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RAiSE
Raising Aspirations in Science Education

Raising Aspirations in Science Education
Interim Evaluation Report

The Robert Owen Centre for Education Change

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1 KEY FINDINGS

This report provides an update on the progress of the mixed methods external evaluation of the Raising Aspirations in Science Education (RAiSE) Programme funded by The Wood Foundation (TWF). It includes emerging findings from the initial data gathering stages of the research.

The Wood Foundation, Scottish Government and local authority education services have co-funded the pilot RAiSE Programme. It originally aimed to cover 10 local authority areas but currently operates in eight. The programme is designed to secure improvements in primary science, by developing the confidence and competence of teachers to ensure all learners experience "highly engaging and motivating learning opportunities". The original RAiSE programme design focused on science alone but as the pilot developed, it quickly reflected the wider policy environment and developments at local authority level to broaden its focus to STEM.

The main evidence base for this report includes:

- Tranche 2 pre programme baseline teacher survey
- Tranche 2 pre programme baseline headteacher survey
- Tranche 2 programme P2-P4 baseline pupil survey
- Tranche 2 programme P5-P7 baseline pupil survey
- Tranche 1 post programme (reflective) teacher survey
- Tranche 1 post programme (reflective) headteacher survey
- Interviews with PSDOs and relevant LA officers
- Reviewing RAiSE's routine data from Primary Science Development Officers (PSDOs) regarding progress, developments and impact.

The survey data for the Tranche 2 schools continued to be submitted as this report was written. The Tranche 2 data provides a robust account of pupil and teacher responses around the evaluation baseline questions for those schools involved in key RAiSE activity, particularly in Dumfries and Galloway, Angus and Glasgow local authorities. If the level of response is repeated in the follow-up this should contribute to a reliable assessment of impact regarding the quantitative indicators. The survey response rate for Tranche 1 was low and was intended to be a post-hoc, reflective data gathering strand for those headteachers and teachers who had experienced RAiSE before or as the evaluation was implemented. The evaluation team has agreed with TWF and Education Scotland that another strand of largely qualitative data gathering activity will be conducted in Spring 2018 to elicit evidence on headteachers' reported impact in the Tranche 1 local authorities. This will also explore reasons for low response rate in the Tranche 1 authorities such as research fatigue or teacher perceptions that the research was of little direct benefit to their planning.

Key interim findings

- At this stage in the evaluation, the research team have gathered data and information which allows a detailed understanding of how RAiSE has developed overall and locally in order to meet the Programme's objectives. This qualitative information has provided a picture of highly skilled and motivated individuals; Primary Science Development Officers (PSDOs) working with colleagues to develop the necessary infrastructure, CLPL and systems to implement and sustain RAiSE. This has been characterised by PSDOs identifying and supporting motivated teachers who will act a local leads in their schools and clusters to sustain RAiSE activity and further the Programme objectives. Key to this process has been PSDOs fostering networks of identified Leaders of Science Learning - practitioners who have often had higher levels of STEM CLPL - and local partner organisations and businesses who can help reach and support other teachers.

- All PSDOs are currently well supported by local authority colleagues. Some work within larger teams that focus on developing the STEM education capacity of teachers, ensuring RAiSE articulates with other educational strategies being deployed within the authority. Often, this process is scaffolded by technology and social media to promote knowledge transfer and share good practice. At this stage in the evaluation, it remains to be seen whether those PSDOs working as part of integrated teams within their local authority have proportionately more impact. However, the research literature would support this possibility [e.g.: Chapman et al 2017]. Also, as the evaluation proceeds, it is expected that insights will be gained on what level of PSDO staffing is required to have a particular impact locally and on building network capacity.

- The evidence to date strongly indicates that the PSDOs are working effectively to promote the RAiSE objectives and that the National Education Officer has had a critical role in ensuring the coherence of the overall approach and in supporting the development of the PSDOs.

- The other main evaluation strands have involved gathering quantitative data to establish a baseline of indicators across headteacher, teacher and primary 2-7 pupils that will allow an assessment of impact when these groups are surveyed again. The pattern of responses and stage at which the various Tranche 2 local authorities were at during this phase of the research means that the main quantitative impact analysis for the first year of the evaluation will focus on Dumfries and Galloway, Angus and Glasgow local authorities. At this stage the findings from the baseline surveys reveal the reported needs of teachers and headteachers that they want RAiSE to address. Tranche 2 Headteachers see building teacher confidence and skills as a key, their teachers are eager for support to enable them to promote specific learner outcomes such as science skills that are relevant for life, society and world of work. While the number of Tranche 1 headteachers/ teachers' responses was low, respondents reported that they had

benefitted from their involvement with RAiSE and that it had had a positive impact on pupils' science education.

- Headteachers and teachers identified a number of challenges facing promoting effective science education. These include building teacher confidence, securing appropriate resources to teach practical science and finding ways to prioritise science alongside literacy, numeracy and health and wellbeing.

- The pupil surveys indicate that the majority of P2-P7 pupils appeared positive about school and their subjects. Pupils were most likely to indicate ICT, PE and Science as subjects that they *liked a lot*. Science was ranked third. In contrast, Social Studies, Languages and Literacy and RME were less popular.

- Science activities were popular among P2-P4 pupils. A clear majority of the pupils 'really enjoy' taking part in all of the science activities listed. *Doing experiments in class* was the most enjoyed activity and *Writing about science in school* was the least enjoyed activity in P2-P4 pupil responses. P5-P7 pupils were less likely than their P2-P4 peers to rate their enjoyment of science activities in the highest category (really enjoy). As with the P2-P4 pupils, *doing experiments in class* as well as *going to the science museum or science centre* were the activities most frequently indicated as *really enjoyed by* P5-P7 pupils, although the percentages reporting this were smaller than the P2-P4 group**.**

- The majority of P5-P7 pupil responses indicated that they were *confident* or *very confident* in their ability to successfully complete each of the 14 science tasks detailed in the question. This suggests that for the follow-up surveys we might see marginal reported shifts, as the 'headroom' for positive gains is limited. The qualitative component of the evaluation scheduled for later in 2018 will explore whether pupils are able to accurately self-evaluate and discriminate between these questionnaire response categories. However, the research team's experience of using the same questions in other national surveys suggests that many can.

- P5-P7 pupil beliefs regarding science were generally positive. There was a strong indication that many of the pupils were keen to be involved with science when they left school. However, there was little indication that they could see themselves as a scientist in the future, which may coincide with the relatively low levels of those who know someone who works in science. It is possible that the term used in the question ("scientist") was too restrictive and that a broader enquiry around "STEM career" would have elicited a more positive response The Tranche 2 follow-up survey will explore any shifts in these responses following RAiSE activity and the evaluation will consider other possible factors that might influence observed shifts at the follow up stage such as other initiatives in place.

On the basis of the interviews with PSDOs and their local authority colleagues, the interim findings provide a positive image of RAiSE progress in terms of developing sustainable systems to achieve the Programme's objectives. The findings to date strongly suggest that the RAiSE programme is being developed in line with what is known from research

about effective CLPL but, furthermore, it also reflects what is known to create system change and foster educational change and increase attainment.

The interim findings also raise a number of lessons learned and reported by the National Education Officer, PSDOs and their local authority colleagues that concern promoting successful participation with, and implementation of, the RAiSE programme. Although there are regional differences, there are clear themes emerging across the national pilot cohort regarding challenges that suggest initial recommendations for the development of the Programme. These challenges and suggested recommendations are detailed in Section 7.2.2 of this report.

2 INTRODUCTION AND CONTEXT

2.1 INTRODUCTION

This report provides an update on the progress of the external evaluation of the RAiSE Programme funded by The Wood Foundation (TWF). It includes emerging findings from the initial data gathering stages of the research. While the RAiSE Programme is still at a relatively early stage, the information gathered from the interviews with the PSDOs and their local authority colleagues provides important insights on how the Programme has developed and is being implemented across the participating authorities in ways that reflect context while addressing the aims and objectives of the Programme. The report also presents the results of the surveys of pupils, teachers and headteachers from the Tranche 2 local authorities. This data will provide the baseline for the follow-up surveys of these groups. At the time of writing responses were still being received and while the final figures will increase a little, it is likely that the main base-line findings will remain unchanged. Tranche 1 teachers and headteachers were also surveyed with a focus on reflective questions to gather their views on what difference the RAiSE Programme had made to date. However, given the limited responses to the Tranche 1 surveys, we have focused on specific findings to glean insights on what respondents thought about the RAiSE Programme and its impact. To augment this data, early in 2018 the evaluation team will visit selected Tranche 1 schools across participating local authorities to gather in-depth case study data to obtain a more detailed picture of teachers and headteachers experience of RAiSE and reports of its impact. This report concludes with some reflections on the findings and issues for consideration. A final evaluation report, looking at the outcomes of RAiSE, will be produced in March 2019.

2.2 CONTEXT

International and local research evidence (Summers, 1994; Harlen, 1999; Jarvis and Pell, 2004; Murphy et al., 2007) suggests that 'thus far progress in enhancing primary teachers' skills, knowledge, and attitudes in the field of science has been slow' (van Aalderen-Smeets and van der Mollen, 2015, p. 710). It is arguable that until recently, this situation has been mirrored in Scotland, the Science and Engineering Education Advisory Group (SEEAG) report (Scottish Government, 2012) highlighted the need for a focus on promoting the confidence and competence of primary teachers to effectively teach STEM education (Section 2.1, p.4). The Scottish Government has responded to this situation in its policies and funding of programmes, including the SSERC Primary Cluster Programme in Science (PCP) and the Raising Aspirations in Science Education (RAiSE) Programme. These use complementary approaches to tackle the need to enhance primary teachers' capacity and skills to effectively teach science and STEM with an emphasis on promoting educational equity, scientific literacy and developing a workforce for the future.

The Wood Foundation, Scottish Government and local authority education services have co-funded the pilot RAiSE Programme. The programme is "designed to secure improvements in primary science, by developing the confidence and competence of teachers to ensure all learners experience highly engaging and motivating learning opportunities. This will equip learners with the context and skills for learning, life and work to enable them to access a wide range of stimulating and rewarding careers including those within science and STEM sectors."[1]

The RAiSE programme originally aimed to cover ten local authority areas but currently operates in eight. The Tranche 1 local authorities are Highland, Moray, West Dunbartonshire and City of Edinburgh Councils. Tranche 2 local authorities include Glasgow, Angus, Dumfries and Galloway and Fife Councils. The programme is a three-year pilot with one or more local authority Primary Science Development Officers (PDSOs) appointed to assist teachers to expand on existing delivery of science education in primary schools. These officers are supported by a National Education Officer for Primary Science who is employed by The Wood Foundation but seconded to Education Scotland to ensure co-ordination and sharing of best practice across the network. This arrangement also ensures continuity of leadership within this role, a fundamental success criteria identified in programme development.

The primary reason for both withdrawals from the pilot was the difficulties associated with recruiting and releasing a seconded PSDO from their substantive school-based post. Although teacher shortages, particularly in STEM subjects, are recognised as a national issue, the extent of the issue varies between authorities.

Given the funding arrangement for RAiSE, a robust external evaluation was warranted with findings also intended to inform any rollout of the model more widely. The Robert Owen Centre (ROC) at the University of Glasgow was appointed as the external evaluator as the programme began in January 2017. The external evaluation of the RAiSE Programme was funded by the Wood Foundation (TWF). This interim report is informed by the team's experience in this field, including prior and on-going national evaluations of other major CLPL programmes and educational initiatives.

Research suggests that there is an 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 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; Lowden et al 2015).

[1] https://www.thewoodfoundation.org.uk/developing-young-people-in-scotland/raise/

Research has shown that teachers' professional development is much more likely to be successful when it involves collaboration between staff (CUREE 2011). The external evaluation analysis will reflect on how the findings align with what is known about programmes that are effective in promoting the confidence, skills, knowledge and enthusiasm of school practitioners in relation to the teaching of sciences. For example, research, including that cited in The Evidence for Policy and Practice Information and Co-ordinating Centre (*EPPI*-Centre) systematic reviews of research evidence (Hargreaves D, 2003, 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; Harris et al, 2005, Harrison et al 2008).

2.3 AIMS AND OBJECTIVES OF THE EVALUATION

The RAiSE evaluation focuses on three main interrelated areas:

2.3.1 Area One: Evidence of Impact/ Step Change

This first area explores the extent to which the RAiSE Programme is making an impact on participating pupils and primary practitioners and their schools' capacity to promote Science and/or STEM. A number of 'indicators of change' were developed that that mapped onto the RAiSE objectives and included pupil and staff self-efficacy questions for use in surveys. The research also developed indicators of initial and longer-term impact relevant to the stakeholder group. For example, teachers' reported levels of confidence to teach STEM, engagement with the Programme, reported evidence on whether the Programme is contributing to STEM in curriculum development and networking to share good practice in STEM teaching and learning. The evaluation design also entails collecting detailed qualitative accounts and evidence that elicits examples of progress and highlights processes involved in the implementation and impact of the Programme. The triangulation of the various sources of evidence allows for a fuller understanding of what difference RAiSE is making against its stated objectives, in what ways and why? The research instruments were developed in collaboration with the Programme's management team, TWF and relevant stakeholders. The research design process also drew on relevant research literature and was informed by the ROC team's experience in the field.

In addition, the evaluation will gauge stakeholders' views on whether the Programme is contributing to approaches that foster positive progression across early years, primary and secondary sectors and promote increased uptake in science options and careers.

An important focus for the research is on the extent to which the Programme promotes a step change for primary practitioners, building their skills, confidence and enthusiasm also whether it increases the science capital of practitioners through the creation of robust networks, partnerships to foster opportunities to share, collaborate, mentor and co-create.

The research also considers whether the RAiSE Programme adds value to existing initiatives and networks, or whether there are alternatives.

2.3.2 Area Two: RAiSE's Position in the Landscape

This evaluation will also explore the extent to which the Programme enhances opportunities for practitioners and local authorities to align with other national education priorities such as National Improvement Framework (NIF), Scottish Attainment Challenge (SAC) and Developing the Young Workforce (DYW). It addresses whether the Programme is contributing to the ability of practitioners to better recognise the opportunities within creative approaches to science education to help deliver upon other National Priorities such as literacy, numeracy and gender balance. The evaluation examines whether the Programme is contributing to the development of a 'progressive and engaging science curriculum' across the participating schools, and wider authorities and how this was done in different contexts. This includes identifying key factors and indicators that are associated with such developments, including having a standards framework, opportunities for professional recognition, consistency of support, ownership of resources and regional support and networks.

2.3.3 Area Three: Effective Approach & Delivery

The third area the evaluation involves is providing formative feedback and examples to inform the Programme as it develops and is implemented. This includes assessing each element of the current model and informing possible improvements and measures to promote sustainability and expansion in various contexts across the local authorities.

Running across these three key areas were the following main *research questions*:

- Is the RAiSE Programme increasing practitioners' capacities, skills and confidence in science education?
- Is the RAiSE Programme providing a more coherent and sustainable career-long professional learning support structure for practitioners?
- Is the RAiSE Programme improving the curriculum and learning and teaching in the sciences?
- Are learners more engaged and excited by their experiences in science education and do they have an improved self-efficacy in relation to the sciences?
- Is there adequate flexibility in the model to work for all local authorities given the diversity of structures and demographics involved?
- Are the changes and structures catalysed by the RAISE interventions systemic and sustainable?
- What impact has RAISE had on partnership working within learning communities/school clusters and with other partners such as employers, colleges and universities?

- Have the aspirations of learners and their parents in relation to careers that use science and STEM been affected positively by the RAiSE Programme?
- What is the overall impact on learners, practitioners, schools, and authorities?

3 EVALUATION APPROACH AND EVIDENCE BASE

The evaluation adopted a mixed method approach to address the research questions, with an emphasis on surveys as well as individual interviews with key stakeholders. The pilot component of the RAiSE programme was already underway in some schools in the participating authorities prior to ROC's involvement. This posed a challenge for externally evaluating aspects of impact since the University team could not gather baseline data from these schools. However, it should be noted that PSDOs had gathered some baseline data on teachers' needs to inform their work. The lack of external evaluation baseline data from learners, teachers and others meant that measuring impact since the Programme was initiated was possible only by analysis of retrospective data. However, in those schools that had yet to implement their programme, it was still possible to collect baseline data. Thus, the evaluation was broken down into two strands to address the evaluation aims. After the initial proposal for evaluation, several changes were mutually agreed between the evaluation team and TWF to adjust the proposed methodology at the onset of evaluation to best fit with the Programme aims and objectives.

In addition to the in-depth findings about how RAiSE makes difference in each local authority, the context-sensitive evaluations allowed the identification of broader, crosscutting themes and findings. This will allow an assessment of how the various approaches contributed to promoting effective primary science education and addressed the evaluation research questions, particularly, how does involvement in RAiSE impact on ability, skills, and pedagogy of practitioners?

Over the course of the evaluation and in consultation with TWF, the ROC team will produce an agreed number of more detailed illustratory case studies that reveal how the Programme variants (e.g. dispersed rural models, learning community/cluster models and multi-partner models) have made a difference and what factors and processes are key to this.

The ROC evaluation design, particularly the research instruments reflected the initial experiences and insights from PSDOs and local authority colleagues. The ROC team and TWF were eager to involve these groups in the evaluation and were asked to comment on initial drafts of key evaluation instruments. Where appropriate, this dialogue was also used to inform and build PSDO's self-evaluation capacity. The evaluation established a sub-group to advise on the design of the evaluation tools. This review group membership included two headteachers from separate local authorities, a team leader with responsibility for Digital Skills & ICT Strategy; STEM; Learning for Sustainability from another local authority, a Senior Manager with responsibility for Scottish Science CLPL

programmes and Service Manager for Education and Children's Services in a local authority.

The next section looks at methods and stages that were developed for use in the evaluation.

3.1.1 Tranche One Approach

Concentrating on those schools that had already started the RAiSE Programme, this approach placed an emphasis on triangulation of detailed post-hoc data and information gathered by the ROC team as well as analysis of available secondary data from PSDOs. While this strand lacks pre and post–programme data to assess impact and attribution, triangulation of detailed post-programme quantitative and qualitative evidence will provide a detailed 'in-depth' narrative of the impact of the RAiSE Programme within the schools.

3.1.2 Tranche Two Approach

Focusing on those schools where the RAiSE Programme had yet to begin operating, this strand gathered baseline data from pupils, teachers, headteachers, the PSDOs and other key stakeholders. This strand was mainly quantitative but also gathered qualitative information focused on assisting interpretation and understanding factors and processes involved in any impact. In the second and final report, this strand will also analyse available relevant secondary data including national test/attainment data. In those schools where baseline and follow-up surveys are possible the evaluation will also aim to include 'matched' schools' in the participating local authorities that are not currently involved in the RAiSE or the SSERC Primary Cluster Programme. Schools will most likely be matched on SIMD profile, denominational/non-denominational status, size and urban/rural positions, challenge/non-challenge authority and SSERC programme involvement. This will provide some measure of comparison and control for the analysis.

3.1.3 The Main Evaluation Activity and Evidence Base for this Report

This main research activity and evidence collected to date that informs this report includes:

- Development of Tranche 1 and 2 survey research instruments
- Conducting the evaluation surveys:
    - Tranche 2 pre programme teacher survey
    - Tranche 2 pre programme headteacher survey
    - Tranche 2 programme P2-P4 pupil survey
    - Tranche 2 programme P5-P7 pupil survey
    - Tranche 1 post programme (reflective) teacher survey
    - Tranche 1 post programme (reflective) headteacher survey.

(Follow up of the T2 surveys will be conducted later in 2018 before P7 pupils move onto secondary).

- Interviewing PSDOs and relevant local authority officers

- Reviewing RAiSE's routine data from PSDOs regarding progress, developments and impact.

Table 2.1 – Quantitative Questionnaire responses for 'core' Tranche 2 baseline

Local Authority	Primary Teacher	Head Teacher	P2-4	P5-7
Dumfries & Galloway	78	22	269	543
Glasgow	157	11	1669	1741
Angus	78	10	281	254

The Tranche 2 data provides a robust account of pupil and teacher responses around the evaluation baseline questions for Dumfries and Galloway, Angus and Glasgow authorities. These local authorities were best placed to implement a baseline survey as the evaluation began, therefore, have become the 'core' or focus of the baseline and follow-up component of the quantitative work for the first year of RAiSE. If the level of response is repeated in the follow-up this should contribute to a reliable assessment of impact regarding the quantitative indicators. Fife Council began collecting survey data later in the process. As a result, their findings are not reflected in this report but will feature in subsequent updates.

Tranche 1 schools were not involved in the pupil survey as they had begun activity beforehand or as the evaluation was being implemented. A retrospective, post-hoc survey of Tranche 1 headteachers and teachers was conducted but received few responses. The evaluation team has agreed with TWF that another strand of qualitative data will be conducted in Spring 2018 to elicit data on impact in the Tranche 1 local authorities. This will also explore reasons for low response rate in the Tranche 1 authorities such as whether there was 'research fatigue' or teacher perceptions that the research was of little direct benefit to their planning.

For this report, the quantitative analysis of survey data is descriptive, focussing on the frequency of responses for each question. For the follow-up final report, any significant statistical associations between the responses of respondent groups (e.g. headteacher and teacher, between pupil year group and between gender) to key variables, and by local authority, will be reported. The pupil surveys will also allow assessment of impact regarding the agreed indicators and self-efficacy variables. All qualitative information gathered is thematically analysed to complement the survey findings. This illuminates PDSOs' and teachers' experiences of the Programme and highlights reported impact. It also helps to identify the processes and factors that influence impact and Programme development.

4 KEY THEMES EMERGING FROM THE PSDO AND LOCAL AUTHORITY INTERVIEWS

This section summarises the main findings emerging from the interviews with PSDOs and their local authority colleagues. Given the stage of the RAiSE Programme and evaluation, these findings focus on how the PSDOs and their colleagues have implemented the Programme locally and how they have addressed issues of sustainability. It includes some initial insights from the interviewees regarding early impact.

4.1 THE NATURE OF PSDOS WITHIN RAISE

The PSDO configuration can vary somewhat to suit the local authority and existing context. In some cases, the challenges of geography have seen a team of PSDOs recruited to ensure reach. Elsewhere, a PSDO has worked with colleagues to develop a growing network of Leaders of Science Learning to promote the RAiSE objectives. Existing resources and the historical capacity for STEM have also shaped the nature of RAiSE locally. The length of time any one PSDO has been in post has influenced the scale and scope of the individual officer's activity.

PSDOs' development of actions and activity has taken cognisance of local authority priorities, national policies and the RAiSE objectives. Overall, there is clear and effective communication between PSDOs and their local authority managers/ colleagues who have a good understanding of the PSDO activity. PSDO and local authority colleagues are working to ensure that the local RAiSE developments are sustainable and embedded in school and local authority plans.

The PSDOs provide the National Education Officer with regular updates of their activity and developments set against the RAiSE objectives, The National Education Officer also maintains a record of the number and type of CLPL and other activities the PSDOs are conducting. This reiterates the insights from the external evaluation and highlights the responsive and adaptive nature of RAiSE and indicates that there are different models emerging across the participating authorities. For example, in Moray and West Dunbartonshire, the RAiSE PSDOs have started with a whole-authority engagement approach, building up broad networks and opportunities for CLPL, whereas in Glasgow, the PSDO is embedded in a team of associated local authority officers and has targeted particular schools and clusters in the first year to develop a cadre of Leaders of Science Learning to focus on the RAiSE objectives.

4.2 INITIAL PSDO ACTIVITY IN THE FIRST YEAR OF RAISE

During the first year, PSDOs have conducted extensive activity to raise the profile of Science within STEM education, facilitate teacher learning and build a social

infrastructure to promote and support STEM education. The activity of PSDOs has typically involved:

Raising the profile of STEM:

- Raising the profile of Science and STEM and related local policies in schools and the improvement agenda within their respective LAs through events, school visits and social media etc.
- Articulating STEM, Developing the Young Workforce (DYW), the Attainment Challenge, NIF and other priorities across the LA within the strategic framework of RAiSE objectives. (The new STEM strategy and associated STEM self-evaluation framework is increasingly informing this strand of their work).
- Promoting progression across early years, primary, secondary using STEM as a vehicle.

Facilitating teacher learning:

- Assessing local teachers' professional learning needs and identifying and developing appropriate CLPL and other means to promote teachers' pedagogical skills and confidence to teach STEM. This often uses interdisciplinary and cooperative approaches and recognises effective strategies such as experiential and enquiry-based approaches. There is evidence of extensive sharing across the PSDO network of ideas and approaches to promote teachers' skills, facilitated by the National Education Officer.
- Gathering evidence and conducting evaluations of their own CLPL activities, including where they have been involved in the local coordination of the SSERC Primary Science Teaching Trust (PSTT) initiative.
- Supporting and moderating teachers' assessment of science skills, and feeding into the other local authority groups.
- Developing teachers' ability to improve their pedagogy, including the use of lesson study and reflective enquiry approaches.

Building a professional learning and social infrastructure:

- Networking to (a) encourage teachers within and across schools to work together to share and support each other and develop professional learning communities (b) enlist motivated teachers, join-up existing and nascent activity and reinvigorate existing networks to develop sustainable support for the teaching of science. This included building links with STEM Ambassadors, local science centres, museums, universities, colleges as well as local businesses and SDS to promote teachers' STEM capacity in primary schools, often within the context of DYW. Indeed, partnership working is a distinct feature of PSDO activity. This includes working with SSERC, IOP and SCEL to develop CLPL opportunities to promote teachers' capacity regarding DYW and career education standards, tackling gender bias in STEM and teacher leadership. Collaboration with outdoor and physical activity

specialists has also helped to link STEM with other aspects of the curriculum. The PSDOs use a range of social media such as Twitter, Facebook and Yammer as well as Google Plus, GLOW and newsletters, to help support and enhance networking, communication and sharing of ideas.

- Promoting family and community engagement with STEM at school level, often in collaboration with other services and in one local authority through STEM Hubs, which are transforming the way young people, and their families learn about and engage with STEM.

It was reported by those PSDO's and their local authority colleagues in large geographical areas that having more than one PSDO available could extend the reach of the Programme and scale of activity. This would be useful in the short-term before capacity was built across networks of local teachers. Working in a wider team with local authority colleagues was also reported to promote PSDOs' communication with colleagues working on related activities and promotes and articulation with other local education policies and initiatives.

The skills and range of approaches of PSDOs in promoting engagement and working with teachers and other colleagues has been evident as they have worked to establish RAiSE locally. The PSDOs have not only made contact with stakeholder groups and contacts but also engineered and promoted networks across these groups to help implement their RAiSE plans and sustain developments. Establishing working groups and teams of committed professionals to take forward plans and supporting these groups has been an important part of this process.

> I think one of the key things has been to develop a working party, a network of people within the city who are, you know, either taking some leadership within their school for science, or they're taking ownership of the curriculum within their school for science. So, to first of all, establish that local authority network and then to build the capacity within the network to share their learning across the rest of their school or across their cluster or indeed, across the network and begin to share ideas and information. So it's been about facilitating a network that should be self-sustaining.
>
> Edinburgh PSDO

4.3 BUILDING LOCAL CAPACITY AND SUSTAINING DEVELOPMENTS

PSDOs, their local authority colleagues and the National Education Officer have sought to address sustainability of the RAiSE developments from the outset. This included networking and building on existing expertise in primary schools and the commitment of teachers across schools and in some cases across local authority boundaries as the Regional Improvement Collaboratives begin to come into focus.

> I'm the person there to support science just now, but when my role is over, what is there going to be? That's where I realised that the currently trained primary science mentors were already doing things at local authority level. They had been providing the local authority with a CPD programme of four science sessions over the course of a year, so they'd actually done eight since they'd been trained, and that that had had about 40 to 50 people each time attending, which showed me that in the area there was a huge desire for the people to learn

> about science, but it also showed me that there might be people who now wanted to take it a step further, so that's why I decided that the primary science mentor training and creating a network of, I'm hoping between 24 and 30 teachers across Moray, would help to continue that work over the next few years. Also, they would help to drive the standards of science upwards in all of the primary schools, because they're taking their enthusiasm for science and actually taking it back to the people they work with, and encouraging them to continue their learning in science, so that's where I thought that they build capacity…
>
> Moray PSDO

Local authorities were eager to create networks of teachers who could help sustain RAiSE related activity given the finite nature of this funding. Indeed, PSDO activity has consistently looked to identify others in the local system who are and will be, able to coordinate and help sustain the developments that are emerging through the RAiSE programme.

> It's about recognising where folks are, and taking them to the edge of their comfort zone, too; not allowing them to be complacent, [the PSDO's] very experienced in coaching and mentoring – so it's about that facilitating professional learning, using that coaching and mentoring model to support and challenge them appropriately. And identify where the early adopters are, where the movers and shakers are, and see how they can support us, you know, because there are only two of us.
>
> Angus LA colleague

In reaching out to enlist the support of others, the RAiSE PSDOs have often built on and extended the support provided through the SSERC PCP. For example, in Glasgow, the PSDO and the local authority team has developed the cluster model to promote cross sector work.

> The initial talking to schools, that gave me a lot of ideas and first meeting of the primary science curriculum working group, that gave me a lot of ideas of the specific areas that people wanted to work on, all of which I've taken on board into the training programmes that I'm putting in place. [Building on] the [SSERC] PCP, the idea is that those people [originally SSERC mentor teachers] will be confident to actually lead science CPD either in their school at ASG or local authority level,…Developing a kind of cluster model as well and having the link-up between the nurseries, the primaries and the secondaries, and working as a cluster…Also, they will be given [via the RAiSE PSDO] lots of different opportunities to develop their skills, not just in their school, as well; so people are looking to upskill as well.
>
> Glasgow PSDO

PSDOs working to identify, empower and build the skills of motivated primary teachers in their local authorities in order to develop a network of practitioners who can support teachers in their own and other schools has emerged as a key approach across the RAiSE local authorities in one form or another. This process is supported by local technology systems and infrastructure. The nature of this collaborative working will be explored in the evaluation's qualitative strand later in 2018.

> Building some sustainability is important, because we do know our role will be, it's [RAiSE] a short-term role…. We're only going to be here for a small number of years. To have a sort of framework, self-supporting framework, in some sort of shape or form, you've got somebody else…it would make it more sustainable. And at the same point, linked to that, we're asking each school, or partnership, to provide us with a STEM contact.
>
> Dumfries and Galloway local authority team

PSDOs have been able to demonstrate to primary teachers that much of what they are doing in school has a STEM aspect to it and that promoting science does not have to be about adding something extra to their work. This was seen as particularly important when teachers were reported to be concerned about a crowded curriculum and the pressure from prioritising literacy, numeracy and health and wellbeing.

One LA representative stressed that there was a danger teachers could become overwhelmed if the different national education priorities were not tackled in a coherent fashion. The PSDOs also stressed that the RAiSE programme had to be introduced to teachers as something that would help them address these objectives.

> To present RAiSE as another priority, I think would meet with some resistance in places, particularly if the schools are already focusing on literacy and numeracy. So, the point of mapping [RAiSE] to the outcomes of the NIF was to show that this is not an add-on, this is a way of achieving those priorities.
>
> Edinburgh local authority colleague

One PSDO added that the many pressures on teachers could hamper their involvement with RAiSE activities; however, the emergence of the national STEM Education and Training Strategy might influence schools' improvement plans and provide a driver to introduce a higher level of STEM activity.

> I think one of the key challenges is the fact that everybody is so busy and that every school has got their own school improvement plan; every school has got their own agenda; every school has got a different 35 hour week agreement; you know, there are different expectations of different staff. For the smaller schools to ask for a STEM contact, that STEM contact might be the same as the language contact, as the secondary language contact, and it's quite hard to put more expectation on practitioners. However, I would think, with the introduction of the STEM strategy, and the self-evaluation in STEM coming out, that possibly next year, now that they're aware of us, before they write the school improvement plans, that hopefully we'll get…you know, STEM or science will get incorporated into that, over and above what the expectation of the schools is.
>
> Dumfries and Galloway PSDO

Developments at national policy level, such as the STEM Strategy and DYW, were seen as helping to promote the profile of STEM and enhance the likelihood of RAiSE developments becoming embedded in school planning. However, a key part of building in sustainability was seen as establishing networks of appropriately skilled practitioners,

including SSERC mentors, other empowered teachers and organisations and businesses that could help provide science and STEM resource, support and inputs.

There is clear complementarity between RAiSE and SSERC, including the latter's coordination of Primary Science Teacher Trust (PSTT) supported, activity. PSDOs have been involved in coordinating professional learning programmes for the PSTT funded activity. Indeed, the RAiSE PSDOs have often built on extending the support provided by the SSERC PCP cluster model. For example, in Glasgow, the PSDO and the local authority team has developed the cluster model to promote cross sector work.

There were also numerous examples of PSDOs identifying existing local activity and sources of CLPL and bringing them together in an interdisciplinary way to meet identified needs and link these to national priorities such as Literacy and Numeracy and Developing the Young Workforce.

PSDOs appear successful to date in demonstrating to primary teachers that much of what they are doing in school has a STEM aspect to it and that promoting science does not have to be about adding something extra to their work. PSDOs and local authority colleagues saw this as particularly important when teachers were reported to be concerned about a crowded curriculum and the pressure from prioritising literacy, numeracy and health and wellbeing. One local authority representative stressed that there was a danger teachers could become overwhelmed if the different national education priorities were not tackled in a coherent fashion. The PSDOs also stressed that the RAiSE programme had to be introduced to teachers as something that would help them address all of their teaching objectives.

> NIF [drives] our work, the National Improvement Framework. And I mean, the three [key things] are raising attainment, DYW and the GIRFEC agenda; we're [also] trying to address these through the RAISE programme.
>
> Angus LA and PSDO

While it might be argued that the national and local policy landscape has become more likely to support and sustain activity and programmes such as RAiSE, PSDOs often stressed the importance having local coordinators and advocates in place to drive and systematise such work.

Building on existing successful local educational approaches and systems was also evident as a way the PSDOs implemented activities that were likely to be sustained and embedded. Indeed, in some cases the role and model of the PSDO was informed by existing and effective local authority approaches to promote learning and teaching. For example, in Glasgow, the approach of the PSDO in developing Leaders of Science Learning reflected the local authority's model of developing teachers as leaders of learning. This reflected the local authority's strategy to build all teachers' capacity to become leaders of learning, including researching and reflecting on their own performance. To help achieve this aim, the approach includes developing teams of skilled and enthusiastic teachers to support and develop their peers. Increasingly, these teachers

adopt a leadership role within and across their clusters and professional networks. In Glasgow City Council, the PSDO used this approach to develop a team of Leaders of Science Learning to focus on the RAiSE and local authority objectives. This network of Leaders of Science Learning included motivated teachers who might have attended SSERC or other CLPL programmes and who wanted to support colleagues to promote their STEM education ability. These Leaders of Science Learning used social media and online resources to promote communication, raise awareness, share practice and resources and extend their reach. Dumfries and Galloway and West Dunbartonshire were also developing similar approaches for their PSDOs.

A theme running through local authority interviews was that there should also be an emphasis on creating and maintaining a store of knowledge regarding what works in promoting teachers ability to teach STEM but also that these should be active and support teacher collaboration.

> Having these banks of information, having these video tutorials, having a website that's a central hub, creating networks and places where people can collaborate, and that's become cultural and normal – all those things are sustainable
>
> Angus local authority / PSDO

4.4 ASSESSING INITIAL PROGRESS AND IMPACT

While it was not anticipated at this stage in the evaluation that there would be evidence of major impact from the RAiSE programme regarding outcomes, the interviews with PSDOs and local authority colleagues provided insights on initial positive developments. They also revealed some of the systems that those involved with RAiSE were developing to monitor the impact of their work.

In addition to the ROC external evaluation, PSDOs and the National Education Officer are gathering routine data to understand the scale and pattern of STEM CLPL uptake and identify gaps. The ROC surveys are also becoming part of the Programme's information base, informing Tranche 2 Local Authorities' planning.

The PSDOs are evaluating their own work, including systematically contributing feedback of activity and insights to the National Education Officer. PSDO surveys and other data gathering, including their own baseline and follow-up surveys has revealed positive feedback and shown that teachers appreciate face-to-face contact (for example, in Highland), and PSDOs finding establishing relationships with teachers and stakeholders is an important factor in their success.

There is evidence of some PSDOs supporting the ability of practitioners to evaluate the impact of their science teaching on learners. In one local authority, there was support for schools to use the Raising Attainment For All (RAFA) Improvement Model[2] that provides a framework for developing, testing and implementing changes leading to improvements.

[2] http://www.gov.scot/Topics/Education/Schools/Raisingeducationalattainment/RAFA

In addition, there were indications that the emerging STEM self-evaluation framework is also influencing how PSDO and their colleagues will be assessing impact.

In working with teachers in schools over time, PSDOs were also well placed to see examples of approaches being implemented, enhancing engagement with learners and having a positive impact.

> The teacher was reporting that they now use that [science] language in their conversation, and in their homework, and their English. So, they're using these structures across a curriculum…they've got the concept of fair testing, and the concept of prediction and the concept of… agreement or argument.
>
> Edinburgh PSDO

> I'm seeing enthusiasm. I'm seeing that what we're [RAiSE team] doing, when I'm sharing it with people and speaking with teachers and head teachers that they acknowledge that this is what we need. I am confident, from the information I've gathered, that this is an appropriate next step for us… [Teachers will reflect this on their] school improvement plan; we want to show that we've made an impact; our schools are becoming increasingly more intelligent about the way they manage data and evidence improvement. And I think especially, I'm going to be working with the schools who are taking on using the new STEM self-evaluation framework that we've got from Education Scotland that's linked to HGIOS (4).
>
> Angus PSDO

Some local authority colleagues stressed that it was also important to reflect in the RAiSE process the "key role that schools have regarding self-evaluation and self-knowledge" and the role this has in school improvement. This process underpinned RAiSE but also wider change for improvement involving the coaching and mentoring of teachers and school leaders so that they developed an "enabling script".

The PSDOs and their local authority colleagues spoke about how RAiSE was being used to help to tackle the attainment gap and educational inequity through the use of an Inter Disciplinary Learning (IDL) stance and building a STEM focus into approaches that had been used to enhance literacy and numeracy locally.

> Research findings show that STEM can raise attainment in literacy and numeracy. But working alongside the literacy development officer, for early years, they were talking about different vocabulary that children use. And there's some vocabulary that needs to be developed more than others. And she was saying that could be linked brilliantly with science, when you're thinking about which vocabulary to help them develop, to help them with their language skills. And that would definitely come into raising attainment. So I think we have to be really clear, and make sure that our science shows to teachers that we can raise literacy and maths attainment, as well.
>
> Highland local authority colleague

> I think we could see teachers taking the initiative to, for example, use STEM ambassadors for things like DYW, or understanding the importance of when and how to request an

> ambassador. What I would like to see is the move away from STEM Week, or Science Week, or a simple STEM challenge, which is very superficial, to something where you've got STEM and IDL complementing each other. And that real connection of literacy and numeracy, and planned interventions, with digital technologies, not as a separate curriculum but seamlessness. And what I would really like to see is that every single teacher within a primary school is engaging with those opportunities, and planning the learning for their own children, using a real interdisciplinary methodology. That's maybe not three years away, that's longer.
>
> West Dunbartonshire PSDO

Those interviewed highlighted the need to recognise that implementing educational developments and strategies supported by RAiSE, such as those aligning to the Attainment Challenge, would require time to embed and have a wider impact.

RAiSE activity has supported teachers to use STEM as a way to tackling the attainment gap and issues of educational inequality. Examples included developing STEM activities that engaged with pupils' families and communities in deprived areas. In Edinburgh, the PSDO had developed a STEM event in the summer that entailed taking a science roadshow out into the community in Pilton, one of the most deprived communities in Edinburgh. This involved the PSDO working with colleagues at the University of Edinburgh. This was well attended with over 250 people participating. The local authority colleague stressed that having a PSDO to develop, organise and help deliver this activity was key and would likely not have happened without the presence of a PSDO. This activity was also seen as informing parental/ community strategies.

In Glasgow, the PSDO has explored how STEM can be used to promote parental engagement in pupils' learning as part of the wider tackling educational inequality and the attainment gap

> 45 per cent of the children in Glasgow live in deprivation, So when we've been looking at things to do with parental involvement, we've been, targeting skills in certain SIMDs, so we've not been going to the schools that we know do it well, because they can get the parents through the door; but we've been going to the schools that maybe have got projects up and running; they're getting parents in, but they need a wee bit of support in terms of STEM… so they're looking at maybe doing a STEM together club, so that they come, the parents come in after school and they do, STEM activities together… So at the moment we're identifying some schools who will build a pilot round in terms of parental engagement, based on STEM, but everyone will have a, kind of, different outline in terms of what happens, just based on the school, and what their needs are.
>
> Glasgow PSDO

4.5 SUPPORTING THE PSDOS

The PSDOs were unanimous in reporting being supported by local authority colleagues and particularly by the National Education Officer. Indeed, the National Education Officer is seen as having been fundamental regarding supporting the PSDOs during the first year,

facilitating their professional development and the sharing of ideas and good practice across the PSDO network. This has included:

- Facilitating sharing across the local authorities, providing regular opportunities for PSDOs to visit examples of good practice and opportunities that can inform their own work.

- Providing strategic direction and guidance to ensure that PSDO activity both addresses local authority and the Programme's objectives. And aligns to national priorities where appropriate.

Having access to local and national networks and sources of CLPL and knowledge exchange was reported to be a key source of support for PSDOs' work

Peer support across the PSDO network was also highly valued as this provided opportunities to visit, observe and share ideas that could be tried and translated in their own local authorities as well as providing moral support and encouragement. PSDOs also often stressed the positive support from their local authority colleagues. Indeed, all reported being supported by their line manager. Where PSDOs were part of a wider team this was reported to help facilitate STEM articulation and synergy between different sectors and policy strands across the council, including DYW.

5 FINDINGS FROM THE TEACHER SURVEYS

This section summarises the main findings from the Teacher and Headteacher surveys for both Tranche 1 (post-hoc) and Tranche 2 (baseline). It is divided into the following sections reflecting the structure of the questionnaire:

- Survey responses
- Awareness of the RAiSE Programme
- Support of the RAiSE Programme
- Comments on the RAiSE Programme.

5.1 SURVEY RESPONSES

5.1.1 Tranche 1

Tranche 1 authorities (Edinburgh, Highland and Moray) participated in a post-hoc survey for both teachers and head teachers. The survey was conducted in the autumn of 2017 and received responses from 35 teachers and 7 headteachers. Table 5.1 provides responses by local authority. The low level of responses from Tranche 1 teachers and their headteachers meant it was not meaningful to provide detailed quantitative findings. However, there were detailed insights provided in the open responses in the teacher and headteacher questionnaire's comments section. These insights have fed into the analysis where appropriate and an additional qualitative strand of the evaluation will revisit these local authorities to gather exemplars and evidence of impact as well as insights on progress and processes. It is not clear why there was a low level of responses for the Tranche 1 surveys and the research team will investigate this as they conduct the in-depth qualitative work with these teachers. We can speculate that because the survey was post-hoc it might not have been seen as useful to their school planning and having limited utility. In comparison, the robust level of responses from Tranche 2 teachers suggests teacher value surveys are able to monitor progress and impact.

Table 5.1 – Respondents by Authority in Tranche 1

	Teachers		**Headteachers**	
Authority	Frequency	Percentage	Frequency	Percentage
Edinburgh	10	29	1	14
Highlands	21	60	3	43
Moray	4	11	3	43
Total	**35**	**100**	**7**	**100**

5.1.2 Tranche 2

Three of the five Tranche 2 local authorities' baseline survey data for teachers and headteachers have been included in the evaluation analysis, these were: Dumfries and Galloway, Glasgow and Angus. Fife, while part of the second wave of RAiSE local

authorities, put in place a PSDO and began their RAiSE activity after the main 'core' of three authorities had conducted their baseline surveys. These local authorities will conduct a separate baseline series of surveys for their headteachers, teachers and pupils. Aberdeenshire Council withdrew from the Programme because of difficulty in recruiting a PSDO.

The Tranche 2 survey was conducted in the autumn and winter of 2017 and into early 2018 via online and paper based collection. The database contains valid responses from 309 teachers and 43 headteachers from the three 'core' authorities. Table 5.2 provides responses by local authority and Table 5.3 provides sex of respondents. There was an even spread of responses across the authorities and from males and females where some authorities provided more responses than others.

Table 5.2 – Respondents by 'core' Authority in Tranche 2

	Teachers		**Headteachers**	
Authority	Frequency	Percentage	Frequency	Percentage
Angus	78	25	10	23
D&G	74	24	22	51
Glasgow	157	51	11	26
Total	**309**	**100**	**43**	**100**

Table 5.3 – Sex of respondents in Tranche 2

	Teachers		**Headteachers**	
Sex	Frequency	Percentage	Frequency	Percentage
Male	35	11	6	14
Female	273	89	36	86
Total	**308**	**100**	**42**	**100**

5.2 AWARENESS OF THE RAiSE PROGRAMME

In the Tranche 2 baseline survey teachers and headteachers were asked to rate their awareness of the RAiSE programme (three-point scale).

5.2.1 Teacher Awareness

In relation to teacher awareness of the RAiSE programme, Table 5.4 summarises responses. Table 5.5 summarises the percentage of teacher responses by local authority.

Table 5.4 – Teachers' Awareness of the RAiSE Programme

	Frequency	**Percentage**
Very Aware	12	4
Partly Aware	110	39
Not Aware	**158**	**56**

A majority of teachers in the 280 who responded to this question indicated that they are not currently aware of the RAiSE Programme in their local authority while a small minority reported that they are very aware.

Table 5.5 – Teachers' Awareness of the RAiSE Programme by Local Authority (%age)

	Angus	D&G	Glasgow
Very Aware	7	7	2
Partly Aware	32	**48**	40
Not Aware	**61**	46	**58**

5.2.2 Headteacher Awareness

In relation to headteacher awareness of the RAiSE programme, Table 5.6 summarises responses. Table 5.7 summarises the percentage of headteacher responses by local authority.

Table 5.6 – Headteachers' Awareness of the RAiSE Programme

	Percentage
Very Aware	26
Partly Aware	**53**
Not Aware	21

A majority of headteachers in the 47 who responded to this question indicated that they are partly aware of the RAiSE Programme in their local authority while a small minority reported that they are very aware.

Table 5.7 – Headteachers' Awareness of the RAiSE Programme by Local Authority (%age)

	Angus	D&G	Glasgow
Very Aware	11	46	10
Partly Aware	**56**	**55**	**50**
Not Aware	33	-	40

Although we should exercise a degree of caution in comparing the teachers' and headteachers' results directly we can conclude that:

- The majority of teachers across authorities were relatively unaware of the RAiSE Programme.
- Headteachers were more aware of the Programme with varying levels of awareness by local authority.

5.3 SUPPORT OF THE RAISE PROGRAMME

Teachers and headteachers were asked to indicate to what extent they would like support from RAiSE in a number of specific categories.

5.3.1 Extent of Support for Teachers

Results for teacher responses are presented in Table 5.8.

Table 5.8 – Teacher desire for support

Percentage	A lot	Some-what	Not Really	Not at All	Not Sure	NA
Promoting my overall knowledge to teach science	37	54	7	1	1	-
Promoting my overall skills to teach science	39	52	7	1	1	-
Promoting pupils' engagement in science	38	47	12	2	2	-
Promoting pupils' aspirations regarding science and technology careers	48	41	8	1	2	1
Promoting science activities in the curriculum	43	49	5	1	1	-
Increasing collegiality between colleagues	26	46	22	2	3	2
Increasing interdisciplinary learning approaches where science is incorporated into a range of common primary topics	41	48	9	-	1	-
Increasing my reflective practice and self-evaluation	15	42	36	4	3	-
Increasing staff networks to support science and technology teaching CPD	32	51	14	1	2	-
Increasing the capacity of classroom assistants to support the delivery of science in the primary curriculum	36	39	16	3	4	3
Improving collegiate planning in my school	19	39	32	6	3	1
Promoting my confidence in relation to the pedagogy of science	31	50	16	2	2	-
Promoting my skills in relation to the pedagogy of science	30	54	12	2	1	-
Promoting my skills in relation to the teaching content of science	31	52	13	2	2	-
Promoting my confidence in relation to the teaching content of science	32	47	17	3	2	-
Promoting my knowledge in relation to the pedagogy of science	29	56	12	2	2	-
Promoting my knowledge in relation to the teaching content of science	29	54	14	2	1	-
Promoting my enthusiasm in relation to the pedagogy of science	18	38	35	6	3	1
Promoting my enthusiasm in relation to the teaching content of science	17	38	38	6	2	1
Promoting my learners' attainment and achievement in primary science	42	49	6	2	1	-
Promoting the science attainment and achievement of those learners most in need	40	50	8	2	1	-
Promoting learners' levels of engagement with primary science education	36	45	15	2	1	-

Promoting opportunities to sustain and extend the impact of the SSERC Primary Cluster Programme in my local authority	25	53	12	1	7	1
Promoting opportunities for my learners to experience breadth in their learning in new contexts, including in STEM	45	47	7	1	1	-
Promoting opportunities for my learners to experience challenge in their learning in new contexts, including in STEM	45	47	7	-	1	-
Promoting opportunities for my learners to apply their skills and knowledge in new contexts, including in STEM	45	50	4	-	1	-
Promoting opportunities for me to support learners to develop their skills for learning with relevance of science both to them and society	44	47	7	-	1	1
Promoting opportunities for me to support learners to develop their skills for life with relevance of science both to them and society	42	51	6	-	1	1
Promoting opportunities for me to support learners to develop their skills for work with relevance of science both to them and society	42	50	6	-	1	1
Promoting opportunities for me to effectively monitor and report learners' progress and achievements	32	52	12	2	1	1
Promoting opportunities for me to support effective progression in learning in the sciences from early years to primary school	35	52	8	2	1	2
Promoting opportunities for me to support effective progression in learning in the sciences from primary to secondary school	36	49	10	1	2	3
Developing my ability to promote 3-18 progression in learning	28	50	18	2	1	1
Developing my ability to assessing progress and achievement regarding science	32	56	11	1	1	1
Developing my leadership capacity	15	35	35	11	2	3
Promoting opportunities for me to network and share with my peers regarding science teaching	15	49	28	4	3	1
Promoting parental engagement to help promote children's learning of science and their related skills	27	51	18	2	2	-
Improving collegiate planning in my school	14	46	29	6	3	1
Improving collegiate planning in my cluster	14	45	31	6	4	1
Promoting opportunities for me to mentor other teachers regarding science teaching	12	29	36	13	6	6

-Indicates responses that are less than 1%

Teachers were mostly somewhat interested in receiving support for individual STEM opportunities. The most requested support was for *Promoting pupils' aspirations regarding science and technology careers*, *Promoting opportunities for my learners to apply their skills and knowledge in new contexts, including in STEM* and *Promoting*

opportunities for my learners to experience challenge in their learning in new contexts, including in STEM.

5.3.2 Extent of Support for Headteachers

Results for teacher responses are presented in Table 5.9.

Table 5.9 – Headteacher desire for support

Percentage	A lot	Some-what	Not Really	Not at All	Not Sure	NA
Promoting teachers' overall knowledge to teach science within the school	51	40	9	-	-	-
Promoting teachers' overall skills to teach science within the school	60	34	6	-	-	-
Promoting pupils' engagement in science throughout the school	47	47	7	-	-	-
Promoting pupils' aspirations regarding science and technology careers throughout the school	60	38	-	2	-	-
Promoting science activities in the curriculum throughout the school	49	40	11	-	-	-
Increasing collegiality between colleagues within the school	26	38	30	6	-	-
Increasing interdisciplinary learning approaches where science is incorporated into a range of common primary topics throughout the school	43	40	17	-	-	-
Increasing teachers' reflective practice and self-evaluation	30	45	21	4	-	-
Increasing staff networks to support science and technology teaching CPD throughout the school	35	57	9	-	-	-
Increasing the capacity of classroom assistants to support the delivery of science in the primary curriculum throughout the school	26	43	19	2	-	11
Promoting the overall quality of learning and teaching methods regarding science within the school	47	51	2	-	-	-
Improving collegiate planning in the school	26	43	26	6	-	-
Promoting teachers' confidence in relation to the teaching pedagogy of science	49	49	2	-	-	-
Promoting teachers' confidence in relation to the teaching content of science	46	50	4	-	-	-
Promoting teachers' skills in relation to the teaching pedagogy of science	55	40	4	-	-	-
Promoting teachers' skills in relation to the teaching content of science	51	45	4	-	-	-
Promoting teachers' knowledge in relation to the teaching pedagogy of science	47	47	6	-	-	-
Promoting teachers' knowledge in relation to the teaching content of science	45	49	4	2	-	-
Promoting teachers' enthusiasm in relation to the teaching pedagogy of science	38	53	9	-	-	-
Promoting teachers' enthusiasm in relation to the teaching content of science	30	60	11	-	-	-

Promoting learners' attainment and achievement in primary science	52	44	4	-	-	-
Promoting the science attainment and achievement of those learners most in need	53	42	4	-	-	-
Promoting learners' levels of engagement with primary science education throughout the school	43	47	11	-	-	-
Promoting opportunities to sustain and extend the impact of the SSERC Primary Cluster Programme in the local authority	36	47	13	2	2	-
Promoting opportunities for learners to experience breadth and challenge in their learning and apply their skills and knowledge in new contexts, including in STEM	47	47	6	-	-	-
Promoting opportunities for teachers to support learners to develop their skills for learning, life and work with relevance of science both to them and society	49	43	9	-	-	-
Promoting opportunities for teachers to effectively monitor and report learners' progress and achievements	45	36	19	-	-	-
Promoting opportunities for teachers to support effective progression in learning in the sciences from early years to primary school	43	43	13	-	-	2
Promoting opportunities for teachers to support effective progression in learning in the sciences from primary to secondary school	47	43	11	-	-	-
Developing teachers' ability to promote 3-18 progression in learning	43	40	17	-	-	-
Developing teachers' ability to assessing progress and achievement regarding science	51	43	6	-	-	-
Developing teachers' leadership capacity	28	50	20	2	-	-
Promoting opportunities for teachers to network and share with my peers regarding science teaching	33	48	17	2	-	-
Promoting parental engagement to help promote children's learning of science and their related skills	47	40	11	-	2	-
Improving collegiate planning outwith the school and/or cluster	26	45	26	2	2	-
Promoting opportunities for teachers to mentor other teachers regarding science teaching	26	45	28	-	2	-

Headteachers were most likely to indicate they would like a lot of support from RAiSE for most of the STEM categories offered in the survey with slightly less prioritising support for collegiate activities and leadership opportunities for teachers. It is clear that headteachers are particularly interested in support that promotes the pedagogical skills and confidence of their teachers to teach STEM. While headteachers prioritise these aspects of support it is worth noting that teacher collegiality, self-evaluation and leadership are important contributing factors to effective teaching as highlighted in HGIOS4 (Education Scotland 2015) and research on strategies to promote effective education systems and research (e.g. Shah 2012).

Although we need to exercise some caution when comparing the teachers and headteachers results, we can conclude that:

- Both teachers and headteachers were highly interested in promoting pupil aspirations regarding STEM.

- Headteachers are more likely to prioritise support from RAiSE regarding teachers promoting teachers' confidence and pedagogical practices and skills to teach STEM.

- Headteachers were more likely to indicate their desire for support from the RAiSE Programme than teachers. This might reflect the fact that Tranche 2 headteachers were also more aware of RAiSE and could envisage the potential benefits. In addition, headteachers' strategic role in leading school improvement and writing the School Improvement Plan might also contribute to their increased levels of need for support at this stage.

5.4 COMMENTS ON THE RAISE PROGRAMME

Teachers and headteachers were asked to provide comments on specific aspects of the RAiSE programme. These were broken down into the following questions:

- What, if any, main challenges do you see facing the teaching of science in your school?
- What do you see as the most important issues that science education should be addressing?
- What is the most important support you would like from the RAiSE Programme and PSDO?
- Any final comments.

Teachers and headteachers in both Tranche 1 and Tranche 2 indicated that resources, curriculum, confidence, planning, equipment and support were the main challenges facing the teaching of science. They also believed that gender, life skills, engagement, careers, and problem solving were the most important issues that science education should be addressing. Both groups indicated that they would like resources, ideas and support with planning from the RAiSE programme and the PSDOs. Finally, their additional comments reiterated the need for support with teaching STEM and a request for educational resources.

6 FINDINGS FROM THE PUPIL SURVEYS

This section summarises the main findings from the pupil baseline surveys. It is divided into the following sections reflecting the structure of the questionnaire:

- Survey responses
- Pupil enthusiasm for school and school subjects
- Pupil enjoyment of science activities
- Pupil confidence in conducting science tasks
- Pupil beliefs about science.

6.1 SURVEY RESPONSES

The Tranche 2 pupil baseline survey across the three core local authorities was initiated in the autumn session of 2017. As shown in Table 6.1, 4,757 responses have been collected.

Table 6.1 – Pupil respondents by Authority

	P2-P4 pupils		P5-P7 pupils	
Authority	Frequency	Percentage	Frequency	Percentage
Angus	281	13	254	10
D&G	269	12	543	21
Glasgow	1669	75	1741	69
Total	**2219**	**100**	**2538**	**100**

Tables 6.2 and 6.3 provide additional detail on pupil databases and give a good indication of the 'even' spread of responses across the year groups and from males and females despite attrition in responses.

Table 6.2 – Sex of respondents

	P2-P4 pupils		P5-P7 pupils	
Sex	Frequency	Percentage	Frequency	Percentage
Male	1067	50	1283	52
Female	1047	50	1179	48
Total	**2114**	**100**	**2462**	**100**

Table 6.3 – Year group of respondents

	P2-P4 pupils			P5-P7 pupils	
Year group	Frequency	Percentage	Year group	Frequency	Percentage
P2	550	26	P5	688	28
P3	622	29	P6	873	35
P4	951	45	P7	899	37
Total	**2123**	**100**	**Total**	**2460**	**100**

The pupil findings displayed are reported and discussed for P2-P4 and P5-P7 separately because the questionnaires used for each age cohort was different, with the P2-P4 being a simpler version with less questions.

6.2 PUPIL ENTHUSIASM FOR SCHOOL AND SCHOOL SUBJECTS

In the baseline survey, pupils were asked to rate their enthusiasm/liking for school (three-point scale) and for individual subject areas (four-point scale).

6.2.1 Pupil enthusiasm for school

Regarding pupil attitudes towards school in general, Table 6.4 summarises responses for P2-P4 pupils and Table 6.5 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.

Table 6.4 – P2-P4 How much do pupils like school?

	%
Smiley face (I really like school)	62
Straight face (I like school sometimes)	31
Unhappy face (I don't like school)	8

A majority of P2-P4 pupils indicated that they liked school while a small minority reported disliking school.

Looking at the findings for the P5-P7 pupils we can see a majority of pupils indicated *liking school sometimes* although only a small minority reported disliking school.

Table 6.5 – P5-P7 How much do pupils like school?

	%
I really like school	35
I like school sometimes	57
I don't like school	8

6.2.2 Pupil Enthusiasm for School Subjects

Both groups of pupils were most likely to indicate ICT, PE and Science as subjects that they *liked a lot*. Table 6.6 shows that more than three quarters of respondents indicated liking these subjects *a lot*. On the other hand, Social Studies, Language and Literacy and RME were less popular among pupils.

Table 6.6 – 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)
ICT	86	10	3	2
PE	80	14	3	3
Science	72	16	7	6
Maths and numeracy	65	22	7	6
Social Studies	59	23	9	9
RE/RME	52	27	11	10
Language and literacy	51	31	10	8

Though P5-P7 pupils agree on which subjects they *like a lot*, their enthusiasm for these subjects is less than their younger counterparts that can be seen in table 6.7.

Table 6.7 – P5-P7 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)
ICT	79	17	3	1
PE	76	18	5	2
Science	62	26	8	4
Maths and numeracy	49	32	12	7
Social Studies	40	40	13	7
Language and literacy	27	48	18	7
RE/RME	21	37	25	16

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

- The majority of P2-P7 pupils appeared positive about school and their subjects.
- RME/RE and Language and Literacy were the least popular subjects among pupils P2-7 while Science ranked third in enthusiasm.

6.3 Pupil Enjoyment of Science Activities

P2-P4 and P5-P7 pupils indicated their enjoyment (on a four-point scale) with a number of activities associated with science both in and out with school. Results for P2-P4 are presented in Table 6.8 while the results for P5-P7 are contained in Table 6.9.

Science activities were popular among P2-P4 pupils. Table 6.8 shows that a clear majority of the pupils really enjoy taking part in all of the activities listed.

Doing experiments in class was the most enjoyed activity and *Writing about science in school* was the least enjoyed activity in P2-P4 pupil responses.

Table 6.8 – P2-P4 How much do pupils enjoy doing the following science activities?

Percentage	**Big smile face** (Really enjoy)	**Small smile face** (Enjoy)	**Small unhappy face** (Dislike)	**Big unhappy face** (Really dislike)
Doing experiments in class	72	19	4	5
Listening to the teacher talking about science	58	27	9	7
Working in groups in class to do science	66	21	8	6
Working on my own in class to do science	53	23	12	12
Answering the teacher's science questions in class	55	28	11	7
Writing about science in school	52	26	12	10
Reading about science in class	56	26	11	8
Doing science homework	54	21	11	14
Reading about science at home	53	24	11	12
Watching science programmes at home	59	20	10	11
Watching science fiction programmes or films	56	21	11	12
Talking to friends and family about science	57	24	10	9

P5-P7 pupils were less likely than their P2-P4 peers to rate their enjoyment of science activities in the highest category (really enjoy) - see Table 6.9. As with the P2-P4 pupils, *doing experiments in class* as well as *going to the science museum or science centre* were the activities most frequently indicated as *really enjoy* although the percentages reporting this were smaller than the P2-P4 group.

Table 6.9 – P5-P7 How much do pupils enjoy doing the following science activities?

Percentage	**Really enjoy**	**Enjoy**	**Dislike**	**Really dislike**	**I don't do this**
Doing experiments in class	66	25	3	1	6
Listening to the teacher talking about science	27	42	19	8	5
Working in groups in class to do science	51	32	8	4	5
Working on my own in class to do science	34	29	20	10	8

Answering the teachers science questions in class	30	37	19	8	7
Writing about science in school	24	32	24	11	9
Reading about science in class	31	31	18	10	10
Doing science homework	27	22	15	11	25
Reading about science at home	27	27	18	11	18
Watching science programmes at home	38	26	12	8	16
Watching science fiction programmes or films	43	25	11	7	14
Going to the science museum or science centre	66	18	5	3	8
Asking questions using scientific investigation	25	31	18	8	18
Doing scientific activities or play	57	24	6	3	10
Talking to friends and family about science ***N=1984***	32	29	13	6	19

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

- Science activities were popular among primary pupils and particularly so among the P2-P4 group;
- *Doing experiments in class* was the most commonly enjoyed activity in both groups of pupils in the study.

6.4 PUPIL CONFIDENCE IN CONDUCTING SCIENCE TASKS

This section of the questionnaire sought information on pupils' confidence in successfully conducting a number of 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 question used categories comprising faces (smiling, neutral, unhappy etc.). Further, the P2-P4 question contained seven items while the P5-P7 version had 14. Table 6.10 summarises responses from the P2-P4 group and Table 6.11 contains findings from the P5-P7 group.

On all of the question items, a majority of P2-P4 pupils indicated very happy.

Table 6.10 – 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)
I can predict what will happen in an experiment ***N=2133***	40	34	16	11
I can create a 'fair experiment' N***=2019***	46	26	15	13
I can select appropriate equipment for my experiment N***=2001***	51	25	14	9
I can carry out experiments **N=2019**	50	28	13	10
I can discuss the result of the experiment N***=2037***	45	27	16	12
I can show my findings in different ways N***=2007***	44	29	16	12
I can make suggestions to make the experiment better N***=1971***	51	24	15	11

Large majorities of P5-P7 pupil responses indicated that they were *confident* or *very confident* in their ability to successfully complete each of the 14 tasks detailed in Table 6.11. Confidence was highest with the following items: *I can carry out experiments* and *I can plan and design experiments*. This is noteworthy given how many pupils indicated enjoying *doing experiments in class* in the previous section. The lowest levels of confidence are found in *I can create a hypothesis to test my predictions* and *I can review and evaluate results to identify limitations and improvements*.

Table 6.11 – P5-P7 How confident are pupils in their ability to complete the following science tasks?

Percentage	**Very Confident**	**Confident**	**Not confident**	**Not confident at all**
I know when a scientific experiment will help me find the answer to my question	26	50	17	7
I can create a hypothesis to test my predictions	24	41	23	13
I can create a "fair test"	41	37	15	8
I can plan and design experiments	46	36	13	6
I can select appropriate samples, equipment and other resources	39	38	17	7
I can carry out experiments	47	35	13	6
I can observe evidence	36	41	16	7
I can collect evidence	43	39	12	6
I can record evidence	41	35	17	7
I can present data in different formats	26	37	26	11

I can analyse and interpret data to draw conclusions	27	37	26	11
I can review and evaluate results to identify limitations and improvements	25	29	24	12
I can use scientific investigation to solve problems	35	37	20	8
I can use scientific language in my school work	28	35	25	12

Reviewing pupil confidence in conducting science tasks we can conclude the following:

- Pupil confidence to successfully complete identified science tasks was higher in the P2-P4 than in P5-P7 pupils.

6.5 Pupil Beliefs About Science

P5-P7 pupils were asked a number of additional questions concerning their beliefs about science (see Table 6.12). In the main pupil responses indicated that they have relatively positive attitudes towards science.

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.

Table 6.12 – P5-P7 Pupil beliefs about science.

Percentage	Strongly agree	Mainly agree	Mainly disagree	Strongly disagree	Don't Know
I am amazed by the achievements of science	49	33	5	2	10
Science is such a big part of our lives that we should all take an interest	40	34	11	5	11
It is important to know about science in my daily life	41	35	11	5	9
Science is too specialised for most people to understand it	21	27	21	18	13
I don't think I'm clever enough to understand science	14	15	20	39	13
I don't understand the point of all the science being done today	14	17	23	33	13
It is important for us to learn science in school	60	26	5	3	6
I can learn about science outside school too	51	29	7	5	7

I would like to do more science when I finish school	39	24	14	12	12
I talk to my parents/carers about science	26	27	17	18	12
I know what a scientist does	39	33	11	5	12
I know someone who works in science	24	13	12	22	29
I can use science in my other school subjects	31	31	14	7	17
I can see myself as being a scientist in the future	15	14	14	35	21

Reviewing pupil beliefs about science (P5-P7) we can conclude the following:

- P5-P7 pupil beliefs regarding science were generally positive, suggesting that they were impressed by the contribution of science to society, acknowledging it has a large part to play in people's lives and that it is an important subject in school;

There was a strong indication that, at this stage, many of the study pupils were keen to be involved with science when they left school, however little indication that they could see themselves as a scientist in the future which may coincide with the relatively low levels of those who know someone who works in science. However, this might be explained by use of the term 'science' in the question rather than the use of a term that describes STEM and its broader connotations.

7 CONCLUSION AND POINTS FOR CONSIDERATION

7.1 CONCLUSION

At this stage in the evaluation, the research team have gathered data and information which allows for a detailed understanding of how RAiSE has developed overall and locally in order to meet the Programme's objectives. This information has provided a picture of highly skilled and motivated individuals working with colleagues to develop the necessary infrastructure, CLPL and systems to implement and sustain RAiSE. This has been characterised by PSDOs identifying and supporting motivated teachers who will act as local leads in their schools and clusters to sustain RAiSE activity and further the Programme objectives. Key to this process has been PSDOs fostering networks so that Leaders of Science Learning and local and national partner organisations, as well as businesses, can reach and support other teachers.

PSDOs are well supported by local authority colleagues and some work within teams that focus on promoting STEM education capacity of teachers and linking this to, and integrating RAiSE, with other educational strategies. Often, this process is supported by a range of technology and social media to promote knowledge transfer and share good practice. At this stage in the evaluation it remains to be seen whether those PSDOs working as part of integrated teams within their local authority have proportionately more impact. However, the research literature would support this possibility [e.g.: Chapman et al 2017]. Also, as the evaluation proceeds, it is expected that insights will be gained on what level of PSDO staffing required to have a particular impact locally and on building network capacity

The evidence to date strongly indicates that the PSDOs are effectively implementing the Programme in context-relevant ways but it should also be stressed that the National Education Officer has been responsible for ensuring the coherence of the overall approach, supporting the development of the PSDOs and also in scoping relevant practice and ideas that can be fed into the RAiSE programme.

The other main evaluation strands have involved gathering quantitative data to establish a baseline of indicators across headteacher, teacher and primary 2-7 pupils that will allow an assessment of impact when these groups are surveyed again. At this stage, the findings from these baseline surveys reveal the reported needs of teachers and headteachers that they want the RAiSE Programme to address. Tranche 2 Headteachers see building teacher confidence and skills as key, their teachers are eager for support to enable them to promote specific learner outcomes such as science skills that are relevant for life, society and world of work. While the number of Tranche 1 headteachers/ teachers' responses was very low, respondents' comments reported that they had benefitted from their involvement with RAiSE and that it had had a positive impact on pupils' science education.

Headteacher and teachers identified a number of challenges facing promoting effective science education. These include building teacher confidence, securing appropriate resources to teach practical science and finding ways to prioritise science alongside literacy, numeracy and health and wellbeing.

The pupil surveys indicate that the majority of P2-P7 pupils appeared positive about school and their subjects. Pupils were most likely to indicate ICT, PE and Science as subjects that they *liked a lot*. Science was ranked third. In contrast, Social Studies, Language and Literacy and RME were less popular.

Science activities were popular among P2-P4 pupils. A clear majority of the pupils 'really enjoy' taking part in all of the science activities listed. *Doing experiments in class* was the most enjoyed activity and *Writing about science in school* was the least enjoyed activity in P2-P4 pupil responses. P5-P7 pupils were less likely than their P2-P4 peers to rate their enjoyment of science activities in the highest category (really enjoy). As with the P2-P4 pupils, *doing experiments in class* as well as *going to the science museum or science centre* were the activities most frequently indicated as *really enjoy by* P5-P7 pupils, although the percentages reporting this were smaller than the P2-P4 group**.**

The majority of P5-P7 pupil responses indicated that they were *confident* or *very confident* in their ability to successfully complete each of the 14 science tasks detailed in the question. This suggests that for the follow-up surveys we might see marginal reported shifts, as the 'headroom' for positive gains is limited. However, if the large number of responses is repeated in the follow-up pupil surveys, the evaluation team will be able to identify statistically significant shifts. In addition, the qualitative component of the evaluation scheduled for later in 2018 will explore whether pupils are able to accurately self-evaluate and discriminate between these questionnaire response categories. However, the research team's experience of using the same questions in other national surveys suggests that many can.

P5-P7 pupil beliefs regarding science were generally positive. There was a strong indication that many of the pupils were keen to be involved with science when they left school. However, there was little indication that they could see themselves as a scientist in the future, which may coincide with the relatively low levels of those who know someone who works in science. However, it is possible that given the term used in the question (scientist), that this limited their response and that more pupils might consider broader STEM careers. The Tranche 2 follow-up survey will look for any shifts in these responses following RAiSE activity and the evaluation will consider other possible factors that might influence observed shifts at the follow up stage such as other initiatives in place. The pupil focus groups planned for later in 2018 will explore in more detail pupils' perceptions of STEM and related careers. If there is an issue regarding pupils' views on the appeal of STEM careers, it indicates a need for efforts to build science capital and engage with parents as well as learners to promote the image of STEM careers.

7.2 DISCUSSION AND POINTS FOR CONSIDERATION

This section reflects on the some of the emerging findings to highlight points for consideration. It also looks at some of the challenges facing the evaluation and suggests initial recommendations.

7.2.1 RAiSE as a Collaborative Change Model

On the basis of descriptions of activity gathered from PSDOs and their local authority colleagues, the interim findings are positive regarding the progress of the RAiSE Programme in terms of developing sustainable systems to achieve the Programme's objectives. The findings to date strongly suggest that the RAiSE programme is being developed in line with what is known from research about effective CLPL (Cordingley et al 2003; Duncombe and Armour 2004; Smith 2014; Smith and Nadelson 2016;) but, furthermore, what is known to also foster educational change and increased attainment. The latter is important regarding the change within and across the system that RAISE is operating. For example, international educational research and practice demonstrates that the most effective collaborative educational improvement efforts are locally owned and led by teachers and school leaders working in partnership and collaboration with like-minded professionals and other stakeholders (e.g. Fullan 2013, Chapman et al. 2016, Chapman, C and Hadfield, M 2010, Donaldson 2012, Ainscow et al., 2012).

To date, the qualities of the RAiSE Programme and its implementation align with these studies, which highlight the importance of the following characteristics:

- Networking and partnership working across schools and local authorities with a focus on exploring specific issues relating to effective teaching and educational equity.
- Developments being informed by use of data and evidence.
- The creation of leadership opportunities and professional learning of staff at all levels.
- Explicit links to strategic improvement planning in schools and local authorities.
- Involving a diverse range of partners.
- Involving a group of committed practitioners, supported by school and local authority leaders. This group has been established quickly to drive the project and has then been able to engage other staff and expand the influence of the Programme to affect behaviours more widely across schools and partnerships.
- Investing time to develop relationships and infrastructure with a priority on professional dialogue and networks to build the 'infrastructure' needed for effective collaborative working.
- Providing early identification and mobilisation of individuals at different levels who are well placed to lead and manage improvement through partnerships/ collaboration.
- Facilitating practitioners and managers to transform and extend their professional roles and identities in ways that promote collaborative enquiry to drive innovation and sustained improvement.

Again in line with the wider research on effective educational change systems, we see the PSDOs and their local authority colleagues are:

- Skilled at recognising how strategic plans and objectives can be operationalised locally within particular contexts.
- Socially skilled to encourage and enlist the participation of colleagues in schools and partner agencies to put the plans into action.
- Are sufficiently influential in their networks to mobilise knowledge and facilitate and sustain action in local and national systems.

It will be interesting to see if RAiSE, possessing these positive attributes, is able to tackle some of the challenges PSDOs identified. These include: overcoming geographical distance in some local authorities, ensuring buy-in from all school leaders and teachers and working within an environment where teachers' time and available cover can limit teacher engagement in CLPL and associated activity.

7.2.2 Considerations for the RAiSE Programme

As was discussed earlier in the report, the initial cohort of ten authorities over the two tranches of activity has since reduced to eight. Throughout the programme there have been key lessons learned and reported by the National Education Officer, PSDOs and their local authority colleagues. Both the challenges and key ingredients for success must be considered carefully to help maximise the opportunities presented through the Programme as it moves forward into a new phase. Although there are regional differences, clear themes are emerging across the national pilot cohort regarding those considerations and opportunities that may shape future development of the Programme.

Considerations

- Recruitment delays – some delays in the release of PSDOs from their substantive posts indicate that at least 6 months is required to ensure that recruitment and release of the PSDO occurs in line with programme timescales.
    - *Opportunity*: Consider overall lead-in time for the programme and factor in additional time beyond initial engagement with authorities to mitigate against recruitment delays.
- Length of secondment – a 23-month secondment is standard practice across authorities. The RAISE programme is taking between 9-12 months to become established and operational in an authority. Often, no one has had responsibility for this type of role for some time and consequently much groundwork is needed. This then cuts in to the time available to expand the reach of the programme.
    - *Opportunity*: Review and consider the possibility of extending the contract for PSDOs to 3 years. This would provide additional time to build the infrastructure that is required for impact and to extend possibilities for the work. Alternatively, consider reviewing when the programme contract begins to align not with commencement of operational activity.
- Governance review – policy shifts in the education landscape are resulting in changes at local authority and regional level. This period of change may result in

the need for review and subsequent adaptation of the structure and implementation of the RAISE Programme moving forward.

    - *Opportunity:* continued close liaison with ADES and Education Scotland is required to ensure RAiSE is aligned to the developments of Regional Improvement Collaboratives.

- Importance of support within the local authority – cascaded engagement beyond the Director of Education has enabled PSDOs to become established more quickly in post. A named strategic lead ensures clear communication between all stakeholders and increased efficiencies in operational delivery. Their guidance and presence at meetings has helped represent local perspectives and demonstrated buy in for both their PSDO and the wider RAISE community.

    - *Opportunity*: as part of the initial commitment to the programme, the importance of the active engagement and support of strategic officers should be emphasised.

- Communications – clear communication channels support progress. However it is understood that situations can change quickly and unexpectedly. The opportunity for early flagging of issues through an established structure of communication is important to success.

    - *Opportunity:* build in additional meetings or milestones to ensure that communications are kept frequent and that there is regular contact with the appropriate local authority contacts.

- Local authority commitment – this is a key factor in ensuring that PSDOs are appropriately supported and resourced and that the programme links effectively to other strategic priorities within the authority.

    - *Opportunity*: the importance of wider local authority commitment to the success of the programme should be emphasised from the first point of engagement. A clear indication of commitment should be sought before authorities enter into the programme.

- Variation in levels of engagement levels across clusters.

    - *Opportunity*: attention should continue to be paid to the relative engagement of clusters to ensure all receive the necessary support, including targeted support where required.

- Other school and authority priorities – schools are addressing a number of other priorities at this time including the National Improvement Framework, Scottish Attainment Challenge, DYW and reporting on literacy and numeracy levels.

    - *Opportunities:* continue to align the work of RAISE to national priorities, as relevant, so that it is not seen as an ‘add on’ but that it is integral to the national efforts.

7.2.3 Future Opportunities for the RAiSE Programme

- The launch of the STEM Education and Training Strategy highlighted the national ambition for STEM.

    - *Opportunity:* Identify opportunities therein to align RAISE objectives more explicitly to the national offer and encourage PSDOs to replicate this at a local level.

- Pupil Equity Funding – authorities report that money is available for schools through the PEF programme but more support would be useful to demonstrate how science and STEM can help raise attainment and tackle inequity.
    - *Opportunity*: develop case studies and evidence base around RAISE and the work underway which could support the objectives of PEF and ultimately benefit learners.

7.2.4 Challenges for the Evaluation

In addition to providing evaluative data, the research team has worked closely with local authorities to ensure that the findings can inform the plans of Tranche 2 local authorities. This has had some implications for the pacing and timescale of the surveys. However, with support from TWF regarding timescales, the evaluation has adapted and gathered data in strands that reflect the activity in the local authorities. For example, 'early entrants' in Tranche 2 have been surveyed, while those that have taken more time to become established, will provide baseline data at an appropriate time. This staggered approach, therefore, enables the aims of the evaluation and supporting local authorities to coexist.

The low response to the Tranche 1 headteacher and teacher surveys is disappointing. However, we speculate that unlike Tranche 2 teachers, those in Tranche 1 perhaps perceived less utility from participating in a post-hoc survey. Whereas, Tranche 2 see the value of having a baseline and follow up survey that can inform their teaching and school planning. The evaluation team has agreed another strand of focused data gathering activity with TWF that will elicit data on teachers' and headteachers' reported impact in these Tranche 1 local authorities. This will also explore reasons for low response rate in the Tranche 1 authorities such as research fatigue or teacher perceptions that the research was of little direct benefit to them. Here, the evaluation team will work with PSDOs to identify key 'sites' where their work has had traction. The ROC team will then use in-depth qualitative methods including focus groups with teachers and pupils and examine any secondary sources of analysis on impact.

The Tranche 2 data provides a robust account of pupil and teacher responses around the evaluation baseline questions for the Dumfries and Galloway, Angus and Glasgow authorities. If the level of response is repeated in the follow-up this will contribute to a reliable assessment of impact regarding the quantitative indicators. The evaluation team will continue to include in the survey programme those Tranche 2 local authorities that have taken longer to become established.

7.3 Evaluation work to be conducted between now and next Update Report (15/06/18).

The main activities planned between now and the next report are:

- On-going attendance at inter-authority meetings and other meetings as required

- Plan with local authority officers and PSDOs the follow-up Tranche 2 surveys
- Conduct focus groups within the Tranche 1 authorities to obtain rich accounts of impact and to enhance the current evidence (March/April 2018)
- Review existing on-line/ Facebook/ Twitter accounts of RAiSE activity and progress to complement main evaluation data (February 2018 onwards)
- Discuss usefulness of Tranche 1 on-line parent survey and conduct if viable
- Continue to review routine data from PSDOs regarding progress, developments and impact at school/ LA level (on-going).

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9 GLOSSARY OF ACRONYMS

RAiSE – Raising Aspirations in Science Education.

TWF – The Wood Foundation, programme co-funder.

ROC – Robert Owen Centre, evaluation team conducting this external evaluation.

STEM – Science, Technology, Engineering and Maths.

PSDO – Primary Science Development Officer, local resource within participating Local Authorities for RAiSE delivery.

LA – Local authority.

RIC – Regional Improvement Collaborative; six regional clusters of Local Authorities across Scotland for enhanced collaborative working and opportunity for improvement at scale.

ASG – Associated School Group – similar to a cluster – normally includes local, early years' establishments, primary schools and the associated secondary school.

CLPL – Continuous Lifelong Professional Learning, formerly referred to as CPD (Continuous Professional Development) refers to the professional training and development requirement for all education practitioners.

ADES – Association of Directors of Education Scotland. Representing all 32 of Scotland's Local Authorities.

SSERC – Scottish Schools Education and Resource Centre – with a specific focus upon STEM education and training.

PSTT – Primary Science Teaching Trust, a funding body working with SSERC to support networks of primary science mentors across Scotland.

IOP – Institute of Physics, an international charity working to advance physics education, research and application.

SCEL – Scottish College for Education Leadership, body established in 2014 to support teachers' professional learning in leadership.

DYW – Developing the Young Workforce, a national initiative to address the work readiness and positive destinations of Scottish school leavers.

NIF – National Improvement Framework, launched in 2018, this is a plan designed to help deliver excellence and equity across Scottish education.

Attainment Challenge – Scottish Government initiative to reduce the education attainment gap in those areas of Scotland of higher SIMD rating (Scottish Index of Multiple Deprivation).

GLOW – The national digital learning platform.

PCP – Primary Cluster Programme, Scottish education programme delivered by SSERC to expand the network of science mentors amongst Scottish primary schools.

GIRFEC – Getting it Right for Every Child, a Scottish government commitment supporting all Scottish youngsters through their education careers.

RAFA – Raising Attainment for All Programme was a Scotland wide programme launched in 2014 to support consistent improvement in attainment and achievement within Scottish education.

HGIOS (4) – How Good is our School (4), the current quality indicators used by schools and educators across Scotland to quality assure teaching and learning.

IDL – Inter-disciplinary learning, enables teachers and learners to make connections across learning through exploring clear and relevant links across the curriculum.