity and Marketing Costs	3175		3175	1410	-1765.00
Teacher Supply / Cover Costs					
Other Participant Costs					
Evaluation Costs	10650		10650	10650	0.00

[1] Please refer to the budget in your grant agreement

Others as Required – Please detail in full					
Total Costs	69772		69772	64987.50	-4784.50

5.2 Spending on teacher cover increased as actual cover costs were higher than budgeted for. Even with agreed match funding, teacher cover was set at £125 a day whereas the original budget had only allowed for approx £60 per day (based on 20 teachers being involved as highlighted in the original bid). Costs were lower elsewhere and so the decision was facilitated to help maintain the number of teachers involved and the schools' engagement in the project. As the project developed, it was clearer that the outcomes were not centred around individual lessons plans, but more broader pedagogies and so the spend on marketing and publicity could be reduced due to the proposed use of the teaching school website to disseminate the findings/resources/commentary. Funding was reallocated to pay for personnel to collate these materials and findings and fund the staffing of an additional celebration event to help share these outcomes and ensure sustainability. Savings on venue costs, refreshments and travel also helped to bring in an underspend in these areas.

6. Project Outputs

Table 4 – Outputs

Description	Original Target Outputs	Revised Target Outputs *[Original + any Additional Funding/GLA agreed reduction]*	Actual Outputs	Variance [Revised Target - Actual]
No. of schools	5	5	5	100%
No. of teachers	15	13	13	87%
No. of pupils	300		211	70%

In this report, pupil data is presented for several subsets of pupils:

423	All higher attaining pupils in sub-groups taught by participating teachers
357	Numbers of pupils in sub-groups with target grades A* - B'
211	Number of participating pupils at baseline (1st return) = 211 (focus group)
178	Pupils that fit the criteria (A*-B predictions) (1st return)
199	Numbers of participating pupils at end of programme (2nd return)
165	Pupils that fit the criteria (A*-B predictions) (2nd return)

For the purpose of project outputs, the figure XXX has been used because YYY

7. Key Beneficiary Data

7.1 Teacher Sub-Groups

All benefitting teachers on the project were secondary school teachers. The project primarily targeted GCSE science teachers. The project was led by an assistant headteacher from the lead school working with specialists from the UCL IOE. The project was designed to keep senior and middle leaders in participating schools informed of the progress and achievements of the intervention group through impact team meetings, celebration event and final evaluation posters.

Table 5 – Teachers benefitting from the programme

	No. teachers	**% NQTs** ***(in their 1st year of teaching when they became involved)***	**% Teaching 2 – 3 yrs** ***(in their 2nd and 3rd years of teaching when they became involved)***	**% Teaching 4 yrs +** ***(teaching over 4 years when they became involved)***	**% Primary (KS1 & 2)**	**% Secondary (KS3 - 5)**
Project Total						
School 1	3		66.6	33.3		100
School 2	2	50		50		100
School 3	2	50		50		100
School 4	3		33.3	66.6		100
School 5	3	33.3	66.6			100

7.1.2 The teaching experience of the benefitting teachers ranged, as indicated above, from teachers new to the profession to those with considerable experience and who, in some cases, carried additional responsibilities. However the majority were in the early stages of their professional careers. The teachers' subject specialisms represented the full range of sciences i.e. science (4), biology (2), physics (2) and chemistry (5). They held a range of qualifications including degrees (BSc) in chemistry, biochemistry, medical science, human biology, biology with forensic science and physics. Some were new to the participating schools whilst others had lengthier service in those schools.

7.2 Pupil Sub-Groups

The benefitting pupils were all studying GCSE science in the 5 participating project schools and taught by teachers participating in the programme. The project was targeted at pupils judged to be capable of achieving at the highest grades in science and so the benefiting group were higher attaining pupils with a target grade A* - B. As previously stated, due to the nature of option pathways and setting within the schools, it was anticipated that some pupils within the study groups would not necessarily be expected to achieve A*-B grades. The data for these pupils has been included in the report and where possible has been used to measure overall impact compared to target students.

Tables 6-8 – Pupil Sub-Groups benefitting from the programme

The tables below indicate the pupil sub-groups in the project at the time of the first data collection at the start of the programme, summer 2014.

Table 6.1. All higher attaining pupils in sub-groups taught by participating teachers

Subgroups	School 1	School 2	School 3	School 4	School 5	Total
FSM	4	4	9		7	24
EVER6	7		16		14	37
EAL	10	8	37	26	50	131
Male	14	15	20	15	36	100
Female	14	8	32	29	24	107
SEN	3	1	8	6	6	24

Table 6.2 Numbers of pupils in sub-groups with target grades A* - B

Subgroups	School 1	School 2	School 3	School 4	School 5	Total
FSM	4	4	6		7	21
EVER6	6		8		14	28
EAL	8	8	15	25	50	106
Male	13	15	10	21	36	95
Female	11	8	17	28	24	88
SEN	3	1	4	5	6	19

Table 7.1 – Pupil sub-groups expressed as percentages

Subgroups	School 1	School 2	School 3	School 4	School 5
FSM	16.7%	16.7%	37.5%	0.0%	29.2%

EVER6	18.9%	0.0%	43.2%	0.0%	37.8%
EAL	7.6%	6.1%	28.2%	19.8%	38.2%
Male	14.0%	15.0%	20.0%	15.0%	36.0%
Female	13.1%	7.5%	29.9%	27.1%	22.4%
SEN	12.5%	4.2%	33.3%	25.0%	25.0%

Table 7.2 Percentages of pupils with target grades of A*-B

Subgroups	School 1	School 2	School 3	School 4	School 5
FSM	19.0%	19.0%	28.6%	0.0%	33.3%
EVER6	21.4%	0.0%	28.6%	0.0%	50.0%
EAL	7.5%	7.5%	14.2%	23.6%	47.2%
Male	13.7%	15.8%	10.5%	22.1%	37.9%
Female	12.5%	9.1%	19.3%	31.8%	27.3%
SEN	15.8%	5.3%	21.1%	26.3%	31.6%

7.2.1 As the five schools are situated across three London boroughs, it is difficult to make detailed comparisons with borough data. However, these pupil sub-groups are largely in line with the local school characteristics. The target cohort comprises a high proportion of students with EAL, as is typical in this area of north east London. In three of the five schools, girls in the higher sets in science are in the minority. Both these cohort characteristics were discussed and highlighted within the SK workshops which addressed issues of scientific literacy, including pupils' abilities to access questions and respond fully to long answer questions, and the confidence and attainment of girls in science.

8. Project Impact

8.1 Teacher Outcomes

Table 9 – Teacher Outcomes: teachers benefitting from the project

Target Outcome	Research method/ data collection	Sample characteristics	Metric used	1st Return and date of collection	2nd Return and date of collection
Increased subject knowledge and greater awareness of subject specific teaching methods in KS4 Science	Baseline audit survey completed June 2014 Audit repeated at the end of the project	9/13 respondents The profile of respondents was broadly representative of the population as a whole. 10/13 respondents The profile of respondents was broadly representative of the population as a whole.	Audit survey metric: My knowledge of: 5= very confident 1 = Not confident at all	Summer Term 2014	Summer Term 2015
Increased teacher confidence to effectively deliver KS4 stretch and challenge in Science	Baseline audit survey completed Audit repeated at the end of the project	9/13 respondents The profile of respondents was broadly representative of the population as a whole. 10/13 respondents The profile of respondents was broadly representative of the population as a whole.	Audit survey metric: My confidence to teach 5 = very confident 1 = not confident at all	Summer Term 2014	Summer Term 2015
Delivery of higher quality teaching including Science-focused teaching methods	3 rounds of lesson observations and learning conversations	Baseline round 13 observations 2 subsequent rounds of observations and learning conversations	Qualitative identification of strategies and their impact and the identification of areas for further development	Autumn Term 2014	Spring Term 2015 and Summer Term 2015
Use of better Science-specific resources co-constructed as a result of participating in the project	Booklet of resources being produced			Autumn Term 2015	

Table 10 – Comparison data outcomes for Teachers *[if available]*

Target Outcome	Research method/ data collection	Sample characteristics	Metric used	1st Return and date of collection	2nd Return and date of collection
e.g. Increased Teacher confidence	*e.g. E-survey*	*e.g. 100 respondents from a total of 200 invites.* *The profile of respondents was broadly representative of the population as a whole.*	*e.g. Mean score based on a 1-5 scale (1 – very confident, 2 – quite confident, 3 neither confident nor unconfident, 4 - quite unconfident, 5 – very unconfident)*	*e.g. Mean score*	*e.g. Mean score*

8.1.1 The baseline audit of teachers' science subject knowledge and confidence was conducted in June 2014 to identify subject knowledge gaps and areas of focus for professional development. The survey revealed a high correlation between level of knowledge and confidence in ability to teach individual science subjects. The areas of least confidence at the beginning of the project were specific chemistry topics, e.g. moles, using key stage 5 (KS5) approaches to enrich GCSE; practical work in non-specialist subjects to maximise learning and the engagement of girls. Given the small sample size, other categories where a significant minority expressed low confidence were also explored namely: specific physics topics e.g. electricity, using models, generators, current in series and parallel circuits, momentum; specific biology topics, e.g. biotechnology, neuroscience, KS5 topics to enrich GCSE and questioning by students. Follow up discussions with teachers also took account of the desire to develop pupils' soft skills such as motivation and independence and their impact on achievement. Subject knowledge workshops threw up other issues staff also wanted to address including literacy. The audit was repeated at the end of the project to evaluate changes in teachers' subject knowledge and confidence.

With regard to teachers' confidence in their own knowledge of subject specific categories the mode value responses all remained the same or improved from the beginning to the end of the project. It was pleasing to see the mode reaching 5, very confident in their knowledge, in eight categories where previously the highest mode had been 4 in the baseline audit.

With regard to teachers' confidence to teach the subject specific categories well, mode value responses remained the same or improved from the beginning to the end of the project in all bar one category. (Not all respondents commented for all three sciences.) Again, it was very pleasing to see the mode response of 5, very

confident to teach, being attributed to 7 categories where 4 had been the highest mode in the baseline audit.

Results from teachers' knowledge audits

Highlighted frequencies are the mode response for each item
5 = very confident 1 = not confident at all

Baseline audit					Final audit					Topics
1	2	3	4	5	1	2	3	4	5	
		3	5	1		1	3	4	1	Specific physics topics, e.g. electricity, using models, generators, current in series and parallel circuits, momentum.
	2	2	3	2		1	1	3	4	Specific chemistry topics, e.g. moles, KS5 topics to enrich GCSE
	1	2	4	2			2	3	3	Specific biology topics, e.g. biotechnology, neuroscience, KS5 topics to enrich GCSE
	1	5	2	1			4	5		Practical work in non-specialist subjects to maximise learning
		1	5	3			1	4	5	Mathematical skills in science
		6	3			1		9		Engagement of girls
	1	2	4	2			1	5	4	Differentiation to meet the needs of all
			5	4				3	7	Creating a learning environment which provides opportunity and nurture
	1	2	4	1			3	3	4	Strategies to improve literacy in science
		2	4	3			1	6	3	Introducing and using context to expand teaching including content at higher levels
		2	5	2				6	4	Organising groupings to facilitate peer learning
	1	2	4	2		1	1	3	5	Planning student led activities
		1	5	3			3	3	4	Questioning by teachers
	1	3	4	1		1	2	3	4	Questioning by students

Results from teachers' confidence to teach audits

Highlighted frequencies are the mode response for each item
5 = very confident 1 – not confident at all

Topics	Baseline audit					Final audit				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Specific physics topics, e.g. electricity, using models, generators, current in series and parallel circuits, momentum.		2	2	3	2	1		4	3	1
Specific chemistry topics, e.g. moles, KS5 topics to enrich GCSE		2	4	3		1		1	3	4
Specific biology topics, e.g. biotechnology, neuroscience, KS5 topics to enrich GCSE	1		3	4	1			2	5	1
Practical work in non-specialist subjects to maximise learning		1	4	2	2		1	5	3	
Mathematical skills in science			1	6	2			1	4	5
Engagement of girls			6	3			1	3	6	
Differentiation to meet the needs of all		1	2	5	1			2	5	3
Creating a learning environment which provides opportunity and nurture		2	4	3					5	5
Strategies to improve literacy in science		1	2	6				2	4	4
Introducing and using context to expand teaching including content at higher levels			3	4	2			3	5	2
Organising groupings to facilitate peer learning		1	1	6	1				7	3
Planning student led activities		1	2	5	1		1	1	3	5
Questioning by teachers			2	5	2			3	3	4
Questioning by students		1	3	5			1	3	2	4

Three subject knowledge (SK) workshops were held led by subject experts from the UCL IOE designed to identify and address subject knowledge gaps and to increase stretch and challenge teaching methods. Collaborative lesson planning between teachers and UCL IOE subject experts took place during these workshops and resources were shared. It is intended to produce a summary of these resources and strategies as a follow up to the project in the autumn term, 2015.

Feedback from participants at the subject knowledge workshops provides some qualitative evidence on the impact of the sessions. From the SK1 session, 82% of the teachers who participated indicated that sharing good practice through joint lesson planning and the discussion of alternative strategies was the most useful, inspirational and exciting aspect of the session. Other participants welcomed the opportunity to focus on neuroscience and learning. Overall all participants rated the session as good or very good in terms of the overall quality of the workshop, the extent to which learning outcomes were met, the usefulness of the day to their practice and their interest and enjoyment. Participants valued the opportunities to share strategies to stretch and challenge more able pupils and requested an even greater emphasis on these. A small minority found the focus on neuroscience less useful. Following SK2, all teachers were able to identify the impact they felt the project was having on improving their own practice. Areas of improvement included a greater focus on literacy in science, techniques to engage and challenge pupils, encouraging independence and embedding of activities to stretch and challenge more able pupils. The teachers again welcomed the opportunity to collaborate in the development of resources and lesson plans. All teachers who participated in the session rated it as excellent or good in terms of resources, delivery and presentation and their own involvement, with 80% considering the content to be excellent or good.

Three rounds of observations and learning conversations took place, the first to establish a baseline to be tracked through subsequent observations. Initial observations indicated that teachers were using a diverse range of strategies to engage and stretch pupils, to ensure topics were understood thoroughly in preparation for exams and to provide challenge.

Effective strategies found to be developing through the rounds of observations included motivational hooks or real world examples to engage pupils, effective questioning techniques to deepen learning and opportunities for pupils to develop more independent learning skills. Lesson observations and learning conversations also identified good practice to be shared between schools and potential strategies for further development. Feedback from the second and third rounds of observations indicated that all teachers were trialling the diverse range of strategies shared in the three subject knowledge sessions to engage and stretch the most able students.

Where progress was at its best, there was a high level of emotional engagement on the part of the students, as commented on in the lesson observations. Teachers were confidently using the range of strategies from the workshops to accelerate progress by creating a learning environment that provided opportunity and nurture. The students were responding well by working more independently and collaboratively in structured groups, supporting their peers and accepting the support of others. Examples from the observations have been outlined in the lesson observation evaluation framework. (Appendix 4, observation evaluation chart)

9 Pupil Outcomes

Date pupil intervention started: September 2014

Table 11 – Pupil Outcomes for pupils benefitting from the project

Target Outcome	Research method/ data collection	Sample characteristics	Metric used	1st Return and date of collection	2nd Return and date of collection
Supporting more pupils to achieve A/A* grades in Science (Greater than expected progress towards GCSE targets in year 10 teacher Assessments/ unit tests and end of year 10 mock exams in biology, chemistry and physics)	Pupil assessment data i.e. target data, mock exam data and final, externally marked, GCSE data	Assessment data collected for identified cohorts in five schools. The profile of students were in line with original project brief, where possible, as having a target grade of an A*, A or B (this wasn't always possible due to the nature of curriculum choices and/or grouping arrangements). Outcomes were analysed in line with the initial outcome described in the Theory of Change i.e. improved outcomes	Teacher assessed (mock data) and externally assessed (GCSE data) was compared with target data (baseline data) as provided by the five schools. Where possible (two schools for the mock and one school for the GCSE results) a comparison with a control group was made and analysed	Comparison of grade outcomes to target grades (baseline data) from mock exams (March 2015)	Comparison of grade outcomes to target grades (baseline data) from mock exams (September 2015)

Analysis of baseline target data

Table 11.1 Numbers of participating pupils at baseline (1st return)

School	Total number of pupils	Pupils that fit the criteria (A*-B predictions)	Pupils outside of initial subject focus
School 1	28	24	4
School 2	23	23	0
School 3	52	27	25
School 4	48	44	4
School 5	60	60	0
TOTAL	**211**	**178**	**33**

Percentage of pupils in project fitting criteria	
84.4	15.6

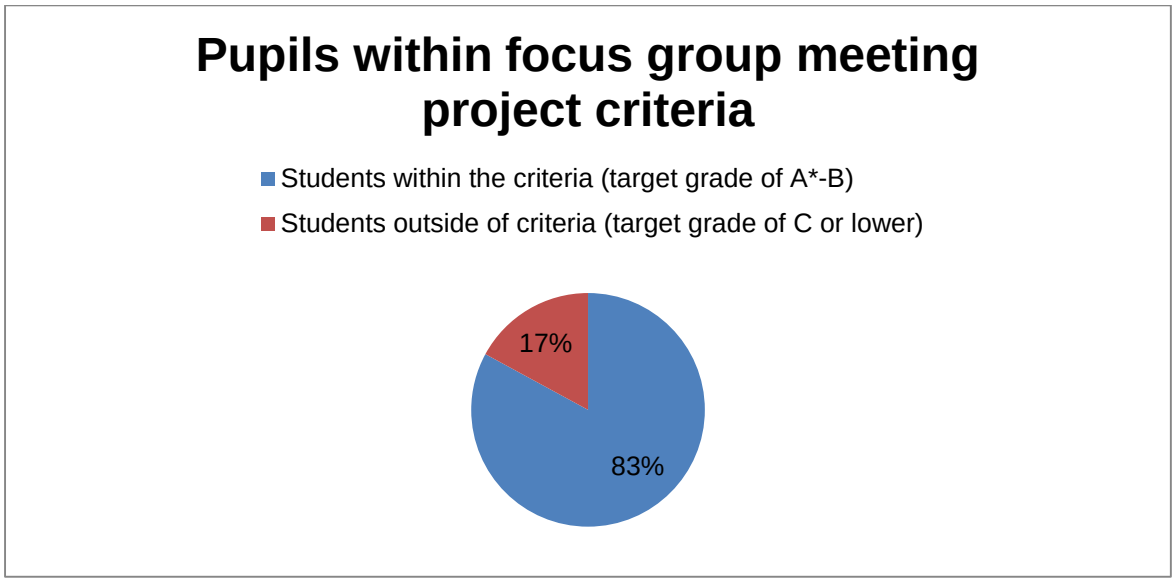
This data was analysed again (2nd return, September 2015) to check for any variations due to class changes and any local decisions around pupils' entry for exams i.e. pupils not in year 11 and not seen as 'ready' to take the exam. This resulted in only slight changes to the numbers of pupils in the benefitting groups and so further analysis of the baseline was not required.

Table 11.2.1 Numbers of participating pupils at end of programme (2nd return)

School	Total number of pupils	pupils that fit the criteria (A*-B predictions)	pupils outside of initial subject focus
School 1	28	24	4
School 2	23	23	0
School 3	51	25	26
School 4	48	44	4
School 5	49	49	0
TOTAL	**199**	**165**	**34**

Percentage of pupils in project fitting criteria	
pupils within the criteria (target grade of A*-B)	pupils outside of criteria (target grade of C or lower)
82.9	17.1

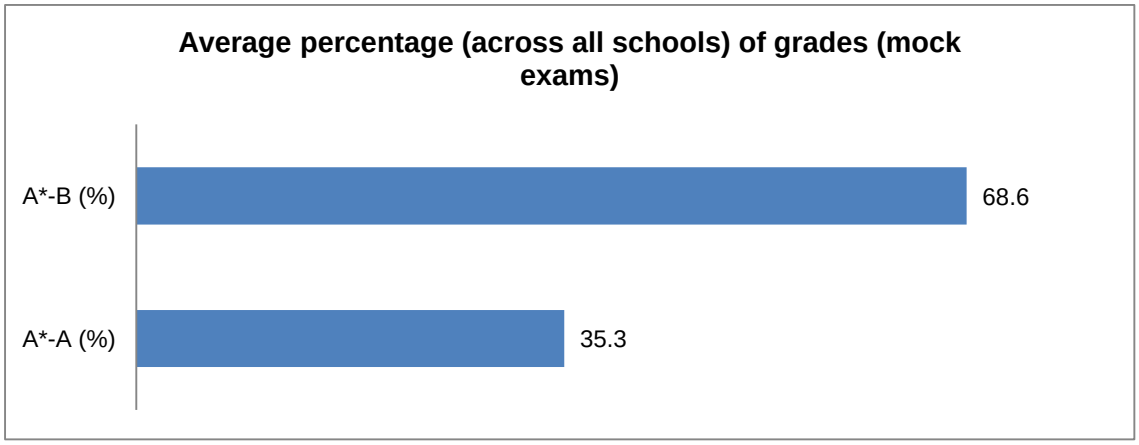
Table 11.2.2 Chart showing participating pupils (2nd return)



Analysis of mock exam results (1st return, March 2015)

With regard to pupil progress towards targets, data was collected at intervals. Mock exams were scheduled by all schools to occur between December 2014 and February 2015. The results for all pupils were analysed in terms of whether they met their target of A*-B and the percentage of pupils exceeding their minimum target grade. A value added analysis was conducted of pupils in the focus group.

Table 11.3 Mock attainment across all schools for target group (1st return)



Mock examinations, December 2014 – February 2015

Table 11.4 – Number of pupils meeting the original project criteria (baseline analysis for 1st return)

School	Pupils fitting criteria (A*-B predictions)	Total number of pupils achieving A*-B	%
School 1	24	24	100
School 2	23	18	78.3
School 3	27	10	37
School 4	44	39	88.6
School 5	60	47	78.3
TOTAL	178	138	77.5

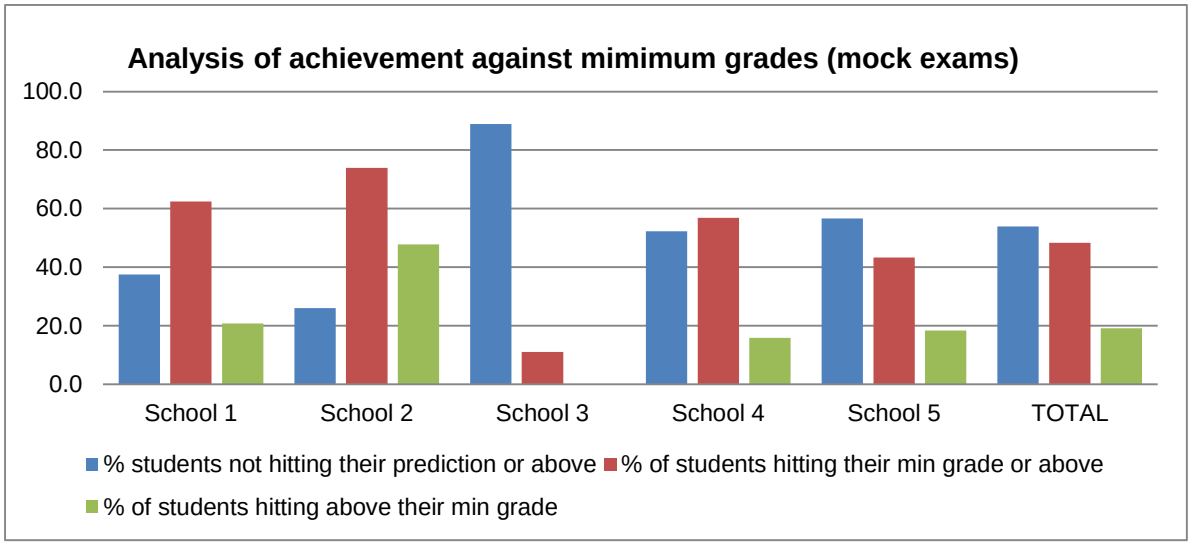
Table 11.5 – Number of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 1st return analysis)

School	Pupils fitting criteria (A*-B predictions)	Number of pupils not meeting their prediction or above	Number of pupils achieving their min grade or above	Number of pupils exceeding their min grade
School 1	24	9	15	5
School 2	23	6	17	11
School 3	27	24	3	0
School 4	44	23	25	7
School 5	60	34	26	11
TOTAL	178	96	86	34

Table 11.6 – Percentage of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 1st return analysis)

School	Pupils that fit the criteria (A*-B predictions)	% pupils not meeting their prediction or above	% of pupils achieving their min grade or above	% of pupils exceeding their min grade
School 1	24	37.5	62.5	20.8
School 2	23	26.1	73.9	47.8
School 3	27	88.9	11.1	0.0
School 4	44	52.3	56.8	15.9
School 5	60	56.7	43.3	18.3
TOTAL	178	53.9	48.3	19.1

Table 11.7 – Cross-school variation from baseline (target grades) to 1st return (mock grades)



Overall, then, 48.3% of pupils reached their target grades, including 19.1% who exceeding them. Hidden within this statistic, though, is considerable cross-school variation. In School 3, no pupils exceeded expectations whereas 47.8% did so in School 2. This may have something to do with the accuracy of prediction across the schools but also reflects pupils' readiness for the mock examinations. There was also limited time for the impact of SK workshops and observation and coaching sessions to be realised.

Externally marked GCSE exam results, September 2015. 2nd return

The results for all pupils have been examined in relation to A*-B target predictions and the percentage variation from expectations. Value added analysis was conducted of pupils on the focus group only.

Table 11.8 Actual attainment across all schools at GCSE for key grade headlines (2nd return)

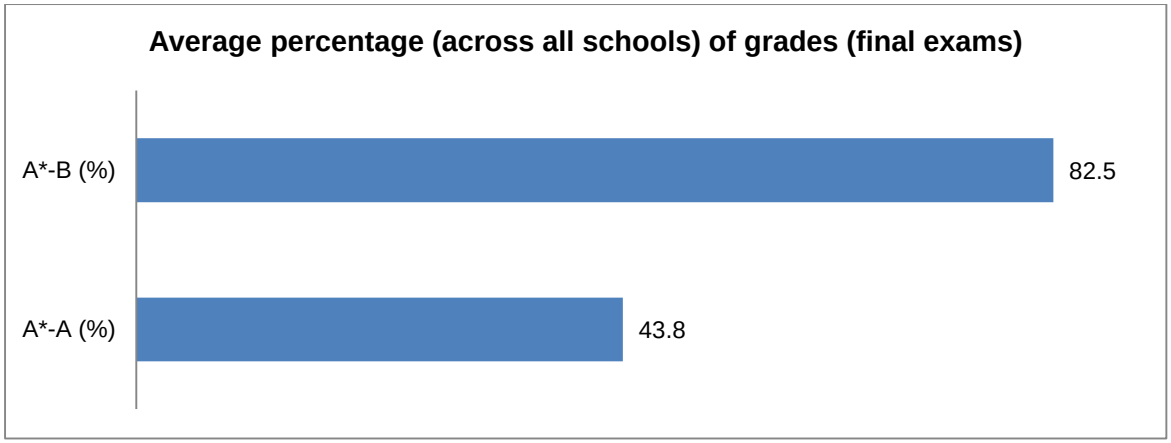


Table 11.9 Achievement of pupils meeting original project criteria (analysis for 2nd return)

School	Pupils that fit the criteria (A*-B predictions)	Total number of pupils achieving A*-B	%
School 1	24	24	100
School 2	23	20	86.9
School 3	25	14	56
School 4	44	43	97.7
School 5	49	49	100
TOTAL	165	150	90.9

Table 11.10 Number of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 2nd return analysis)

School	Pupils fitting criteria (A*-B predictions)	Number of pupils not meeting their prediction or above	Number of pupils achieving their min grade or above	Number of pupils exceeding their min grade
School 1	24	3	21	7
School 2	23	6	17	6
School 3	25	21	4	0
School 4	44	11	33	14
School 5	49	16	33	4
TOTAL	165	57	108	31

Table 11.11 Percentage of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 1st return analysis)

School	Pupils fitting criteria (A*-B predictions)	% Pupils not meeting their prediction or above	% of Pupils achieving min grade or above	% Pupils exceeding their min grade
School 1	24	12.5	87.5	29.2
School 2	23	26.1	73.9	26.1
School 3	25	84.0	16.0	0.0
School 4	44	25.0	75.0	31.8
School 5	49	32.7	67.3	8.2
TOTAL	165	34.5	65.5	18.8

Overall, then, the proportion of pupils achieving A* - B grades rose from 68.6% in the mock exams to 82.5% in the actual GCSEs, as did the proportion achieving A* or A grades (from 35.3% to 43.8%). Furthermore, an increased proportion (65.5%) of pupils met or exceeded their expected target grades compared with 48.3% who did so at the mock exam assessment point.

However, the cross-school variation continues to be a significant feature with pupils in School 3 achieving less well than the other four. This school has seen a significant drop in achievement across all measures though it seems that science results have fared better than other subjects. If School 3 is removed from the data set, 75% of all pupils can be deemed to have met or exceeded their target grades, with 23.8% attaining a grade above it.

Figure 11.5 Cross school variation from baseline (target grades) to 2nd return (GCSE grades)

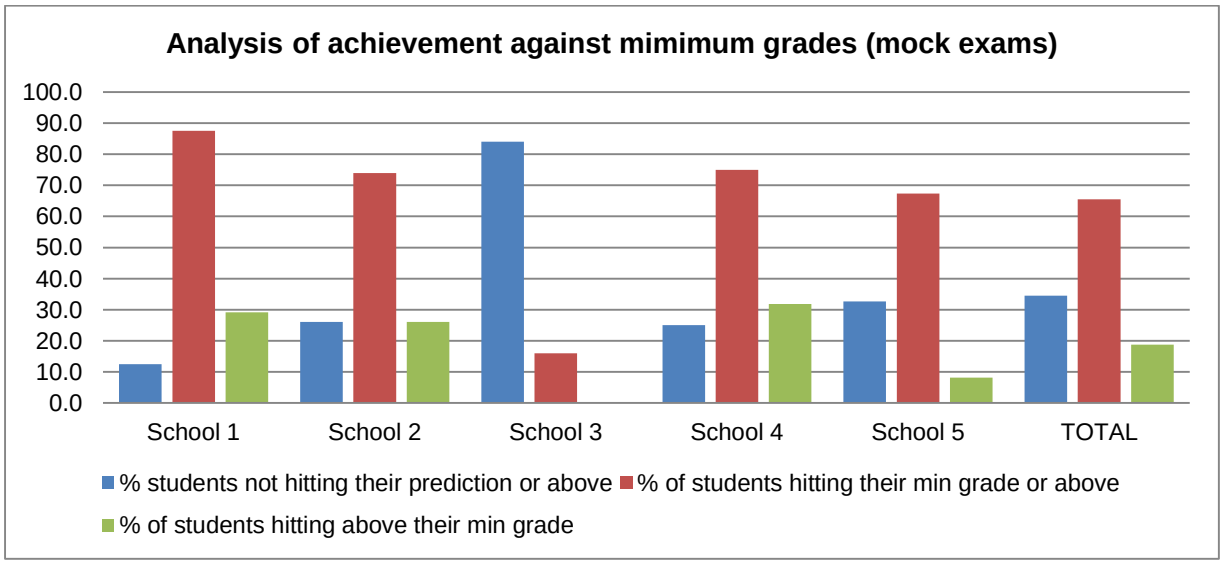


Table 12 - Pupil outcomes for pupil comparison groups *[if available]*

Target Outcome	Research method/ data collection	Sample characteristics	*Metric used*	1st Return and date of collection	2nd Return and date of collection
Supporting more pupils to achieve A/A* grades in Science	Pupil assessment data i.e. target data, mock exam data and final, externally marked, GCSE data	Assessment data collected for identified cohorts in five schools. The profile of students were in line with original project brief, where possible, as having a target grade of an A*, A or B (this wasn't always possible due to the nature of curriculum choices and/or grouping arrangements). Outcomes were analysed in line with the initial outcome described in the Theory of Change i.e. improved outcomes	Teacher assessed (mock data) and externally assessed (GCSE data) was compared with target data (baseline data) as provided by the five schools. Where possible (two schools for the mock and one school for the GCSE results) a comparison with a control group was made and analysed	Comparison of grade outcomes to target grades (baseline data) from mock exams (March 2015)	Comparison of grade outcomes to target grades (baseline data) from mock exams (September 2015)

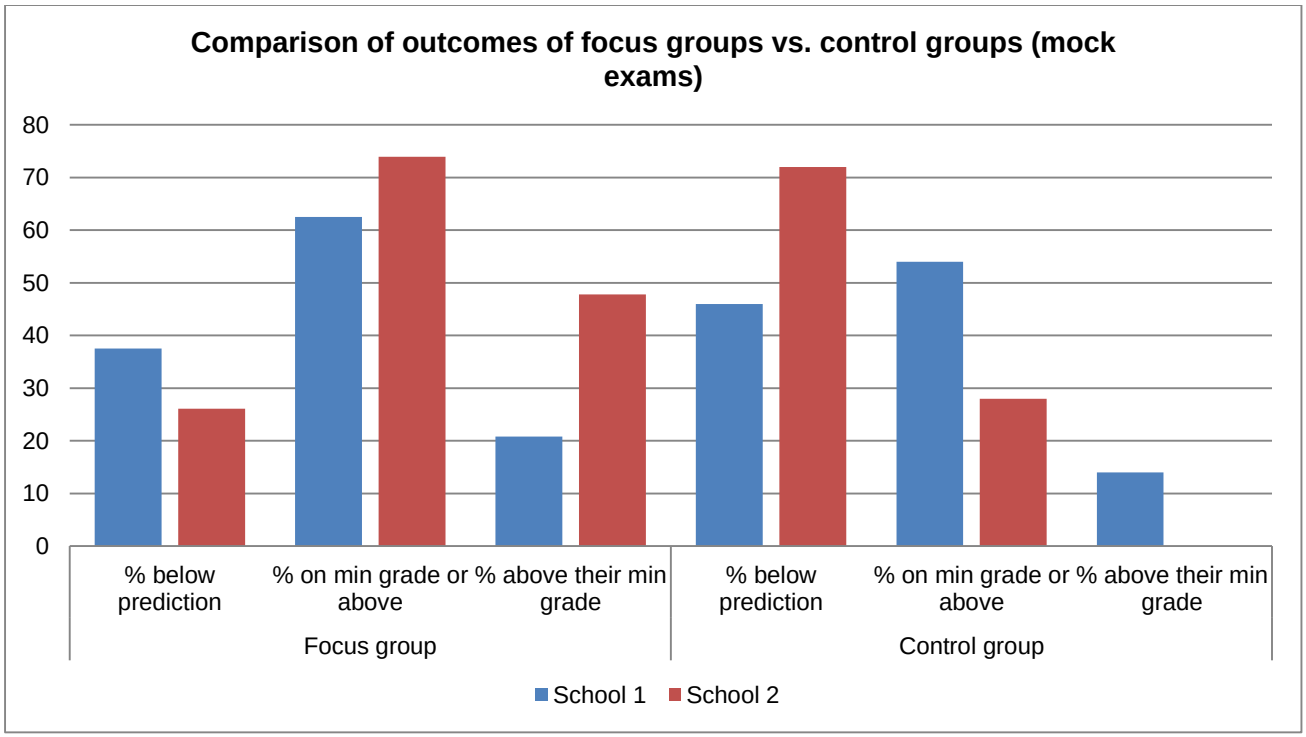
8.2.1 Analysis of intervention group to control group (1st return)

Opportunities to compare the impact of stretch and challenge strategies on an intervention and control group have been limited because of the restrictions posed by curriculum blocking, option pathways and setting. However, it was possible to undertake a limited comparison in two schools where two sets of pupils were broadly similar in make-up. In School 1, for example, the focus group was a triple science class. There were two other groups, not involved in the project, with a similar prior attainment and target grade profile. Their mock data was analysed in the same way as the focus group. School 2 offered a similar opportunity.

Table 12.1 Percentage of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 1st return analysis) for intervention and control group

School	Treatment focus group			Control group		
	% below prediction	% on min grade or above	% above their min grade	% below prediction	% on min grade or above	% above their min grade
School 1	37.5	62.5	20.8	46.0	54.0	14.0
School 2	26.1	73.9	47.8	72.0	28.0	0.0
AVERAGE	31.8	68.2	34.3	59.0	41.0	7.0

Figure 12.1 Percentage of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 1st return analysis) for the treatment focus group and control group



This analysis suggests that early on in the programme (autumn term 2014), the input from the subject knowledge workshops and developmental feedback observations was indeed impacting on pupil achievement. This analysis was continued where control groups were available to help to deepen an understanding of impact.

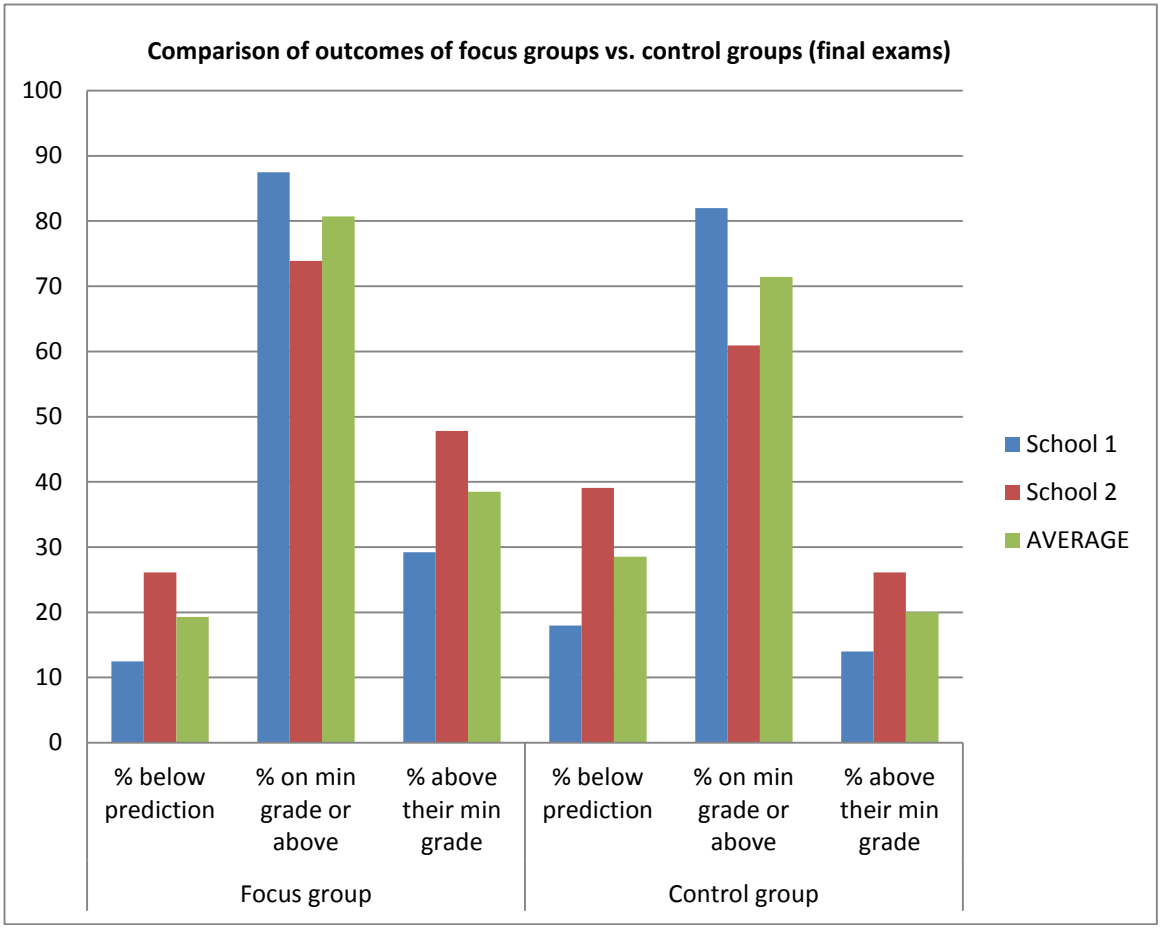
Analysis of intervention group to control group (2nd return)

Despite the small cohort sizes, Table 12.2 suggests that a higher proportion of pupils in treatment groups in both schools met or exceeded their target grades in the final GCSE examination.

Table 12.2 – percentage of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 2nd return analysis) for intervention and control groups

	Treatment Focus group			Control group		
School	**% below prediction**	**% on min grade or above**	**% above their min grade**	**% below prediction**	**% on min grade or above**	**% above their min grade**
School 1	12.5	87.5	29.2	18.0	82.0	14.0
School 2	26.1	73.9	47.8	39.1	60.9	26.1
School 3	N/A	N/A	N/A	N/A	N/A	N/A
School 4	N/A	N/A	N/A	N/A	N/A	N/A
School 5	N/A	N/A	N/A	N/A	N/A	N/A
AVERAGE	19.3	80.7	38.5	28.6	71.5	20.1

Figure 12.2 - percentage of pupils from each school not meeting, achieving and exceeding their target grade (baseline vs. 2nd return analysis) for intervention and control group



The differences in achievement between the treatment and control groups would seem to indicate that the input from the subject knowledge workshops and developmental feedback observations has had an impact. Pupils seem to have benefited from the strategies used by teachers participating in the research project and that this benefit was sustained during the two main periods of analysis as shown by a comparison of Figures 12.1 and 12.2.

8.3 Wider System Outcomes

Table 13 – Wider System Outcomes

The main beneficiary group for the project moving forward into 2015 – 2016 are science teams and their pupils within the participating schools. However, it is hoped that generic learning regarding how best to support students with the potential to achieve higher grades at GCSE will be shared across a range of subject teams. The teaching school alliance network provides a possible forum for sharing how learning has been disseminated.

Target Outcome	Research method/ data collection	Sample characteristics	*Metric*	1st Return and date of collection	2nd Return and date of collection
Programme activities/ model is embedded in department/ schools participation beyond the intervention group	*Impact team Meetings* *Feedback from participant teachers*	*Meeting minutes* *Presentation by each participant school with poster at the celebration event*	*5/5 schools presented*	*Summer 2014*	*Spring 2015* *Summer 2015*
Use of better resources by teachers/ schools outside the intervention group	*Booklet of resources* *Shared on lead school website*		*Number of website hits*	*Autumn Term 2015*	*End of academic year, 2016*
Teachers/ schools outside the intervention group have the opportunity to increase their subject knowledge through the programme	*Booklet of resources* *Shared on lead school VLE* *UCL IOE future projects* *Lead school future projects*	*Evaluation framework / stretch and challenge strategies*		*Autumn Term 2015* *Autumn Term 2015*	*End of academic year, 2016*

8.3.1 The structure of the project enabled senior and middle leaders within the participant school, including heads of science, to be fully informed of the progress and achievements of the intervention group through the impact team meetings, celebration event and evaluation posters. Leaders are crucial in ensuring that professional learning (subject knowledge development) results in sustained changes in practice. The model also has the potential to ensure departments are kept abreast of strategies being trialled and facilitates networking between science departments from different schools. Additionally, if senior leaders are aware of the progress of the project within the science departments, they are more likely to be able to identify

successful strategies which could have wider school application in terms of stretch and challenge.

At the celebration event in June 2015, participating schools presented their learning and findings in poster format. Two of these are attached as Appendix 5. The event was filmed and the posters kept in PowerPoint form enabling strategies to stretch and challenge pupils to be shared within the participant schools and beyond through the school VLE and through UCL IOE future events and projects. Interim findings were also presented by the school project lead at the IOE R&D Network Conference in June 2015 and will feature in an IOE dissemination event in October 2015. Arising from the celebration event and confirmed in the posters teachers are a range of follow up activities developed through the collaborative SK workshops.

It's clear that the primary beneficiary teachers in each school, beyond the participating teachers, will be colleagues in the science departments where strategies are already being embedded. Wider dissemination of new knowledge is also being facilitated across departments through professional development led by participant teachers. In one school, a participating teacher has led a 'sharing good practice' session on PADLET software and has been asked to lead further professional development. In a second school, the scientific literacy strategies will be shared with all staff as literacy is a whole school focus this academic year. In another school examples and sources of motivational hooks or real world examples of science syllabus topics are to be gathered and shared with other schools.

8.4 Impact Timelines

Evidence from the baseline and second lesson observations undertaken by science specialists from UCL IOE suggests teachers quickly began trialling a diverse range of strategies to engage and stretch pupils, to ensure topics were understood thoroughly in preparation for exams and to provide challenge. These occurred in autumn 2014 (baseline) and spring 2015 (impact). Observation notes were recorded shared with participating teachers and the data anonymised for research purposes. As the SK workshops were responsive to the teachers' knowledge and confidence audit and teachers' feedback they directly addressed pedagogy and topics which the participant teachers had identified for focus. The SK baseline audit had been developed collaboratively by participating teachers and completed individually. A final SK audit was completed individually during the final celebration event.

It was anticipated that the three rounds of lesson observations and learning conversations would reveal increasing impact on the pupils. The observations did confirm that pupils were responding increasingly positively to the strategies being trialled. It was further anticipated that progress would be identified between the first and second pupil data collection points, mock exams and final exams. Final data collection confirms increased impact from mock to final result.

It was anticipated that successful strategies would be shared within participant school science departments during the project and that wider school outcomes and sharing beyond the participant schools would follow on from the project. The

development of web materials has been slightly delayed to the Autumn Term 2015, following the final celebration event.

At the celebration event in June of 2015, beneficiary teachers outlined how their science department would take the project forward. They also shared examples of conducting or being asked to conduct CPD on strategies developed through the project with other teachers within their schools beyond the science department.

9. Reflection on overall project impact

The outcomes of this project resonate with the findings of an extensive research project undertaken by UCL IOE researchers and teaching schools across England between 2012 and 2014. The National Research Themes Project, supported by NCTL, required schools to undertake research into 'what makes great pedagogy?' and 'what makes great professional development that leads to great pedagogy?'. One of two literature reviews produced for this project (Stoll et al, 2012) identified nine features of effective professional development. Table 14 maps successful features of the Stretch and Challenge project against Stoll's nine claims.

Table 14. Key features of the Stretch and Challenge project design mapped against Stoll's Nine Claims.

1. Effective professional development starts with the end in mind.	Teachers created desired impact pictures of pupil learning and outcomes. They also collected target grades against which outcomes could be evaluated.
2. Effective professional development challenges thinking as part of changing practice.	Subject experts challenged teachers to try new strategies.
3. Effective professional development is based on the assessment of individual and school needs.	Subject knowledge audits identified individual and collective areas for development.
4. Effective professional development involves connecting work-based learning and external expertise.	External expertise from UCL IOE was brought in to provide support for design, facilitation and evaluation.
5. Effective professional learning opportunities are varied, rich and sustainable.	PD model included collaborative learning and planning and tailored observation and coaching.
6. Effective professional development uses action research and enquiry as key tools.	Teachers engaged at a deep level in collaborative enquiry.
7. Effective professional development is strongly enhanced through collaborative learning and joint practice development.	Learning was enhanced by the development of trusting relationships within and across science departments.
8. Effective professional development is enhanced by creating professional learning communities within and between schools.	There were already established relationships between schools which supported a learning culture.

9. Effective professional development requires leadership to create the necessary conditions.	Leaders created the space and time for collaborative planning and lesson observations. The project funding helped facilitate this.

In effect, the professional development was tailored to the needs of participating teachers as originally identified through the subject knowledge and confidence audit and through subsequent conversations between teachers and subject experts at the workshops. The audits revealed a strong correlation between teachers' confidence to teach a particular scientific topic and their depth of understanding of that topic.

Crucially, the project provided opportunities for teachers to work collaboratively across schools and share good practice in a subject learning network. At the celebration, teachers confirmed that they found this approach beneficial and it has strengthened and widened the subject networking between schools

Teachers valued the subject expertise of the science specialists who they had the opportunity to work with in the SK workshops and through lesson observations and learning conversations. In line with new OfSTED guidance in approaches to lesson observation, the quality of teaching in individual lessons was not given a score as had been planned in the original evaluation schedule. Rather, the observer commented specifically on the effectiveness of strategies to promote learning which provided stretch and challenge. This coaching model, with the emphasis on improving teaching and learning, promoted a sense of trust between the participant teachers and UCL IOE subject experts.

The UCL IOE baseline impact framework enabled teachers to track and evidence change and also strengthened the evaluation of the impact of the project within individual schools. The approach begins with the end in mind and emphasizes the importance of establishing a firm baseline before strategies are trialled.

The celebration event in June 2015 was an opportunity for all five schools to exchange knowledge gained from the project, agree the most effective strategies to stretch and challenge the most able and to evaluate impact. All five schools attended having produced a poster to outline their particular school's engagement with the project. The event was filmed to record findings, facilitate dissemination and follow up to the project. Each school prioritised different strategies gleaned from the project SK workshops to trial depending on their particular context.

In summary, teachers agreed common messages to share with others about how to activate student learning and stretch and challenge them. These centred on how to

provide opportunities in class to develop student autonomy and shift from teacher-led to student-led learning. Strategies included:

- structured group work, flipped learning, developing the role of pupils as experts or ambassadors, students having access to course specifications and mark schemes and the use of technology including PADLET to support classwork and to take the learning beyond the classroom.

Teachers also felt strongly that developing literacy and scientific language is pivotal to exam success at the highest levels, particularly in 6 mark questions. These strategies are reliant on a high level of teacher planning that allows for increasingly challenging objectives.

At the event, teachers also shared their summation of the impact of the project on the pupils that they had observed in their schools, for example:

- increased engagement and enjoyment as was evidenced by pupils spending more time after school discussing their work, increased numbers attending revision classes, pupils spending more time reading around the subject and pupils expressing an interest in careers or pathways in science
- greater autonomy, with pupils more able to find their own resources and therefore lead their own learning ,enjoying the flipped learning and the role of expert or ambassador within structured group work and responding favourably to problem solving and creative activities as evidenced through pupil voice
- improved scientific literacy resulting in better written and verbal responses in the focus group, more pupils answering 6 mark questions more confidently
- the development of transferable skills including meta-cognition

Overall teachers agreed that they wanted to promote engagement in science and the scientific world beyond the curriculum to develop students as scientists, prepared to take risks with their learning and make mistakes in pursuit of solutions. To that end it is important to develop pupil resilience.

Interim mock examination and final GCSE science outcomes indicate that these strategies have had a positive impact on pupil achievement. Overall, the proportion of targeted pupils achieving A* - B grades rose from 68.6% in the mock exams to 82.5% in the actual GCSEs, as did the proportion achieving A* or A grades (from 35.3% to 43.8%). Furthermore, an increased proportion (65.5%) of pupils met or exceeded their expected target grades compared with 48.3% who did so at the mock exam assessment point. Finally, a limited, small control comparison in two of the five schools suggests that a higher proportion of pupils in treatment groups in both schools met or exceeded their target grades in the final GCSE examination.

10. *Value for Money*

A value for money assessment considers whether the project has brought about benefits at a reasonable cost. Section 5 brings together the information on cost of delivery which will be used in this section.

10.1 Apportionment of the costs across the activity
Please provide an estimate of the percentage of project activity and budget that was allocated to each of the broad activity areas below. Please include the time and costs associated with planning and evaluating those activity areas in your estimates.

Broad type of activity	**Estimated % project activity**	**£ Estimated cost, including in kind**
Producing/Disseminating Materials/Resources	15%	660
Teacher CPD (face to face/online etc)	50%	30846.25
Events/Networks for Teachers	5%	750
Teacher 1:1 support	10%	8281.25
Events/Networks for Pupils	0%	
Management of project, collation of data, evaluation of findings and	20%	24450
TOTAL	100%	£ 64987.50

Please provide some commentary reflecting on the balance of activity and costs incurred: Would more or less of some aspects have been better?

10.2 Commentary of value for money
Please provide some commentary reflecting on the project's overall cost based on the extent to which aims/objectives and targets were met. If possible, draw on insight into similar programmes to comment on whether the programme delivers better or worse value for money than alternatives.

As seen by the supporting evidence, the aims of the project were met. As seen from the developmental observations and teacher confidence surveys, staff employed an increasingly diverse range of strategies in their classrooms; developing the independence of learners. Staff collaboration at the subject knowledge workshops supported the increased confidence in staff when handling more challenging topic within the science curriculum. The impact of this was improved outcomes for students when compared with student cohorts of a similar profile. The various inputs, both the preparation of INSET materials and staff time in the preparation, delivery and participation in these INSETs, from UCL IOE, School leaders and participating teacher all led to these successful outcomes and so represent good value for money.

The expenditure was reviewed at several points in the programme and where possible was rationalised e.g. publicity and marketing, to ensure that the project came in under budget. This was the most effective and economical way to bring about this project and its positive outcomes and so again represents value for money.

Seven Kings School, as a Teaching School, has a plan in place to develop the findings of the research project and how this might be shared across its Teaching School Alliance and beyond. It has in place a plan for the development of pedagogy working parties within its own school and, as all expect one of the project schools are in the Seven Kings Teaching

School Alliance, it will look to see how it can involve staff from a wider network and will aim to share the outcomes from this continued focus in summer 2016; both within Seven Kings and across its Alliance. This continued focus, development of and wider dissemination of the project aims and outcomes proffers significant value for money.

10.3 Value for money calculations
Note: This section is only required for projects with control or comparison groups

In order to demonstrate the cost effectiveness of the project we would like those projects who had control or comparison groups to provide some value for money calculations. Further guidance will be issued to support projects with this.

A control group was not part of our original bid or project proposal. As there were two schools that had cohorts that could be analysed in a similar way to the focus groups, the data was used as a comparison. As this did not incur any significant additional input (some extra time was given in kind to analyse these additional data sets) no value for money calculations are necessary or valid in this section.

11. Reflection on project delivery

The lead school as a teaching school was committed to developing networks for CPD and research and development. They had already worked with some of the participant schools on previous projects and had also worked in partnership with the UCL IOE. This suggests that the network of schools developed through the project is likely to be sustained.

This project was initially put in place following changes to the GCSE science curriculum in 2011 for chemistry, physics and biology which were designed to ensure more challenging curricula. As previously stated, in 2013 the national proportion of A/A* grades decreased ‘largely due to the more challenging science subjects’ (Ofqual). This project addressed the specific and more rigorous subject knowledge that KS4 Science teachers now need to support more pupils to achieve A/A* grades in Science. It aimed to enable teachers to plan for this increased rigour and challenge for more able pupils. The period of the project has seen continued transformation of assessment protocols including the move away from controlled assessment. Consequently teachers need to continue to work together to refine their strategies to stretch and challenge the most able pupils so they fulfil their potential to achieve the top grades within the new exam assessment criteria.

12. Final Report Conclusion

Key findings for assessment of project impact

- The UCL IOE impact evaluation framework enabled teachers to track and evidence change and also strengthened the evaluation of the impact of the project.

- Data from observation records and the teacher audits indicate that teachers gained new knowledge and understanding of a range of strategies to stretch and challenge their higher attaining learners. The workshops and celebration event enabled teachers to work collaboratively to share and develop good practice and strategies to be disseminated across the schools and, potentially, beyond the participant schools.

- The coaching approach to lesson observation supported the movement of knowledge into practice so new strategies were sustained and embedded.

- Lesson observation records show that, where progress was at its best, there was an increased level of emotional engagement and motivation on the part of the students. They were able to work more independently of their teachers and more collaboratively in structured groups, supporting their peers and accepting the support of others.

- Progress data shows that pupils in the focus groups made significant progress from mock to final exam results in relation to their minimum target grades established at the baseline. In the final GCSE exam, 65.5% of pupils achieved their targets with 18.8% exceeding them. This had risen from 48.3% and 19.1% respectively in the mock exam.

- Teachers have created new lesson plans and resources in the light of new methods learned which will be shared more widely in the dissemination phase of the project.

Key lessons learnt for assessment of project delivery

- The project was tailored to the needs of participating teachers as originally identified through the subject knowledge and confidence audit and through subsequent conversations between teachers and subject experts at the workshops and through the teachers' feedback on the workshops.

- The project provided opportunities for teachers to work collaboratively across schools and share good practice in a subject learning network supported by subject experts, something which teachers expressed the desire to continue in the future.

- Teachers valued the subject expertise of the science specialists who they had the opportunity to work within the SK workshops and through lesson observations and learning conversations. The coaching model of lesson observation and learning conversation emphasized the developmental aspect of the programme to improve teaching and learning and promoted a spirit of trust and cooperation.

Informing future delivery

- The time commitment required to gather and analyse pupil data from across the participating schools has been challenging. In the future it would be beneficial to build time into the SK workshops and impact team meetings to track pupil progress more closely and analyse data. This would also enable a multi-levelled analysis of the performance of sub groups throughout and at the end of the project so that individual pupil needs can be even more closely addressed.

References

Stoll, L., Harris, A., & Handscomb, G (2012) *What makes great professional development that leads to great pedagogy? Nine strong claims from the literature* (NCTL, Nottingham)

Appendices

Appendix 1 theory of change.pptx

Appendix 2 evaluation framework

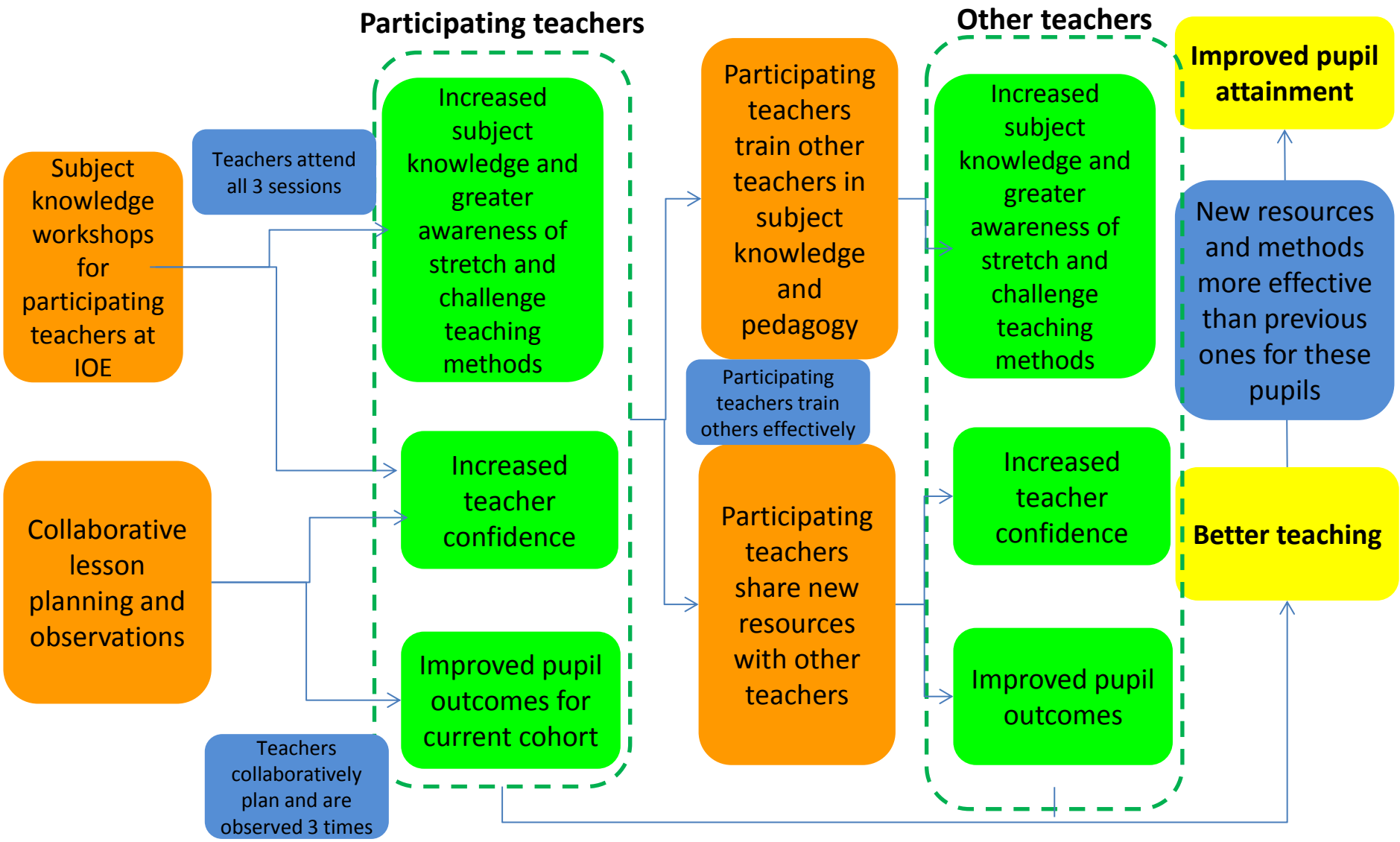
Appendix 3 project structure with dates.p

Appendix 4 observation evaluatio

Appendix 5 sample of final posters.pptx

Appendix 1

Theory of Change: KS4 Science Stretch and Challenge



Appendix 2 **Evaluation Framework: Stretch and Challenge: accelerated achievement in Science at Key Stage 4**

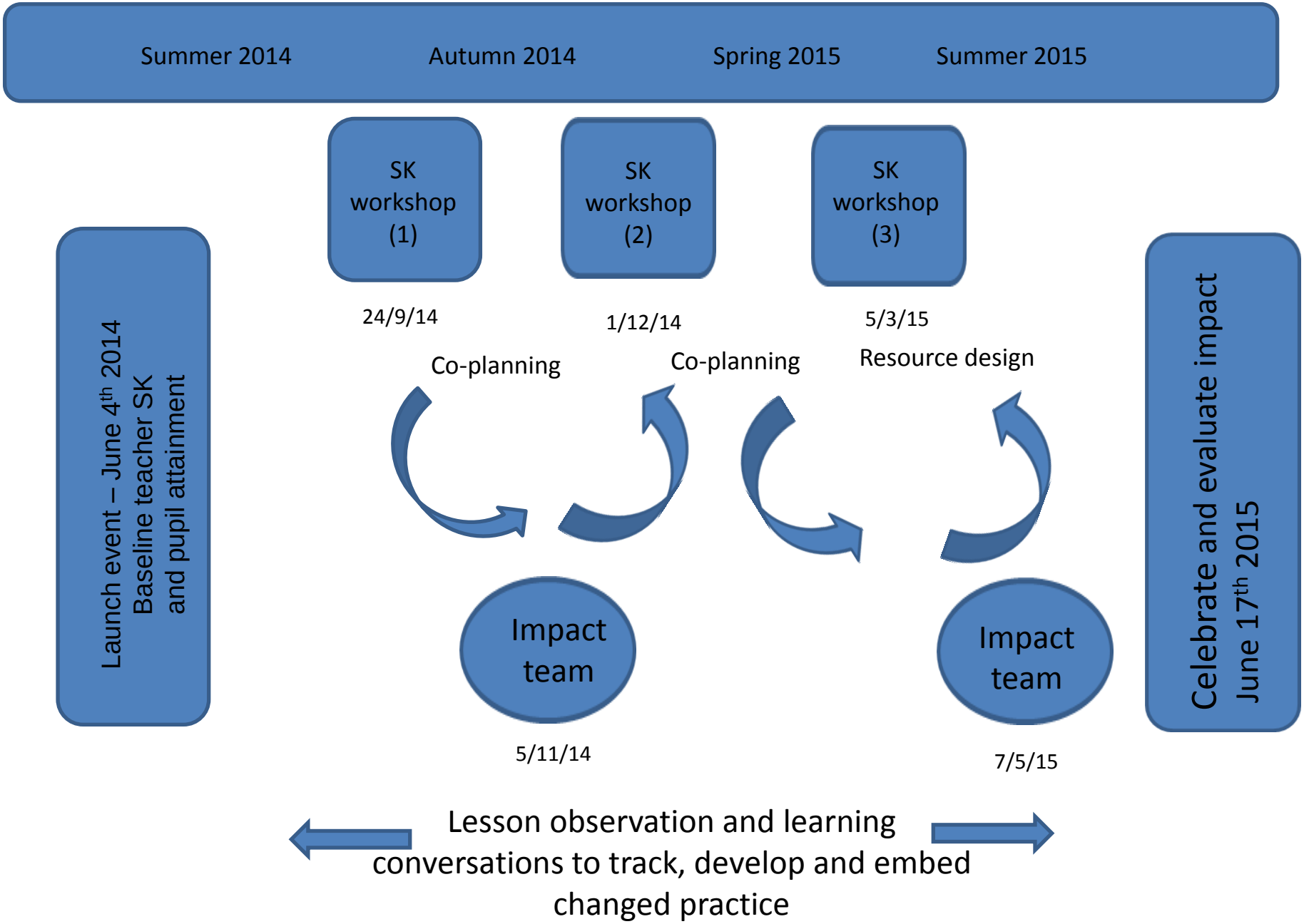
	Outcomes	Indicators	Baseline data collection	Impact data collection
Teacher outcomes **Sub Groups** As part of establishing the baseline, the characteristics of the eligible cohort should be analysed across the following sub groups: ☑ NQTs ☑ 3 years + ☑ Primary/ secondary ☑ Other (project specific) These should be expressed as a % of the whole group. **Churn** Throughout the programme thorough records of any "churn" of teachers leaving or joining the intervention group must be kept. In order to do this records must be kept of: ☑ Unique teacher identifier ☑ Engagement date ☑ Disengagement date and reason	☑ Increased subject knowledge and greater awareness of subject specific teaching methods in KS4 Science	☑ Increased scores in subject knowledge survey, devised by IOE, to be taken by all teachers involved in the intervention.	☑ Scores collected for individual Science teachers from pre intervention subject knowledge survey Summer Term 2014	☑ Scores collected for individual teachers from post intervention subject knowledge surveys after completion of programme July 2015
	☑ Increased teacher confidence to effectively deliver KS4 stretch and challenge in Science	☑ Increased scores in subject knowledge survey (confidence measure), devised by the IOE, to be taken by all teachers involved in the intervention.	☑ Scores collected for individual teachers from pre intervention confidence surveys Summer Term 2014	☑ Scores collected for individual teachers from post intervention confidence surveys after completion of cohort's programme July 2015 ☑ Interviews/ focus group of sample of survey respondents to moderate survey findings (sample size = 50% min) July 2015 – September 2015
	☑ Delivery of higher quality teaching including Science-focused teaching methods	☑ Improved teaching performance in observed lessons - Key Stage 4 Science curriculum. Observations to be conducted for all teachers taking part in the programme (12). ☑ Improved effectiveness of strategies to promote learning which provide stretch and challenge.	☑ Standards collected for individual teachers from pre intervention observations. November 2014	☑ Standards collected for individual teachers from observations after completion of programme. July 2015

	Outcomes	Indicators	Baseline data collection	Impact data collection
	☑ Use of better Science-specific strategies co-constructed as a result of participating in the project	☑ Development of subject specific teacher guidance and resources ☑ Uptake of new resources and co-construction of their design.	☑ Audit/sample scrutiny of existing subject specific resources being used May/June 2014 ☑ Launch date of new resources Ongoing throughout duration of programme	☑ Review of new subject specific resources by IOE and schools within alliance ☑ Use of new subject specific resources in lessons (through lesson observations or work scrutiny). Usage analysed against performance in observed lessons. Ongoing throughout duration of programmes

	Outcomes	Indicators	Baseline data collection	Impact data collection
Pupil outcomes **Sub Groups** The characteristics of the eligible cohort should be analysed across the following sub groups: ☑ LAC continuously for 6 months+ ☑ FSM ☑ FSM at any time during last 6 years* ☑ Disadvantaged pupils ☑ EAL ☑ Gender ☑ Ethnicity ☑ Statement of SEN or supported at School Action Plus ☑ Started respective Key Stage below expected level, at expected level, above expected level	☑ Increased Science attainment for high ability KS4 Science students. ☑ Greater than expected progress towards GCSE target grades seen in Year 10 teacher assessments / unit tests and end of Year 10 mock exams in Biology, Chemistry and Physics	☑ Increased attainment (grades) of Yr 10 students taught by teachers involved in programme compared against a comparison group. The comparison group will be classes in Yr 10 taught by teachers not involved in programme across participating schools. Data will also be used from previous cohorts of students. ☑ Increased levels of progress (point scores and % achieving higher point scores than expected) compared against a comparison group ☑ Reduced gap between attainment of different sub-groups/disadvantaged groups of pupils (e.g. **FSM**) compared against a comparison group	Intervention Group will be identified once teachers participating in the project have been finalised. (Baseline data in Summer Term 2014) ☑ Intervention group: assessed level on entry to the programme and for 3 years previous for Yr 10 Science students ☑ Comparison group: assessed level on entry to the programme and for 3 years previous. ☑ Trend data: Actual attainment (grades) for the 3 previous year groups (current Yrs 11, 12, 13) ☑ Intervention group: estimated point score without intervention (for Y1 and Y2 of programme) ☑ Comparison group: estimated point score without intervention (for Y1 and Y as above)	Intervention Group will be identified once teachers participating in the project have been finalised. (Impact data: September, December 2014, March 2015, July 2015) ☑ Intervention group: actual pupil attainment levels during and after intervention ☑ Comparison group: actual pupil attainment levels during and after intervention ☑ Where attainment is based on teacher assessments (i.e. not at the end of a KS) a sample of pupil assessments will be independently moderated ☑ Intervention group: difference between actual attainment and expected attainment (without intervention) ☑ Comparison group: difference between actual attainment and expected attainment (without intervention)

	Outcomes	Indicators	Baseline data collection	Impact data collection
School system outcomes	☑ Use of better resources by teachers/ schools **outside the intervention group**	☑ Uptake of new resources developed by LSEF programmes by non LSEF teachers/ schools	☑ Planned new resources to be developed by LSEF programmes ☑ Avenues of dissemination/ promotion	☑ Number of resources downloaded from website (by different schools) ☑ Number of resources taken from training sessions/ conferences (by different schools) ☑ User feedback on quality of resources through participant feedback
	☑ Teachers/ schools **outside the intervention group** have the opportunity to increase their subject knowledge through the programme	☑ Increased number of teachers outside of the intervention group schools improve their subject knowledge as a result of this programme	☑ Professional learning courses/ sessions/ workshops offered to teachers outside of the intervention group ☑ Number of teachers outside of the intervention group attending existing training offered by your programme	☑ New KS4 Science subject knowledge/pedagogy training courses/ sessions/ workshops offered to teachers outside of the intervention group based on/ as part of your programme. ☑ Number of teachers outside of the intervention group attending training offered by your programme ☑ Subject knowledge audits and teacher self-reflection to capture development of subject knowledge. By July 2016

Appendix 3 - Project plan with dates



Appendix 4 Tracking changes in practice against baseline subject knowledge audit
June2015

Baseline SK audit – areas of least confidence highlighted	Strategies to support stretch and challenge	Observation 1	Observation 2	Observation 3
Specific physics topics, e.g. electricity, using models, generators, current in series and parallel circuits, momentum.	SK day collaborative planning, sharing excellent practice	Topic areas covered: Light reflection Nuclear fission and fusion	Topics covered: Light refraction Equilibrium	Topics covered Structure of the earth / plate tectonics
Specific chemistry topics, e.g. moles, KS5 topics to enrich GCSE	SK day collaborative planning, sharing excellent practice	Topic areas covered: Performance enhancing drugs Rates of reaction Converting moles	Topics covered: Pollution Chemicals in water / flame tests Halogens Reactants: Endothermic and Exothermic	Topics covered: Carbon fuel; crude oil, hydrocarbons, Alkanes /alkenes Reactions in the limestone cycle Chemical structures and bonding Atomic structure and electronic configuration Charles Law / Boyles Law/ Pressure Law / ideal gas equation
Specific biology topics, e.g. biotechnology, neuroscience, KS5 topics to enrich GCSE	SK day collaborative planning , sharing excellent practice	Topic area covered: Genetic diagrams	Topics covered: Genetic engineering Plant and animal adaptation	Topics covered: Processes involved in breathing-measuring lung volume Structure of the gas exchange system The circulatory system –blood flow in the arteries, veins and capillaries
Practical work in non-specialist subjects to maximise learning		Flip lessons		
Mathematical skills in science		“They will be given the opportunity to experiment with the factors such as temperature and surface area.”	Topic covered: Working out angles of refraction through experiment Solve problems involving calculations – percentage compositions and empirical formula “ students who were more able were able to determine the critical angle”	“For the work with graphs used ‘TASTE’ (title, axis, scale, trends, evaluate) to help students deconstruct graphs and what they mean , and this has really helped”
Strategies to improve literacy in science	Talking to think, reading and tackling 6 mark questions	“Initially, I would like them to be able to recall the science behind the factor by completing a literacy task”	“have been using literacy mats…. To support extended writing tasks, which is being used in the majority of lessons and working well.”	“Focussed on the difference between command words, like describe and explain, so students answer correctly and don’t waste time in exams”

	Accessing past papers, mark schemes, example answers			"Been trying guided writing with long answer questions." "Students completed a written explanation in pairs on 'how do we inhale' with the stimulus of a bell jar demonstration and key words provided." "The level of discussion in the groups and with the facilitators is of a very high quality – they are unpicking key words e.g. inter /intra" "When going through the exam links were made back to the specification point as well as to the examiner's report alongside the mark scheme"…. All of this gave them a clearer understanding of how to do well" "Found that focussing on exam skills, such as command words and data analysis, really helped achievement in recent mock. Students were able to do questions which used skills they had explicitly practiced" "using sequencing activities to help them structure their extended answers"
Introducing and using context to expand teaching including content at higher levels	Neuroscience of learning, including the use of motivational hooks or 'wow' factor to make the learning memorable. How to maintain motivation and interest in a lesson Reviewing what recent research says about what makes excellent teaching	"On laptops in pairs, rearrange the slides about what happens during the fission of uranium – 235 in a nuclear power plant on a power point into the correct order and add notes using a text book. Students get on well with this…" "Demo to show chain reaction – this was elicited independently by a student straight away and all students were engaged and interested" "Using Henry V111 as a context got them really interested…"	"using items in the news, like ' The Dress' to hook students and get students to write extended answers with explanations on HW on Padlet. For students it does not seem like HW, it converts something that would be a boring chore into an exciting challenge"	"The project ...has meant really focusing on stretching learning beyond the specification and also getting students to see how topics relate to the real world"

Creating a learning environment which provides opportunity and nurture	Listening to and acting on what students say	"This class are a very enthusiastic and really enjoyed the challenge set. There was a very excited buzz throughout – lots of laughs and smiles and whoops when they managed to achieve a solution to the problem."	" it was good that if students did not get the expected outcomes , they were asked to write up why they thought that was, forcing them to reflect on their method" "Since the last time have been using more open investigations to challenge students to think more. First time was difficult but students have risen to the challenge and found that engagement has improved." " the emotional engagement of the class is very good – the teacher is able to use a variety of tactics to make the learning environment very positive…. Real interest shown in the students' ideas brought in from their discussion…Participation in all activities is very good."	"When students didn't know the answer, the teacher gave them time to think before returning to them and got another student to provide information which would lead to the answer. This was an effective strategy" "The students are very positive working with anyone in the class. The learning environment is very, very positive and supportive" "This classroom has a very supportive atmosphere, especially in the emotional sense"
Planning student led /student centred activities to promote independent learning	How to develop independent learners Strategies for increasing challenge – including open tasks and enquiry Students in role e.g. expert / ambassador Using student voice	"Another group is designing a lesson on a future topic that pupils have not covered, so are essentially teaching themselves before delivering." "Group of four students delivering a planned lesson. All students had a structure for planning and key success criteria." " as you had given the students the aim of becoming experts to teach each other they could also have peer assessed one another based on whether they had learnt what was required from the presentations"	" one student … uploaded a video they had made" "Getting students to write their own questions was also difficult the first couple of times, but then students have got the hang of it and again it has provided greater challenge and allowed them to understand the requirements for the exams better". "Students in the class are very keen to prepare and teach others; in fact they have asked to take on a particular topic in order to improve their understanding of given topics."	"Students are now more independent which will give them lifelong learning skills. Students have become very self-reflective and able to come up with specific targets for themselves" "Each table had a tray of dictionaries….which allows students to be more independent" "The student facilitators have all the qualities of good teachers – well prepared, excellent questioning skills, use of background info to support explanations, including text books" "Padlet is used to provide the mark scheme for students to continue correcting their work at home"

			“The students have been involved in producing videos to enhance their learning – these are quite high tech in terms of filming time” “The groups were genuinely motivated to get the correct answer, and the group got it right first time and were very pleased.	“Have got students to use Padlet to create revision mind maps, which they then share. This has been seen to have impact on topic tests. Students also really engaged with it and did a lot of independent research.” “Using Padlet to put up past papers and mark schemes, students find it a lot easier to use than the school VLE.”
Organising groupings to facilitate peer learning	Use of competition and structured group work	“Students ...working in groups to teach each other about performance enhancing drugs. Students all on task and engaged” “The groups with their roles assigned and defined, worked really well. All the students were on task and were organised, with students working cooperatively.” “Good questioning, leading students to get to work out the answers for themselves.”	“ students are used to peer and self-assessment, though they need more practice on being comfortable with terms that come up in the mark scheme” “Group leaders termed ‘ambassadors are told they are in charge and responsible for their group completing the work. This work seemed to raise the confidence of some students like A……” “ Some students are very effective, acting as a teacher for the group- including checking work and explaining misconceptions”	“For some questions, students looked at each other’s answers and tried to deduce what they needed to do to get the marks, to engage them with the questions” “Students working semi independently, seeking support form peers. When a student gets stuck and asks the teacher for help he first directs them to their peer and their book, which they have to consult before coming to the teacher for help”
Differentiation to meet the needs of all	What is a ‘gifted’ learner and how do you recognise this? Use of Blooms Taxonomy to ensure pupils know which are the higher order skills / questions Strategies for increasing challenge -	“ you had a good idea of which tasks were more challenging so you have good differentiation across the group “	“ tried using experts , but although some students enjoyed this and rose to the challenge, other did not and felt it was too pressured and demotivation -, so need to think about which strategies work best for which students”	“Applied Bloom’s effectively and explicitly so that students know that, for example, application is a higher skill” “With the multiple objectives this class works better if they start off at the same point and then they may skip ahead or work faster” “One student is able to bring some detailed knowledge to the class because of the open-ended nature of the task e.g. one pupil spotted today’s Google ad which is linked to the topic”

	differentiation for stretch with multiple objectives and use of interactive technology Homework set menus			"…implemented the use of a spreadsheet to track progress when using multiple lesson objectives… an effective strategy to track and ensure progress."
Engagement of girls	Pupils as ambassadors	"you could have more balanced groups on occasions"	"This is the first time the teacher feels he has got A….. doing a group task in which she flourished and enjoyed"	"Lovely to see students fully involved in the lesson – the girl helping to present is a success story i.e. massively more confident and lifted her level of attainment from D to high B"
Questioning by teachers	Effective questioning techniques, including hinge-point questions and flexible planning	"Good questioning, leading students to get to work out the answers for themselves." "The group discussion… did raise interesting ideas and the style of questioning you used was good to draw out deeper ideas behind the answers to the questions." "Some good questioning e.g., what is angina?"		"There was very good questioning of students' to draw out their knowledge"
Questioning by students		"There were interesting questions from students arising from the uses of light e.g. how long it would take to send a Morse message"		" the student facilitators have all the qualities of good teachers – well prepared excellent questioning skills, use of background information to support explanation including text books"

Appendix 5

Strategies for improving A-A* in Science

'Ensuring that the brightest pupils fulfil their potential goes straight to the heart of social mobility, of basic fairness and economic efficiency.' **(Smithers and Robertson, 2012 , from Sutton Trust report)**

Background and drivers for project

Research by The Sutton Trust illustrates a failure to ensure that our most able students achieve their potential both restricts their choice of university and limits their future economic well-being.
In this study strategies to help our most able students reach excellence were investigated in a small high ability cohort in all three sciences.

Methodology

Selected students took part in various strategies which were aimed at improving their attainment in both a short and long-term context. For each strategy, the impact was measured both qualitatively and quantitatively using either a red ☹ amber😐, green ☺ (RAG*) barometer system or by their ability to improve the answers they provided to higher level (6 mark) exam questions and as a result improve their overall working grade.

Key strategies used

- RAG of the specification points
- 6 –mark AQA exam questions.
- Ambassadorial roles
- Collaborative planning
- 1-1 coaching focussing on positive praise
- Students writing exam questions for the class
- 'Beat the expert'

Key learning

This study found a varied response to key strategies used. Of special note, students responded well to ambassadorial roles as opposed to competitive roles. Interestingly, some of the strategies demonstrated a clear gender divide with respect to likeability; the competitive roles were considered 'overwhelming' and 'unproductive' by girls in target group , whereas the boys enjoyed these roles the most.
Verbal feedback from students demonstrated increased engagement in lessons and a perceived increase in their rate of progress, particularly for the more ambassadorial and collaborative roles.

Impact on students' learning

Qualitative assessment of understanding demonstrated that all (100%) of the target group would consistently rate themselves having gone from red to green on a RAG* scale. In contrast the control group only 60% would rate themselves as having made this leap, 40% suggesting that they had made progress from red to amber.
Quantitative testing of each intervention didn't indicate any significant improvement in attainment for 6-mark questions for all interventions used. However, mock data analysis indicated that the overall outcomes had improved when compared to a control group with a similar set of target grades (focus group 62.5% on MG or above and 20.8% above MG compared to a control group where 54% on MG or above with 20.8% above MG)

Next steps

Although the strategies used in this study demonstrate a small tangible effect with small gains in quantitative outcomes, the overall level of engagement from the target groups was a positive factor in itself. In feedback from the target group it was evident that in addition to the intervention, the realisation that they were a group the school had targeted for engagement and challenge, made them engage with the subject matter and has resulted in improved outcomes.
This research primed the hypothesis that from a **school perspective**, appropriate **identification and targeting** is essential to **harness and nurture** our most able and gifted students. From a teacher perspective, this research challenges our approach to teaching A-A* students, ensuring they are aware of **school and classroom expectations and** enriching their **learning experience** with these strategies is itself a positive move towards **engage and challenge** them across all the sciences and perhaps other disciplines too.

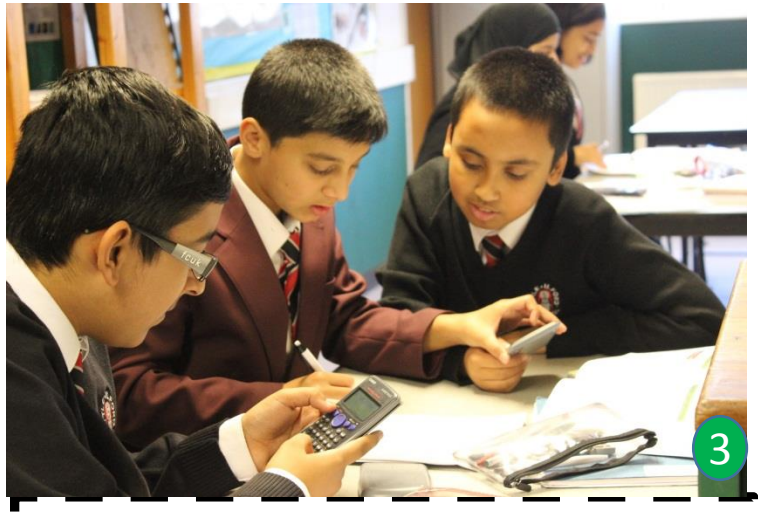
Supporting independent learners to enjoy achieving their potential

KEY STRATEGIES

1. **Independent levels of learning**
2. **Using online resource 'padlet' to engage in out of classroom learning**
3. **Revision experts and student teachers**

What Works

- Pupils enjoyed being given responsibility and being allowed to take ownership for their learning
- Careful planning of activities and providing frameworks to structure and support independent work
- Giving a class time to practice using a new strategy. It didn't always work well the first time round!
- Using technology to engage pupils in learning – the online resource 'Padlet' provided a stimulating platform for student led discussions, explanations and for us to address pupil misconceptions



IMPACT ON STUDENTS

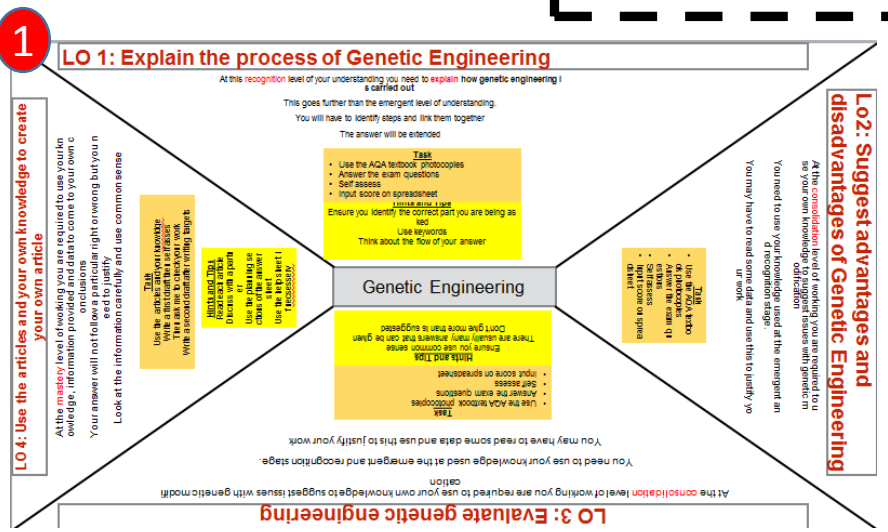
- Students have become much more independent during the year and now take more responsibility for their own learning
- Students engaged in lessons and understand the real world applications of Science content
- Greater awareness of their own strengths and weaknesses, and their own progress in relation to their targets
- Students are more confident to collaborate with and support their peers in learning
- - Students have developed transferable skills such as leadership, communication and creative thinking
- Students on track to achieve their target grades in Science

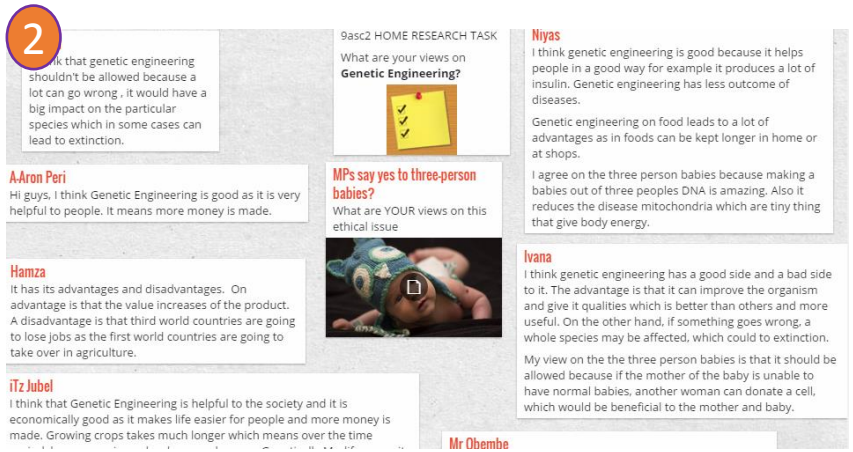
IMPACT ON TEACHING PRACTICE

- Confidence to try new teaching strategies
- Greater awareness of the importance of stretching and challenging all pupils in the class
- Confidence to provide students with opportunity to support their peers in learning
- Challenge to set more open ended and problem solving tasks, including higher order questions that engage and challenge pupils

EVIDENCE

- Observed clear developments in autonomy and independence, with learning increasingly moving reliance away from teacher, and students beginning to independently pursue their own lines of enquiry
- Student voice – pupils have themselves identified how the key strategies used in the project have supported them in developing self-confidence, their ability to overcome obstacles and engagement in Science
- Class data supports pupil progress throughout the year and shows they are on track to achieve their end of year targets





NEXT STEPS

- Continue to develop pedagogy by practicing key strategies more often, and embedding techniques used when teaching other classes
- Refresh and improve our own understanding of content outside of our own subject specialism in order to be confident enough in expertise to really stimulate and challenge more able pupils
- Sharing practice within Science department
- Providing whole school training and support to allow the application of 'Padlet' resource