University of Glasgow | Robert Owen Centre for Educational Change

Evaluation of the SSERC Primary Cluster Programme in Science and Technology

Final Report

Teacher Survey, 2012-2018

Pupil Survey, 2015-2018

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Key findings

The main findings contained in this evaluation report of the SSERC Primary Cluster Programme in Science and Technology indicate that, by the end of the Programme, it has been extremely successful in meeting its stated aims. It has:

- produced highly motivated mentors who are promoting the skills and confidence of their cluster colleagues to teach science and technology;
- developed teachers' pedagogic and assessment skills;
- promoted and exemplified more varied approaches to learning and teaching of science and technology;
- promoted more science and technology activities in classrooms;
- had a greater impact on school science education in schools recording higher levels of deprivation;
- significantly impacted on learners' confidence to engage in science activities in schools with higher levels of PCP involvement compared to schools with lower levels of involvement;
- significantly impacted on the attitudes and beliefs about science in schools where the headteacher reported the Programme had a high impact on pupils' STEM learning;
- been recognised by HMIE inspections as contributing to quality learning and teaching in science and technology.

The Programme has also empowered mentors who have:

- liaised with cluster colleagues to identify needs, adopting a collaborative action-research model to inform practice and providing Career Long Professional Learning (CLPL) sessions;
- provided support and guidance for science and technology to other teachers in their school and cluster;
- promoted collegiality between staff in school and across cluster schools;
- facilitated a network that has shared ideas and expertise and influenced the direction of appropriate Career-Long Professional Learning (CLPL);
- increased teachers' awareness of sources of support for teaching science/technology;

There was consensus across mentors, senior management and other teachers in the schools regarding the CLPL Programme's high level of impact. Almost all respondents in these groups agreed that the Programme had a positive impact across the range of evaluation criteria, including those specified above.

The findings demonstrate that the reported high quality of the SSERC Primary Cluster Programme in Science and Technology has been maintained since its inception.

Reviewing the findings from the pupil survey we can conclude that most pupils in the study were generally enthusiastic about school and about the subjects they study. After PE and ICT, Science was ranked third most popular subject for all pupils.

There was some evidence to suggest that over a year, the enthusiasm of both P2-P4 and P5-P7 pupils towards school and towards all their subjects began to wane.

Pupil responses in the P5-P7[1] group show relatively positive attitudes towards science with substantial numbers indicating their enthusiasm for science education in school (along with ICT and PE) and an interest in pursuing science beyond school.

A majority of pupils in both P2-P4 and P5-P7 enjoyed taking part in a range of science related activities. *Doing experiments in class* and *Going to the science museum or science centre* were particularly popular across both groups. These findings indicate that learning science experientially through *conducting experiments in class* and *visiting science centres* may be key methods to engage young people with science and help maintain their enthusiasm for the subject.

Finally, more than 70% of pupils were open to the idea of further involvement in science after completing school. Moreover, in relation to the impact of the SSERC CLPL the data indicated that in schools with higher impact ratings[2] the pupils were significantly less likely than their peers in lower impact rated schools to see their attitudes and beliefs about science follow the general 'negative drift' over the evaluation period. This suggests that the SSERC CLPL may, in addition to supporting pupil enjoyment of science activities and confidence in conducting science tasks, also encourage the preservation of positive pupil attitudes towards science.

There was an extremely high level of praise for the SSERC staff delivering the professional learning, the organisation and content of the CLPL events as well as the quality of the associated resources and follow-up support. In addition to the quality of

[1] P2-P4 pupils were not asked about their attitudes regarding science.

[2] Headteachers were asked in their questionnaire to provide a score regarding the impact of the Programme on the science and technology education in their school.

the SSERC CLPL, other factors appear to be key to the success of the model. These are:

- The collaborative developmental/ research activity approach that focused mentors' reflective planning and activity;
- Mentors working collaboratively across clusters to assess and address colleagues' science and technology teaching needs;
- Access to funding from different sources that allows clusters to acquire resources for CLPL and use by teachers in the classroom;
- Having support from local authority and school managers for mentors' work. This includes reflecting STEM and the work of mentors in authority and school improvement plans and ensuring time to plan and meet.

Management support appears crucial for sustaining the impact of the SSERC CLPL. It should be noted that the time and effort invested by SSERC personnel to liaise with headteachers and local authority officers has played an important role in facilitating the support of senior management across the schools and alignment of the Programme with local authority policies and priorities.

Key Recommendations

The findings suggest a number of recommendations which are detailed in Section 8 of the report and address the following issues:

- Sustaining and expanding the Programme. Given the very positive evaluation findings, the SSERC Primary Cluster CLPL Programme should be sustained and expanded. The need for such a Programme delivered by SSERC as an established and trusted provider is particularly salient given local authority officer feedback on the increasing staffing and resource challenges they face in supporting schools' CLPL;
- Exploring how best to build on the initial impact of the Programme within and across Local Authorities. This includes SSERC and Scottish Government emphasising to school and local authority managers the importance of looking at how science and technology / STEM can be addressed systematically within School Improvement Plans and in a way that contributes to other priorities such as the Raising Attainment objectives and relevant policies such as the recent STEM Education and Training Strategy and Developing the Young Workforce (DYW) (Scottish Government 2014). The Programme also has clear relevance to the work of the Regional STEM Advisors and Regional Improvement Collaboratives (RICs) as they work to bring together relevant professionals to support practitioners to improve learner attainment and outcomes. SSERC provides crucial sector and curriculum area support and targeted advice and support in order to drive improvement. In particular SSERC's Programme aligns well

with the RIC objective of helping teachers access the practical improvement support they need.

- Exploring ways to enhance primary and secondary partnerships regarding the teaching of quality science and technology and particularly for points of transition;
- Extending the SSERC primary mentor model to the secondary sector as a way of addressing that sector's particular needs;
- Exploring ways that the CLPL model can enhance the STEM capacity of Early Years practitioners and promote Early Years– Primary transition across the clusters;
- Recognising that stakeholder feedback highlights that SSERC continues to be exceptionally well placed to inform the focus of national science CLPL and models for its delivery and play a key role at the centre of national efforts to promote teachers' ability to effectively teach science topics. This includes working strategically with a range of partners including the Education Scotland Regional STEM Advisors;
- Continuing to develop SSERC's strategic partnership with Education Scotland that recognises SSERC's unique position regarding their expertise and close relationship with schools and networks of key partners, professional bodies and associations within and beyond Scotland;
- Education Scotland and the Scottish Government should ensure that SSERC has maximum opportunity to extend the Primary Cluster Programme with its local authority and strategic partners. This includes developing ways to strengthen links with the RAiSE programme and PSTT SEP so that the complementary strengths of each programme contribute to strategic policy goals;
- Recognising the need for further research on the longer-term impact of the SSERC Primary Programme;
- Developing international perspectives and links with other similar programmes.

Section 1: Introduction and context

The Scottish Government, SSERC and the NSLC (National STEM [then Science] Learning Centre), identified the need for a national programme to improve the confidence and expertise of primary teachers in science and technology. SSERC's proposal for their SSERC Primary Cluster Programme in Science and Technology cites various research sources such as the SEEAG report (Scottish Government, 2012) that highlight the need for a focus on promoting the confidence and competence of primary teachers to effectively teach STEM education (section 2.1 p4). The CLPL model builds on SSERC's effective professional learning programme and is also informed by the HMIE publication: *Learning Together – Improving teaching, improving learning (HMIE, 2009)*. This advocates central CLPL supplemented by follow-up events and activities at cluster and school levels.

Research, including that cited in EPPI systematic reviews of research evidence (Hargreaves D, 2005, Hopkins and Harris, 2001, Cordingley *et al.*, 2003 and 2007) has identified key features of CLPL that are likely to impact on the skills and knowledge of teachers and ultimately on pupils' learning. These studies stress that at the core of effective CLPL are reflection and professional learning (Harris *et al.,* 2005). Such reflective CLPL is seen as central to school improvement and transformation (Gray, 2000; OFSTED, 2000; Harris *et al*, 2005, Harrison *et al.*, 2008).

The SSERC CLPL approach with teacher mentors supporting their cluster schools at its core is well founded given that much of it is grounded in research evidence and the wider literature. For example, the research conducted and reviewed by CUREE has consistently shown that teachers' professional learning is much more likely to be successful when it "involves collaboration between staff and that effective mentoring and coaching is key to this professional development". In a meta-research study conducted by CUREE (2012) it was found that when teachers worked together on a sustained basis (over at least one term but more usually two or three terms), this collaborative and sustained CLPL was linked to positive effects on:

- students' learning, motivation and outcomes;
- teachers' commitment, beliefs, attitudes, self-esteem and confidence in making a difference to their pupils' learning;
- teachers' repertoires of strategies and their ability to match their teaching approaches to pupils' different needs;
- teachers' attitudes to their pupils, the curriculum and to learning; and
- teachers' commitment to CLPL.

Hargreaves' (2005) research has also explored the spectrum of mentoring, coaching and the value of mentors as a 'critical friend' in CLPL. It is arguable, then, that the core component of the SSERC model is particularly innovative and novel. This is the emphasis on supporting nominated teachers in each cluster who then act as mentors to drive and support the Science and Technology professional learning and development of their peers. For this reason, a rigorous independent evaluation was warranted, not only to assess its impact but also to inform thinking on effective CLPL approaches**.**

1.1 Programme aims

The main aims of the SSERC Primary Cluster Programme in Science and Technology are for all primary teachers in a cluster regarding their teaching of science and technology to:

- raise levels of confidence and expertise;
- further develop pedagogic and assessment skills;
- develop further individual professional practice;
- develop further collegiality.

1.2 The CLPL model

The cluster approach involves centralised professional learning involving two residential events; Part One, consisting of three days and Part Two consisting of two days. During the approximately eight-month interval between the events, the teacher-mentors implement a 'task' in their schools and clusters. Mentors from a cluster work as a group in a session at the first residential event called 'cluster conversations' with a view to jointly devising an approach to the task of designing and implementing a programme of Career Long Professional Learning that will support promoting and improving science and technology teaching in their cluster. The mentors adopt a collaborative action research approach to implement and evaluate their task. During Part 2 of the residential, the cluster mentors, working as a group, showcase progress and impact of their work to date. This is shared with the other clusters from their own and other local authorities participating in the same residential. Additionally, and with a view to promoting collegiality across the primary/secondary sectors, clusters have invited colleagues from the associated secondary school to the showcase sessions. Local authority officers with responsibility for science and technology have also been invited.

This process is supplemented by access to follow-up CLPL events and activities at cluster and school levels provided by a range of accredited agencies and individuals, including mentors themselves, SSERC on-going support and interactive e-learning via

SSERC_Meets. Each cluster receives around £2,500 or more to help support the work.

The role of the mentor-teachers is to work with mentor colleagues to:

- disseminate relevant activities / information;
- share training experiences amongst other primary teachers working across CfE levels;
- liaise with colleagues to identify and select professional development sessions;
- provide support and guidance for science and technology to other teachers in the cluster;
- promote more science and technology activities in classrooms;
- promote and exemplify more varied approaches to learning and teaching of science and technology;
- promote collegiality between staff across all cluster schools;
- be part of a network that will share ideas and expertise and influence the direction of appropriate CLPL;
- promote science and technology pursuits outwith everyday classroom activity which enhances and enriches the curriculum.

By November 2018 the SSERC Primary Cluster Programme had involved the following:

- 32 Local Authorities;
- 85 clusters;
- 590 schools;
- 440 mentors;
- more than 480 Face-to-Face workshops;
- more than 110 interactive electronic workshops
- more than 5,000 teachers;
- more than 17,000 attendances (on average teachers participate in 3 or 4 CLPL events during the first year of a cluster participating in the Programme).

1.3 Aims and objectives of the evaluation

In 2012 and 2015, the Robert Owen Centre at the University of Glasgow was commissioned by SSERC to evaluate the effectiveness of the SSERC Primary Cluster

Programme in Science and Technology. The findings from the final evaluation of the latest phase of the Primary Cluster Programme are reported in this document.

The main aims of the evaluation are to:

1. gauge the standard and satisfaction rates regarding the CLPL across the participating local authorities;
2. collect baseline data on mentors' needs, aspirations and plans and then assess the impact from the perspective of mentors, teachers, headteachers and other relevant key stakeholder groups;
3. collect data from pupils to contribute to assessing the impact of the Programme;
4. use the emerging findings to inform and refine the development of the Programme and to feed into knowledge exchange process with SSERC's local authority members, ADES and other relevant professional bodies.

The Scottish Government, as main funders of the Programme, were also keen to gather evidence on whether there was an impact on learners in the clusters, particularly regarding learners' self-efficacy, engagement and views on science. Given that the mentors and their colleagues were implementing what they had learned from their CLPL into their practice in various ways across the clusters it was not meaningful to administer a standardised test for pupils. However, the research literature stated that looking at shifts in pupils' self-efficacy for science was a recognised indicator of learners' future performance and engagement. This was intended to provide a robust indication of the impact of the Programme on relevant pupil outcomes. It was hoped that, with a focus on pupil views, future evaluations would provide much more information regarding the nature of the impact on learners, their disposition towards science and technology, and the likelihood of them pursuing a future career in these fields. These evaluation aims are all the more important now given the Government's focus on tackling the attainment gap, addressing educational inequity and supporting employment in the growing STEM sectors of the economy.

In previous evaluations of SSERC's CLPL programmes impact on learners has been gauged by responses from teaching staff observing changes to pupils' engagement with science topics and their improved understanding of science. Indeed, through detailed open-ended responses, interviews and reflective journals, teachers have consistently provided rich accounts of the impact of the CLPL on their own practice and learners' abilities.

There is a body of research that highlights the association between teacher self-efficacy (domain specific confidence) and pupil self-efficacy such that increasing teacher confidence, in any given area, has an impact on pupil learning gains (Ross, 1992). This may be due to the fact that "teachers who set high goals, who persist, who try another strategy when one approach is found wanting… those with high self-efficacy… are more likely to have students who learn" (Shaughnessy, 2004, p.

156). This claim is supported by other research that suggests that teachers' sense of self-efficacy is one of the characteristics that has been linked to student achievement. Interestingly it has been found that a teacher's self-efficacy impacts not only on student motivation (Midgley *et al*., 1989), but also on the student's sense of self-efficacy (Anderson *et al.,* 1988).

Considering the research on self-efficacy, high self-efficacy is important because it suggests that the way in which individuals behave is best predicted by the beliefs they hold about their capabilities rather than what they are actually capable of (Bandura 1986). Therefore, measuring pupil self-efficacy in the evaluation served two purposes. Firstly, it would confirm that higher teacher self-efficacy and confidence in science is having the desired increase in pupil self-efficacy in science. Secondly, and perhaps of greater importance, consideration of pupil self-efficacy and engagement could become an important proxy measure for continued engagement in the field of STEM. Indeed, Bandura (1998) proposes that pupils with increased self-efficacy will be more engaged for longer periods of time. This may be particularly influential in predicting longer-term gains since, having high self-efficacy is also believed to be a relevant factor in career choice and persistence in a given field (Lent *et al.*, 1994).

1.3.1 The research approach

The main research approach for the evaluation comprised:

a) survey of teacher mentors: This involves a census of all the participating teacher mentors at two points in the Programme:

i) upon completion of part one of their residential event to allow identification of needs, aspirations etc.

ii) eight months after the work has begun in their cluster. This gives sufficient time for the work to have developed and progress to be assessed. It focuses on mentors' perceptions of their work and their impact on cluster schools, teachers' practice, aspects of the curriculum and pupil engagement, enthusiasm and attitudes towards science and technology.

b) *postal survey of all headteachers/senior management in those clusters where teacher mentors have been involved in the SSERC CLPL Cluster Programme.* This took place 13-16 months after the first residential events, giving time for the work to have developed and embedded itself in schools. It focused on headteachers' perceptions of the work of the mentors and its impact on teacher practice, aspects of the curriculum and pupil engagement, enthusiasm and attitudes towards science and technology.

c) *on-line survey of all teachers in those clusters where teacher mentors have been involved in the SSERC CLPL Programme*. This again took place 13-16 months after the work began in their cluster. It provided data to triangulate with findings from mentor and headteacher data. It focused on teachers' perceptions of support received (from both mentors and wider SSERC activities/events) and impact of the Programme on teacher practice, aspects of the curriculum and pupil engagement, enthusiasm and attitudes towards science.

d) focus groups with mentors with a purposive sample of teacher mentors across the participating schools at the end of their first and second CLPL residential sessions. These discussions explored in detail participants' views of the CLPL experience, its ability to prepare them for working in their clusters and, from the second session, progress to date.

e) *supported action research/reflective practice*. The Glasgow University research team provided self-evaluation input during initial sessions as appropriate to mentor teachers to supplement the input from SSERC to enhance teachers' reflective practice capacity. This input was primarily aimed at encouraging teachers to keep a reflective diary to provide a narrative to inform their practice, the evaluation and, if desired, to contribute evidence for possible accreditation of their learning.

f) observation of CLPL events. These included; i) observations of a sample of Part 1 and Part 2 residential training events for each participating local authority and ii) observation of a sample of non-residential CLPL events selected from the range of courses offered by SSERC approved providers as part of the wider Programme of support available to the clusters. These observations provided valuable insights to enhance the interpretation of the data and provide an opportunity to gather additional feedback from participants. The research team have collected 108 reflective diaries.

g) *pupil survey*. From the Autumn of 2015 a pre and post-Programme pupil survey (P2 – P7) was also initiated in those schools involved in the SSERC CLPL. The main aim of this survey was to provide additional evidence on the impact of the CLPL on pupil science experiences, attitudes towards the subject and self-efficacy regarding science. The evaluation conducted this survey annually over three years.

h) *Impact Rating proforma*. Headteachers and mentors of schools taking part in the SSERC CLPL and who had submitted baseline and follow-up pupil questionnaires were asked to provide an overall school rating for the impact of the SSERC mentor

Programme on a six-point scale[3]. The proforma also included an open question to allow responders to comment on issues concerning impact and sustainability of the SSERC CLPL.

1.3.2 Surveys and administration

Mentor questionnaires were distributed as part of the final session at Part 1 and Part 2 CLPL residential events. The headteacher questionnaires were sent out at the end of the summer term 2013, 2014, 2015, 2016 2017 and 2018. The headteacher questionnaire also asked headteachers to make their teachers aware of an online questionnaire designed to gather evidence of the impact of the Programme on teachers across the clusters. Mentors were also provided with guidance on the use of their reflective diaries during the initial (Part 1) CLPL event and were asked to bring along their diaries at the follow-up (Part 2) CLPL event.

The additional pupil strand of the evaluation, beginning in Autumn 2015, has been undertaken through the use of questionnaire survey. In each year (2015/2016, 2016/2017, 2017/2018) pupils in P2 – P7 in primary schools involved in the CLPL have completed a questionnaire at two points:

- baseline – after teachers take part in the CLPL but before the bespoke cluster CLPL Programme has started (early Autumn term);
- follow-up – towards the end of the academic year (late Summer term).

The baseline survey takes place after the teacher mentors have undertaken the SSERC CLPL but before the bespoke cluster programme has started. The follow-up survey takes place after the whole cluster CLPL has been completed. Identical questionnaires are used at both points. However, there are two versions of the questionnaire one for P2-P4 pupils and one for P5-P7 pupils. Questionnaires cover similar topics although the P2-P4 version is shorter and simpler than the P5-P7 version. The baseline and follow-up surveys give the evaluation the opportunity to gauge changes in pupil responses over time. Copies of the questionnaire are available from SSERC or ROC on request. In addition to gathering basic demographic information (gender, year group, school attended) the questionnaires focused on:

1. Pupil attitudes towards school and school subjects;
2. Pupil enjoyment of science activities;

[3] 1 represented little/no impact on science education and 6 represented major and sustained impact on science education.

3. Confidence in completing science tasks;
4. Beliefs about science (P5-P7 only).

The focus on pupil self-efficacy in questionnaire sections 2 and 3 was included to provide insights into potential impact of the Programme on pupils. A brief rationale for this approach is outlined towards the end of section 1 of this document.

1.3.3 Approach to analysis

Mentors, teachers and other professionals

Analysis of questionnaire returns was conducted using SPSS (Statistics Package for the Social Sciences) and largely comprised the running of frequencies and cross-tabulations. Anonymity of responses meant that we were unable to match and track responses from individuals. However, analysis of responses would appear to indicate that the overwhelming majority of responding mentors had taken part in both the initial and follow-up CLPL sessions. Indeed, SSERC's own attendance sheets for the events confirm that almost all mentors returned for a Part 2 event.

Qualitative material gathered from the open-ended sections of the survey and focus groups was thematically analysed to highlight key topics and issues emerging within and across the various groups. This evidence helped to corroborate the quantitative findings and provide insights on the factors and processes underpinning survey findings.

Pupils

The pupil data was also analysed using SPSS, with the analysis largely comprising the production of frequencies and carrying out statistical tests to ascertain the significance of any changes noted in pupil responses between the baseline and follow-up surveys. Extensive use was made of the Wilcoxon signed-rank test, a nonparametric test, which is helpful in comparing two sets of scores/responses that come from the same participants. In this instance we used the test with pupil data at the baseline and follow-up survey to assess whether differences in the distribution of responses between the two surveys were statistically significant**.**

To ensure that the P2-P4 and P5-P7 databases were as robust as possible only pupils who returned a baseline and follow-up questionnaire were included in the final analysis. This approach meant that any comparisons made between the surveys were based on exactly the same group of pupils. Pupils who failed to complete individual survey items on either survey were not included in the specific analysis of that particular variable. The annotated pupil questionnaires included in the appendices

include all pupil responses and not the matched data sets presented/ discussed in the report. In addition, on a number of questions we excluded don't know answers to focus on definite pupil responses and opinions and assess changes in direction of pupil responses.

1.4 Scope of this report

This report draws together the findings from;

- mentors, teachers, headteachers and insights from their local authority representatives collected over the duration of the Programme, and
- pupil survey data from across the three years of the Programme. (Autumn 2015 - Summer 2018).

The mentor findings build on those contained in previous annual reports, adding and analysing new responses from increasing numbers of participants who have attended the CLPL events. With greater numbers becoming involved in the Programme the evaluation has become increasingly robust and confidence in the findings grows. Over the period of the pilot, SSERC have initiated The Primary Cluster Programme in 85 clusters across 32 Local Authorities. Findings from the staff surveys have been supplemented by information gathered during focus group discussions conducted at the CLPL training and observations of additional SSERC organised CLPL or SSERC recognised CLPL events offered to staff. In some instances, clusters organised their own internal CLPL events with staff and the members of the research team attended a sample of these events.

1.4.1 Structure of this report

The report is organised around the findings from the staff and pupil surveys with additional qualitative input from focus group discussions, observations and reflective diaries where applicable. The report focuses on the impact of the Programme from the perspectives of mentors, headteachers and other staff members.

Section 2 provides a summary of the characteristics of those who took part in the staff surveys, Section 3 reports mentors' views of the SSERC CLPL while Section 4 focuses on mentors' and school staff views, including headteachers, of the impact of the Programme by drawing on survey data from schools where mentors had completed both Part 1 and Part 2 CLPL. Section 5 provides insights from local authority officers/ QIOs based on information collected in 2015 and again in 2018. Section 6 provides the findings of the P2-P7 pupil survey. This is followed by a conclusion and a commentary in Section 7 while Section 8 provides recommendations.

Section 2: CLPL survey respondents

2.1 Who took part in the CLPL staff survey?

In total 811 questionnaires were returned from mentors who took part in the initial (431) and follow-up (380) CLPL sessions. In addition, 218 headteachers/senior management staff and 275 other teachers from schools where the mentor had completed both Part 1 and Part 2 CLPL also returned questionnaires (see Table 2.1).

Table 2.1 - Questionnaire responses

Mentors		Headteachers	Other Cluster teachers
Initial residential CLPL event	Follow-up residential CLPL event		
431	380	218	275

The large majority of mentors were female (reflecting the gendered nature of the profession at primary level) and the majority were experienced teachers – 73% of staff at the initial session and 79% at the follow-up session had taught for at least six years. Moreover, 31% of respondents at the initial session and 37% at the follow-up session were in promoted positions. Tables 2.2 to 2.5 profile the mentor respondents.

Table 2.2 - Sex of respondents

Sex of respondent	% Initial session	% Follow-up session
Female	84	84
Male	17	16
N=	**430**	**376**

Table 2.3 - Role within the school

Role	% Initial session	% Follow-up session
HT/DHT/AHT	12	15
Principal teacher	20	23
Class teacher	65	59
Other	4	3
N=	**429**	**377**

Table 2.4 - Part or full time working

Full or Part time	% Initial session	% Follow-up session
Full time	92	93
Part time	8	7
N=	**430**	**375**

Table 2.5 - Teaching Experience

	% Initial session	% Follow-up session
Probationer	1	1
Teaching up to 5 years	26	20
Teaching 6-15 years	46	48
Teaching 16 years or more	27	31
N=	**428**	**377**

Section 3: Mentors' views of the SSERC CLPL events

This section reports on mentors' assessment of the SSERC CLPL and how well it had prepared them for their science and technology mentoring role. This included preparation of their chosen task activity from Part 1 sessions, assessment of the initial outcomes of this task, and early indications of progress in the clusters as they concluded their Part 2 events.

3.1 Mentors' views of their initial and follow-up CLPL sessions

Science and technology mentors who attended the SSERC initial and follow-up events were overwhelmingly positive about their experiences (see Table 3.1 for a summary of responses). It was clear that the CLPL Programme was regarded by participants as relevant, supportive and encouraging of their work and development as science and technology mentors. Moreover, it was also evident that participants regarded the CLPL as very useful in supporting the development of their own science teaching skills and practice and in enthusing pupils towards science. For example, at least four out of five mentors at both events indicated *complete agreement* with the following statements:

the event:

- was conducted in a professional manner;
- comprised presentations of a high standard;
- gave access to quality support materials;
- encouraged networking with other colleagues;
- increased their enthusiasm for science and technology;
- provided a number of useful ideas for teaching;
- encouraged them to try new ideas;
- will help them enthuse pupils about science and technology;
- increased their confidence for teaching science and technology;
- was relevant to their science and technology teaching.

It is apparent that while mentors were positive about their experiences of the SSERC CLPL, their follow-up survey responses show a shift from 'Completely agree' to 'Mostly agree' for many of the variables. This could indicate that mentors face a range of challenges in schools in practice regarding acting on their CLPL or that expectations were increased after the first residential. However, the important message here is that, overall, mentors consistently report that the SSERC Programme has had a positive impact on their role.

In their open comments, mentors often took the opportunity to thank SSERC and some also commented that this was one of their best CLPL experiences. They praised it for being well planned, delivered by passionate, enthusiastic and approachable staff and

it was seen to be relevant to science development in their school. The following comments were typical.

I have enjoyed this opportunity for training and found it very useful indeed. Have come away with great practical ideas and increased understanding of what to teach and how to give the children the best possible experiences. I've improved my skills and experience of leading, learning and organised and delivered my first parent/child workshop and received a positive response.

Incredibly useful course with very practical and useful activities. Too often we see videos of one teacher with 5 pupils which isn't realistic. SSERC keep in mind that up to 33 pupils could be working on an activity.

Class Teachers, Calderhead High and St Aidan's clusters

The training has been fantastic, I've had the opportunity to develop team teaching within the school. I am so much more aware of excellent resources.

Depute Headteacher, St Machar cluster

Great ideas and networking with colleagues to share ideas and experiences, very supportive.

Class Teacher, Perth and Kinross cluster

This course has been fantastic. I've taught science for 30 years and have enjoyed learning about new ways of teaching concepts I'm familiar with. The resources will be so useful. The networking has been good too and we have plans to do things together to benefit Orkney pupils' science knowledge and enthusiasm for STEM and possible careers within it.

Class Teacher, Orkney Islands

Absolutely loved the whole experience. Intense, informative, exciting and so well worth it. Sessions were slick, organised and professional, and covered all the bases.

Class Teacher, West Calder High School cluster

An excellent course which has completely changed my view on how to teach science. Will go back with a different mindset.

Class Teacher, Comhairle nan Eilean Siar

This has been a hugely positive experience. I feel equipped to return to my school and really make a difference.

Class Teacher, Musselburgh Grammar cluster

SSERC is an amazing opportunity. It has made me fall in love with teaching again. The children are so engaged, and the teaching is much more effective

Class Teacher, St Thomas Aquinas Secondary School cluster

In addition, the residential nature of the CLPL was also praised with participants who often stated that this model facilitated a greater opportunity for more meaningful professional dialogue.

The concentrated 3 days followed by 2 days at SSERC HQ with overnight stays really reinforced the teamwork and inter-school relationships of the STEM mentor group. Not to mention the SSERC's team positivity and enthusiasm

Headteacher, Inverkeithing cluster

Table 3.1 – Mentors' views of the initial (1st) and follow-up (2nd) CLPL sessions

The CLPL event …	% Completely agree 1st (2nd)	% Mostly agree 1st (2nd)	% Not sure either way 1st (2nd)	% Mostly disagree 1st (2nd)	% Completely disagree 1st (2nd)
Was conducted in a professional manner N=430 N=379	99 (97)	1 (3)	-	-	-
Comprised presentations of a high standard N=430 N=378	97 (92)	3 (8)	- (<1)	-	-
Gave access to quality support materials N=428 N=376	98 (93)	2 (6)	- (1)	-	-
Encouraged networking with other colleagues N=427 N=377	96 (90)	4 (9)	<1 (1)	-	-
Increased my knowledge of science and technology N=429 N=378	88 (85)	11 (13)	- (1)	1 (-)	- (<1)
Increased my enthusiasm for science and technology N=430 N=378	91 (88)	8 (11)	1 (1)	-	-
Increased my confidence for teaching science and technology N=430 N=378	85 (83)	14 (15)	1 (2)	-	(<1)
Was relevant to my science and technology teaching N=429 N=378	88 (83)	11 (15)	<1 (1)	- (<1)	-
Provided support for my development as a school mentor in science and technology N=426 N=378	89 (76)	11 (21)	1 (3)	-	-
Provided support for my development as a cluster mentor in science and technology N=422 N=378	85 (74)	14 (23)	1 (3)	-	-
Provided support for my leadership development N=427 N=376	65 (50)	28 (36)	7 (11)	1 (2)	-
Provided support for developing science and technology education in my cluster N=427 N=377	88 (73)	11 (25)	1 (2)	- (<1)	-
Provided a number of useful ideas for teaching N=428 N=379	96 (93)	3 (7)	1 (-)	- (<1)	-
Encouraged me to try new ideas N=429 N=379	95 (90)	4 (10)	<1 (<1)	-	-
Increased my awareness of sources of support for teaching science/technology N=426 N=379	89 (79)	10 (20)	1 (1)	-	-
Highlighted the importance of science/technology education for pupils N=429 N=377	87 (79)	13 (19)	1 (2)	-	-
Left me with a desire to attend similar CLPL N=429 N=378	82 (77)	15 (18)	3 (5)	<1 (<1)	-

Underlined the importance of CLPL for my professional development N=426 N=377	78 (73)	18 (23)	5 (4)	- (<1)	<1 (-)
Encouraged me to be more positive about my career prospects N=426 N=377	49 (39)	29 (31)	20 (28)	2 (2)	<1 (<1)
Will help me enthuse pupils about science and technology N=429 N=377	90 (87)	9 (13)	<1 (1)	<1 (-)	-
Will mean I'm better able to meet the range of pupil needs in teaching science and technology N=429 N=378	83 (71)	15 (25)	2 (3)	-	-
Improved my pedagogic skills in science and technology N=429 N=375	81 (70)	17 (26)	2 (4)	<1 (-)	-
Improved my reflective practice skills in science and technology N=427 N=378	59 (59)	28 (32)	12 (8)	1 (1)	1 (-)
Left me with a better understanding of what SSERC offers N=429 N=379	91 (79)	9 (20)	1 (1)	-	-

3.2 How well did the CLPL prepare mentors?

Most participants indicated that the CLPL had prepared them well for their role as a science and technology mentor. Table 3.2 summarises responses from both the initial and follow-up events. The figures suggest that, in the majority of cases, mentors' initial expectations of the CLPL were subsequently borne out in their experience. Indeed, there were almost no instances where mentors initially believed, or subsequently reported, that they were left unprepared by the SSERC CLPL.

Table 3.2 - How well did the CLPL prepare mentors for the following?

Prepared for…	**% Well prepared 1st (2nd)**	**% Prepared 1st (2nd)**	**% Unprepared 1st (2nd)**	**% Not at all prepared 1st (2nd)**
Planning for your mentor role N=428 N=366	64 (53)	36 (44)	1 (3)	-
Carrying out gap task activities N=422 N=364	70 (54)	30 (43)	1 (3)	-
Reporting on these activities N=422 N=362	55 (49)	43 (46)	2 (5)	-

3.3 Mentors' views on becoming a Science and Technology mentor

On completion of the initial CLPL, 82% of respondents indicated that they were feeling confident about becoming a mentor and were looking forward to it. The remaining 18% indicated a degree of nervousness at the prospect. Following the second CLPL event all but one participant indicated having *mostly or completely* enjoyed their mentor experiences.

Participants' qualitative comments from the surveys reinforced the view that all had enjoyed their experience of mentoring. Some also reported being surprised at how much they had achieved already given some initial anxiety. Working with colleagues in their school and especially working with other mentors across their cluster were seen as particularly enjoyable experiences. Participants also mentioned rewarding feelings as their confidence in their new role grew and they saw the impact of their efforts. Mentors also noted that their own enthusiasm and ability to teach science and technology had been enhanced. They had also unanimously enjoyed the Programme and found the experience 'inspiring'. The following comments were typical.

Not being from a science background…I was a little nervous about my abilities but the SSERC residentials have made learning for me, my colleagues and pupils accessible and fun!

The experience was so positive and encouraging that I have become a more enthusiastic teacher of Science in that my understanding that practical, mind-challenging, hands-on experiences are an absolute necessity to capture the minds of tomorrow's scientists

Class Teachers, St Ninian's cluster

The whole Science Champions experience has been fantastic. It has really impacted on my personal teaching of science but more importantly, my confidence to pass on resources and knowledge to other staff in the school and cluster. The course has been delivered in a very professional and inspirational way throughout.

Class Teacher, Mearns cluster

This has been a very valuable experience and I have learned a lot. The mentor process, although time heavy, was beneficial to both my school and cluster. I look forward to the next stage.

Class Teacher, Inverkeithing cluster

Working with colleagues across the cluster has been very valuable. New things to try in my own school has been great too. Receiving positive feedback from CPD we have delivered has been very rewarding

Headteacher, The Gordon Schools cluster

3.4 Engagement with other SSERC-supported CLPL support sessions

The Programme also provided mentors and their fellow teachers with access to a range of other relevant science and technology CLPL delivered at school/cluster level and organised and run by SSERC and a number of individuals and other organisations known to SSERC. For example, over the period of the pilot there were:

- more than 480 Face-to-Face workshops;
- more than 110 'SSERC_meets', some run through Glow have been conducted as part of the non-residential aspect of the Programme;
- more than 5,000 teachers participating.

In the overwhelming majority of these sessions' participants[4] reported that the CLPL had been *very helpful or mostly helpful.* Some sessions were particularly popular with Mentors and teachers, e.g. 160 participants found the 'fun with forensics' session to be very or mostly helpful, 118 similarly appreciated the 'Forces' CLPL while 56 were positive regarding a session on 'Electricity'. Outwith the programme of SSERC approved CLPL topics, 118 mentors also indicated that they had organised and/or conducted additional science CLPL in their cluster or were intending to do so in the near future.

Having mentors acting as CLPL co-ordinators was another innovative component of the SSERC Programme and had the added benefit of allowing additional science and technology CLPL needs of teachers to be addressed at a local level. Each event was co-ordinated by the mentors themselves and was additional to their coaching and mentoring activities.

The quality of these additional courses and participant satisfaction was also carefully monitored by SSERC's own internal evaluation.

[4] In many instances the number of respondents who attended individual sessions and replied to the questionnaire was very small.

Section 4: Staff views on Programme impact

This Section of the report summarises the impact of the Programme from the point of view of the mentors, senior management and other teaching staff in participating clusters.

4.1 Impact of the SSERC CLPL on mentors' role in Science and Technology teaching

Following both CLPL events, participants were asked about the extent to which they expected to, or had taken on a greater role in science and technology developments in their school, cluster, local authority, and/or nationally. Table 4.1 demonstrates that, in a relatively short period of time, the overwhelming majority of mentors had taken on development roles in both their own school and in their cluster. There was also evidence that some mentors had embarked on science development roles within their local authority and, in a small number of cases, had taken on a role at national level.

Table 4.1 - How well did the SSERC CLPL facilitate mentors' role?

I will / I have taken on a more significant role in science and technology developments …	**%** ***Very* or *quite likely*** **From 1st event**	**%** ***Has happened*** **By 2nd event**
in my school (N=428 / 370)	98	93
in my cluster (N=431 / 373)	98	90
at local authority level (N=430 / 363)	47	21
at national level (N=427 / 364)	15	9

4.2 Contribution of the CLPL Task to the mentors' work

A key feature of SSERC's CLPL, both for secondary and primary programmes, has been the inclusion of a 'task' progressed between CLPL events. In relation to the Primary CLPL Programme, this entails participants at the initial residential session identifying a focus or activity for development that will promote Science and Technology teaching when they return to their school/cluster. At the follow-up CLPL residential participants reflected on the impact of their activity and shared lessons learned with other participants. In the Primary Cluster Programme this activity was collaborative with groups of cluster mentors working together to develop plans for promoting the capacity for and quality of Science and Technology teaching across their schools. Seventy-seven percent (77%) of participants agreed with the statement that the 'task' had been a *major help* in their mentor role with a further 22% agreeing that it had been of *some help* in their mentoring role.

Typical examples of task activities have included:

- review and development of cluster plans and moderation across the cluster regarding 'Sciences Experiences and Outcomes';
- provision of lesson plans to support colleagues' teaching science and technology;
- improving and sustaining monitoring of needs and evaluation of impact regarding colleagues' Science and Technology teaching;
- supporting colleagues' development of appropriate assessment for Science and Technology;
- dissemination and sharing of quality CLPL, teaching ideas, videos, resources and experiences in science and technology with other teachers across the school and cluster;
- encouraging colleagues in school and across the cluster to participate in more science and technology teaching, including, for example, team teaching with colleagues at all stages;
- furthering CLPL access for staff within the cluster through twilight sessions, workshops, speakers and 'SSERC_meet' sessions;
- promoting sustainable impact on teaching science and technology, increasing confidence and enthusiasm and stimulating new ideas in this area;
- introducing new methods of teaching and extended teaching (e.g.: involving community education and University, in topics such as Geo Sciences);
- winter science, encompassing a range of stages across the cluster and a variety of Experiences and Outcomes;
- introducing a thematic 'science area' with science vocabulary on display across school and classes for children that changes regularly to engage with and enthuse pupils;
- developing approaches to facilitate STEM education contributing to promoting learning in numeracy and literacy, including through IDL;
- increasing family and parental engagement in STEM activities, including well attended in and out-of-school events, with follow-up teacher self-evaluations revealing increased parental science capital;
- developing STEM education that articulates with Developing the Young Workforce (DWY) objectives.

4.3 Impact of the CLPL on mentors' own science and technology teaching

Four hundred and thirty (99%) at the initial CLPL event indicated that they were intending to introduce *new materials/resources* from the CLPL to their science teaching or practice while 94% (N=429) also reported that they would be introducing *new methods* to their teaching of science and technology.

The overwhelming majority of mentors attending the follow-up CLPL session indicated that they had realised these intentions with 96% introducing *new materials/resources* to their teaching (N=377), and 85% introducing *new methods* to their science and technology teaching (N=377).

What was striking from the observation of the Part 2 events and discussions with participants was the amount of activity engaged in by mentors working in their cluster teams between the two CLPL residentials. At the same time there was a noticeable increase in their optimism and enthusiasm over the duration of the Programme. Participants in Part 1 of the Programme had been relatively cautious in their projected assessment of the likely progress of the Programme. However, Part 2 showcasing of 'task' activities revealed considerable progress, a situation which appeared to be also reflected in mentors' disposition towards and general enthusiasm for the work.

4.4 How had mentors spent their time since the initial CLPL?

Mentors most frequently (51%) indicated spending *a lot of their time* working in *group settings with colleagues from their cluster*. Indeed, they were more than twice as likely to report this than *working with colleagues* or *working with individuals in their own school*. See Table 4.2 for details. This finding alone suggests that mentors recognised and implemented a support and development role beyond their own establishment.

Table 4.2 – How were mentors spending their time?

Mentor activity	% indicating *a lot of time*
Working in group settings with colleagues from cluster (N=367)	51
Working on own (N=371)	40
Carrying out routine administrative tasks related to science and technology (N=367)	26
Working with individual colleagues from cluster (N=366)	21
Responding to colleagues' requests for support with science and technology (N=371)	19
Working with individual colleagues from school (N=373)	17
Working in a group setting with colleagues from school (N=369)	16
Taking part in other science and technology CLPL (N=366)	11
Attending conferences related to science and technology (N=365)	5

4.5 Who have mentors been working with?

Almost all mentors (98%) indicated working directly with primary teachers, more than three quarters (77%) had worked with primary pupils and 59% had worked with senior managers within their cluster. In addition, 39% reported working with early years workers and 35% worked with other professionals within their cluster. Table 4.3 details

responses. Given the cluster-based approach to the CLPL, it is encouraging to note that by the follow-up CLPL event, substantial numbers of mentors had engaged with colleagues across different educational stages including secondary and early years.

Table 4.3 - Groups whom mentors have worked directly with

Group	% of mentors	Group	% of mentors
Primary teachers	98	Secondary teachers	43
Primary pupils	77	Local authority personnel	22
Senior managers (HTs, DHTs)	59	Children in early years centres	7
Other cluster professionals	35	Secondary pupils	2
Early years workers	39	**N = 377**	

4.6 What proportions of staff have mentors worked with?

Mentors were also asked to estimate the percentage of staff from different educational stages that they had worked directly with between the initial and follow-up CLPL. Table 4.4 summarises the results and clearly shows that mentors were most likely to have worked with primary staff in their cluster.

Table 4.4 - Percentage of staff by stage within the cluster that mentors had worked directly with

% of staff in the cluster that mentors worked with directly	% of mentors who had worked with this proportion of Early years staff	% of mentors who had worked with this proportion of Primary staff	% of mentors who had worked with this proportion of Secondary science staff
91-100%	11	46	3
76-90%	4	18	<1
51-75%	2	8	1
26-50%	10	8	4
11-25%	10	8	5
Up to 10%	31	11	46
None	33	<1	40
N=	**365**	**369**	**371**

4.7 Contact with other mentors

There was strong evidence to suggest that mentors had established and developed links with other mentors during the period between the first and second CLPL residential. For example, almost all respondents indicated having *been in contact with*

other mentors (99%) or *having shared ideas/activities with them* (98%) while almost nine out of ten mentors (86%) reported *collaborating on training events with other mentor colleagues*. Table 4.5 summarises the findings.

Table 4.5 - Links with other mentors

Activity	% of Mentors
I have been in contact with other mentors (N=373)	99
I have shared ideas/activities with other mentors (N=373)	98
I have collaborated on other activities with other mentors (N=373)	92
I have talked over science and technology problems with other mentors (N=373)	89
I have collaborated on training programmes with other mentors (N=373)	86
I have been involved in additional CLPL training programmes with other mentors (N=372)	79
I have been involved in other ways with science and technology mentors (N=368)	34

4.8 Impact of science and technology mentoring on the cluster

Mentors were asked to indicate impact of their science and technology mentoring against a number of pre-set statements. Table 4.6 summarises the results in relation to the percentage of mentors who indicated either *to a large extent* or *to some extent*. Again, these results are encouraging with almost two thirds of the mentors (62%) reporting that their mentoring had *increased collegiality between cluster schools* to a large extent. Moreover, over half of the respondents (54%) had witnessed *increased pupil engagement in science and technology to a large extent* and just under half (45%) also noted *increased teacher confidence to teach science and technology to a large extent*. A further 42% reported an increase in teachers' knowledge to teach science and technology *to a large extent*.

Table 4.6 - Key impact and progress regarding mentors' activity

As a result of science and technology mentoring there has been…	% Indicating to a large extent	% indicating to some extent
Increased collegiality between cluster schools (N=366)	62	29
Increased pupil engagement in science and technology (N=366)	54	39
Greater knowledge about the work of SSERC and NSLC (N=364)	50	39
More opportunities for teachers to share their science and technology experiences in clusters (N=366)	45	39
Increase in teachers' confidence to teach science and technology (N=367)	45	48
More varied approaches to science and technology learning and teaching (N=367)	45	43
Increased science and technology activities in the curriculum (N=366)	44	42

Increase in teachers' knowledge to teach science and technology (N=366)	42	49
Increase in teachers' skills to teach science and technology (N=367)	40	52
Increased teacher networks to support their science teaching CLPL (N=363)	35	42
Increased interdisciplinary learning approach where science can be incorporated into a range of common primary topics (N=366)	24	53
Increased pupil aspirations towards science and technology careers (N=364)	19	41
Increased teachers' reflective practice and self-evaluation (N=366)	16	44
Increased capacity of classroom assistants to support the delivery of science in the primary curriculum (N=363)	8	15

4.9 Mentors' views on the most successful science and technology developments across the clusters

The qualitative findings illustrate the wide variety and nature of mentors' progress regarding their intended objectives for their respective clusters. Some participants reported that their activity was having an impact on pupils' learning and enthusiasm for science and technology shortly after the SSERC CLPL activity. Examples of reported success are highlighted below as well as three more detailed vignettes of how mentors' activity has made a notable impact:

- Mentors working together as a regular, systematic team. In, for example, establishing a cluster working party whose plans were already felt to be demonstrating an impact. This includes the cluster science mentors meeting regularly to take forward the aims of their role and CLPL activities.

ASG working together to design and carry out science challenges in all ASG schools

Class Teacher, Hazlehead cluster

- Review and development of cluster plans and moderation across the cluster of Sciences Experiences and Outcomes, including 'Moderation Days' that have promoted reporting consistency across the cluster and brought stage partners together and facilitated further sharing of good practice. In some cases, developments such as 'enquiry and assessment' moderation approaches and lesson plans have been taken-up across local authorities;

The moderation across the cluster also brought all teachers in the cluster together taking and sharing their teaching of science.

Class Teachers, Boroughmuir cluster

Lesson plan made by the cluster is being used by every school in Perth and Kinross.

Class Teacher, Perth and Kinross cluster

Vignette 1: Acting head teacher, previously SSERC mentor. involved with programme in 2017/18

Ross High cluster, East Lothian

Activity: We met regularly as a group of nine mentors along with the high school teacher. The secondary school was our base for meeting for meeting in the science department. This helped foster better links. We organised, CLPL sessions for 90 staff, across early, first and second level. We delivered them ourselves as mentors and we used funding from SSERC to buy the resources that we needed, and we ran these across our schools and all members of staff attended four workshops. So, in total that would be 4 hours per staff member, four hours of CLPL that all 90 teachers experienced. These workshops included: Investigating owl pellets, electrical circuits, pneumatics and hydraulics, Antarctica, forces, forensics and it was great actually! Really engaging and we had excellent feedback from all our evaluations. I also ran an after-school science club at our school for the year. I did three blocks of 6 weeks of time and got 12 pupils each time so managed get 36 pupils to come to after school science club. We only have 120 pupils so that was actually quite a big proportion of the school. They were all very keen to come and since the training we've changed our planning format in school for science.

Impact: We've improved the curriculum framework and the progression of each science concept. Science is being taught all year round discreetly as well as interdisciplinary so it's not just a sort of bolt on to a topic so that's been a good change. As a cluster we asked staff to rate their level of confidence at the beginning of the year and then at the end and we noticed a huge positive difference in confidence following the activity.

We've included more pupil voice and engagement in science lessons, including letting them come up with the questions and investigate the answers. They really loved the fact that the sessions were practical and hands on and they were given the specific resources or ideas to use in the classroom.

The pupils are a lot more excited about science; science is more visible within the school. There's the science club and a pupil coordinator for science. I think that none of this enthusiasm and buzz about science would have happened without the SSERC programme. It was so organised, so professional in the way they delivered it and the experiences they gave the mentors and we felt confident to deliver that to a room full of teachers. So, now there's more science in the curriculum in the cluster schools, there's definitely more sharing of resources. We try to raise the profile of women in science as well and we've also got a Developing the Young Workforce board and science features on that and a lot of children talk about careers in science now.

- Raising the profile of science and technology in the cluster and enthusing children;

  Science masterclass approach to teaching science [has been effective] Children have been enthused and it has deepened their scientific knowledge.

  Depute Head Teacher, St Luke's cluster

- Delivery of mentor led/organised CLPL within and across schools including inset and twilight sessions. This has included CLPL on a significant scale, for example, in the Mearns cluster, CLPL was delivered by mentors to 140 staff through four workshops;

- Innovative cross-sectoral work including HE involvement to support teachers' development in science and technology;

  Introduction of Edinburgh University Geo-science students to every school as it builds on the teachers' learning community promoted by SSERC

  Learning Assistant, Boroughmuir cluster

- Raising the profile of science and technology across the cluster;
- Making links with other cluster schools including the secondary school;
- Giving a focus for teachers to introduce and deliver science and technology in classes and finding that they were increasingly likely to take science ideas and implement them in class;

  Cluster CLPL has had a huge impact on colleagues' confidence in delivering Science Es and Os.

  Depute Head Teacher, Williamwood cluster

  Increasing other teachers' confidence in teaching science with super speakers and resources.

  Class Teacher, Perth and Kinross cluster

Vignette 2: Depute Headteacher and SSERC mentor programme in 2015-2016

St Andrew's cluster. Glasgow City Council

Activity: Our main aim across the cluster was to build confidence in staff in the teaching science. One example was that SSERC enabled access to external CLPL and we decided to do was to do it as whole learning community. So I contacted all the heads of our communities and asked them if they could hand over the morning of an in-set day where we could all come together and I put my school forward as the place to come. Each then member of our SSERC team took a different area within science. We took some of the ideas from SSERC and what we wanted to do was like small experiments, small lessons that we could show staff that they could easily do within their school without lots of equipment but that you know they could then lead with their children in their school. Teachers led that and the idea behind that was that teachers would watch teachers teach lessons. But then we also had the experts that could also support this. We did it in a kind of round robin way with teachers circulating round as many different as they could in the morning and the idea was they took that back and then the mentor in each school could then make sure those lessons were then cascaded back to the staff and children.

Impact: Using self-evaluation survey of teachers' level of confidence to teach science and assess the impact across the cluster and school levels, we could see how teachers' confidence had improved in teaching science. So, from taking that initial benchmark and then doing it a year and a half later the results were very positive. The teachers felt a lot more confident in teaching science. Most of this was due to the input of the mentors and the strength that group; you know to lead the processes through each school.

- Building colleagues' enthusiasm and confidence to teach science and technology;

Cluster CLPL in-service day. Staff greatly enjoyed the practical activities we provided; it made them realise the ease in teaching science.

Depute Head Teacher, St Luke's cluster

Breaking down barriers, showing colleagues that it is not scary

Depute Head Teacher, Hillfoot cluster

Vignette 3: Headteacher and SSERC mentor programme in 2016/17

Huntly cluster. Aberdeenshire

Activity: The cluster improvement plan focused on improving learning and teaching and improving teacher and wider staff confidence in teaching science. Following the first residential part of the course, the mentors, supported by Aberdeen science centre, delivered one day of training that involved: all the teachers from the primary schools in the cluster; the pupil support assistants; students that were out on placement at the time and also three colleagues from the secondary school. We used materials that we had used at the SSERC session and delivered a whole day's programme for everybody. There were nearly 100 people at that event. Since then, we've encouraged schools to get involved in the SSERC meets, we've put together resource boxes for every primary school and we know that schools then engaged with the SSERC meet programmes and they wouldn't have done that, if we hadn't done that particular input. Through the PSTT SEP programme some of the teachers who were at our probationary training have put themselves forward and their schools to become science mentors for their schools and clusters through their experience from our probationary training days.

Using Pupil Equity Fund funding across the cluster, we agreed that we would work to engage parents and raise aspirations in STEM and build science capital with families. In our cluster there are areas of rural deprivation, poverty of experience, poverty of opportunity, poverty of aspiration. The mentors put together two family learning events, running the same workshop three times in one day at a school and at the second workshop three times again the school later in the year. Children can opt in and out of the workshops with mum or dad or granny. This has improved the collaboration between schools and links across the community.

Impact: Feedback from staff included 'It was the best day's training they've ever had. Can't wait to get back to the classroom.' Their confidence had improved so, it was very satisfying to see that. The feedback we got from the parents following the family learning events around understanding what STEM is and that STEM is for everybody and that the opportunity to learn alongside their children was really fantastic. As a result of that as well we made the materials available to all our cluster colleagues and delivered the workshop to three other primary schools to support colleagues.

We are now into our second year of science/ STEM work and again, the feedback from families and colleagues is tremendous. The enthusiasm, the confidence, the motivation to share the STEM learning with families blew us away and as a result of that we received a Rolls Royce Merit Science award.

We're developing materials on supporting STEM based our SSERC experience and we will try them in our own schools then roll it out across the cluster and support it using the family learning

model to build science capital, raise aspirations. The impact it's having on our families is evident from our evaluations. All this has been possible because of the quality of training that we have received through SSERC. The SSERC mentor cluster programme has had a terrific impact in terms of getting the cluster going and the spinoff from that is being able to convince Aberdeenshire to have a CORE day for probationers. We don't have time to develop material and resources and [through involvement with the Programme] that's been huge part of it, and we were able to use that experience and those materials to develop what we're doing now.

- Team teaching and supporting other staff in their school;
- Promoting professional dialogue;
- Arranging additional cluster meetings over and above those originally planned;
- Developing sustainable 'in-school' CLPL provision by drawing on SSERC GLOWmeets;

  The GLOW meet 'Fun with Forensics' was well organised and an exciting context. Staff liked doing this in their own schools...

  This was greatly enjoyed by staff in school and people were highly motivated to use this in school

  Class Teachers, Perth and Kinross cluster

- Sharing the cost of resources among schools in the cluster;

  The boxes that are currently created by the mentors will have a long-term impact on staff across the cluster. They will provide staff with all the resources that they need to deliver specific aspects of science along with suggested lesson ideas. We have spoken about adding a pen drive to each box so that staff can add useful resources for others to use.

  Principal Teacher, Inveralmond Community High School cluster

- Disseminating lessons learned across the education community using GLOW and social media.

  We are now offering open access through our GLOW blog to further inspire and support all who have access to GLOW.

  Principal Teacher, Inverclyde cluster

4.10 Insights from mentors' reflective diaries

One hundred and eight reflective diaries were submitted by November 2018. These typically included commentary on the mentor's activity with a reflective overview of an eight-month period between the two SSERC CLPL residential events. While they often contained descriptive comments documenting weekly developments, the diaries also contained mentors' thoughts on the various challenges, achievements and impact of the Programme within and across their clusters. The diaries often detailed the range of measures that mentors adopted to promote the capacity of their cluster colleagues to provide more effective science and technology teaching. This included: adapting SSERC materials and advice to suit the local context; writing materials to link science with other topic areas; auditing and evaluating; planning and arranging division of tasks in collaboration with other mentors; being responsible for SSERC-related budget for external CLPL; arranging external SSERC accredited CLPL input. This is impressive given the relatively short period of time between the two residential CLPL events. The diaries, therefore, provided additional insights regarding the processes underpinning the implementation and impact of Mentors' activities. Furthermore, the diary entries also indicated the wider recognition of their achievements such as reference to praise in HMIE reports for the teaching of science and technology.

Diary entries regularly indicated the commitment of mentors to their science and technology development roles and their strength of feeling regarding wanting to make a difference. Comments also revealed how mentors experience of the SSERC CLPL sessions had been directly applied to support school and cluster colleagues.

Diaries indicated the importance of having regular meetings and professional dialogue between mentors and between mentors and teachers across clusters. This on-going collaboration appears crucial in driving forward science and technology developments across the schools. They also highlighted mentors' use of a collaborative action research approach to scope teacher needs and assess progress and impact of their work. This enquiry typically demonstrated the need to promote teachers' confidence and provided evidence of initial impact of the mentors' activity on the confidence and skills of their peers as well as providing insights of impact on learners.

These documents demonstrate the typical systematic and well-planned approach mentors adopted in their work. Of particular note is the prevalence of collaborative action research (CAR) approaches with mentors gathering information and data to inform the focus of their work and later assess impact. This included auditing and base lining teachers' professional learning needs and status of science and technology in their clusters and then later data collection to assess shifts. In some cases, mentors worked with teachers to evidence initial impact on learning outcomes. These were often used in the feedback demonstration presentations at the part two CLPL residential events.

Diary information, therefore, illustrated the scope of support provided by mentors, their impressions of impact and plans for sustaining and developing their work. For example:

- establishing cluster-wide systems to improve implementing science within the curriculum that are likely to be embedded and sustained across clusters

  Science is now a priority on our School Improvement Plan over the next three years. I have now established that we are going to gather, collate and create a database for our Science resources...Working as team we have embarked on a new approach to Science as facilitators and have made ourselves available to support colleagues.

  Class Teacher Borders cluster

  It [mentor activity] has fed into our cluster plans for next year and CLPL sessions. The collegiality and relationships it has built within the cluster will hopefully have a sustained impact for both science and other curricular areas.

  Deputy Headteacher Boroughmuir cluster

  I believe these inputs have given teachers many positive fresh ideas that they can take into the classroom, which was our overall aim from the beginning, Workshops were well received by almost all staff in the learning community and there has been evidence of them being used…I have also helped support staff in their planning in science and made suggestions to resources and activities…I feel we were very well supported during this time from SSERC, as questions and queries were answered very quickly through email. From my own personal professional development, I believe that I have grown markedly in confidence through the delivery of the workshops to my colleagues and when supporting staff in their planning. Also, my knowledge of teaching science has improved greatly assisted in planning using CfE Experiences and Outcomes. I believe that these developments will be sustained within my learning cluster, as there are discussions of developing and creating science planners and transition days between the primary and secondary schools.

  Class Teacher St Mungo's cluster

- Introducing STEM and STEAM subjects with greater reference to DYW and skills pathways
- Arranging CLPL input including external experts from SSERC but also others who address science and technology practice and also relevant learning and teaching approaches
- Involving pupil feedback and discussion in STEM lesson planning
- Development of strategies to engage parents/ carers in the STEM learning of their children. This included parents attending science workshops led by class teachers and taking part in lessons with their children. This was seen as helping

to support parent/carers to support their children's learning and also building science capital

- Development of resources, including those shared on-line as well as specific information on practical experiments for colleagues
- Developing local networks and sharing ideas, including the use of ICT, social media, GLOW etc., and promoting SSERC and other sources of support
- Raising colleagues' wider awareness of relevant CLPL opportunities and Edina Trust funding
- Improving collaboration with secondary science teacher colleagues but reducing reliance on them
- Providing on-going support and mentoring for individual and groups of colleagues.

This week during Curriculum Development, I worked with staff to look at the science milestones again. The staff are now more familiar with them but were still worried about the topics currently used for learning throughout the school. The staff are now more open to IDL approaches but recognise the importance of recording learning for transition purposes.

Depute Head Teacher Auchmuty cluster

I would say that the planning and moderating as well as showcasing new ideas, approaches and resources has promoted staff confidence, which the children have, therefore, benefitted from.

Science Mentor South Kintyre

A consistent theme across the diaries was that the provision of quality "hands-on, easy to locate and use resources and ideas" from SSERC had greatly facilitated schools' ability to "develop an interest in science/STEM and change the way science is taught within the classroom".

The comments illustrated how mentors have combined advice on general good teaching and learning and assessment approaches as part of promoting effective science and technology teaching in a holistic fashion as well as using team teaching and lesson observation approaches to enhance their pedagogy. Participative teaching methods were reported to be particularly effective in engaging pupils in STEM learning.

Diary comments also reinforced themes arising from other sources of the evaluation evidence. For example, mentors' comments included reference to the importance of having management support for their work.

This far into the year a lot of the time has already been allocated and has had to be reconsidered, which will in turn have an impact on our school/cluster improvement plan. Having a Depute Head Teacher on the team has probably made it easier to push for priority and time.

It [mentor activity] has fed into our cluster plans for next year and CLPL sessions. The collegiality and relationships it has built within the cluster will hopefully have a sustained impact for both science and other curricular areas.

Mentors from the Boroughmuir cluster

Certain challenges were also evident from mentors' diaries including not always having full support of all headteachers and staff in their cluster schools. Some diaries suggested stronger encouragement from local authority officers to headteachers regarding the SSERC Programme and STEM, including a higher profile of STEM in School Improvement Plans. In some cases, mentors liaised and worked with local authority colleagues to explore ways to encourage greater staff and leader engagement with STEM across schools. The development and support of on-line resources and sharing of information was seen by some mentors as one strategy to reach all teachers in their cluster and beyond, regardless of headteacher buy-in. The diaries also revealed the often creative, approaches mentors adopted to finding time to support colleagues. This included talking to staff in the staffroom during lunchtime or after school.

Importantly, the diaries gave valuable insights from the classroom on the impact of the Programme on pupils. Frequently, mentors' entries indicated that there has been a positive impact on learners with an improvement in their 'engagement and motivation' because of the approaches used.

I have been impressed by the investigative work and questioning that the pupils have engaged in when planning their learning. The active nature of the learning has meant that all pupils have been engaged in their learning.

Depute Headteacher. Auchmuty cluster

The children have responded with great enthusiasm to any science lesson I have delivered, and they were keen to sign up for the lunchtime science club. They have been engaged in the lessons and the discussion generated has been excellent ... the children were able to respond well to the level of challenge and demonstrated a good understanding of the Experiences and Outcomes.

Principal Teacher. Eastbank cluster

Very positive response from pupils, increased engagement and beginning to develop a better understanding of the principles of scientific enquiry across the school.

Principal Teacher. Oban and Lorne cluster

Comments referred to impact on pupil engagement, knowledge and skills including 'enquiry skills and the 'big ideas in science' reflecting improvement in these areas for staff involved in the Programme. In addition, over the six years of the evaluation, there was increasing evidence in the diaries of teachers using science to promote the development of literacy and numeracy skills across the school, including Pupil Equity Fund (PEF) supported science groups.

4.11 The views of senior management and other teaching staff on impact

In an attempt to collect the views of a wider audience on the impact of the Primary Cluster CLPL Programme the evaluation asked headteachers of all participating cluster primary schools to complete a postal questionnaire survey and also invited other teaching staff within the cluster to complete an online questionnaire. These surveys took place at the end of the period of participation in the PCP (i.e. at the end of academic year) and several months after the follow-up CLPL sessions for mentors.

4.11.1 Who responded to the senior management and other teacher surveys?

Senior management

Two hundred and nineteen members of the senior management team returned questionnaires. This included headteacher, depute headteacher or another member of the senior management team. Eighty nine percent were female and 11% were male with the overwhelming majority (83%) having taught for 16 years or more.

Other teaching staff

Two hundred and seventy-five teachers, 90% female and 10% male, completed the online questionnaire with the majority (75%) having taught for six or more years. Ninety nine percent of respondents worked in a primary school. Two thirds of the teachers indicated being *very aware* of the SSERC Primary Cluster Programme while the other third reported being *partly aware* of the Programme.

4.11.2 The introduction of new materials, resources and methods of teaching science and technology

There was good evidence to suggest that the impact of the Primary Cluster Programme had spread beyond the mentors' own teaching to, among other things, the introduction of new materials and ways of teaching science by other teachers in the clusters.

Almost all responding teachers (95%) reported having taken part in school/cluster-based science organised CLPL as part of the Primary Cluster Programme with a

further 77% indicating that they had worked with their science and technology mentor. Three quarters (75%) also reported that *new materials/resources* from the SSERC CLPL had been introduced to their science and technology teaching or practice while 77% also indicated adopting *new methods of teaching* science and technology.

At the senior management level 98% indicated that *new materials/resources* from the CLPL had been introduced to their school's science and technology teaching or practice while 89% also reported that *new methods of teaching* science and technology had been introduced to the school.

4.11.3 Senior managers' views of mentors' impact on the role and profile of science and technology

Senior managers indicated substantial impact from the Programme on school and cluster developments in science and technology roles. For example, almost all senior management responses (90%) indicated that their *staff had taken on a more significant role in science and technology developments* and a large majority (79%) also reported that their school had *taken on a greater role in science and technology developments within their cluster*. There was less evidence of impact at the local authority level or national level as a result of the Programme. This is hardly surprising since the Programme is designed primarily to foster developments at a school and cluster level. Table 4.7 summarises results.

Table 4.7 - Changing role of the school in science and technology developments

Action	% has happened
Staff have taken on a more significant role in science and technology developments in the school (N=215)	90
The school has taken on a greater role in science and technology developments within our cluster (N=210)	79
The school has taken on a greater role in science and technology developments at local authority level (N=196)	25
The school has taken on a greater role in science and technology developments at national level (N=194)	7

Open comments from school managers were overwhelmingly positive and indicated that mentors were not only delivering CLPL for their cluster colleagues but that their input had impacted on cluster-wide collegiate working including:

- developing learning and teaching approaches in science and technology topics, with some evidence of wider impact across the curriculum;
- greater and more systematic science and technology input in the curriculum;

- science and technology more likely to be included in school planning;
- developing and sharing science and technology resources across the cluster;
- increased staff confidence to teach science and technology;
- greater pupil engagement with science;
- improved learning outcomes for pupils.

Overall, headteachers' comments revealed that the Programme has developed the capacity and capability of mentors and teachers within and across the clusters. The majority of comments indicated that the Programme has promoted and influenced the planning and practice of teaching science and technology. There were also accounts that the Programme had positively influenced pupils 'engagement and attainment'.

> *…boosted teachers' confidence in teaching science and lead to a change in practice which has had a positive impact on pupil engagement and attainment*
>
> Headteacher, North Lanarkshire Calderhead cluster

> *[there was] Impact on learning and teaching and the confidence of staff in delivering science.*
>
> North Ayrshire, St Anthony's Primary

> *[There was] increased professional confidence in the delivery of science outcomes leading to enhanced learner experiences. Having a mentor in school means staff feel supported in their learning and are able to seek advice and guidance on an ongoing basis.*
>
> Depute Headteacher Musselburgh Cluster

Headteachers reported that the collegiate and collaborative approach meant mentors have shared good practice and this networking had promoted collaborative working and sharing of other learning and teaching and assessment ideas and approaches. Some headteachers highlighted work on skills progression, primary secondary transition and moderation had developed with closer and more systematic working with the colleagues in the science departments of their cluster secondary schools (e.g. Glasgow, East Dunbartonshire).

There were some accounts from the headteachers that it had been a challenge to engage secondary schools in building on the mentors work across the cluster primary schools and that this would require further work, and some suggested more direction from their local authority.

Headteachers comments revealed that the approach was fostering more systematic cross cluster collaboration that not only included a focus on science and technology but had extended to use the approach to develop other aspects of teachers'

professional learning, assessment strategies and planning as well as sharing resources. This was particularly valued in clusters of smaller schools.

The enhanced collegiate working as a result of the Mentor Programme approach was particularly welcome in areas were schools were geographically spread out because it has reduced professional isolation and enabled sharing of resources and expertise. There was also evidence of mentors working at local authority level (e.g. Highland) to support science and technology education planning and developments.

The mentor role was seen as much more than a 'cascade model' where knowledge is simply transmitted via the person who has attended the CLPL. Headteachers stressed that the mentors had worked collaboratively in working parties across their cluster, using the knowledge and skills from their SSERC CLPL to enhance the science and technology learning and teaching capability of their peers. The mentors were reported to have delivered CLPL for colleagues that was based on their own SSERC experience but tailored to their own school and cluster context. They had also organised other professional development and learning opportunities provided by SSERC-accredited sources or via the SSERC_Meet courses.

Some headteachers made reference to attending the school-based CLPL delivered by the SSERC accredited providers and were able to experience first-hand the outcomes of the mentors' work. This appeared to further enthuse the headteachers and their staff, which supported building on the initial work of the mentors. In one cluster, a headteacher in East Dunbartonshire had attended the 'Space' CLPL session. This had stimulated plans to undertake a whole school project on science that linked to the work of the British astronaut who visited the International Space Station in December 2015.

Headteachers reported that the approach has developed mentors' leadership capacity working with SMT to support the planning of science and technology teaching in order to ensure longer-term impact (e.g. East Dunbartonshire Boclair Academy).

The following quotes typify headteachers' praise for the impact of the mentor for their school and cluster

> *…highlighted good practice, successful activities across the school…Children are enthusiastic about science. Staff are more confident teaching it. We have science club partnership with Satrosphere. We get involved in more external opportunities. We have 'Science Street' and all classes contribute to this.*
>
> Headteacher, St Machar cluster

> *There is science progression throughout school. Science is taught at all stages and staff expertise and confidence is increasing.*
>
> Headteacher, Forrester cluster

There are more learning conversations now between staff and they know who to approach for help and advice. This means that staff are prepared to try something new, with some extra support, and so the children have a broader experience of STEM subjects in the classroom.

Headteacher, Musselburgh cluster

Headteachers also stated that there was particular value in having a class teacher as mentor. One headteacher noted that, as a result, colleagues

are more likely to take ideas on board and it gives staff ownership of leading learning.

Another senior manager saw particular strength in the

responsibility and motivation from teachers that know what other teachers are looking for.

School managers typically saw the mentor as a 'leader of learning', a catalyst and facilitator. Their activity in promoting networking and facilitating teacher skills and confidence to teach science and technology is having a positive impact across each cluster.

Mentors are dedicated leaders of this area of curriculum, so this is building capacity amongst staff. Their enthusiasm is infectious. Bringing ideas and resources to the school. Discussions between the Headteacher and mentor clarify thinking and enables schools to find a clear way forward. Discussions between the schools in the cluster enable the sharing of ideas.

Headteacher, Moray Lossiemouth cluster

The mentors' impact within the school regarding pedagogy, school planning but also in facilitating engagement with the wider community was also evident in school leaders' comments

Science and Technology is more prominent in planning and evident in class activities. This has been successful due to Kirsty Brennan's mentoring approach and how she has delivered staff and parent workshops.

Headteacher, Comhairle nan Eilean Siar

School managers' comments reiterated some of the challenges that mentors could face, including time pressures from other responsibilities. There was some indication from headteachers' comments that mentors were likely to be teachers who were highly motivated and willing to take on leadership and other duties. This led one headteacher

to suggest that the Science Mentor role could be passed on or shared so that particular staff did not get 'pigeonholed' or overly burdened.

4.11.4 Impact of the Primary Cluster Programme on teaching staff

Senior managers and other teaching staff gave an indication of the extent to which the mentor developments in science and technology had impacted on a number of pre-determined areas. Results were generally positive and suggest that good progress has been made. Table 4.8 summarises the responses from the three stakeholder groups, mentors, senior managers and other teaching staff in relation to a number of variables designed to capture the range and depth of impact from the Programme These findings also provide support for the view that mentors themselves have not, in general, overestimated the impact of the Programme in their cluster. From the table it can be seen that, in a number of instances, senior managers and other teaching staff were just as likely as mentors to suggest that the mentoring development had impacted *to a large extent*. For example, of particular note is the fact that more than half of the headteachers (54%) reported a large *increase in teachers' confidence to teach science and technology* and a large *increase in pupil engagement in science and technology (50%)*, also a large *Increase in teachers' skills to teach science and technology* (44%). However, there are cases where there are notable differences in reported impact by stakeholder group. For example, mentors are more likely than headteachers to report that the Programme has promoted collegiality between staff in their cluster schools. This might be a result of standpoint, with mentors being able to see interactions between staff and schools more than headteachers and also because an increase in collegiate working will be greater for mentors than for headteachers. It is also apparent that teachers' reported impact is generally less positive than mentors and headteachers in terms of agreeing 'to large extent'. This could be due to mentors and headteachers having a better overview of the Programme's impact. Moreover, the relatively low teacher response rate makes their comments less likely to be representative of the teachers covered by the Programme.

Table 4.8 - Impact of mentoring developments by stakeholder groups

As a result of science and technology mentoring….	% Mentors indicating ***to a large extent***	% Senior management indicating ***to a large extent***	% Other teachers indicating ***to a large extent***
Increased collegiality between cluster schools (N= 366 / 213 / 264)	62	46	31
More varied approaches to science and technology learning and teaching (N= 367 / 214 / 267)	45	43	37
Greater knowledge about the work of SSERC and NSLC (N=364 / 214 / 264)	50	25	27
More opportunities for staff to share their science and technology experiences in clusters (N= 366 / 214 / 269)	45	42	31
Increased pupil engagement in science and technology (N= 366 / 214 / 267)	54	50	42

Increase in teachers' knowledge to teach science and technology (N= 366 / 215 / 267)	42	46	38
Increase in teachers' skills to teach science and technology (N= 367 / 213 / 266)	40	44	38
Increased science and technology activities in the curriculum (N= 366 / 213 / 265)	44	38	37
Increase in teachers' confidence to teach science and technology (N= 367 / 215 / 267)	45	54	38
Increased teacher networks to support their science teaching CLPL (N= 363 / 215 / 262)	35	27	27
Increased interdisciplinary learning approach where science can be incorporated into a range of common primary topics (N= 366 / 214 / 266)	24	23	26
Increased teachers' reflective practice and self-evaluation (N= 366 / 215 / 266)	16	17	24
Increased pupil aspirations towards science and technology careers (N= 364 / 211 / 267)	19	8	21
Increased capacity of classroom assistants to support the delivery of science in the primary curriculum (N= 363 / 214 / 266)	8	1	8

The vast majority of headteachers' qualitative comments were unanimous in their praise for the Programme's impact on mentors' ability to promote the confidence and capacity of teachers' ability to teach quality science and technology topics. Typical quotes include:

> *Staff confidence in teaching science [has improved] so children are definitely getting more science of higher quality, more regularly. Working as a cluster has been very valuable for all staff, new relationships have been made, there's great sharing of expertise and resources.*
>
> Headteacher, Fortrose Academy cluster

> *The joint cluster in-service training has allowed teachers 'hands-on' experience of science activities and material. This has impacted on the confidence of teachers, with active science and technology taught across all stages of the school. Staff are now aware of resources available and can use the experiences and outcomes to plan confidently.*
>
> Depute Head Teacher, Auchmuty cluster

> *This has been a wonderful experience for the mentors and the staff. The enthusiasm generated has been backed by specific knowledge which has added both breadth and depth to children's experiences of STEM subjects. Wonderful!*
>
> Depute Headteacher, Musselburgh cluster

4.11.5 Most and least successful science and technology developments

Senior management were asked to provide examples of what they regarded as the most and least successful cluster developments in science and technology since their school became part of the Primary Science and Technology Cluster Programme.

Eighty nine percent of senior managers provided details of what they regarded as the most successful science and technology development while 39% provided a response regarding least successful developments. However, many of these comments merely reiterated that there had been no negatives or less successful aspects to the Programme.

Overwhelmingly, senior management believed that the Programme had been extremely successful and were able to highlight a range of key successes. These included:

- more systematic science and technology planning, guidelines and CLPL;
- introduction of regular master classes, cluster workshops, showcase events, twilight sessions and INSET days and school/ cluster organised science and technology CLPL;

  Implementation of 'science master classes' within the cluster, giving teachers the opportunity to team teach and develop their skills in teaching science. Science CLPL organised.

  Depute Head Teacher

- greater interest in, and engagement with, science and technology by both teachers and children;
- science and technology events that have facilitated parental and pupil involvement and engagement;

  We had a science showcase event for the parents. The event was led by pupils and gave the pupils a chance to display their learning in Science. The CLPL sessions (part of the primary cluster programme) helped increase confidence in staff to deliver certain topics. As a result, the teachers planned interdisciplinary topics which enhanced the pupils learning experiences. Staff and pupils have had an enthusiastic approach to science because of the focus this year.

  SMT member

- staff confidence to teach science and technology has generally improved;

  CLPL in service training on energy and forces for all staff introducing new resources of a practical nature giving staff confidence in approaching scientific experiments in the primary curriculum.

  Headteacher

- increased cluster working, professional dialogue and sharing of practice;

  Greater links with the cluster and a more consistent approach across the establishments in the planning and teaching of science

  SMT member

  Strong network of support established in the cluster as a result of the programme

  Headteacher

- science and technology used to facilitate and enhance transition development: P7/S1;

- reports of pupils having notably improved learning experiences and engagement with science and technology with some headteachers stressing an impact on attainment and learning outcomes.

  Twilight training sessions [as a result of SSERC mentor activity] in school and across the cluster have boosted teachers' confidence in teaching science and lead to a change in practice which has had a positive impact on pupil engagement and attainment

  Headteacher

Only one senior manager provided an example of something that worked less well in the Programme. This was that the timing of cluster events in one meant that staff had other pressures such as reports and sports days to address. It was thought that more staff would have become involved if the CLPL cluster twilight sessions had been conducted at another point in the year.

4.11.6 Advantages and disadvantages of the mentor approach for the development of teaching science and technology.

Senior management and other teaching staff were also asked to describe the advantages and disadvantages of the mentor approach for the development of teaching science and technology in their school. Both groups' comments clearly saw the Programme comprising more advantages than disadvantages.

Advantages

One hundred and eighty-six senior managers (85%) provided comments on the advantages of the mentor model. Their comments stressed the value of having key staff available who could provide advice on science and technology and coordinate within their schools and across the cluster on a day-to-day basis. Senior managers saw the model as facilitating more effective links with other schools in their cluster and contributing to teachers' enthusiasm and motivation. As a result, the model was a driver for a stronger focus on science and technology in the school and improved staff abilities.

Teachers' comments stressed that the mentor approach meant a rapid response to teachers' CLPL needs and their mentor had helped to tailor professional learning regarding science and technology to their specific needs and school context. In addition to this increasing teachers' confidence to teach these topics, a notable theme in class teachers' open-ended comments was reference to the positive impact on pupils' learning outcomes.

Key themes across those teachers' who commented on the advantages of the mentor approach were:

- having easy access to reliable advice and support regarding science and technology queries;
- having a colleague who can highlight relevant resources to use and other science CLPL opportunities;
- having a teacher as a mentor gives credibility and ownership to the science and technology developments introduced through the mentor's CLPL;
- greater awareness across teachers of developments in science and technology and how to reflect these in teaching;
- improvement in teachers' confidence to teach science and technology;
- contribution to school leadership development;
- coherent approach across cluster.

The mentor approach was especially valued by teachers as being helpful for less experienced staff and those who were less confident regarding science and technology and mentors were praised for their "patience, knowledge and scientific skills". Some quotes that demonstrate teachers' value and support for the mentor model include:

> *[it] Increases confidence in teaching science and provides good ideas to teach different parts of science*.

> *I believe the children and staff have benefited from a fantastic experience in science this year. Science areas are now set up in each class and are in the most changed on a*

fortnightly basis by the individual class teachers when they come to me for ideas of what can be put in.

A huge support when delivering lessons, gathering resources and organising CLPL.

Class Teachers

Disadvantages and challenges

Ninety-two (42%) senior managers made comments regarding disadvantages associated with the mentor model. However, many of these comments actually stressed the point that the Programme had no disadvantages. While headteacher accounts were overwhelmingly positive about the impact of the SSERC CLPL Programme and the work of their mentors and most highlighted plans to build on this work, there were some who also stressed that there were certain challenges for the Primary CLPL project.

The most commonly reported challenges concerned time and cover. These were seen as potentially limiting the class cover for mentors when they were out of school as well as limiting the scope of what mentors could do to embed or extend the impact of the initial CLPL. Some headteachers stressed time constraints for science champions to meet and plan. Others stressed that they wanted to explore using mentors to work in classes to team teach and model approaches but staffing and cover issues meant that this was difficult to implement.

Some headteachers reported issues arising when a mentor moved on to another area which had presented challenges to maintaining coherence for the strategies the mentors had developed.

Since several schools have lost their mentors due to promotion and new jobs, it would be good to have a cluster mentor whose job is to oversee all of the schools

Headteacher, Dumbarton Academy cluster

A theme in headteachers' comments was the suggestion of having more teachers trained as mentors in each school to build a more sustainable capacity and offset challenges posed by staff mobility. There were accounts of headteachers and teachers working with their cluster colleagues' schools to ensure plans were not disrupted by changes when mentors and other key staff moved on. Headteachers noted that smaller schools were more vulnerable to such staff changes. Headteachers also demonstrated flexibility to tackle challenges. For example, while arranging for another teacher to take up the mentor role, one headteacher in the Moray Lossiemouth cluster had covered some of their mentor's activities to ensure the planned work did not falter.

4.11.7 Developing the science and technology mentoring approach in schools

One hundred and seventy-three senior managers (79%) and 125 other teaching staff (40%) took the opportunity to suggest how the Primary Cluster Programme could be developed. Many of these responses included statements to the effect that the Programme should be continued and given time to embed the initial positive advances and keep up to date with relevant developments. Some headteachers expressed a hope for continued involvement with SSERC in one way or another.

Other than stressing the need for the Programme to be continued, senior managers' comments regarding developing the National Programme included:

- Expand and enhance the model to increase the number and coverage of mentors supported by appropriate levels of funding
- Having more time to spend the funding provided
- Exploring ways to apply the model to develop other areas of the curriculum

There was a theme in headteacher accounts advocating using the mentors to work in classrooms to model effective approaches and working alongside teachers and pupils in class (e.g. East Dunbartonshire, Clackmannanshire and Moray clusters). One barrier to this, however, was a lack of staff cover.

> *If I could arrange the time out of class for the Mentor, I would like her to team-teach as a way of supporting classes. Along with carrying out class monitoring*
>
> Headteacher, Forres Academy cluster

Senior managers also used this open question to describe how they were already building on the initial impact of the mentors developing the model in their own schools and clusters. Headteachers reported a wide range of developments that were underway or planned to enhance their school's science teaching that had emerged as a result of the CLPL Programme. Headteachers generally reported that the work of the mentors would continue to be reflected in their school planning and measures to promote effective science teaching.

> *The mentor will continue their work and will lead a school working party next year and develop progression of skills and ensure this is evaluated and monitored. The goal is to support staff to develop scientific strategies and skills that is planned and embedded as a scientific investigation approach…We now need to use the science mentors within a cluster development programme for improvement. This will involve planning, assessment, resourcing and further staff CLPL.*
>
> Headteacher, Douglas Academy cluster

Staff training together, using GLOWmeets has meant all staff have attended the training. This wouldn't usually happen. This will allow us to move on in a consistent way next session.

Headteacher, Forres Academy cluster

…To develop moderation and assessment of science within the school and across the learning community and appoint a PSA in charge of science resources.

Headteacher, St Mungo's Academy cluster

In some cases, these plans involved attempting to forge closer links with secondary colleagues.

Next session mentors across cluster will work with secondary colleagues to ensure consistent opportunities to ensure consistent approaches from feeder primaries to secondary to support transition

Headteacher, Boclair Academy cluster

Headteachers generally reported that the impressive impact of the mentors had facilitated a capacity and a willingness in their clusters to continue to build on mentors' work. This included continuing to develop practical lessons with pupils, enhancing collegiate curriculum development and planning, assessment and lesson progression.

A complete overhaul of science progressions; planning various excellent resources alongside each other to support an interesting and new way to present science; staff more confident; staff thinking about how they can improve science developing this across the cluster.

Headteacher, Lossiemouth cluster

[there will be] continued support in linking science and technology outcomes to other curricular areas

Headteacher, Fortrose Academy cluster

We need to consider how we develop an appropriate tracking of skills document and tracking pupil progress through the levels.

Headteacher, Castlehead cluster

There were also reports of mentors' work being used to reinforce wider developing strategies, including strategies linked with the Attainment Challenge.

Our science mentor attended a recent National Network event in Glasgow. we hope that involvement in this will allow us to continue to develop our approach to science

Headteacher, Dunbartonshire cluster

There were also reports from headteachers of schools making and planning to make links with external agencies and companies that could have a role in supporting their science and technology education.

The teachers' comments on developments focused mainly on the need to build on progress to date including, further CLPL opportunities to 'maintain improvements', safeguarding time for the mentors to continue with their activities and providing time for staff to access CLPL in science and technology. Some teachers, like headteachers, suggested that mentors should be able to go into classes and *'team-teach with the teacher to model approaches'.* Here Lesson Study could be deployed as part of teachers' collaborative critical reflection and could further enhance the impact of the mentors' work.

Insights from the mentor focus groups, including the use of self-reporting 'post-it' feedback techniques, emphatically endorsed the survey findings and particularly confirmed findings regarding the quality of the SSERC training and how this had facilitated mentors' ability to make a difference in schools. The mentor focus group themes included the view that secondary cluster colleagues should be involved in the SSERC Primary Cluster Programme. During the evaluation it was evident that a there was a shift in the attitudes of primary and secondary teachers from one where primary teachers were somewhat reticent about involving secondary colleagues in their CLPL sessions to a stance that was much more confident and collegial. This was reflected in that from 2015/16 session onwards, a number of clusters had a secondary colleague join them at the initial residential and work with them throughout the period of engagement with PCP. Most clusters also took part in a dedicated Primary/Secondary transition day in Year 2 of participation in the Programme where colleagues from upper Primary (usually 4 teachers across the cluster) and 2 from early secondary work together at SSERC. In addition, there was also a change in attitude of secondary teachers who became more open to and interested in Primary as they senior phase changes 'bedded in'.

There were reports from mentors that increased collaborative working with secondary colleagues was already beginning to occur in some of the clusters as mentors' plans had included transition activities and / or had reached out to the science departments of their cluster secondary school to enhance knowledge exchange.

One respondent stressed that there should be regular contact with appropriate secondary colleagues who should be involved in planning new developments. Teachers also suggested rolling out the mentor model to address other areas of the curriculum. They also highlighted the support from local authority for the Programme

and stressed that this should continue including measures to ensure that good practice was shared across clusters.

One teacher believed that it would be beneficial to ensure that science and technology mentors were given a PT role within their school given their leadership role. Another drew attention to the need to address wider contextual issues such as promoting colleagues' willingness to engage in new developments.

4.12 Factors influencing the work of the science and technology mentors in schools and clusters

School management (47%) and school colleagues (46%) were viewed by mentors as sources of *major support* in the development of science and technology education within their school. Conversely [a lack of] time (36%) was reported as a *major hindrance* to the work while [a lack of] resources (22%) was seen as *something of a hindrance*. This should be seen against a context where the issue of resources has been addressed during the period of the evaluation. For example, from 2013/14, all cluster schools that have had teachers participate in the PCP have had opportunity to apply from a grant of up to £350 to buy classroom resources to serve as a legacy from participation in PCP. Some £30K per year had been put into Scottish schools through this scheme.

At the cluster level, cluster management (43%) and school management (44%) were regarded as *major supports* for the development of the work, as were colleagues in other schools (36%). Again [a lack of] time (33%) and [a lack of] resources (16%) were viewed as a m*ajor hindrance* and *some hindrance* respectively.

Mentors' open comments also stressed the importance of having time for their work and the challenge that a lack of it could present for mentors' proposed activities such arranging CLPL opportunities for staff and conducting core mentor activities. Mentors often reported being frustrated by a lack of time available or allocated to fulfil their role and highlighted that there could be a dependency on them investing their personal time. Some suggested that they could have achieved even more in their cluster if they had had more time available for planning activities. In some cases, schools' planning timetable meant that available INSET time had been allocated in advance of the mentor taking up his/her role. In such cases, it could be difficult to find a place in the timetables for science and technology CLPL. However, mentors demonstrated considerable creativity in their strategies to overcome such challenges including the adoption of twilight sessions and introducing class-time, team teaching approaches. Mentors often believed that the success of their work would influence the next cycle of planning. Additionally, and in light of this finding, SSERC staff sought to engage

cluster headteachers at an earlier stage in the cycle than had been the case previously in the hope that INSET days could be set aside for science and technology.

Qualitative feedback from mentors also indicated that achieving uniform levels of support from teachers across the cluster and the slow uptake of activities among some school staff was also a challenge for some mentors. However, teachers explained that such a 'slow-burn' model was preferable to something that was seen to be a 'flash-in-the pan'. Mentors suggested that establishing a core of enthusiasts among their colleagues and using this group as a basis for supporting development, could have a greater impact on science and technology teaching in the cluster.

Infrequently, mentors suggested that more active involvement and support of school management would have increased the impact of their work. In such cases, mentors believed that a lack of headteacher support and/ or not having a member of senior management as a mentor had limited their impact.

> *I have found the coordinator part of the role quite challenging due to the lack of support at HT/ cluster level… As a cluster we have not met regularly to plan and discuss Gap Task and CLPL activities…but we are still working towards organising and delivering cluster-wide CLPL events both at INSET and twilight.*
>
> Class Teacher

> *Overall, I have loved doing the role, however, it has been frustrating when we met with barriers or management not wanting to engage with us. Very time consuming on top of teaching full time*.
>
> Class Teacher

Participants were beginning to use the range of additional external CLPL delivered by associated providers. With the exception of one provider, this CLPL had been highly valued.

> *One of the external CLPL events chosen for early level staff was not motivating, didn't leave them with ideas or promote their enthusiasm. This was unfortunate as we wanted to 'wow' staff and it was important to have them feeling positive about future CLPL events.*
>
> Acting Depute Head Teacher, Hillfoot cluster

It is notable that SSERC continually monitors all of the non-SSERC external CLPL sessions provided within the Programme and, if necessary, acts to address concerns and teacher criticism.

For each school involved in the Programme, headteachers and mentors were asked to rate the impact of the SSERC project and summarise the range of factors that they believed were facilitating or impeding the impact and sustainability of the CLPL.

Overall, there was consensus in the responses across the two groups and their responses highlighted similar factors raised by the local authority officers in the third and final year of the evaluation of the project. Together, these findings reveal that the SSERC CLPL has had a positive initial impact on primary teachers' ability to teach effective science and technology that such gains could be influenced by the following factors:

Changes in staffing, particularly mentors. Where those teachers who had received CLPL or a cluster mentor had moved on to a new post elsewhere or where new staff who had not been involved in the CLPL joined the school, this could reduce the capacity that had been developed. This posed challenges for the cluster mentors and managers to maintain the skill base available and levels of confidence.

> *Staff changes have also meant that those with the training have moved schools/stages and newer staff members have not had the opportunity to take part in various workshops…Lots of staff changes limited the continuity of training in school.*
>
> Headteacher response

> *Many changes in staff lead to breakdown in progression despite best efforts of the staff trained. Lack of supply staff to allow staff trained to offer team teaching opportunities. CLPL was carried out but I feel the team teaching was crucial part of the process, but we continue to try to support this. Staffing is a major issue.*
>
> Headteacher response

Some headteachers stressed that such issues arising from changes in staff were anticipated and being addressed by ensuring existing staff who had undergone CLPL with SSERC were given opportunities to systematically share what they had learned from the CLPL with other teachers who could take an active role to sustain the work of the mentors and move forward.

Limited availability of teaching cover. This was seen a challenge in that it limited the ability of teachers and mentors to meet to plan or attend CLPL sessions.

Other or changing priorities for schools. Headteachers and mentors highlighted that changes in priorities from national and local policies could put pressure on the amount of time given to planning and teaching science and technology as planning refocused on other priorities. As one headteacher said this meant 'there is no time to remind and refresh staff about previous CPD undertaken'.

A common priority was reported as the focus on literacy and numeracy as part of the Attainment Challenge, with some headteachers reporting that the drive to raise attainment in these subjects meant a reduced focus on science and technology.

Schools are under significant pressure to raise attainment in maths and literacy in particular and this clearly has an impact on the amount of time available to spend on other subject areas, such as science. I thought the programme was very good and was well resourced, our challenge is to ensure that this is sustained and that is difficult given the RA agenda.

Headteacher response

[SSERC CLPL] Made a huge impact during the first year - science progression for whole school developed and lots of resources purchased and organised. Not sure how well this will be sustained as nurture, numeracy and writing are now on the school improvement plan and will be the focus for CPD, class visits, etc.

Mentor response

These comments stress the importance of ensuring science and technology are reflected in the School Improvement Plan (SIP) and interestingly, there was only mention from one headteacher that these priorities could be combined with literacy and numeracy tackled within science topics and vice versa as through Inter Disciplinary Learning / cross-curricular teaching.

Time. Pressures on teachers' time from other priorities and exacerbated by staff absences or lack of cover, were frequently mentioned as something that could limit planning and participation. However, some headteachers and mentors stated that effective school planning and foresight could limit the impact of other priorities and time commitments.

Limitations has to be time for the science mentors to get together more regularly to discuss a collaborative way forward with science. I know that we still had numerous action points to address but ran out of time to do these and now with new SIP priorities in different schools, science is not a focus for all and therefore the science group within the Learning Community is no longer and it is down to individual schools to continue to take science forward. It is a fantastic initiative run by SSERC and something that I strongly believe all schools that participate in benefit hugely from. More GLOWmeets would allow the experts at SSERC to deliver training sessions to more teachers and engage the more reluctant staff members. Within [the school] itself we have a robust science progression plan that staff are now happy with using, we have a science hub that is accessed by all classes termly. We are very much well on the science journey.

Mentor response

The qualitative comments from mentors and headteachers also identified support from school and local authority managers as important for ensuring science was reflected

in School Improvement Plans and so reducing its vulnerability to other pressures and time.

> *Staff knowledge and understanding was increased which had a direct impact…An authority commitment to ensure the programme is included into school improvement planning, advance warning of taking part in the programme (1 year) would have been useful as many staff meeting/in-service had already been accounted and committed to other things when we began course. This meant that our CPD events relied on many teachers coming along, many of whom had completed their PRD's with a focus on other areas.*
>
> Mentor response

> *The limitation on the programme within the learning community is giving the mentors time out of class to ensure that there is a consistency across all schools of positive learning experiences for the children. There will always be excellent practice in schools from specific teachers at specific stages but in my opinion a programme like this is looking at all children in all schools receiving a similar experience that therefore means as they leave P7 and attend their respective High Schools that the children are all at similar stages within their learning of science. This is something that I think we need to continue to promote and work on, however with the continued change within each school regarding their SIP focus this is going to be a challenge. As an individual school I feel that we are in a positive place and on a positive journey with science and our teachers are on this journey with us.*
>
> Headteacher response

Mentors and headteachers highlighted the importance of staff commitment and enthusiasm in sustaining the positive impact of the SSERC CLPL in often challenging circumstances and headteachers recognised the importance and value of mentors in this process.

> *Our science champion/mentor has used the learning across the school with pupils, with colleagues also accessing learning opportunities. Time remains a factor in trying to take forward with all staff team and having them working at the same higher level of confidence as the science champion. We are getting there to allow this to have a greater impact including how we try and offer science within the school.*
>
> Headteacher response

Section 5: Insights from Local Authority officers/ QIOs

In 2015 and again in 2018, the external evaluation included an additional strand that aimed to elicit the views of local authority officers / QIOs responsible for science education in their councils and who were able to comment on the impact of the Programme. In 2015, information was gathered from QIOs using telephone interviews and in 2018, information was largely gained via an on-line proforma. In both cases, the main questions focused on eliciting the views of these stakeholders on the impact of the SSERC CLPL Programme, plans for sustaining and expanding the work of the mentors and whether there had been any challenges regarding the implementation of the Programme. For this component of the research we gathered information from 19 officers representing 14 of the Local Authorities involved in the Programme over the six years...

Aberdeen City (2)

Aberdeenshire

Angus

Argyll and Bute

Dumfries and Galloway

Falkirk Council (2)

Fife Council (2)

Glasgow

Highland Council (2)

Moray Council (2)

North Lanarkshire

Scottish Borders Council

South Ayrshire

Stirling and Clackmannanshire.

All of the officers providing information had been involved in the initial stages of setting up the SSERC CLPL Programme and the selection of clusters. Two of those providing information reported that they had not been involved in the setting up of the clusters and two of the officers had not attended any the Programme's residential sessions or external SSERC accredited CLPL sessions in the schools.

There was consensus that SSERC had worked collaboratively with stakeholders during the planning and setting-up phase in each local authority and took time to make presentations and discuss the approach with teachers in the clusters in order to inform but also reflect teachers' needs.

5.1 Local Authority officers' understanding of the aims of the Programme

There was consensus regarding the officers' understanding of the main aims of the CLPL Programme. Overall, they saw it as aiming to build the confidence and capability of practitioners regarding the delivery of science and technology within mentors' schools and across their primary clusters.

One officer also saw the Programme as aiming to develop the leadership of teachers regarding Science CLPL and learning and teaching. Another four noted that in their authority, the Programme aimed to build effective partnerships within the primary cluster in order to get clusters to work collaboratively on collegiate activities to better support the needs of individual and teams of teachers so as to promote pupil outcomes.

Overall, the officers saw the aims of the Programme as closely aligned with their local authority plans and priorities for science and technology education and curriculum development. Indeed, one officer stressed that this had been designed into the Programme from the outset in the authority to ensure science was reflected in the School and Cluster Improvement Plans. In Stirling and Clackmannanshire, the SSERC Programme was also seen as contributing to the *Developing the Young Workforce* agenda. In Fife local authority, there had been a move from 'STEM' to 'STEAM' to improve articulation of the science and arts topics across 3-18 curriculum and was developing its Skills Framework and SSERC was seen as a key partner in helping to promote the capacity of staff to develop this.

5.2 Local Authority officers' account of the impact of the Programme

All but one of the officers reported that the Programme had made a major impact regarding primary teachers' capability to teach quality science topics as part of the curriculum with one officer stating that it had met this aim to some extent.

In 2018, the Programme was also seen as having contributed to primary-secondary working. For example, working to promote transition, impact on secondary pedagogy or lesson content. The nature of the Programme was also reported to have facilitated more collaborative working and professional dialogue across clusters. In 2018, there

were five officers who thought that the Programme had made some contribution to shaping local authority plans regarding science and STEM education.

Officers typically highlighted mentors' impact on raising the profile of science and technology across the participating clusters and the capacity of their colleagues.

> *SSERC primary mentors are now delivering CLPL for all primary teachers across the local authority. There are 4 twilights across the year. Each twilight event is attracting around 45 teachers from across Moray. Glow is being used to share information.*
>
> Moray Local Authority Officer

> *This was a fantastic opportunity for the clusters involved, having access to quality intensive CLPL, as well as funding for external providers was invaluable in up-skilling our practitioners. The networking opportunities between staff was key when creating the Science Skills Frameworks for consistency across the LA. We are hoping to extend our experience of this with two additional clusters taking part in this session.*
>
> South Ayrshire Local Authority officer

> *All involved have raised the profile of the delivery of science within their cluster. All clusters have continued to work together after being involved in this process. It has linked in with the local authority development of the primary science framework which supports all practitioners in the delivery of Science and Technology Experiences and Outcomes*

> *There has been a clear impact on mentors' own skills in science education and as facilitators of CLPL in order to foster working in more collegiate ways across the clusters to help support other colleagues and improve their ability to teach science topics…it has met all of the [Programme] aims across all three of the clusters.*
>
> Highland LA Officers

> *I have very high praise indeed for all the SSERC team. Their training and resources have been of a very high quality and has had considerable impact on the practitioners involved.*
>
> Argyll and Bute LA officer

Local authority officers often referred to their own verification visits, evaluations and HMIe inspections when evidencing the impact of the SSERC Cluster Programme. In one local authority, an evaluation of CLPL had found well over 90% of participants reported high levels of satisfaction with SSERC CLPL.

> *The impact is clear across the five clusters of schools involved…the amount of science included in the curriculum has increased…teachers' confidence has increased…science is now written into school and cluster plans. There are other pockets of good practice elsewhere in the authority and other initiatives, but in the [SSERC] clusters, it has taken the whole area of STEAM forward, which is exactly what we had hoped for. SSERC is*

unique in that their CLPL is well thought through, is adapted to suit our needs and is of an extremely high quality.

Fife LA Officer

There were also examples of the SSERC Programme contributing to the schools' parental engagement, using science and STEM as a vehicle.

Children were keen to request Science and STEM-based clubs during and after school, there may have been an increase in engagement with events such as open days at Dumfries House etc. with their families. Schools shared STEM and Science learning with parents and carers through open afternoons and curriculum evenings.

South Ayrshire LA officer

Overall, the officers reported that the Programme had made a positive difference to collaborative working and professional dialogue across those primary schools in the participating clusters. In some cases, specific working groups have been established as a result of mentors' activity and this has helped to take forward and sustain their work.

The Lossiemouth cluster has created a working group that is providing excellent CLPL and leadership.

Moray LA Officer

All clusters have continued to work together after being involved in this process in other science developments, supporting each other and providing further CLPL for their colleagues to attend.

Highland LA Officer

The design of the Programme was highlighted by most of those officers providing evidence as being key to the successful impact and they made reference to its practical nature and residential approach as well as the setting of collaborative developmental tasks. Indeed, the officers, like other stakeholders, highlighted the importance of the collaborative developmental activity that was developed at the initial residential event, implemented across the cluster and then reported and reflected upon at the second residential event eight months later. Some officers were looking at ways to draw on this reflective collaborative model to inform school and cluster CLPL strategies.

Local authority officers saw the residential aspect of the Programme as an important factor in its success because it allowed time away from school distractions and facilitated professional dialogue and building social relationships that helped to bond mentors and strengthen their networking. For this reason, local authority officers often

stressed the importance of the SSERC Cluster model which appeared to require a substantial investment of time and resources, as having a substantial and sustained impact.

> *It's important that the CLPL is face-to- face. We don't want to see the main form of CLPL as something that is virtual…the human interaction builds the cluster and it becomes a unit that will work together. There is a place for on-line CLPL support, but this should be supplemental.*
>
> Fife LA Officer

> *The residential approach has facilitated the creation of a very effective development group that can work with a high level of leadership and autonomy.*
>
> Stirling and Clackmannanshire LA Officer

This meant that the participating local authorities were willing to invest in the Programme and its approach. In one local authority, the officer reported that the SSERC Primary Cluster Programme is so highly valued that mentors and headteachers found ways to ensure mentors can attend the SSERC Programme's residential events. In Fife, for example, funding has been allocated for cover for the weekdays (Thursday and Friday for part of residential and Friday for Part 2 residential) with staff giving up their free time to attend the Saturday of the Part 1 and 2 residentials.

In one local authority, the officer reported that the positive impact of the Programme and experiences of participating staff was disseminated via headteacher meetings and this promoted an increase in teachers in other clusters signing up for SSERC CLPL courses.

While not an aim of the SSERC Primary Cluster CLPL Programme, officers' comments illustrated examples where the mentors' work had contributed to closer partnership working between primary and secondary schools in their clusters.

> *There has been some increase in closer collaboration between primary and secondary colleagues within in the clusters. We will have to see whether this is sustained. It needs commitment from both primary and secondary teachers to maintain and develop the dialogue. This also needs time.*
>
> Highland LA Officer

In Fife, examples were provided of the SSERC Programme fostering useful collegiate working between primary schools and their associated secondary schools. For example, Inverkeithing Cluster had a secondary colleague working with primary colleagues to help develop joint plans and transitional activities. In Stirling and

Clackmannanshire, particularly in the Wallace High Cluster, the SSERC Programme had been very influential in promoting collaboration between primary and associated secondary schools. The impact of this work had extended beyond science and technology to other transitional opportunities and contributed to the *Developing the Young Workforce* activities. In Moray such developments were seen as being at 'a very early stage' but it was expected that there would be a significant increase on cross sector working in the coming year.

In Highland and Borders there was close working between the primary and secondary schools in the participating clusters and the mentors had helped maintain these good links and were looking to explore transition activity. Another officer stated that impact on promoting cluster links with secondary schools varied and highlighted that this was an issue beyond the SSERC Programme and clusters involved and was a common issue across Scotland.

One officer stressed that there was a need at national level to promote secondary teachers' engagement with primary colleagues. One suggested that local authorities could focus on encouraging relevant secondary teachers to join their primary colleagues on the SSERC Cluster Programme. However, the challenges of finding appropriate time and cover would have to be addressed. One strategic informant noted that the extent to which local authorities encouraged secondary and primary schools to liaise and collaborate regarding science and STEM varied.

5.3 Local Authority officer's views on challenges when applying the Programme to practice?

While officers reported that there had been no challenges regarding applying what had been learned from the Programme to practice in the clusters, they did highlight challenges regarding sustaining the focus of mentors' planned science and technology activity across their clusters. This appeared to feature more as a theme in 2018 compared to 2015, with LA officers more likely to stress the challenge of maintaining momentum when mentors moved to other clusters or outwith the local authority. Also, a shortage of supply cover, or finding funding for supply cover, was reported by some to be a factor in limiting teachers access to some of the SSERC CLPL available "even if funding is there for supply cover, there are no available teachers".

External factors mainly changes in key staff and other demands on teachers' time were also seen as limiting the impact of some mentors to extend and sustain their impact.

The second cluster, Forres, has struggled with staffing issues that have impacted on their ability to lead on CLPL across the ASG.

Moray LA Officer

Success was limited to the period of training, which made a big impact on the primary schools involved. Demands and other initiatives have diminished the provision for science IS.

Scottish Borders LA Officer

The Programme has been of great benefit to the staff involved, and (where these staff remain in post) others within their schools and even other clusters. The challenge is where staff move on and the momentum is not sustained.

Stirling LA officer.

Local authority officers commented that cluster headteachers had a key role to play in that "some schools in the cluster allowed more time for staff involved in the Programme to meet and plan". Other challenges included pressure on teachers' planning and development time to address other competing priorities and issues for their Associated Schools Groups (ASGs). These priorities included the national and local government focus on Literacy, Numeracy and Health and Wellbeing in Primary schools. While some officers stressed that within CfE, science and technology could make cross-curricular contributions to these learning areas these priorities had, in some cases, displaced some planned science CLPL in schools.

Two officers highlighted a particular challenge regarding applying the CLPL to practice that was more to do with ensuring that all teachers in their local authorities could benefit from the SSERC Primary CLPL Programme given the limits of time, cover and resources. However, in such cases, measures were being applied to try and maximise the impact of the mentors' work more widely across the local authority.

Only 2 out of 8 ASGs in Moray were chosen to be part of the SSERC Programme. This has led to an inequality of experience across the authority. All ASGs would have benefitted greatly from this Programme. This is why we have begun the twilight CLPL sessions, delivered by the SSERC primary mentors. We are currently exploring how to make the CLPL, professional sharing and transition experience sustainable across the authority.

Moray LA Officer

The challenge which was envisaged from the outset was in terms of equity and allowing the other 21 clusters in North Lanarkshire to gain the same opportunities as the two involved in the SSERC Programme.

North Lanarkshire LA Officer

Another officer stressed that the main challenge was how best to 'extend this excellent professional learning' across the other seven clusters given the limited resources available. In rural and remote areas, LA officers noted that their geographic factors meant there could be difficulty in "gathering practitioners together in a manageable way" and "the challenges of island geography" meant that meetings relied heavily on video links. In another rural local authority, while the benefits of the SSERC PCP Programme were recognised, one local authority officer highlighted issues regarding the Programme's reach and sustainability, given staff changes and the local geography.

> *Two clusters [that had gone through the SSERC PCP]…each had a mentor and those mentors should have been able to work together to share information and across the authority, [but] some of them left the authority altogether, some of them moved schools and some of them didn't have the confidence necessary to go out and do things other than in their own school, and actually the geography again [was a factor]…There has to be a different model for rural authorities where their geographies are a challenge.*
>
> Dumfries and Galloway. LA officer

5.4 Local Authority officer's views on sustaining and extending the mentor approach across their authority

The officers generally reported that mentors' work in their respective clusters has been sustained and developed since their involvement in the SSERC Programme and had continued to positively influence the teaching of science and technology in those schools already involved with the Programme.

> *There was evident momentum during the Programme and the mentors have continued to work together systematically after their involvement in the main Programme.*
>
> Highland LA Officer

Sustaining and building on the work of the mentors was strongly facilitated where local authority officers and headteachers had agreed that the mentors' plans and activity would be written into the school and cluster plans. Again, officers emphasised the need to systematically embed the learning from the SSERC CLPL into school and cluster planning in order to sustain the impact of the Programme and offset any original mentors moving on. For example, in Glasgow, the local authority team, including RAiSE funded Primary Science Development Officers built on the SSERC mentor capacity and model to promote cross sector work and developing teams of teachers as leaders of STEM learning., Similarly, in Fife the RAiSE PSDO and local authority were able to draw on the expertise and capacity of SSERC mentors to address complementary objectives. Each local authority involved in the RAiSE pilot programme received funding through the PSTT Sustain and Extend Programme (PSTT SEP) to

further develop the mentor network and support them in providing experiential professional learning opportunities beyond the original clusters.

The local authority officers' comments also emphasised that there were substantial barriers to extending the approach beyond the clusters and across their authorities without additional resources. A common theme in the officers' comments regarding difficulties in co-ordinating further development of the mentors' work was the diminishing level of local authority personnel to support CLPL activity across schools. Officers argued that given this situation, there would be far more onus on schools and clusters to build their own capacity to provide CLPL. Some local authority officers stated that this emphasised the need to ensure SSERC was able to provide continued, or periodic, follow-up support to local authorities to help schools to sustain and build their CLPL capacity and capability regarding science and technology education.

In 2015, one officer recommended that at the very least, there should be provision at local authority level for a person with a clear coordinating role for science and who had some time allocated to strategic activity of helping to sustain the work of SSERC mentors. This was seen as key in fostering primary and secondary collaboration. In 2018, this feature was introduced in those local authorities that were involved in the RAiSE initiative pilot with its introduction of Primary Science Development Officers (PSDOs) Here, LA officers reported that this had, indeed helped to support and extend the impact of SSERC mentors. In such cases the presence of SSERC mentors provided PSDOs with local capacity on which to build and contribute to the RAiSE Programme objectives. This complementarity benefited both programmes.

Other approaches to further build on the SSERC Cluster Programme impact were also developed. For example, in Fife other sources of funding had been used to develop the CLPL infrastructure.

> *We're working with SSERC to explore using some funding from the Primary Science Teaching Trust (PSTT) to support the deployment of a teacher who will facilitate expanding and extending the mentors' work across the local authority.*
>
> Fife LA Officer

5.5 Local Authority officer's views on the need for further support in sustaining and extending the Programme across their Authority

There was consensus from local authority officers regarding the need for continued support from SSERC to support and extend the developments that had been evident as a result of the initial clusters' involvement. In 2015, the lack of dedicated officer to support science and technology developments was frequently seen as a strong rationale for continued and more support from SSERC. Suggestions for further support

included ideas and case studies on how Science education CLPL could best address the challenges faced by rural and remote schools on ways to build on the impressive impact from the SSERC STEM education programmes for teachers. Suggestions included, developing further on-line and technology-supported approaches.

As highlighted in Section 5.4, the picture emerging from the local authority officers over the duration of the Programme has been one where there has been a diminishing ability to support and co-ordinate science education CLPL particularly because of reduced staffing. Officers drew attention to the limited resources and lack of funding to provide local authority staff to help take forward ideas from the Programme as one officer stated, 'no one is in post now so there is no support available within the authority to help sustain the process' and stressed the need for continued SSERC CLPL opportunities to be provided to the other clusters who had yet to participate in the local authority.

In addition to requesting on-going provision of the Primary Cluster Programme, officers also highlighted the need for SSERC's support through their wider range of CLPL courses and general advice via phone and on-line newsletters and information

Section 6: Pupil survey findings

This section of the report summarises findings from the aggregation of three cohorts of pupils who took part in a baseline and follow-up survey conducted in the academic years 2015/2016 (cohort 1), 2016/2017 (cohort 2) and 2017/2018 (cohort 3). It is divided into the following sections:

- Survey timetable and responses;
- Approach to analysis;
- Pupil enthusiasm for school and school subjects;
- Pupil enjoyment of science activities;
- Pupil confidence in conducting science tasks;
- Pupil beliefs about science;
- Summary of findings.

6.1. Survey timetable and responses

Baseline surveys in each of the three years took place early in the autumn session with the follow-up surveys distributed towards the end of the following summer term. Once pupil responses were coded and entered, matched at individual pupil level and cleaned, the final database contained 11,793 cases (6288 P2-P4, 5505 P5-P7). In total 139 schools who took part in the SSERC PCP CLPL, returned questionnaires for pupils at both the baseline and follow-up surveys. Some additional attrition in pupil returns was due to an inability to match baseline and follow-up survey pupil identifiers ascribed to pupils by schools.

Tables 6.1 provides additional detail on respondents in terms of sex and year groups. The table gives a good indication of the 'even' spread of responses across the year groups and from males and females.

Table 6.1 - Sex of respondents

	All pupil responses			
	P2-P4 pupils		P5-P7 pupils	
Sex	Frequency	Percentage	Frequency	Percentage
Male	3157	50	2788	51
Female	3127	50	2716	49
Total	**6284**	**100**	**5504**	**100**

Tables 6.2 and 6.3 give additional detail on responses by pupil year groups. Like Table 6.1, they also show a relatively 'even' spread of responses by individual year group.

Table 6.2 - P2-P4 pupil year groups			*Table 6.3 – P5-P7 pupil year groups*		
Year Group	***Number***	***Percentage***	***Year Group***	***Number***	***Percentage***
P2	1805	29	P5	1909	35
P3	2120	34	P6	1800	33
P4	2350	37	P7	1791	33
Total	**6275**	**100**	**Total**	**5500**	**100**

6.2. Approach to Analysis

Previous annual evaluation reports provided substantial analysis on pupil findings and associations with a number of additional variables including gender, deprivation and year group. For this final evaluation report, we have adopted a simplified two strand approach to analysis:

Strand 1 - reporting of aggregate findings for all P2-P4 and P5-P7 pupils;

Strand 2 - analysis of impact on pupils based on headteacher's rating of the SSERC CLPL impact on their school's science education.

Strand 1 of the analysis includes an aggregation of the data from the three pupil cohorts presented in relation to the P2-P4 and P5-P7 pupil groups. Any statistically significant associations in the data over the period of the evaluation are noted. Pupil data for P2-P4 and P5-P7 are presented and discussed separately since the questionnaires used for each grouping were different. Where baseline and follow-up survey figures are presented in one table the follow-up figures are in red. Where tables include information on statistical significance 'NS' is used to indicate no significant difference. Where significance is established, generally using the Wilcoxon Matched Pairs Sign Test[5], this will contain the P value (significance level) and an indication of the direction of change in pupil responses (either negative or positive).

Strand 2 of the analysis is focused on identifying impact of the SSERC CLPL on pupils. Headteachers of schools involved in the SSERC CLPL, who had submitted baseline and follow-up pupil questionnaires, were asked to provide an overall rating for the impact of the SSERC mentor initiative. This was scored on a six-point scale[6]. As we have seen elsewhere in this report, the vast majority of responding headteachers

[5] The **Wilcoxon signed-rank test** is a non-parametric statistical hypothesis test used to compare two related samples, matched samples, or repeated measurements on a single sample to assess whether their population mean ranks differ.

[6] 1 represented little/no impact on the school's science education and 6 represented major and sustained impact on the school's science education.

indicated that SSERC had made a positive difference to their science education. From Headteachers' numerical responses, schools were grouped into either 'lower' or 'higher' impact categories (1-4 lower) (5-6 higher) to give an overall impact score. Category allocation was based on individual responses in relation to the median scores for schools. Unfortunately, not all headteachers provided an impact rating (see Tables 6.4 and 6.5) and this restricted the generalisability of the findings. Moreover, it is important to bear in mind that the impact variable represents a relatively crude measure of impact and the grouping of 'higher' and 'lower' is based on a statistical desire to maximise the number of schools in the two groups and does not represent a definitive 'evaluation' of the impact of the SSERC CLPL. No headteacher rated impact as a one and the majority of those responding in the 'lower category' recorded a four.

Table 6.4 –Headteacher impact rating P2-P4

Headteacher rating	Number of Schools	Number of Pupils
Lower impact	21	1280
Higher impact	22	1247
Total	**43**	**2527**

Table 6.5 –Headteacher impact rating P5-P7

Headteacher rating	Number of Schools	Number of Pupils
Lower impact	19	971
Higher impact	22	1109
Total	**41**	**2080**

From Tables 6.4 and 6.5 we can see that substantial numbers of schools and their pupils are included in each grouping which enables some robust statistical analysis to be carried out. However, it is important to remember that the groups represent less than 40% of all responding pupils and approximately a third of schools who took part in baseline and follow-up surveys.

Some additional notes on analysis

The relationship between Deprivation and SSERC CLPL Impact

School level deprivation: To examine the association between levels of deprivation and impact in this evaluation we utilised school level data from the SIMD[7] 2016 dataset. This approach involved categorising the schools into two groups, those with less than 20% of their pupils in deprivation category deciles one and two and those

[7] www.simd.scot/

with 20% or more of their pupils in deprivation category deciles one and two. Tables 6.6 and 6.7 give an indication of the numbers of schools and pupils in each category.

Table 6.6 – P2-P4 - schools and pupils by deprivation category

SIMD category	Schools	Pupils
Higher levels of deprivation*	32 (27%)	1974 (31%)
Lower levels of deprivation**	87 (73%)	4314 (69%)
Total	**119 (100%)**	**6288 (100%)**

* 20% or more pupils in deciles one and two
** less than 20% of pupils in deciles one and two

Table 6.7 – P5-P7 - schools and pupils by deprivation category

SIMD category	Schools	Pupils
Higher levels of deprivation*	36 (28%)	1733 (32%)
Lower levels of deprivation**	93 (72%)	3772 (68%)
Total	**129 (100%)**	**5505 (100%)**

* 20% or more pupils in deciles one and two
** less than 20% of pupils in deciles one and two

While there are obvious differences in the proportion of schools/pupils in the two deprivation categories the numbers are still sufficient to allow some additional statistical analysis to take place. The variation in the number of schools and number of pupils in each category suggests that, on average, schools with higher levels of deprivation are more likely to have larger pupil rolls than schools with lower levels of deprivation.

Deprivation and SSERC CLPL impact: There was some evidence to suggest that the SSERC CLPL was more likely to have an impact in schools with higher levels of pupil deprivation. Headteachers in schools with higher levels of deprivation were significantly ($P<0.000$) more likely than headteachers in schools with lower levels of pupil deprivation to report a higher positive impact of the SSERC CLPL on their school science education. See Tables 6.8 and 6.9

Table 6.8 –Headteacher impact by school deprivation P2-P4

Headteacher impact rating	% Pupils in lower deprivation schools	% Pupils in higher deprivation schools
Lower impact	56	36
Higher impact	44	64
Total	**100** (N=1869)	**100** (N=658)

Table 6.9 –Headteacher impact by school deprivation P5-P7

Headteacher impact rating	% Pupils in lower deprivation schools	% Pupils in higher deprivation schools
Lower impact	51	38
Higher impact	49	62
Total	**100** (N=1398)	**100** (N=682)

A note on attribution

Establishing causality in social science research is notoriously difficult and expensive, often requiring large scale randomised control trials (RCTs) which can be difficult to operationalise in the real world and the findings difficult to apply in other settings (Pawson and Tilley 1997). In negotiation with SSERC and Scottish Government colleagues, the ROC team developed an approach that sought to establish the impact of the SSERC Programme through comparing the changes in the pupil data (baseline to follow-up survey) with impact rating collected from school headteachers (collectively called the Headteacher Impact Rating). In the pupil strand we set out to establish whether, and to what extent, there was a change in pupil self-efficacy and enthusiasm for school and science across the schools involved in the SSERC CLPL Programme.

This section of the report presents a number of significant associations between the reported impact of the SSERC CLPL on schools' science education and findings from the pupil surveys. We can see instances where pupil enthusiasm for science, enjoyment of science activities, confidence in conducting science activities and beliefs about science are positively or negatively associated with headteacher rating of impact of the SSERC CLPL on their school. However, it is important to remind ourselves that such associations should not be taken to represent causality. Whilst there appears to be a relationship between the levels of SSERC CLPL impact and a number of the findings from the pupil survey we should also be aware that other variables may be influencing the picture. For example, it may be the case that the SSERC CLPL impact is higher in some schools because there are staff in the school with a strong interest in science education and who are keen to drive the initiative forward.

6.3 Pupil enthusiasm for school and school subjects

The first area of investigation in the pupil survey concerned enthusiasm for school and school subjects. Discussions within the evaluation team and with SSERC officers at the outset of the evaluation identified pupil enthusiasm for science as a potential indicator of SSERC CLPL impact. The logic being that more confident and enthused teachers could be reflected in more confident and enthused pupils. In addition to asking about enthusiasm for science we also sought comparative data on pupil enthusiasm for other subjects and enthusiasm for school in general. Pupils rated their enthusiasm/liking for school on a three-point scale and for individual subject areas on a four-point scale.

Pupil enthusiasm for school

In relation to pupil attitudes towards school in general, Table 6.10 summarises responses for P2-P4 pupils and Table 6.11 summarises responses for P5-P7 pupils. The P2-P4 questionnaire opted for age appropriate response categories comprising

faces (smiling, neutral, unhappy etc.) whereas the P5-P7 questionnaire used word-based categories. In addition, some of the questions in the P2-P4 questionnaire represented simplified versions of those in the P5-P7 questionnaire. This means that, in some instances, comparing findings for the two groups requires a degree of circumspection.

P2-P4 pupils

A majority of P2-P4 pupils in both the baseline and follow-up surveys indicated liking school while a small minority at both stages reported disliking school. The Wilcoxon signed rank test showed a statistically significant (P< 0.001) negative shift in pupil attitudes towards school between the two surveys with increased numbers of pupils indicating *neither liking nor disliking* school and fewer pupils reporting *liking school* at the follow-up stage.

Table 6.10 – P2-P4 How much do pupils like school?

Percentage	Baseline survey %	Follow-up survey %
Smiley face (like school)	**65**	**57**
Straight face (neither like nor dislike school)	27	35
Don't like school (unhappy face)	8	8
Total (N=5984)	**100**	**100**

P5-P7 pupils

Looking at the findings for the P5-P7 group we can see that pupils were less likely than the P2-P4 pupil group to indicate *liking school* and more likely than them to indicate *liking school sometimes* at both the baseline and follow-up stages.

Table 6.11 – P5-P7 How much do pupils like school?

Percentage	Baseline survey %	Follow-up survey %
Really like school	36	28
Like school sometimes	**58**	**62**
Don't like school	7	11
Total (N=5176)	**100**	**100**

As with the younger group of pupils, the Wilcoxon signed rank test showed a statistically significant (P< 0.000) negative shift in pupil attitudes towards school between the two surveys with increased numbers of pupils indicating *liking school*

sometimes and fewer pupils reporting *really liking school* at the follow-up stage compared with the baseline survey.

Impact of SSERC CLPL and pupil enthusiasm for school

P2-P4 pupils

Pupil enthusiasm for school showed a general reduction between the baseline and follow-up surveys irrespective of the SSERC headteacher impact rating. However, the reduction in enthusiasm among pupils in schools with a lower SSERC impact rating was statistically significant (P<0.000) while in those schools with a higher SSERC impact rating the reduction was not significant (P=0.340).

P5-P7 pupils

In terms of SSERC CLPL impact and pupil enthusiasm for school, we noted a significant (P<0.000) reduction in enthusiasm for school between the baseline and follow-up surveys for pupils in both higher impact and lower impact rated schools.

Pupil enthusiasm for specific school subjects

Pupil enthusiasm for a range of school subjects including science was recorded in both the baseline and follow-up surveys.

P2-P4 pupils

P2-P4 pupils were most likely to indicate PE, ICT and Science as popular subjects. Table 6.12 shows that in both baseline and follow-up surveys three quarters or more of respondents indicated liking these subjects *a lot*. On the other hand, Maths and numeracy, RME and Language and literacy were less popular subjects. In the case of

RME and Language and literacy there was a significant negative shift in the profile of pupil attitudes towards the subjects between the two surveys.

Table 6.12 – P2-P4 How much do pupils like the following subjects?

How much do pupils like?	Percentage Big smile face (like a lot)		Small smile face (like some)		Small unhappy face (dislike some)		Big unhappy face (dislike a lot)		Significance
	B	F	B	F	B	F	B	F	
ICT *(N=6002)*	**83**	**83**	10	12	4	3	3	3	NS
PE *(N=6082)*	**81**	**80**	13	14	4	5	3	2	NS
Science *(N=6039)*	**75**	**75**	15	16	6	6	4	4	NS
Maths and numeracy *(N=6078)*	**63**	**60**	20	24	10	10	7	7	NS
Language and literacy *(N=6082)*	**49**	**40**	32	39	12	14	8	8	-ve P<0.000
RE/RME *(N=5905)*	**52**	**44**	25	29	13	15	11	12	-ve P<0.000

B – Baseline survey F – Follow-up survey

Impact of SSERC CLPL (P2-P4)

Focusing on the P2-P4 pupils with a SSERC CLPL headteacher impact rating we noted a few significant associations between the higher and lower impact groups and between the baseline and follow-up surveys. However, none of these associations indicated that the SSERC CLPL has had a significant impact on pupil enthusiasm for science or any of the other subjects.

P5-P7 pupils

Turning to the findings for the P5-P7 pupils (Table 6.13) we see that the statistically significant negative shift in attitudes towards school in general was reflected in attitudes to all of the individual subjects between the baseline and follow-up surveys. As with the P2-P4 pupils PE, ICT, and Science were the most popular subjects.

Table 6.13 – P5-P7 How much do pupils like the following subjects?

How much do pupils like?	Percentage Like a lot		Like some		Dislike some		Dislike a lot		Significance
	B	F	B	F	B	F	B	F	
PE *(N=5273)*	**79**	**71**	15	19	4	7	2	4	-ve P<0.000
ICT *(N=5301)*	**79**	**74**	17	21	3	4	2	2	-ve P<0.000
Science *(N=5218)*	**69**	**63**	23	27	6	7	3	3	-ve P<0.000
Maths and numeracy *(N=5314)*	**49**	**45**	31	33	13	14	7	8	-ve P<0.000
Language and literacy *(N=5317)*	27	24	**50**	**48**	17	20	7	8	-ve P<0.000
RE/RME *(N=5151)*	22	20	**38**	**35**	24	26	16	19	-ve

P<0.000
B – Baseline survey F – Follow-up survey

Impact of SSERC CLPL (P5-P7)

Looking at the P5-P7 pupils with a SSERC CLPL headteacher impact rating we saw pupils recording a loss of enthusiasm for; Science, PE, ICT and RE/RME irrespective of the headteacher impact rating for the SSERC CLPL. With Language and literacy and Maths and numeracy there was a significant loss of enthusiasm for the subjects among the pupils in higher impact rated schools but not in those schools with a lower rating score. Again, these findings suggest no evidence for the SSERC CLPL having a measurable impact on pupil enthusiasm for science or any of the other subjects.

Summary point – Attitudes towards school and individual subjects

Although we should exercise a degree of caution in comparing the P2-P4 and P5-P7 results directly we can conclude that:

- There was little evidence of impact of the SSERC CLPL (measured by the headteacher impact rating) on pupil enthusiasm for science or any of their other subjects over the period of the evaluation;
- The majority of P2-P7 pupils appeared positive about school and their subjects;
- Attitudes towards school and individual subjects were more positive generally among the P2-P4 pupils than the P5-P7 pupils. There was a statistically significant negative shift in attitudes towards school and all of the specific subjects between the P5-P7 baseline and follow-up survey;
- RME/RE and Language and literacy were the least popular subjects among pupils. In P5-P7 RME/RE was also the only subject where less than 25% of pupils recorded *like a lot* in both baseline and follow-up surveys.

6.4 Pupil enjoyment of science activities

The pupil survey also focused on pupil enjoyment of a range of science activities. The evaluation team and SSERC colleagues agreed that improved teacher skills, knowledge and resources for teaching science resulting from teachers' experience of SSERC CLPL may be observed in increased pupil enjoyment of science activities.

Pupils indicated their enjoyment (on a four-point scale) with a number of activities associated with science both in and outwith school. Results for P2-P4 are presented in Table 6.14 while the results for P5-P7 are contained in Table 6.15.

P2-P4 pupils

Science activities were popular among P2-P4 pupils. Table 6.14 shows that a clear majority of the pupils reported *really enjoying* all of the activities at the baseline survey. However, enjoyment was generally lower by the follow-up survey stage and was significantly lower for the following five activities:

- Listening to the teacher talking about science (P<0.001);
- Answering the teacher's science questions in class (P=0.015);
- Writing about science in school (P<0.001);
- Doing science homework (P<0.001);
- Reading about science at home (P<0.001).

Interestingly, *Doing experiments in class* and *Going to the science museum or science centre* both witnessed a significant positive shift in pupil enjoyment between the baseline and follow-up surveys.

Table 6.14 –P2-P4 How much do pupils enjoy the following science activities?

Percentage	**Big smile face** (Really enjoy)		**Small smile face** (Enjoy)		**Small unhappy face** (Dislike)		**Big unhappy face** (Really dislike)		**Significant difference between baseline and follow-up**
	B	**F**	**B**	**F**	**B**	**F**	**B**	**F**	
Doing experiments in class *(N=5639)*	**78**	**78**	14	17	4	3	4	2	+ve P=0.002
Listening to the teacher talking about science *(N=5752)*	**59**	**50**	24	32	10	11	7	7	-ve P<0.001
Working in groups in class to do science *(N=5680)*	**66**	**63**	19	22	9	9	7	6	NS
Working on my own in class to do science *(N=5465)*	**56**	**53**	19	22	10	12	15	12	NS
Answering the teacher's science questions in class *(N=5622)*	**57**	**51**	23	29	11	13	9	7	-ve P=0.015
Writing about science in school *(N=5343)*	**53**	**45**	22	26	13	16	12	13	-ve P<0.001
Reading about science in class *(N=5166)*	**59**	**54**	20	25	10	12	12	10	NS
Doing science homework *(N=3602)*	**60**	**51**	18	23	9	11	13	15	-ve P<0.001
Reading about science at home *(N=4700)*	**58**	**51**	19	24	9	12	13	13	-ve P<0.001
Watching science programmes at home *(N=4960)*	**66**	**63**	14	18	8	9	11	10	NS
Going to the science museum or science centre *(N=3051)*	**76**	**78**	10	11	5	4	9	7	+ve P=0.001
Watching science fiction programmes or films *(N=4814)*	**63**	**60**	16	20	8	9	12	11	NS

Black – baseline survey Red – follow up survey

Impact of SSERC CLPL (P2-P4)

There was some evidence to suggest that pupil enjoyment of science activities was associated with their headteachers' rating of impact of the SSERC CLPL. In schools with a higher impact rating, pupils witnessed a significant positive shift in their enjoyment of five science activities from the baseline to follow-up survey which was not replicated in schools with a lower impact rating. These activities were:

- Doing experiments in class (P<0.001);
- Working on their own in class to do science (P=0.010);
- Watching science programmes at home (P= 0.019);
- Going to the science museum or science centre (P<0.001);
- Watching science fiction programmes or films (P=0.006).

Moreover, on four other variables, pupils in schools with a lower headteacher impact rating saw a significant negative shift in their enjoyment of activities compared to the higher impact group who recorded no significant change on the same activities. These activities were:

- Answering the teacher's science questions in class **(**P=0.002);
- Writing about science in school (P=0.002);
- Doing science homework (P=0.002);
- Reading about science at home (P<0.001).

P5-P7 pupils

A number of science activities were clearly enjoyed by P5-P7 pupils although levels of enthusiasm were generally lower than among the P2-P4 pupils (See Table 6.15). As with the younger pupils, *doing experiments in class* and *Going to the science museum or science centre* were the activities with the highest enjoyment rating. However, unlike the younger pupils, all activities showed a significant negative shift in pupil enthusiasm between the baseline and follow-up surveys although *Doing experiments in class* and *Going to the science museum or science centre* were still 'really enjoyed' by a clear majority of pupils at the follow-up survey.

Table 6.15 –P5-P7 How much do pupils enjoy the following science activities?

Percentage	Really enjo		Enjoy		Don't like		Really don't like		Significant difference between baseline and follow-up
	B	F	B	F	B	F	B	F	
Doing experiments in class *(N=4969)*	**73**	**63**	24	30	2	5	1	2	-ve P<0.001
Listening to the teacher talking about science *(N=4930)*	26	20	**48**	**46**	20	26	6	8	-ve P<0.001
Working in groups in class to do science *(N=4897)*	**56**	**48**	33	39	8	9	3	4	-ve P<0.001
Working on my own in class to do science *(N=4715)*	**41**	**37**	32	34	18	21	8	8	-ve P=0.001
Answering the teacher's science questions in class (*N=4770)*	31	24	**45**	**43**	18	24	6	8	-ve P<0.001
Writing about science in school *(N=4473)*	25	20	**38**	**35**	24	30	12	15	-ve P<0.001
Doing science homework *(N=3161)*	**40**	32	33	**34**	16	21	11	13	-ve P<0.001
Reading about science in class *(N=4123)*	35	27	**39**	**38**	18	25	8	10	-ve P<0.001
Reading about science at home *(N=3317)*	35	29	**37**	**36**	20	25	8	10	-ve P<0.001
Watching science programmes at home *(N=3462)*	**52**	**47**	31	34	11	14	5	5	-ve P<0.001
Going to the science museum or science centre *(N=3817)*	**75**	**70**	19	23	4	5	2	3	-ve P<0.001
Watching science fiction programmes or films *(N=3729)*	**53**	**49**	31	32	12	14	5	5	-ve P<0.001

Black – baseline survey Red – follow up survey

Impact of SSERC CLPL (P5-P7)

As we can see from Table 6.15, all activities witnessed significant negative shifts in pupil enjoyment rating between the baseline and follow-up surveys. However, there were several qualifications to this picture when we reviewed the data against the headteacher impact rating. While these differences were less substantial than those with the P2-P4 group they are nonetheless encouraging. Pupils attending schools with a lower headteacher impact rating showed a significant negative shift in their enjoyment of the following activities between the baseline and follow-up survey:

- Working on their own in class to do science (P=0.003);
- Watching science programmes at home (P< 0.001).

This negative shift was not mirrored by pupils in schools with a higher headteacher impact rating where no significant change in pupil enjoyment was recorded. Interestingly, neither lower or higher impact group pupils showed significant changes in their enjoyment of:

- Going to the science museum or science centre science;
- Watching science fiction programmes.

Summary point - Reviewing the pupil enjoyment of science activities we can conclude the following:

- There was some evidence of a positive association between headteacher rating of the SSERC CLPL impact on school and pupil enjoyment of science activities. This association appeared more marked with the P2-P4 group than with the P5-P7 group.
- Science activities were generally popular among primary pupils and particularly so among P2-P4 pupils;
- *Doing experiments in class* and *Going to the science museum or science centre* were the most commonly enjoyed activities among both groups of pupils in the study;
- P5-P7 pupil reporting of enjoyment of science activities was significantly lower in the follow-up study than in the baseline on all of activities.

6.5 Pupil confidence in conducting science tasks

This section of the questionnaire sought information on pupils' confidence in conducting a number of science tasks. If the SSERC CLPL was having a positive impact on the teaching of science this could be seen in growing confidence of pupils to conduct specific science tasks.

While the P5-P7 questionnaire used the word 'confidence', the P2-P4 version substituted this term with the word 'happy'. Again, the P2-P4 questionnaire used categories comprising faces (smiling, neutral, unhappy, very unhappy.). Further, the P2-P4 question contained seven items while the P5-P7 version had 12. Table 6.16 summarises responses from the P2-P4 group and Table 6.17 contains findings from the P5-P7 group.

P2-P4 pupils

Both the baseline and follow-up surveys showed that, on all the question items, most P2-P4 pupils indicated *very happy*. Moreover, on all items there was a statistically significant positive shift in pupil responses between the baseline and follow-up surveys. This positive shift is well demonstrated in Table 6.16 where substantial

reductions in the percentage of pupils recording *very unhappy* and increases in the percentages indicating *happy* and *very happy* can be seen in most items.

Table 6.16 – P2 P4 How happy are pupils in their ability to complete the following tasks?

Percentage	**Big smile face** (Very happy)		**Small smile face** (Happy)		**Small unhappy face** (Unhappy)		**Big unhappy face** (Very unhappy)		Significance
	B	**F**	**B**	**F**	**B**	**F**	**B**	**F**	
I can predict what will happen in an experiment *N=5614*	**50**	**44**	25	36	12	13	13	7	+ve P=0.009
I can create a 'fair experiment' *N=5113*	**52**	**55**	21	28	12	10	16	7	+ve P<0.001
I can select appropriate equipment for my experiment N=*5265*	**56**	**59**	21	25	12	10	12	6	+ve P<0.001
I can carry out experiments *N=5402*	**57**	**59**	21	26	11	9	11	5	+ve P<0.001
I can discuss the results of the experiment N=*5395*	**52**	**52**	23	28	13	12	12	7	+ve P<0.001
I can show my findings in different ways N=*5167*	**51**	**49**	21	29	14	14	14	8	+ve P<0.001
I can make suggestions to make the experiment better N=*5300*	**55**	**55**	22	27	11	11	13	8	+ve P<0.001

Black – baseline survey Red – follow up survey

Impact of SSERC CLPL (P2-P4)

Focusing on the responses of pupils and the headteacher impact rating a number of significant findings emerge. There was a statistically significant positive shift in pupil happiness among pupils whose headteacher had rated the SSERC CLPL as high impact which was not matched by pupils in the lower impact group in the following tasks:

- I can predict what will happen in an experiment (P=0.008);
- I can discuss the results of the experiment (P<0.001);
- I can show my findings in different ways (P<0.001);
- I can make suggestions to make the experiment better (P<0.001).

In the lower impact group there was no statistically significant difference in pupil responses between the baseline and follow-up surveys.

P5-P7 pupils

Large majorities of P5-P7 pupil responses indicated that they were *confident* or *very confident* in their ability to successfully complete each of the 12 tasks listed in Table 6.17. Confidence was highest with the following items: *I can plan and design experiments*, *I can carry out experiments* and *I can collect evidence*. This is noteworthy

given how many pupils indicated enjoying *doing experiments in class* in the previous section. We also noted a statistically significant positive shift in confidence of P5-P7 pupils on eleven of the twelve science tasks in Table 6.17.

Table 6.17 – P5-P7 How confident are pupils in their ability to complete the following tasks?

Percentage	Very Confident		Confident		Not confident		Not confident at all		Significance
	B	F	B	F	B	F	B	F	
I know when a scientific experiment will help me find the answer to my question *N=5311*	25	26	**53**	**54**	17	16	6	4	+ve P<0.001
I can create a hypothesis to test my predictions *N=5201*	23	26	**38**	**41**	23	25	16	9	+ve P<0.001
I can create a "fair test" *N=5171*	**39**	**42**	37	41	15	13	9	5	+ve P<0.001
I can plan and design experiments *N=5217*	**48**	**47**	35	37	12	12	5	4	NS
I can select appropriate samples, equipment and other resources *N=5252*	**41**	**41**	**38**	**41**	15	14	6	5	+ve P<0.001
I can carry out experiments *N=5298*	**48**	**51**	35	35	12	10	4	3	+ve P<0.001
I can observe evidence *N=5217*	36	39	**41**	**43**	17	14	7	4	+ve P<0.001
I can collect evidence *N=5242*	**45**	**46**	37	40	13	11	5	4	+ve P<0.001
I can record evidence *N=5196*	**42**	**43**	36	40	16	14	6	4	+ve P<0.001
I can present data in different formats *N=5190*	27	27	**37**	**42**	24	24	11	7	+ve P<0.001
I can analyse and interpret data to draw conclusions *N=5189*	27	26	**35**	**41**	26	26	12	8	+ve P<0.001
I can review and evaluate results to identify limitations and improvements *N=5103*	23	23	**39**	**42**	24	25	14	10	+ve P<0.001

Black – baseline survey Red – follow up survey

Impact of SSERC CLPL (P5-P7)

Looking at the pupil data and the headteacher impact rating there were three variables where a significant difference between the higher and lower rated impact groups were recorded. Pupils attending schools which had received a higher impact rating than those in schools where the SSERC impact rating was lower were significantly more likely to indicate increasing confidence in the following three tasks:

- I can plan and design experiments (P=0.001);
- I can observe evidence (P=0.026);
- I can present data in different formats (P=0.040).

While the evidence was less ‘comprehensive’ than that witnessed with the P2-P4 pupils it still indicates that, in those schools where the SSERC CLPL has had greatest reported impact on science education, there is an associated growth in the confidence of P5-P7 pupils in conducting science activities.

Summary point - Reviewing the pupil confidence in carrying out science activities we can conclude the following:

- There was evidence of a positive association between the headteacher rating of the SSERC CLPL impact on school and pupil confidence in conducting science activities among both the P2-P4 and P5-P7 group, on several tasks we saw a growth in confidence between the baseline and follow-up survey among pupils in the higher impact group which was not matched by pupils in the lower impact group;
- In general, confidence in conducting science activities grew in both P2-P4 and P5-P7 pupils between the baseline and follow-up surveys;
- P2-P4 pupils appeared confident (very happy) in conducting most tasks while P5-P7 pupils reported higher levels in confidence in *Planning and designing* and in *Carrying out experiments*.

6.6 Pupil attitudes and beliefs about science (P5-P7)

P5-P7 pupils were asked several additional questions concerning their beliefs about science (see Table 6.18). The evaluation was keen to know if pupils’ beliefs and attitudes towards science were associated with the impact of the SSERC CLPL.

In the main, pupil responses indicated that they have relatively positive attitudes towards science. Indeed, aggregating the *mainly agree* and *strongly agree* categories resulted in large majorities of pupils agreeing with most statements. For example, more than 90% of pupils in the baseline and follow-up survey agreed that they were *amazed by the achievements of science*. Similar high percentages also agreed that it *was important for them to learn science in school.* There was also evidence of enthusiasm for continued involvement in science after school, 75% of baseline survey pupils and 71% of follow-up survey pupils agreed with the statement - *I would like to do more science when I finish school.*

Three of the statements were worded in such a way that agreement would not indicate a positive response. These were:

- Science is too specialised for most people to understand it;
- I don't think I’m clever enough to understand science; and;
- I don't understand the point of all the science being done today.

Agreement with these statements was substantially below that of the other items, while disagreement was substantially higher than the others. Interestingly, it was only the two latter personalised statements that showed any significant (positive) changes in pupil responses between the baseline and follow-up surveys. In each case pupils recorded increased levels of disagreement with the statement in the follow-up survey.

Table 6.18 – Pupil beliefs about science (P5-P7)

Percentage	Strongly agree		Mainly agree		Mainly disagree		Strongly disagree		Significance
	B	F	B	F	B	F	B	F	
I am amazed by the achievements of science *N=4659*	**57**	**56**	37	39	4	4	1	2	NS
Science is such a big part of our lives that we should all take an interest *N=4505*	**47**	**44**	37	40	11	12	4	5	-ve P=0.001
It is important to know about science in my daily life *N=4515*	**47**	**44**	40	40	11	13	3	4	-ve P<0.001
Science is too specialised for most people to understand it *N=4114*	24	19	**33**	**30**	25	28	18	24	-ve P<0.001
I don't think I'm clever enough to understand science *N=4300*	12	11	16	15	24	25	**47**	**49**	+ve P=0.005
I don't understand the point of all the science being done today *N=4135*	14	10	18	15	24	26	**45**	**48**	+ve P<0.001
It is important for us to learn science in school *N=4813*	**69**	**64**	25	30	4	4	2	2	-ve P<0.001
I can learn about science outside school too *N=4649*	**60**	**57**	29	31	7	7	4	5	NS
I would like to do more science when I finish school N=*4098*	**47**	**42**	28	29	13	17	12	13	-ve P<0.001
I talk to my parents/carers about science *N=4234*	30	27	**31**	**31**	19	21	21	22	-ve P=0.013

Black – baseline survey Red – follow up survey

Impact of SSERC CLPL (P5-P7)

There was some evidence that the headteacher impact rating was associated with pupil attitudes and beliefs about science. In response to the five following statements pupils in schools with higher headteacher impact ratings showed no significant change in their attitudes between the baseline and follow-up surveys while their peers in schools with lower impact ratings showed statistically significant negative shifts in their attitudes:

- I am amazed by the achievements of science (P=0.042);
- Science is such a big part of our lives that we should all take an interest (P=0.001);
- It is important for us to learn science in school (P=0.029);
- I would like to do more science when I finish school (P<0.001);
- I talk to my parents about science (P=0.033).

In two further statements pupils in schools with higher impact ratings again showed no change in their attitudes while pupils in schools with lower impact ratings indicated a statistically significant positive shift in their attitudes.

- I don't think I'm clever enough to understand science (P=0.038);
- I don't understand the point of all the science being done today (P<0.001).

Taking these findings together we can speculate that the SSERC CLPL may, through teacher involvement, operate to support the preservation of positive attitudes towards science among pupils and therefore potentially increased pupil involvement in science in future.

Summary point - Reviewing pupil attitudes towards science we can conclude the following:

- There is some evidence to suggest that the SSERC CLPL may have a role in supporting the preservation of pupil attitudes towards science when the general trend between the baseline and follow-up survey was for a more negative shift in pupil attitudes;
- More than 70% of pupils in P5-P7 *strongly agreed* or *mainly agreed* that they would like to do more science when they finished school.

6.7 Summary of Findings

The P2-P4 and P5-P7 baseline and follow-up surveys indicated a number of trends. Over the course of the academic year pupils become less positive about school in general. While P2-P4 pupil enthusiasm for particular subjects tends to remain fairly static with the majority of subjects including science among P5-P7 pupils all subjects are seen less favourably towards the end of the year. Where headteachers indicated that the SSERC CLPL had had a 'major and sustained' impact on the school's science education there was, as yet, no evidence of this positively affecting pupil enthusiasm for science.

When the evaluation focused more specifically on pupil enjoyment of science activities a number of important findings emerge. *Doing experiments in class* and *Going to the science museum or science centre* were the most commonly enjoyed activities among both groups of pupils in the study. For any local authority, school or teacher developing their science curricula these are key findings and indicate the centrality of these methods/activities within an effective science curriculum.

Further, in those schools where the SSERC CLPL had been identified as having a higher impact there was a positive association with pupil enjoyment, particularly among the younger pupil groups, of a number of science activities.

Unlike their attitudes towards school and school subjects where pupils were more likely to record a negative shift in their enthusiasm recorded, pupil confidence in

conducting science tasks generally showed a positive shift between the baseline and follow-up surveys among both groups of pupils. Looking specifically at the relationship between the impact rating of the SSERC CLPL and pupil confidence in conducting science activities, we noted several tasks where a growth in confidence between the baseline and follow-up survey among pupils in the higher impact group was not matched by their peers in the lower impact group.

Finally, we reviewed P5-P7 pupils' attitudes towards a number of statements regarding science including their view on post school involvement in the subject. Again, we witnessed generally less positive attitudes towards each statement over the academic year. However, against this backdrop we still found that more than 70% of pupils were open to the idea of further involvement in science after completing school. Moreover, in relation to the impact of the SSERC CLPL the data indicated that in schools with higher impact ratings the pupils were significantly less likely than their peers in lower impact rated schools to see their attitudes and beliefs about science follow the general 'negative drift' over the evaluation period. This led us to venture that the SSERC CLPL may, in addition to supporting pupil enjoyment of science activities and confidence in conducting science tasks, also encourages the preservation of positive pupil attitudes towards science.

Section 7: Conclusion and commentary

The findings from this evaluation demonstrate that the SSERC Primary Cluster CLPL Programme has produced a body of highly motivated mentors who are promoting the skills and confidence of their cluster colleagues to teach science and technology. Importantly, in those schools where the SSERC CLPL had been identified by school leaders as having a higher impact, there was a positive association with pupil enjoyment, particularly among the younger pupil groups, in a number of science activities. Pupil confidence in conducting science tasks demonstrated a positive shift between the baseline and follow-up surveys for pupils in the 'higher impact' schools. In schools with higher impact ratings the pupils were also significantly less likely than their peers in lower impact rated schools to indicate a 'negative drift' in their attitudes and beliefs about science over the evaluation period. Of particular interest is the fact that the SSERC CLPL Programme appears to have had greater impact in schools recording higher levels of deprivation. These findings are extremely encouraging regarding the effectiveness of the SSERC CLPL model.

The SSERC Primary Programme in its organisation and provision of support promotes teacher collegiality within and among schools in the cluster approach. It provides a quality CLPL experience for mentors who then are able to subsequently empower and enhance the skills and confidence of colleagues across their cluster.

The mentors, their senior management and other teacher colleagues report an improvement in the scale and quality of science and technology teaching across participating schools. There is consistency in mentor responses from those experiencing CLPL early in the Programme with those participating in more recent cohorts. This emphasises the consistent quality of the Programme and its reported impact on mentors, their practice and that of their cluster colleagues.

Furthermore, there is evidence from headteachers, other teaching staff and from mentors' diaries that the Programme is increasing pupils' engagement with science and technology. Headteacher and local authority officers' accounts and comments in mentor diaries also demonstrate that HMIE inspections are recognising the success of the SSERC mentoring Programme and its contribution to developing schools' ability to provide quality learning and teaching regarding science and technology.

The findings highlight particular benefits from the Programme that include:

- improving teaching and learning approaches;
- moderation approaches;
- collegiate working and professional dialogue; and,
- leadership across the clusters.

Senior managers' accounts reveal how the SSERC cluster and mentor model has also acted as a catalyst to promote schools reviewing their capacity to teach science and technology. There are indications from headteachers' comments that those who take up mentor roles are more likely to go onto leadership roles, highlighting further the capacity building and wider impact of the SSERC Programme.

The findings reiterate those of other research, including reviews of evidence of what works in professional development for teachers, such as CUREE (2011) that has highlighted the importance of collaboration between staff and the key role of effective mentoring and coaching in this process.

The range of data collected reveals the key factors and processes that are responsible for such impact. Of particular note here are the skills, expertise and credibility of the SSERC CLPL team. The willingness of the SSERC team to support mentors during and after their CLPL events is also of particular importance and key to mentors' confidence to engage with promoting CLPL in their clusters following their initial involvement in the Programme. Mentors have also used the in-school CLPL events they organised as opportunities to update their knowledge and liaise with colleagues to ensure that progress is being made and to address any queries or issues colleagues had regarding their science and technology teaching. The CLPL Programme has clearly helped mentors to develop a strong rapport with cluster colleagues and foster a sense of community.

Another key factor in the mentors' success has been the residential and collaborative developmental activity approach. This is a key feature of most SSERC CLPL programmes. Mentors found that this focused their efforts and provided a structure for the work across their clusters. This approach provided a systematic plan and evidence base, without which mentors believed their efforts would have become diverted by other commitments.

Mentors' comments stressed that the SSERC Cluster Programme has encouraged and enhanced their systematic enquiry and collaborative working. The findings reveal the importance of mentors conducting collaborative research to identify colleagues' needs and then assessing the impact of their CLPL activity. This collaborative action research and enquiry-based practice is particularly noteworthy as it is a core element for working to improve educational and public services and is a key component of a model for improvement for Scotland's Public Services. It uses practitioner enquiry / research to critically examine current arrangements, make changes based on evidence, monitor the impact of these changes and refine and adapt them as appropriate. Such collaborative improvement strategies are supported by a body of international research that confirms the value of school-to-school networking as key levers of innovation and system improvement (e.g. Fullan 2013, Chapman *et al*. 2012, Chapman and Hadfield 2010, Donaldson 2012, Ainscow et al., 2012, OFSTED, 2000;

Harris *et al*, 2005, Harrison, *et al* 2008, Cochran-Smith and Lytle 2009, Wohlstetter *et al* 2003). Indeed, the SSERC Programme is in line with research that indicates that raising educational outcomes, especially in disadvantaged communities, requires the alignment of change processes in curriculum development, teacher development and school self-evaluation (Menter et al., 2010: 26).

The findings demonstrate the importance of having the support of senior management for the mentors' activities. In the small minority of instances where mentors report a lack of senior management support and engagement, securing time to plan and provide CLPL has been particularly difficult. It is notable that senior SSERC Programme managers have invested considerable time liaising with local authority officers and headteachers to ensure that there is adequate support and commitment to providing the time for staff to plan and participate in CLPL activity.

We can conclude that the Programme is effective in bringing about improved professional practice that impacts positively on specific learner outcomes salient to STEM education. The pupil findings in particular, such as the relative impact of the SSERC Programme on schools in deprived areas has implications for the challenge of 'Raising Attainment' which is currently a key pillar of Scottish educational policy.

It has been established that pupils from more deprived communities and families do less well educationally than their less deprived peers (Francis and Perry 2010, The Sutton Trust, 2009, Wedge and Prosser 1973). Interventions can have an impact but sustaining and widening the impact is less well demonstrated (Sosu & Ellis, 2014, Greaves et al., 2014, Ainscow et al., 2010). However, teacher quality and effectiveness has been shown to be a crucial element in promoting positive educational outcomes irrespective of social/economic background (RAND corporation, 2012). With this in mind the findings of the evaluation highlight the importance of the SSERC Programme. The focused and well designed and sustained SSERC CLPL has influenced classroom teachers regarding their renewed enthusiasm and practice.

Such findings are in-line with other research that has shown that CLPL that is similar to the SSERC Programme is recognised as a model of effective CLPL regarding impact on professional confidence, skills, practice and subsequently, learner outcomes (e.g. Desimone 2009 and Whitworth and Chui 2015).

It is clear from this evaluation then that the activity and impact of the mentors across the participating clusters aligns strongly with the aims and aspirations of the Scottish Government and Education Scotland regarding learning in the sciences within Curriculum for Excellence. Indeed, the evaluation evidence reported here provides numerous examples of how the SSERC Primary Cluster Programme is promoting teachers' learning and teaching capacity, confidence and competence regarding

assessment, progression and connections with other areas of the curriculum as detailed in Education Scotland's Principles and Practice paper. There is clear linkage with the Education Scotland Corporate plan 2013-2016 (Education Scotland 2013a) , specifically, Strategic Objective 2 and Strategic Objective 3.

The findings also strongly indicate that the SSERC Primary Programme learning is contributing to the aims and targets of the Scottish Government's recently published STEM Education and Training Strategy. In particular those that seek by 2020, to achieve increased

> "practitioner engagement in STEM professional learning opportunities in the early years, primary years…(Excellence); significant reductions in the equity gaps in participation and achievement in STEM learning, engagement, study, courses … (Equity); increased numbers of people who understand the benefits and value of STEM for themselves, their families and their communities (Inspiration); increased collaboration between schools, colleges, universities and employers (Connection)…"
>
> (Scottish Government 2017. p10)

SSERC's Primary Programme has addressed key objectives congruent with The *Sciences 3-18 curriculum impact report 2013 update (Education Scotland 2013b).* In particular, the Programme effectively addresses certain *Aspects for Development* set out in the report, namely; a) concerns over the quality, breadth and progression of primary school science education and b) fostering stronger curricular links between pre-school centres and primary schools and between primary and secondary schools to ensure continuity in learning. (Education Scotland 2013b p48),

In addition, the Education Scotland impact report stressed that 'while staff are increasingly sharing and developing good practice by visiting colleagues in other schools, this was not a consistent feature of good practice across schools' (Education Scotland 2013 p42). The mentoring approach at the heart of the SSERC Cluster Programme directly facilitates cross-school and increasingly cross-sectoral professional collaboration regarding good practice in science teaching.

The Programme's integrated opportunities to access the SSERC_meets echo recommendation 40 of the Donaldson review (Scottish Government 2011) that 'Online CPD should be part of the blended, tailored approach to CPD for all teachers.'

The Donaldson report states that, 'All teachers should see themselves as teacher educators and should be trained in mentoring' (Recommendation 39). Indeed, Donaldson goes on to argue that mentoring is central to professional development at all stages in a teacher's career. The value and relevance of the SSERC Primary Programme to this goal is clear.

The evaluation findings also demonstrate that the SSERC Programme supports the General Teaching Council for Scotland (GTCS) measures to address the professional learning needs of teachers particularly in their standards to support self-evaluation within professional learning.

Against the very positive evaluation findings of the SSERC Primary CLPL Programme is a concern highlighted by information gathered from a sample of local authority officers across the participating councils in the third and sixth third year of the evaluation and echoed in headteacher and mentor comments that a number of local and system-wide factors can impinge on the efficacy and particularly the sustainability of the Programme. These factors include central support for professional development and learning being diminished because of funding cuts that reduce key coordinating and advisory personnel. As some local authority officers stressed, this makes the work of SSERC all the more important in relation to the need to build capacity across the clusters. Mentors and headteachers added that there are increasing challenges arising from staff changes and shortages and finding time and cover to free up mentors and others involved in planning and delivering CLPL. Strong school leadership, careful forward planning and teacher commitment can ameliorate the effects of these factors to some extent. The wider educational landscape has developed during the duration of this evaluation. Policy developments such as the new STEM Education and Training Strategy and Developing the Young Workforce (DYW) will provide a supportive policy context for growing science and STEM education capacity in schools. However, it remains to be seen whether local and regional conditions and factors will facilitate or inhibit a coherent improvement in STEM education learning and teaching across primary schools

Section 8: Recommendations

Given the volume of evidence, the evaluation findings and the marked consistency in the outcomes, we suggest the following recommendations regarding the SSERC Primary Cluster Programme.

8.1 Sustaining and expanding the Programme

This evaluation has demonstrated that participants were very positive in their responses to the CLPL, indicated a high level of enthusiasm for the Programme and suggested that the work was impacting positively in their own schools and clusters. Considering these findings, we would suggest that appropriate funding and resources be allocated to sustain and expand the Programme to allow SSERC to support Local Authorities to extend the Programme into new clusters. At the same time, it is important that any development of the Programme continues to reflect the national priority to reduce educational inequity through including more disadvantaged learning communities and clusters in the CLPL.

8.2 Building on the initial impact of the Programme within and across Local Authorities

There is a need to explore how to maintain impact and momentum of the SSERC Primary Programme in those clusters already participating. Insights from mentors and headteachers and local authority representatives highlight several pressures and tensions that can act as inhibiting factors to sustaining the impact of the mentors within and across the cluster schools. Often such challenges are associated with time issues, staffing and 'competing priorities'. This highlights the need for SSERC and Scottish Government to emphasise to school and local authority managers the importance of looking at how science and technology / STEM can be addressed systematically within School Improvement Plans and in a way that contributes to other priorities such as the Scottish Attainment Challenge objectives and relevant policies such as the recent STEM Education and Training Strategy and Developing the Young Workforce (DYW) (Scottish Government 2014). The Programme also has clear relevance to the work of the Regional Improvement Collaboratives (RICs) (Scottish Government 2018) as they work to bring together relevant professionals to support practitioners to improve learner attainment and outcomes. SSERC provides crucial sector and curriculum area support and targeted advice and support in order to drive improvement. In particular SSERC's Programme aligns well with the RIC objective of helping teachers access the practical improvement support they need.

Regarding approaches to spreading the impact of the SSERC Programme, one option would be to consider how a cadre of volunteer mentors could work within and beyond their clusters to facilitate wider impact and contribute to the efforts of SSERC to promote effective science and technology teaching. This team could develop

resources with SSERC's assistance to support each other and within their own local authority to replicate aspects of the SSERC model but without the residential component. Where available, this would articulate with the RAiSE Programme PSDO efforts to develop networks of practitioners and supporting professionals to promote capacity for STEM education in the context of the National priorities and polices. These efforts would be enhanced by the PSTT SEP available in each local authority involved in the RAiSE pilot programme to help Local Authorities sustain and extend the impact of their participation in the SSERC Programme. The PSTT SEP schools also receive Edina Trust funding to support provision of classroom resources.

Developing further the growing associations and partnerships that SSERC has across the system, again, including its contribution to Programmes such as RAiSE is also likely to help enhance the impact of the Programme in local authorities. This also stresses the importance of local authority leaders assessing how the various SSERC, PSTT SEP, RAiSE and other programmes articulate with each other to work in a coherent and effective way.

8.3 Enhancing primary and secondary partnerships

Over the course of this evaluation, practitioner and school and local authority leaders' accounts indicate that primary and secondary colleagues have increasingly worked together to enhance transition of learners and share practice regarding science and STEM. Such developments should be encouraged and facilitated by SSERC, local authority and Education Scotland.

8.4 Exploring ways to enhance Early Years – Primary transition across the clusters

The Programme has already demonstrated that primary schools are developing stronger links with Early Years providers in their clusters. This is another transition area that could be explored more systematically. If possible, SSERC could consider the possibility of conducting an Early Years/Nursery and Primary conference to generate interest and explore demand.

8.5 Extending the SSERC Primary mentor model to the secondary sector

Given the success of the mentor model, it is recommended that SSERC and its partners look at ways to extend the SSERC Primary Programme approach to facilitate collaborative networks across secondary schools and communities of practice. This could help address changes at senior phase.

8.6 SSERC's role regarding informing the focus of national science CLPL and models for its delivery

Considering stakeholders' comments and key themes across the evaluation findings, continuing to having SSERC at the centre of national efforts to promote teachers' ability to effectively teach science topics and subjects is reiterated. Indeed, given the organisation's expertise and high standing in science education networks, it has a key role regarding informing the focus of national science CLPL and models for its delivery.

8.7 Developing SSERC's strategic partnership with Education Scotland and Scottish Government

SSERC's Primary Cluster Programme and its other CLPL activity and programmes framed by SSERC'S Vision 2030 statement (SSERC 2018) clearly articulates with, and supports, the Scottish Government's 'STEM Education and Training Strategy for Scotland. Within this policy landscape SSERC has a unique position regarding expertise in delivering high quality and relevant science education CLPL that is facilitated through a close relationship with local authorities, schools and networks of key partners, professional bodies and associations within and beyond Scotland. SSERC is a key partner with Education Scotland and Government regarding efforts to develop effective STEM including CLPL efforts as well as the STEM Ambassadors and Young STEM Leaders programmes. The SSERC PCP, other CLPL and activities also contribute to the work of the newly appointed Regional STEM Advisors and the Improving Gender Balance and Equalities team. This makes a compelling case for sustaining and developing further the collaborative partnership with Scottish Government, Education Scotland, RAiSE and other strategic partners. As part of this, Education Scotland and the Scottish Government should ensure that SSERC has maximum opportunity to extend the Primary Cluster Programme and its other CLPL activity across its local authority partners.

8.8 Further research on the longer-term impact of the SSERC Primary Programme

The current findings strongly indicate that the Programme is having a very positive impact on pupils' engagement with science and technology. Therefore, research to assess the impact on pupils' science and technology achievement, scientific literacy and aspirations as they progress into secondary school is warranted. The ROC led pupil survey, highlighted earlier, represents the first step in such a strategy.

We stress the need for research to assess the longer-term impact of the Primary Programme on cluster secondary schools' teaching and learning approaches and impact on their science and technology curriculum. There is already some indication from the current evaluation that secondary schools are reviewing their teaching to

ensure better alignment with the knowledge and understanding of science and technology demonstrated by new S1 pupils. We would argue that future research should revisit the early adopters and mentor networks to investigate the longer-term impact on mentors, their schools and clusters.

There is also scope for working even more closely with PSTT initiatives to research and explore ways to enhance the impact and capacity of SSERC mentors and partners in their local authorities and promote the impact of those teachers involved in PSTT Programmes.

8.9 Developing international perspectives and links with other similar programmes

The successful SSERC Primary Programme could be further enhanced by linking it with similar national and international programmes of collaborative enquiry and mentoring. For example, at a national level, there are possible synergies with developments across local authorities as part of the attainment challenge. There is evidence in some local authorities, particularly West Dunbartonshire, that STEM is providing an important way to tackle attainment and achievement in numeracy in primary schools. Research could, therefore, involve exploring how collaborative mentor-driven science education approaches could be used to promote educational achievement and engagement for target groups of pupils.

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Appendices

Appendix 1: Annotated Part 1 questionnaire from Mentors who have completed both parts of the CLPL

Appendix 2: Annotated Part 2 questionnaire from Mentors who have completed both parts of the CLPL

Appendix 3: Annotated Headteacher questionnaire (completed after Part 2 events)

Appendix 4: Annotated 'other' teacher questionnaire (completed after Part 2 events)

Appendix 5: Annotated P2-P4 pupil questionnaire (baseline)

Appendix 6: Annotated P2-P4 pupil questionnaire (follow-up)

Appendix 7: Annotated P5-P7 pupil questionnaire (baseline)

Appendix 8: Annotated P5-P7 pupil questionnaire (follow-up)