

**Final Evaluation
of the
Science Skills Academy**

Final Report

For

Highlands and Islands Enterprise

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1 Introduction

Overview

- 1.1 ekosgen was commissioned by Highlands and Islands Enterprise (HIE) to review the work of the Science Skills Academy (SSA) in promoting Science, Technology, Engineering and Maths (STEM) to young people and delivering STEM support to practitioners. This evaluation will provide evidence and insight into how effective and impactful the programme deliverables and wider outcomes have been over the period October 2017 to March 2023.
- 1.2 The SSA project was funded under the ten-year Inverness and Highland City-Region Deal, and this funding required an evaluation of final project delivery. Building on the Interim Review of the Science Skills Academy undertaken in 2021, this Final Evaluation provides evidence and insight into how effective and impactful the programme deliverables and wider outcomes have been over the period October 2017 to March 2023. At the time of the evaluation it is being temporarily delivered by HIE, until December 2023, through funding from the Highland Council Shared Prosperity Fund – and HIE – until a sustainable funding model is developed prior to any potential ownership transfer.
- 1.3 The SSA project aims to redress the shortage of skills relating to STEM disciplines, and is a long term, innovative and ambitious programme aiming to encourage more young people to study STEM and have the skills to enter employment in STEM sectors and raise awareness of STEM-related careers. Core delivery has been the provision of STEM learning in Newton Rooms across the Highlands and has latterly included the delivery of professional learning and training for teachers in response to the COVID-19 pandemic and its accompanying restrictions imposed on schools. Following the pandemic, delivery returned to in-person.

Interim Review

- 1.4 In 2021, ekosgen completed an Interim Review of the Science Skills Academy and as context, it is useful to understand the findings at that stage.
- 1.5 In the Interim Review, the SSA was deemed to be very successful and to have responded positively to the restrictions of the COVID-19 pandemic. Despite the pandemic, it had achieved some strong outputs, and the evidence indicated that it was well-placed to work towards realising its targets by the end of the delivery period. It had achieved wide engagement across Highland schools and was very positively viewed by stakeholders and beneficiary practitioners (teachers).
- 1.6 At a strategic level, the Interim Review highlighted that the SSA project was making a strong contribution to STEM education and training in Highland, and undoubtedly enhanced and augmented provision. The model of the SSA was found to complement other projects, and the combination of Newton Room delivery with outreach activity clearly delivered benefits to practitioners and learners.
- 1.7 It had helped to drive a positive change in learners' motivation in, and engagement with STEM learning. It was valued by teachers, who viewed it as an important resource to support STEM teaching in schools and raising awareness and understanding of the importance of STEM education and careers. The findings showed that the SSA project had, since its inception, provided valuable support activity for the delivery of STEM lessons in schools, and to support the Career-Long Professional Learning (CLPL) of STEM teachers and practitioners.

- 1.8 The Interim Review identified some challenges to be considered and tackled. There had been some delays in the early part of operational delivery, and of course the COVID-19 pandemic meant that delivery had to pivot to on-line, which it successfully achieved.

Objectives

- 1.9 The objectives of the evaluation, outlined by HIE, were to:
1. Test the original rationale for the SSA project back in 2016 in the context of the STEM policy and delivery environment at that time;
 2. Understand the effectiveness of the SSA in engaging with young people and STEM with a clear account of progress to date, including effectiveness and impact of project delivery;
 3. Examine the impact of the SSA in extending the reach of STEM activities and resources and developing partnerships to drive engagement and awareness;
 4. Provide comment on the suitability of the delivery model applied by the SSA, despite disruption to 'normal' service delivery in parts due to COVID-19; and to
 5. Provide a summary of key conclusions on the effectiveness and impact of the SSA project over the time-period, taking cognisance of the wider policy landscape and evolving nature of STEM delivery.
- 1.10 One aspect of Objective 2 was to consider any economic impacts generated through participation in the SSA project, where measurable, including safeguarded impacts and expected future impacts. However, testing the economic impacts of the SSA as an intervention is challenging in the current period. Many of the pupil beneficiaries are still in school and it will be some time before they enter the labour market and so impact economically in the region. These impacts will only be accrued and evidenced in the longer term although attribution will also have to be assessed because there are a range of other external factors that may influence further/higher education and career path choices of pupils. This means demonstrating the causality and any additionality of SSA activity over and above any other factors requires a considerable range of assumptions and will need to be carefully managed and articulated.

Study approach

- 1.11 Examining the impact of the SSA project required a range of qualitative and quantitative approaches to collate and analyse primary data gathered through surveys, interviews, and focus groups, along with in-depth interviews with key stakeholders and HIE staff. Specifically, the evaluation methodology comprised:
- Desk review of secondary sources, including the wider STEM policy environment and changes in STEM education and professional learning;
 - Review and analysis of project documentation and monitoring information to understand how the project has been delivered in practice and its performance to date against the priorities and targets set;
 - Review and analysis of SSA generated survey material;
 - Consultations with stakeholders, project staff, and teachers to gain strategic and operational perspectives on the project's delivery as well as direct insight into the SSA offer for teachers, schools, and wider STEM practitioners. This included:
 - One-to-one consultations with six stakeholders;
 - Face-to-face and telephone/video call consultations with 13 teachers; and
 - An online survey of teachers which received 11 responses;These consultations covered a range of topics including experience and impact of the SSA project, strategic fit and contribution locally, regionally, and nationally; strengths and weaknesses; and views on future delivery and activity;

- Participatory focus groups with pupils from six schools that have participated in an SSA session(s) to gain their perspective on the SSA's impact on their awareness of STEM skills and careers, how it may have influenced their ambitions, and to gather views on their experience of the SSA including the impacts of multiple engagement; and
- An online survey of pupils and teachers to understand their experiences of the SSA and any other STEM programmes that they have participated in, which received 176 responses. The survey sample achieved included primary and secondary aged pupils and teachers, from schools from across the region, and covered all the Newton Rooms including the pop-up.

Report structure

1.12 The remainder of report is structured as follows:

- **Chapter 2** provides a programme overview and describes the SSA project, including aims and objectives and an analysis of programme performance against targets and indicators;
- **Chapter 3** summarises the current policy and delivery context for STEM education, including STEM participation in the Highland area;
- **Chapter 4** considers the management and delivery of the SSA project;
- **Chapter 5** Analyses the experiences and impacts for pupils and teachers that have attended one of the SSA's Newton Rooms;
- **Chapter 6** examines the wider strategic impacts of the SSA project; and
- **Chapter 7** sets out conclusions for the evaluation and some considerations for future delivery.

2 Science Skills Academy

Key findings summary



- The SSA's vision is to 'make the Highlands and Islands a region of excellence where the skills and aspirations of our young people are matched to the growth of science and technology-based sectors'.



- A Newton Room usually consists of a main room with workstations, an auditorium/amphitheatre (collaboration zone) for group discussion and reflection, a lab area, a storage room, a coatroom, and a workplace/office for the STEM Engagement Officers.

- The SSA model in the Highland area currently consists of four Newton Rooms and one touring pop-up/mobile Newton Room facility, the former located in community or education centres across the region.



- There are a total of nine staff in the SSA comprising: five STEM Engagement Officers, two full-time core support staff, and two part-time core support staff.

- The SSA project was provided with a £3 million budget under the Inverness and Highland City Region Deal for delivery from April 2017 to March 2022 with an extension to March 2023. HIE and Highland Council funded an extension of SSA delivery from March 2023 to December 2023.



- From 2017 to March 2023 the SSA had received a total of 21,982 engagements through 1,146 sessions. Engagements are currently above 25,000 (December 2023).

- The SSA project has performed well against many of its targets, although there are some data gaps relating to the longer-term (and indirect) outcomes.

Introduction

2.1 This chapter provides an overview of the Science Skills Academy with a summary of the project, delivery model and performance to date. It presents the number of schools and learners engaged and sessions delivered, as well as an area breakdown by Newton Room and pop-up Newton Room.¹

Project overview

2.2 As is the case nationally, Highland and the wider Highlands and Islands region has skills shortages in STEM and STEM occupations can be hard to fill. There are also widespread concerns about the future supply of well-qualified and highly skilled STEM professionals and the impact this could have on economic growth and resilience. These high-quality jobs are expected to increase in sectors such as Life Sciences and Renewable Energy, and the workforce must be equipped to fill these jobs and contribute to the economic growth and prosperity of the region in addition to reaching net zero targets and adapting to digital transformation across all sectors. These sectors are key priorities in the Scottish Government's National Strategy for Economic Transformation (NSET).²

2.3 There is also a lower proportion of young people in the Highlands and Islands and long-standing trends of out-migration, due to factors such as education, training, and employment opportunities, lack of housing, poor transport infrastructure and digital connectivity. Although this deficit is decreasing and there is a strategic focus on talent retention and attraction, there continues to be a lack of a sufficiently skilled workforce for STEM employers in particular.³

¹ Analysis considers engagements from 2017 to March 2023 unless otherwise stated.

² <https://www.gov.scot/publications/scotlands-national-strategy-economic-transformation/>

³ <https://www.skillsdevelopmentscotland.co.uk/media/49107/rsa-highlands-and-islands.pdf>

- 2.4 The Science Skills Academy (SSA) project was created to address some of these issues by supporting hands-on STEM learning in Highland using state of the art equipment.⁴ The Highland region did not previously have a Science Centre and the SSA is sometimes regarded as the Science Centre of the North. It secured funding in April of 2017, and was originally intending to run until March 2022, with a possible one-year extension. The project was initially funded under the ten-year Inverness and Highland City-Region Deal, receiving around £3 million to invest from 2017/18 to 2022/23. The City-Region Deal⁵, aims to transform the Highland economy, with a vision of being a region of digital opportunity. It has £315 million of funding, consisting of £135 million from the Scottish Government, £127 million from the Highland Council and partners, and a further £53 million from the UK Government. The City-Region Deal has three broad thematic priorities including: *a growing economy; enabling the economy; and a skilled economy*.
- 2.5 The SSA project delivery was extended to December 2022 because of the COVID-19 pandemic; which led to fewer engagements than initially anticipated, leading to additional funding being leftover. It was then further extended to December 2023 giving HIE and partners scope to build a sustainable funding model prior to any ownership transfer. Funding was secured from Highland Council (Shared Prosperity Fund) and HIE to cover the core project costs over this time until a viable future funding stream and plan has been identified.
- 2.6 The aim of the project is to encourage more young people to study STEM in school and beyond, develop STEM skillsets and raise awareness of STEM careers. Its overarching vision is:
- “to make the Highlands and Islands a region of excellence where the skills and aspirations of our young people are matched to the growth of Science and Technology-based sectors”.*
- 2.7 It promotes STEM to young people and delivers STEM support to teaching practitioners to redress the shortage of skills in these disciplines, providing the skills to enter employment in STEM sectors, particularly new and emerging job opportunities in the Highlands and Islands, both now and in the future.
- 2.8 The seven objectives of the SSA project are:
1. To increase the proportion of young people engaged in STEM, raise their levels of attainment in these disciplines and allow them to pursue their interest into a fulfilling career;
 2. To raise the awareness in pupils, parents, carers, and teachers about the current and expected availability and appeal of STEM-related careers;
 3. To develop new forms of delivery, integrating school, further education, and higher education provision to meet the needs of employers, and to ensure equality of access that is irrespective of geographical location;
 4. To fully engage employers, communities, parents, carers, and teachers;
 5. To co-ordinate and extend the reach of current activities promoting young people’s engagement with STEM and to enhance the use, reach and impact of current support and resources;
 6. To transform the scale and nature of investment through developing regional, Scottish, UK and international partnerships; and
 7. To identify and respond to barriers and gaps that may exist in support and resources to encourage young people’s engagement.

⁴ <https://scienceskillsacademy.co.uk/>

⁵ <https://www.highland.gov.uk/cityregiondeal>

- 2.9 The SSA aims to meet these objectives by building Science Capital through making learning accessible and relevant to help young people feel that STEM is ‘for them’. These aim to help to build the vision of a sustainable pipeline of skills that are important to a modern and successful economy in key growing sectors in the Highlands. These objectives align with the themes of the Highlands and Islands Regional Skills Investment Plan, particularly in building a region for young people, meeting current skills needs for employers, and planning for the future.
- 2.10 The SSA has been delivered through a collaborative partnership approach in establishing the Newton Room network and working with local schools and businesses in each area across Highland. The SSA’s Project Board includes HIE, Highland Council, the University of the Highlands and Islands, Skills Development Scotland (SDS), NHS Highland and High Life Highland.
- 2.11 The Glasgow Science Centre has delivered a ‘Learning Lab’ STEM programme since 2020. The Learning Lab delivers STEM programmes to support teachers and pupils through varied and mixed-method teaching⁶, and over **2,000** teachers and **56,000** pupils have engaged with the programme so far from across Scotland. The Learning Lab aims to create a STEM Learning Pathway, extending learning beyond a visit to a Science Centre or Newton Room back into the classroom, and offering pupils the chance to meet someone from industry. The SSA is now part of the Learning Lab initiative, offering access to Highland Schools, alongside delivery partners at Dundee and Aberdeen Science Centres. In September 2022, a STEM Engagement Manager post was filled through secondment from Glasgow Science Centre. This was originally until March 2023, at which point this post was extended to December 2023; it has subsequently been extended further to June 2024. The STEM Engagement Manager works with HIE and wider stakeholders in the management and delivery of the SSA.

Delivery model

The Newton Room concept

- 2.12 The Newton Room concept is owned, developed and managed by the non-profit foundation FIRST Scandinavia. Since 2000, FIRST Scandinavia has developed and implemented STEM concepts and projects for over **500,000** children and young people. FIRST Scandinavia started the development of the Newton concept in 2003, as a result of a recognised lack of hands-on activities, outdated equipment, and shortage of resources for science laboratories in the Norwegian schools. The first Newton Rooms opened in 2007, and at the time of writing there are over 40 in Norway. The first international room opened in Denmark in 2015, and two rooms were established in Highland in 2019.
- 2.13 Since then, a number of Newton Rooms have opened across Europe including an international team set up in Berlin to support their wider growth strategy.
- 2.14 Newton Rooms aim to be an appealing and inspiring learning environment. Individual settings and conditions help to make each Newton Room unique. The overarching goal is always functionality and outstanding quality. A Newton Room usually consists of a main room with workstations, an auditorium/amphitheatre (collaboration zone) for group discussion and reflection, a lab area, a storage room, a coatroom, and a workplace/office for the Newton Teachers. FIRST Scandinavia offer recommendations on how the rooms should be laid out, placing emphasis on the utilisation of bright colours, sound and lighting to help create “dynamic and inspiring” learning sessions.

⁶ <https://www.glasgowsciencecentre.org/learn/education-programmes-for-schools/learning-lab>

- 2.15 The long-term goal of the Newton Rooms is to inspire more young people to become interested in STEM subjects and encourage them to study these subjects in school and beyond through high quality, hands-on science-based activities. There can be one or more teachers affiliated with the space, teaching visiting classes from three-hour lessons to several days. As well as school lessons, it is anticipated that they can also be used on evenings, weekends and holidays for other science related activities such as teacher training, family and public events and business events.
- 2.16 During the establishment of the SSA model, HIE partners looked for areas of best practice of STEM delivery in rural areas. The Newton Room concept stood out as the most established and highest quality approach and so a partnership was developed which would see the first international expansion of the concept. This partnership brought a number of efficiencies in the planning phase of SSA, with the established Newton Room concept providing guidance and advice on room design and implementation, as well as a number of ready to use Newton Modules at primary and secondary level. HIE provided a sum to First Scandinavia for use of the concept as well as for marketing and promotion.⁷

Science Skills Academy delivery model

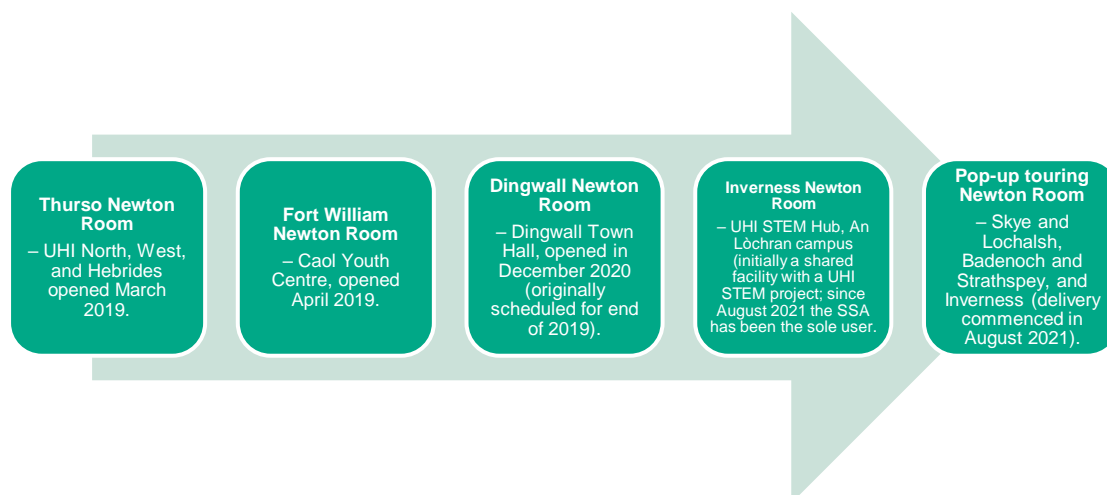
- 2.17 The SSA was designed as a hub and spoke model with the SSA central team dealing with overall strategy, development and maintaining an overview of quality and best practice. The spokes are the Newton Rooms and the activities delivered by STEM Engagement Officers. At each Newton Room there are local partnerships to ensure that community involvement and local requirements are prioritised within the framework of the SSA. The focus and content of delivery activity consists of modules developed to match STEM sectors in the Highland area, which complement the Scottish Government's Curriculum for Excellence and the Scottish STEM Strategy, all whilst targeting locally important sectors including Aquaculture, Space, Renewable Energy, Life Sciences, and Peatlands.^{8,9}
- 2.18 The content aims to increase awareness of, and career opportunities for young people in STEM and demonstrate how STEM knowledge and skills are applied in industry. It is about taking the theory and bringing it alive by showing how it translates to real-life and workplace situations.
- 2.19 The SSA model in the Highland area currently consists of four Newton Rooms and one touring pop-up/mobile Newton Room facility, the former located in community or education centres across the region, as shown in the following infographic below.

⁷ See Table 2.2 for costs.

⁸ <https://education.gov.scot/curriculum-for-excellence/>

⁹ <https://www.gov.scot/policies/science-and-research/stem-education-training/>

Figure 2.1: SSA Newton Room timeline



2.20 During the COVID-19 pandemic, the SSA delivered online Newton Room materials to teachers so that they could engage their pupils in SSA STEM activities, whilst the Newton Rooms and Pop-Up Room could not open. Approximately 170 schools also received Maths or Space Boxes with lesson plans and materials. During school holidays some staff delivered activities in community settings such as libraries, however, to deliver in the Newton Rooms a second PVG checked adult must be in attendance which can limit delivery outside of school hours. There are a total of nine staff in the SSA comprising: four core members and five STEM Engagement Officers delivering in Newton Rooms.

Delivery roll-out and impact of COVID-19

Table 2.1: Science Skills Academy – key delivery milestones March 2023

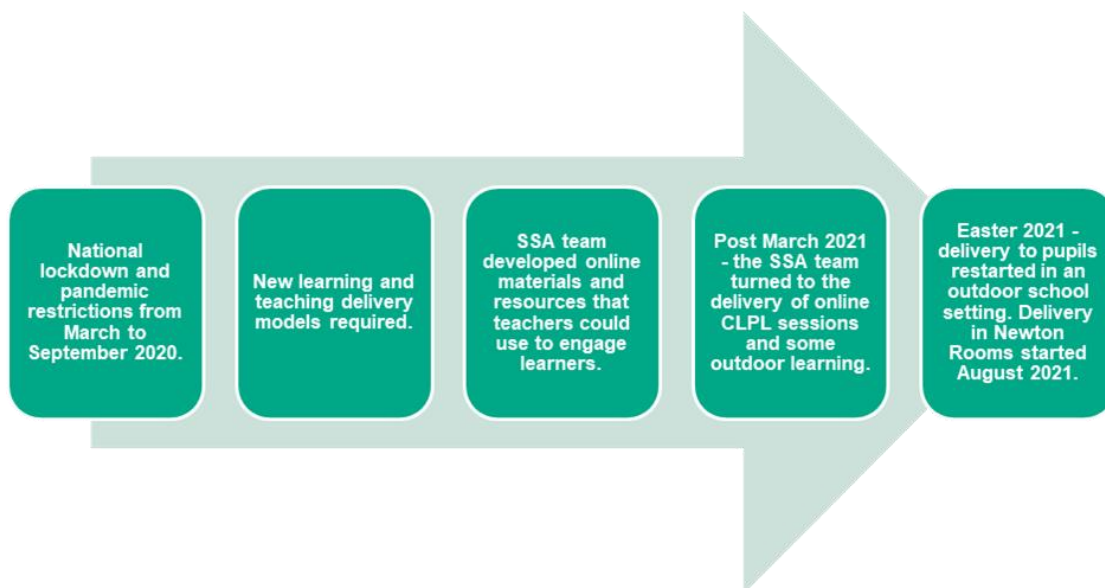
Key delivery milestones	Last Date	Comment
Project Start: City-Region Deal funding secured	01/04/2017	Complete
SSA Core Team employed	18/03/2019	Project Senior Responsible Officer, Project Manager, STEM Engagement Manager posts in place
SSA Delivery Team employed	06/01/2020	Five main STEM Engagement Officers employed (Thurso, Fort William, Inverness, Dingwall, West Coast/Outreach) An additional 0.6 FTE for outreach still to be employed
Monitoring and Evaluation Framework Developed	30/04/2020	Interim Report published November 2021
Develop SSA STEM Strategy	31/05/2020	SSA strategy written and links with Scottish Government STEM Strategy identified
Newton Module Roll Out	31/12/2021	2 Newton modules being delivered; 1 module being trailed, 3 modules in final stages of development
Highland Newton Room network established	31/12/2021	Thurso, Fort William, and Dingwall Newton Rooms open; Pop-Up Newton Room ready for West Coast; Inverness Newton Room not until mid-2021 but activities delivered in interim locations
City-Region Deal funding ends	30/03/2022	Conversations underway with Scottish Government to carry over any underspend into next financial year
Annual Newton Module delivery to 8,500 pupils in academic year 21/22	01/07/2022	Delayed due to COVID-restrictions placed on schools since March 2020

Key delivery milestones	Last Date	Comment
Glasgow Science Centre Secondment	01/09/2022	STEM Engagement Manager post filled through secondment from Glasgow Science Centre (until March 23)
Business Market Testing Begins	01/11/2022	Meetings held with businesses to understand their appetite to support the project
Sustainable Funding Model	01/12/2022	Future funding strands identified as well as series of industry investment options outlined for market testing
Project Ownership Options Appraisal	01/12/2022	Project to remain with HIE until December 23 to build a sustainable funding model prior to any ownership transfer
Funding Extension to December 2023	22/12/2022	Funding secured from Highland Council (Shared Prosperity Fund) and HIE to cover core costs to December 23
Business Donation/Sponsorship Process	01/02/2023	HIE Sponsorship working group convened to begin development of business donation/sponsorship process
Business Sponsorship Brochure and Showcase Video	30/03/23	Near completion to assist with future funding discussions
Glasgow Science Centre Secondment Extended	30/03/23	Secondment agreement extended to December 2023
Updated SSA Strategy	30/03/23	Completed
Newton Module delivery to 4,300 (P6-S2, Aug 22 – March 23)	30/03/23	Aiming to engage 8,000 pupils by Aug 2023
Newton Module Roll Out	30/03/23	6 modules being offered to schools, with 1 additional module pending roll out and 1 in pilot phase

Source: SSA Monitoring Data

- 2.21 The SSA started to deliver in late 2017 with a small number of sessions delivered from a mix of community centres across the Highland region because at that stage no Newton Room had been established. As the project was still to recruit its STEM Engagement Officers, sessions were delivered by partners, e.g., NHS Highland and the SSA Project Manager. A total of 15 sessions were delivered up to the end of 2018.
- 2.22 The first two Newton Rooms were opened in early 2019 and delivery commenced with the appointment of the STEM Engagement Manager. By January 2020, five STEM Engagement Officers had been recruited and a third Newton Room and pop-up touring Newton Room came onstream in the latter part of 2020 and summer 2021 respectively. The following infographic illustrates the timelines and responses to the restrictions resulting from the COVID-19 pandemic.

Figure 2.2: COVID-19 pandemic response and activity timeline



- 2.23 Due to the national lockdown in March 2020 and COVID-19 pandemic restrictions until September 2020, the SSA was not able to deliver activity as initially planned. The pandemic put great pressure on the education system as a whole. Periods of full lockdown and restrictions required high levels of adaptation and flexibility within education to allow as many people as possible to continue their learning, including in STEM. This created a need to design new learning and teaching delivery models to respond to high levels of remote working and restricted numbers in schools which adversely affected the delivery of SSA activities in the Newton Rooms.
- 2.24 The SSA team responded during much of 2020 by developing online materials and resources that teachers could use to engage learners. These included digital downloads including presentations, quizzes and interactive resources for pupils. Some 170 schools also took receipt of Maths or Space Boxes which included lesson plans and materials for experiments etc. The team also used the time to develop new Newton Room modules. Post the January-March 2021 lockdown, the SSA team turned to the delivery of online Career-Long Professional Learning (CLPL) sessions for teachers as well as delivering some outdoor learning for P3-7.
- 2.25 As schools began to return to some day-to-day normality after Easter 2021, delivery to pupils restarted in an outdoor school setting. Delivery in Newton Rooms did not start again until August 2021. Understandably COVID-19 impacted on the ability to engage teachers in primary research as part of this Interim Review. In this Final Evaluation, there has been good engagement with teachers, pupils, staff and wider stakeholders and this has provided a very rich seam of information and evidence.
- 2.26 The impact of COVID-19 meant that for around 18 months the SSA delivery model had to be adjusted, and this was successfully achieved. During this period there was less of a local aspect to the SSA project delivery and by necessity, very limited face-to-face experience in STEM learning. Following the pandemic, delivery fully returned to in-person learning. Whilst the pandemic experience was challenging, there has been good learning about the potential and opportunity to enhance access through some degree of online delivery

Delivery content

- 2.27 The content of SSA delivery is varied and spans numerous STEM subjects and disciplines. Primary pupils and secondary pupils participate in different activities. Primary Newton Modules include Healthcare Science, Robotics and Mathematics, and Salmon and Aquaculture.

Secondary Newton Modules include Space, Sustainable Biofuels, Renewable Energy and Up in the Air with Numbers Pilot. Robotics and Mathematics is the most delivered Primary Newton Module and Renewable Energy is the most delivered Secondary Newton Module.

- 2.28 The SSA also delivers activities to the public, including meetings and promotional events and family events, in addition to CLPL sessions for teachers. Extra-curricular activities such as Step into STEM, Destination Space, Outdoor Maths, Partner Delivery, and STEM Ambassador Activity are also delivered by the SSA. Newton Module Taster sessions and Peatlands Mini Newton Modules are also delivered.

Funding

- 2.29 The SSA project was provided with a £3 million budget under the Inverness and Highland City-Region Deal, split across six years. Table 2.2 summarises running costs since inception.¹⁰ Spending increased from 2019 when additional Newton Rooms, and engagement activities, were delivered.
- 2.30 Despite approval to support commencement in April 2017, there was no recruitment for the project delivery team until 2019, apart from the Project Manager who came in to post in 2017. There was also a delay in Newton Rooms opening, with Thurso and Fort William opening in 2019, whilst Dingwall opened in late 2020 – it was originally due to open in 2019. In some cases, properties were owned by third parties, so HIE was relying on project partners to facilitate spaces, which slowed delivery down at the outset. Anecdotal evidence also indicates that some properties required renovation works to enable them to become Newton Rooms. The lack of delivery space resulted in the later recruitment of staff.

Table 2.2: Running costs 2016-2023¹¹

	Original Business Case Profile	Revised Profile	Claims in Year
2016/17	£171,000	£67,857	£67,857
2017/18	£488,000	£99,013	£99,013
2018/19	£620,000	£106,562	£106,562
2019/20	£736,000	£687,360	£687,360
2020/21	£514,000	£674,808	£674,808
2021/22	£511,000	£630,901	£630,901
2022/23	£0	£742,499*	£227,460*

Source: SSA and HIE Final Briefing Document

- 2.31 In addition, there has been funding from sources outside the City Region Deal, to deliver activity relating to Maths Week and provision of Association of Science and Discovery Centres STEM kits as well as the procurement of the Newton Module kit for Thurso and Fort William Newton Rooms, a contribution towards the Dingwall refurbishment and some transport for selected schools to the Dingwall Newton Room. Further funding has been provided by the Association of Science and Discovery Centres this year (2023) and funding has also been provided from OPITO through Glasgow Science Centre to deliver the Learning Lab resources related to the energy transition modules.
- 2.32 As previously mentioned, SSA funding was extended to March 2023 due to additional funding from the City-Region Deal. With the growth in the success of the SSA programme, the actual spend has increased since its inception and this is reflected in the most recent forecast for the 2022/23 spend. The total forecast spend for the 2022/23 period is **£742,499**, which has remained a consistent forecast throughout the year.

¹⁰ * Indicates forecast spend.

¹¹ Though the project commenced in April 2017, some spend occurred during the 2016/17 financial year.

- 2.33 The SSA has been supported by additional funding from HIE and Highland Council to extend delivery to December 2023, allowing time to agree a transition to a new funding arrangement and project ownership model. The total minimum costs forecasted for this nine-month period are **£330,000**.

Delivery and performance

- 2.34 This section presents an overview of the STEM sessions and engagements that have been and are being delivered by the SSA project.
- 2.35 From inception in 2017 to the end of March 2023, the SSA project team have delivered **1,146** sessions across the Highland Council area. The SSA delivered total of **21,982** engagements during this period. As of December 2023, SSA engagements total more than **25,000**. The recent increase in engagements, since March 2023, is partly derivative of a big reach to the general public during the summer of 2023 in addition to school and other engagements.
- 2.36 The SSA has engaged with **94%** of schools in the Highlands and when schools without P6/P7 pupils are excluded from the total, and schools that have recently closed, this rises to 98%, which demonstrates a very positive reach.¹²

Participant groups

- 2.37 From the academic year (AY) 2017/2018 to March 2023, the SSA had a total of **21,982** engagements as shown in Table 2.3. Most participants (**60%**) from 2017 to 2023 were from primary schools, from which there was a relatively even split between the target age groups of P6, P7, and P6/7.
- 2.38 The second largest proportion of participants came from secondary schools (**34%**) with S1 pupils making up the majority of participants, followed by S2 pupils and S1/S2 composite groups. Delivering to pupils beyond S2 can be challenging due to exams and courses. The size of classes and the complexities of the secondary timetable make multiple class visits challenging for some secondary schools. The Pop-Up Newton Room has been deployed to support with some of these challenges. The remaining participants came from Teacher CLPL sessions (4%), the general public (2%), SSA Stakeholders (1%) and seventeen home educated participants.
- 2.39 The SSA has also engaged with disadvantaged young people, from a wider community angle, and has worked collaboratively with Highlife Highland to engage care experienced children and children that are not registered in the school system (such as children seeking asylum).

Table 2.3: SSA engagement by audience type

Audience Type	AY 17/18	AY 18/19	AY 19/20	AY 20/21	AY 21/22	AY 22/23*	Total
General Public	*	63	155	*	164	31	413
Home Educated	*	*	12	*	5	*	17
Primary School	182	359	1,975	1,664	5,228	3,748	13,156
Secondary School	31	465	978	1,632	2,912	1,444	7,462
SSA Stakeholders	*	138	5	*	*	*	143
Teacher CLPL	18	24	91	600	8	50	791
Total	231	1,049	3,216	3,896	8,317	5,273	21,982

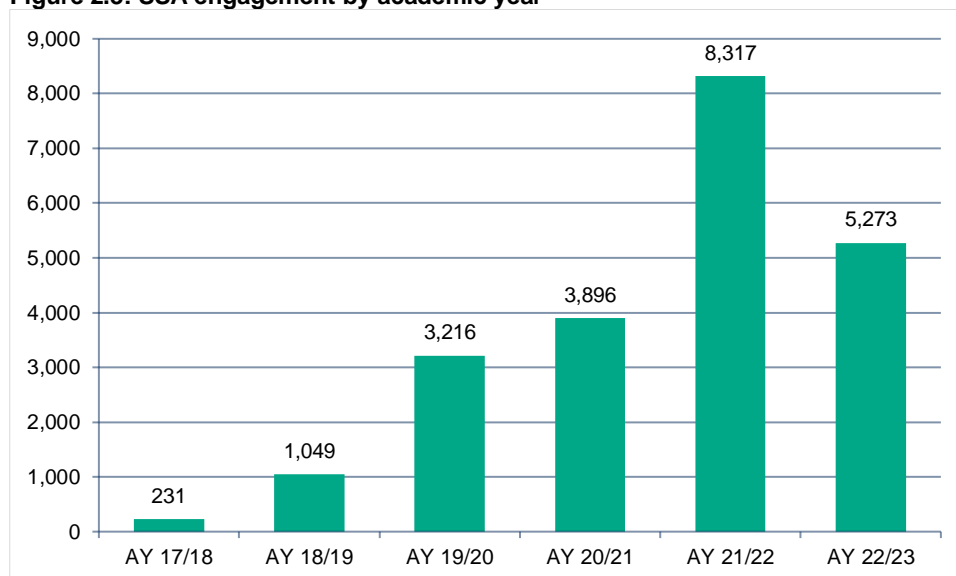
Source: SSA Participation Dashboard

* To end March 2023 only

¹² If there are Highlands schools that have closed down, that the SSA has not engaged with, then this will increase the total percentage of schools engaged by the SSA.

2.40 Figure 2.3 shows SSA engagement by academic year (2017/18 to March 2023). Engagement has significantly increased over the period, with around **8,317** participants in AY 2021/22, rising from 231 at the beginning of the period in 2017/18. By March 2023, there had already been **5,273** engagements which means that it is likely that by the end of the full academic year, the SSA will have exceeded 2021/22 engagements in the 2022/23 academic year.

Figure 2.3: SSA engagement by academic year¹³



Source: SSA Monitoring Data; AY 22/23 to end March 2023 only

Engagement by Newton Room

- 2.41 Recognising the geographic complexities, as well as the learning needs of participants, there is an interesting spread of engagement with the SSA by geography.
- 2.42 The Thurso Newton Room was the first to open and understandably has received the highest number of engagements (**one fifth** of all SSA participants). Fort William was the second Newton Room that opened but it has received the fewest participants out of all the permanent Newton Rooms (**8%** of all SSA participants). This is likely due to it only being open for three days a week, due to its smaller catchment numbers.
- 2.43 The pop-up Newton Room programme has engaged with a number of participants since opening (**13%**) with a relatively equal engagement spread across the academic years 2021/22 and 2022/23. Pop-up Newton Room locations have included Portree High School, Millburn Academy, Grantown Grammar School, and Kingussie High School amongst several others.
- 2.44 The Outreach sessions delivered from 2017 to March 2023 received a total of 4,632 engagements (**21%**). The online sessions delivered as a result of the pandemic engaged with **1,195** participants through **52** sessions, accounting for **5%** of overall SSA engagement.

¹³ Data for 2023 is accurate to September 2023.

Table 2.4: Participation

Location	AY 17/18	AY 18/19	AY 19/20	AY 20/21	AY 21/22	AY 22/23*	Total
Dingwall	*	*	*	160	2,067	1,071	3,298
Fort William	*	316	583	*	458	427	1,784
Inverness	44	16	397	*	2,320	1,191	3,968
Online	*	*	*	1,195	*	*	1,195
Outreach	187	134	1,043	2,541	621	106	4,632
Pop-Up	*	*	*	*	1,472	1,336	2,808
Thurso	*	583	1,193	*	1,379	1,142	4,297
Total	231	1,049	3,216	3,896	8,317	5,273	21,982

Source: SSA Participation Dashboard

* To end March 2023 only

Performance against targets

- 2.45 Through its Newton Room model, the SSA has delivered a range of engagement sessions to pupils, practitioners, and stakeholders. Despite delays experienced at the outset of the project, and significant disruption as a result of the COVID-19 pandemic, the SSA project has performed well against many of its targets, although there are some data gaps relating to the longer-term (and indirect) outcomes. The correlation between SSA pupil-participation and indicators, such as an increase in STEM jobs or an increase in inward investment in STEM, is difficult to quantify and evidence. This is due to the influence of many factors on the indicator outcomes.
- 2.46 Table 2.5 sets out the SSA's project performance against targets to date. Whilst the project has not established the SSA Hub as originally intended due to a number of factors, including the COVID-19 pandemic and varying sources of project funding, it has performed well in terms of direct project outputs. The SSA was initially designed as a hub and spoke model with the SSA central team dealing with overall strategy, development and maintaining an overview of quality and best practice. The spokes were intended to be the Newton Rooms where the delivery of high-quality, hands-on science-based activities are delivered by STEM Engagement Officers.

Table 2.5: Performance against business case outcome targets

Indicator	Performance to date
The creation of the SSA hub	Achieved – consisting of the core project team including Director/SRO, Project Manager and STEM co-ordinators.
The creation of a minimum of 5 Newton Rooms in the Highland Region	4 Newton Rooms established plus the pop-up Newton Room. The project business plan contained an objective to establish a purpose-built STEM facility on Inverness Campus; this has not progressed, and the Inverness Newton Room operates in An Lòchran, which has been leased to the end of the project.
9,500 school children attending a Newton Room one day per annum	8,317 engagements (AY 2021/22); 88% of target.
Increased business investment in developing a pipeline of skills for the Science, Technology, Engineering, and Digital sectors	No data
Numbers of external users of SSA facilities	3% of participants from 2017 to 2022 were made up by SSA stakeholders, the public, and family science groups.
Numbers of school children taking/passing STEM (STEM and Digital) examinations	2017: 8,799 2018: 8,264 2019: 8,341 2020: 9,838 2021: 8,543 2022: 9,170
School leaver destinations to STEM FE/HE and employment	No data
Reduction in STEM vacancies deemed 'hard to fill'	No data
Increase in STEM jobs	No data
Increase in technology start-ups	No data
Increase in the numbers of inward investing (STEM) companies attracted	No data

Source: SSA Monitoring Data

3 STEM policy context

Key findings summary



- STEM and STEM skills are significant contributors to economic growth. It is vital that education, industry and strategic actors across Scotland support the STEM education pipeline to provide well-paid jobs in the future.



- STEM subjects and industries are critical for developing a Wellbeing Economy and achieving a Just Transition. They contribute to almost every new market opportunity identified in the National Strategy for Economic Transformation (NSET).



- The STEM Education and Training Strategy and accompanying refresh sets out the objectives and accompanying actions under the themes of excellence, equity, inspiration and connection. This sets the framework in which the SSA operates.

- There is much change in the education policy landscape that the SSA must take cognisance of. A series of reviews of the strategic education and qualification landscape in Scotland have been undertaken. Of these, the Muir Report and Hayward Review are focused on the learning experience and needs of pupils and young people.



- Both nationally and within the Highlands there is complex landscape in STEM education and professional learning support provision, and also in the strategic structures that underpin this activity.

- There is a mixed picture in terms of STEM education enrolment and attainment. In particular, school entries have increased by 17% between 2017 and 2022, but this trend has not been matched by school passes (+1%) over the same period.

Introduction

- 3.1 This chapter sets out the policy context for STEM in Scotland and the Highland Council region. It discusses the challenges relating to engagement, participation, and achievements in STEM education, including the impact of the COVID-19 pandemic. It also considers STEM activities and education in the Highland area and provides a summary of STEM education and attainment.

STEM strategic overview

- 3.2 STEM - Science, Technology, Engineering and Mathematics – are subject areas that are significant contributors to economic growth, innovation, research and development, and healthcare. These subject areas, and associate industries, help to drive high levels of productivity through innovation and automation and contribute to a variety of wellbeing indicators such as life expectancy and quality of life. STEM is an umbrella term that comprises a wide range of subjects and skills that span several industries and have a huge impact on our daily lives. It is paramount that education and employment opportunities across Scotland support the STEM education pipeline to provide well-paid jobs for future generations, tackle global issues such as climate change, improve the health and quality of life of the nation, and help Scotland to compete in competitive global markets.
- 3.3 STEM subjects and industries are vital to achieving a Just Transition in Scotland and meeting legally binding Net Zero targets by 2045.¹⁴ The Scottish Government's Climate Change Plan states that their approach will be "led by science" to generate sustainable solutions.¹⁵
- 3.4 STEM subjects and industries are similarly important to developing a Wellbeing Economy whereby the Scottish Government operates within safe environmental limits and serves the

¹⁴ <https://www.theccc.org.uk/what-is-climate-change/a-legal-duty-to-act/>

¹⁵ <https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents/>

collective wellbeing of current and future generations.¹⁶ This is supported by the STEM education pipeline as, Universities Scotland reports that, 90% of STEM graduates are working in skilled jobs within 6-months of their graduation.¹⁷ STEM jobs have an important role to play in creating collective economic and social benefits and should consequently be prioritised as part of the delivery of a Wellbeing Economy.

- 3.5 STEM subject(s) knowledge contributes to almost every new market opportunity outlined in the Scottish Government's National Strategy for Economic Transformation (NSET).¹⁸ The NSET sets out the roadmap for building Scotland's economic model based on the principles of a Wellbeing Economy and a Just Transition. A wellbeing economy is built on a society that is thriving across economic, social and environmental dimensions that delivers prosperity for all Scotland's people and places. The Just Transition embodies this move to a net zero, nature positive economy that moves beyond traditional fossil fuel industries to a more sustainable economy. Recognising the need to address this transition in a way that is fair to everyone NSET strives to support people with the skills, education and retraining required to access green, fair and high value work. Consequently, the NSET aims to strengthen Scotland's position in new markets and industries, generating new, well-paid jobs: renewable energy; the hydrogen economy; the decarbonisation of transport; space exploration and satellite design; the blue economy; industrial biotechnology; photonics and quantum technologies; and digital technology.¹⁹

STEM policy context

STEM Education and Training Strategy: Refresh

- 3.6 The STEM Education and Training Strategy, refresh and annual report, was published by the Scottish Government in May 2022 and sets out a range of actions by education and other public sector stakeholders under each of the four themes of the original strategy published in 2017.²⁰
- 3.7 The key aims, objectives, and delivery plans of the refresh are broadly similar to those set out in the original strategy. Key aims outlined by the strategy are:
- To build the capacity of the education and training system to deliver excellent STEM learning so that employers have access to the workforce they need;
 - To close equity gaps in participation and attainment in STEM so that everyone has the opportunity to fulfil their potential and contribute to Scotland's economic prosperity;
 - To inspire children, young people, and adults to study STEM and to continue their studies to obtain more specialist skills; and
 - To connect the STEM education and training offer with labour market need – both now and in the future – to support improved productivity and inclusive economic growth.
- 3.8 The Scottish Government mid-point review originally intended for the STEM Education and Training Strategy was not conducted as a consequence of the COVID-19 pandemic. Instead, the fourth annual report for the Strategy represented a refresh for the Strategy's extension to 2025. This refresh followed the OECD Review of the Curriculum for Excellence (CfE).²¹ The refresh acknowledges that the context for STEM education, and indeed education as a whole, is incredibly dynamic. It also recognises that:

¹⁶ <https://www.gov.scot/groups/wellbeing-economy-governments-wego/>

¹⁷ <https://www.universities-scotland.ac.uk/publications/rsr22/>

¹⁸ <https://www.gov.scot/publications/scotlands-national-strategy-economic-transition/>

¹⁹ <https://www.gov.scot/publications/scotlands-national-strategy-economic-transformation/>

²⁰ <https://www.gov.scot/publications/stem-education-training-strategy-refresh/documents/>

²¹ <https://www.oecd.org/education/scotland-s-curriculum-for-excellence-bf624417-en.htm>

‘...it is essential that our approach to STEM skills stretches from early years, through school and into higher and further education and on to the world of work. Getting any single element right will not of itself be sufficient to fully leverage the potential of our young people or maximise their opportunities.’

- 3.9 The STEM education and training landscape is partly constituted by several programmes that are typically funded and operated out with or in collaboration with the traditional education system of schools, colleges, and universities to build STEM capacity. The Scottish Schools Education Research Centre (SSERC) delivers a Primary Cluster Programme and a Secondary Professional Learning Programme and a range of STEM engagement and enrichment programmes to increase STEM participation.²² The Young STEM Leader Programme’s main aim is to facilitate the development of peer STEM role models to inspire more young people to develop an interest in STEM.²³ The STEM Grants Programme aims to build the capacity and skills of education practitioners to improve the wider STEM education system.²⁴
- 3.10 The STEM Education and Training Strategy will attempt to achieve its aim of closing equity gaps by tackling inequity in STEM learning and careers, improving participation in STEM Further and Higher Education courses and apprenticeships, and increasing access to public science engagement events.²⁵ This aim is supported by an increasing focus on the promotion of women working in STEM.²⁶
- 3.11 STEM inspiration will be promoted by creating positive STEM role models, mentors and coaches, promoting the opportunities and benefits of STEM learning and careers, and recognising and celebrating success.²⁷ This will be supported by offers such as Maths Week Scotland, Parental Engagement, My World of Work, STEM Nation Award Programme, Young STEM Leaders Programme and Science Centres.
- 3.12 Aiming to connect STEM training and the labour market will be promoted by improving the support available to schools, delivering up-to-date advice and information on STEM careers, and increasing the responsiveness of colleges, universities and the apprenticeship programmes to the needs of the economy.²⁸ Regional Support for STEM, through Regional Improvement Collaboratives, STEM Ambassadors, the Life and Chemical Sciences National Transition, the Energy Skills Partnership, Labour Market Intelligence (LMI), Developing the Young Workforce (DYW), and the Science Skills Academy (SSA) will have supported this and will continue to play a key role.

A changing policy context

- 3.13 Since the original STEM Strategy was published in 2017, new steps have been set out in consecutive Programmes for Government published by the Scottish Government. The Scottish Government’s Programme for Government (2019/20) set out actions for taking advantage of the economic opportunities offered in the STEM sector to address the climate emergency. Actions relating to the COVID-19 response and the climate emergency were prioritised in the Programme for Government (2020/21). The Programme for Government (2021/22) highlights the integral role STEM education and skills play in meeting the demand for green skills and the Programme for Government (2022/23) aims to align skills investment with NSET ambitions and other skills plans such as CESAP. The new Programme for Government (2023/2024) sets out the commitments of the Scottish Government to deliver against the Hayward and Withers Reviews. It also sets out commitments to deliver a digital strategy for the education

²² <https://www.sserc.org.uk/stem-engagement/>

²³ <https://www.youngstemleader.scot/about>

²⁴ <https://education.gov.scot/resources/a-summary-of-stem-resources/>

²⁵ <https://www.gov.scot/publications/stem-education-training-strategy-refresh/documents/>

²⁶ <https://www.gov.scot/policies/science-and-research/women-stem/>

²⁷ Ibid.

²⁸ Ibid.

system, and the implementation of a strengthened Learning for Sustainability Action Plan to support learning about the causes and effects of climate change, action for prevention, and the importance of climate justice.²⁹

- 3.14 Following the refresh and OECD review, the Scottish Government announced reforms to Scotland's education system, and in particular the creation of new agencies with responsibility for developing and awarding qualifications, and for improved support and professional learning to teachers and schools, and to provide advice and guidance on curriculum, assessment, learning and teaching. The intention to create a new independent inspectorate body will be created alongside these.³⁰ This followed Ken Muir's Review, *Putting Learners at the Centre: Towards a Future Vision for Scottish Education*.³¹ The Report set out the case for a renewed vision of education in Scotland, one that places the learner at the centre of all decisions.
- 3.15 More drastic change in the skills and policy landscape may follow the independent review *Fit for the Future: developing a post-school learning system to fuel economic transformation* (the Withers Review). The review was published by the Scottish Government in June 2023, and considers skills functions and remits of Scotland's national public bodies and makes fifteen recommendations for future adaptations to support the NSET.³²
- 3.16 Key recommendations such as streamlining education funding and delivery by merging SDS, SFC and SAAS, embedding and integrating workforce planning into the enterprise agency remit, developing a successor to the Scottish Qualifications Authority (SQA), moving national skills planning to the Scottish Government and reforming SDS will all have significant effects on the STEM education and training pipeline as well as STEM labour markets in Scotland if they are actioned.³³ The STEM education policy environment is a moving picture and enterprise agencies, funding bodies, skills planning and other elements of the training landscape must be adaptable to change.
- 3.17 In addition, the *Independent Review of Qualifications and Assessment* (the Hayward Review)³⁴ identified that learners in Scotland need opportunities to develop the knowledge and skills they need as they progress beyond school and college. It also identified that learners need to develop the ability to work together, to use knowledge to tackle problems, to think creatively, and to persevere. Though the review was concerned with Senior Phase qualifications in schools, colleges and wider educational settings, these identified issues are of relevance for how the SSA project approaches engagement.

STEM and the Highlands

Landscape

- 3.18 Both nationally and within the Highlands and Islands there is complex landscape in STEM education and professional learning support provision, and also in the strategic structures that underpin this activity. This crowded landscape is in part considered to be the case because of the wide-ranging nature of STEM, and the overlapping remits and interest that each organisation involved has. Within the Highlands, there is a mix of national, regional and local STEM education structures, but it is arguable that there is limited alignment in terms of geography and remit.

²⁹ <https://www.gov.scot/publications/programme-government-2023-24/>

³⁰ <https://www.gov.scot/news/new-national-education-bodies/>

³¹ Ibid.

³² <https://www.gov.scot/publications/fit-future-developing-post-school-learning-system-fuel-economic-transformation/>

³³ Ibid.

³⁴ <https://www.gov.scot/publications/future-report-independent-review-qualifications-assessment/>

- 3.19 The importance of and need for STEM skills has only increased as the rate of technological change continues apace. The education landscape and context, nationally and in the Highlands, has also changed with a number of significant changes in the policy and strategy environment in recent years.
- 3.20 Highland STEM partners include, amongst others, the SSA, the University of the Highlands and Islands and its STEM Engagement Programme, Aberdeen Science Centre, Glasgow Science Centre, SSERC, STEM Ambassadors, STEM Learning, Highland Numeracy, Highland Digital Learning, HIE, Skills Development Scotland, Education Scotland, and SQA.

University of the Highlands and Islands

- 3.21 The University of the Highlands and Islands (UHI) is supported by industry partners to deliver a range of funded STEM programmes to early year and primary school learners in the Highlands and Islands region through local STEM coordinators.³⁵ The current UHI STEM Outreach Programme commenced during the academic year 2023/2024 for a three-year period and its main aims are to:
- Increase STEM confidence for pupils and practitioners;
 - Widen primary schools' access to equipment and teaching resources to aid STEM teaching and learning capacities;
 - Culturally embed STEM within schools by supporting more than one practitioner per school; and to
 - Collaborate and coordinate STEM partners to inform and enhance STEM learning, activities, and careers.³⁶
- 3.22 Another UHI STEM initiative is the 'Lend a Lab' project which allows primary schools to borrow equipment and receive lesson ideas and training on a range of STEM topics.³⁷
- 3.23 These STEM outreach initiatives and programmes follow a project delivered by UHI using the SSE Renewables Highland Sustainable Development Fund over the period 2016/17 to 2020/21.³⁸ This fund aimed to provide inspiring STEM activities to schools across the Highland region, building STEM skills to support the future of the Highlands and Islands economy.
- 3.24 The UHI STEM project was well-received by its beneficiaries, and the support and resources provided were highly valued. It made a positive contribution to teacher development in STEM education across a range of different competency areas, but particularly in terms of confidence and capability. The project also increased engagement with, and use of, STEM teaching resources more generally in the Highlands and Islands. The UHI offer differs from the SSA offer in that UHI delivers STEM kit through 'Lend a Lab' and some teaching materials whereas the SSA delivers bespoke STEM learning experiences, mostly lasting a full school day, within which more advanced technology is made available to learners.^{39&40}

Energy Skills Partnership

- 3.25 The Energy Skills Partnership (ESP) in collaboration with West Highland College and with support from Developing the Young Workforce (West Highland) organised a Big Bang event, in April 2023, where Lochaber High School S1 and S2 pupils spoke to numerous employers,

³⁵ <https://www.uhi.ac.uk/en/about-uhi/stem/>

³⁶ Ibid.

³⁷ <https://www.uhi.ac.uk/en/about-uhi/stem/primary-schools/>

³⁸ <https://www.sserenewables.com/communities/sustainable-development-fund/>

³⁹ <https://www.uhi.ac.uk/en/about-uhi/stem/primary-schools/>

⁴⁰ <https://www.scienceskillsacademy.co.uk/>

participated in STEM activities, and were informed about possible STEM careers.⁴¹ Plockton and Portree High School pupils also attended a similar event in the same month.

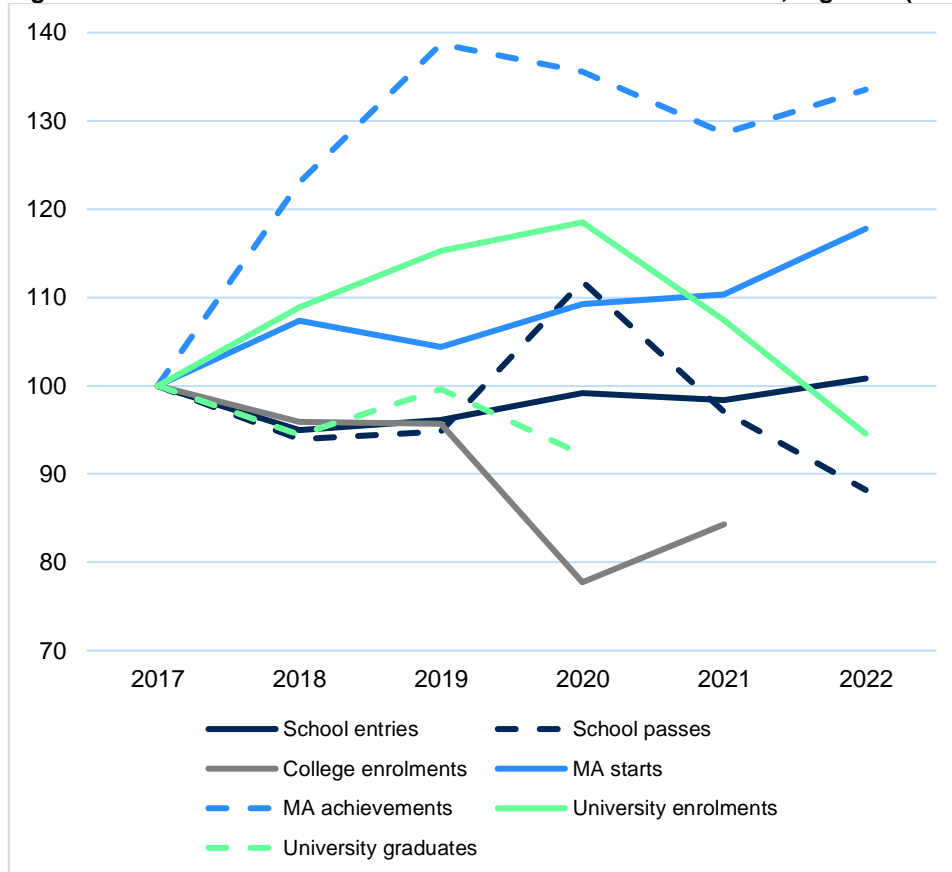
3.26 Visiting employers, at the Big Bang event, included Lochaber Geopark, BSW, The Underwater Centre, Liberty Aluminium, Royal Navy, Army, CITB, West Highland College⁴², Skills Development Scotland, Strathclyde University and BAM Nuttall.⁴³

STEM education and attainment⁴⁴

3.27 This section presents a trend analysis of education enrolment and attainment in STEM for the Highlands and Scotland. Analysis is presented across several different education levels, including school, college, apprenticeships, and university (as far as available data will allow).

3.28 As Figure 3.1 shows, there is a mixed picture in terms of STEM enrolment and attainment. Exam entries for school-level qualifications (+17%) and starts on Modern Apprenticeship (MA) frameworks (+33%) have increased between 2017 and 2022, but overall, across the period, college (-16% to 2021) and university enrolments (-5%) have decreased. Whilst MA achievements have increased, school level passes have only shown a minimal increase, and university graduates have decreased. In terms of school-level attainment, this is important in the context of the SSA, given that school attainment has not followed a similar trend to school exam entries.

Figure 3.1: Overall indexed trend in STEM education and attainment, Highland (2017 to 2022)



⁴¹ <https://www.dywesthighland.org/highlighting-local-stem-opportunities/>

⁴² Now part of UHI West Highland

⁴³ Ibid.

⁴⁴ Data analysis was undertaken using the definition of STEM education used in the Scottish Government’s STEM Education and Training Strategy and supporting evidence base. The summary of analysis presented here captures the broad trends and challenges around STEM education that are evident in the Highland area. Some codes have changed during the data capture period; however, subjects have been matched with their closest approximate.

Source: SQA, SFC, SDS and HESA. Please note trends are indexed from 100 in 2017

- 3.29 Table 3.1 shows the number of exam entries and attainments across each education level in the Highlands from 2017 to 2022. Please note, due to data suppression across particular subjects to avoid disclosure issues, school-level exam entry and attainment figures presented may be slightly lower than the actual figures.
- 3.30 There were 11,475 STEM-related school exam entries across the Highland Council area in 2022, representing approximately 5% of all school exam entries in STEM-related subjects across Scotland. Similarly, the number of Highland passes at school level in 2022 accounted for 6% of all school STEM passes in Scotland. As a proportion of the overall Scottish STEM school exam entries, Highland has slightly increased by one pp. between 2017 and 2022. As a proportion of the overall Scottish STEM passes, Highland has increased by four percentage points between 2017 and 2022.
- 3.31 Highland College STEM Enrolments were 4,230 in 2021, representing 3% of all STEM college enrolments in Scotland. This continued a downward trend in Highland college enrolments as a proportion of all college enrolments in Scotland between 2017 and 2021, down four percentage points across the period.
- 3.32 There were 3,040 university enrolments in STEM-related courses in the University of the Highlands and Islands in 2022, accounting for 2% of all STEM-related university enrolments in Scotland. This proportion has decreased by five per cent since 2017.
- 3.33 At National 5 level, Mathematics was the most popular subject in 2022, with 1,415 exam entries, followed by (1,085) Applications of Mathematics and Biology (996). At Higher level, Mathematics was the most popular subject again, with 650 exam entries, followed by Chemistry (360) and Physics (345). At Advanced higher-level, Biology was the most popular subject, with 130 exam entries, followed by Mathematics (120) and Physics (110).⁴⁵
- 3.34 In terms of Modern Apprenticeships in 2022, the most popular STEM courses for Modern Apprenticeships were Construction & Related (6,375 leavers), followed by IT and Other Services (2,372 leavers) and Engineering and Energy Related (1,652). These occupational groupings also had the highest achievement rates of 72.3%, 75.5% and 72.3%, respectively.⁴⁶
- 3.35 According to 2021 Highland Council College statistics, Construction was the most popular course with 650 enrolments, followed by Psychology (350) and Electrical Engineering (285).
- 3.36 In terms of course enrolments in 2022 at the University of the Highlands and Islands, subjects allied to Medicine, Engineering and Technology and Biological and Sport Sciences were the most popular.⁴⁷

Table 3.1: Number of STEM education enrolments and passes, Highland (2017-2021)

Education level	2017	2018	2019	2020	2021	2022	% change 2017-2022
School entries	11,382	10,810	10,942	11,285	11,199	11,475	1%
School passes	8,799	8,264	8,341	9,838	8,543	9,170	4%
College enrolments	5,019	4,813	4,802	3,902	4,230	*	*
MA starts	9,619	10,325	10,038	10,507	10,612	11,329	18%
MA achievements	6,076	7,473	8,427	8,239	7,816	8,115	34%

⁴⁵ School passes equivalent to grades A-C.

⁴⁶ Please note: Modern Apprenticeship data for Highland was not available, therefore MA data in table 3.1 is for STEM-related frameworks in Scotland as a whole.

⁴⁷ SFC graduate outcome data is only available up until 2020/21.

Final Evaluation of the Science Skills Academy (SSA)

University enrolments	3,215	3,500	3,705	3,810	3,455	3,040	-5%
University graduates	1,350	1,275	1,345	1,245	*	*	*

Source: SQA, SFC, SDS and HESA

4 Programme management and delivery

Key findings summary



- The SSA has achieved significant reach across the Highland area, with 94% of schools engaged, and 98% when those without P6/P7 pupils are excluded from the total.



- The pop-up Newton Room has proved particularly effective in overcoming geographical barriers for more rural and remote schools, and increasing equity of access to valuable extra-curricular learning, though some geographical barriers remain.



- The non-traditional mode of delivery is a key strength and USP for the SSA project.
- The localised and bespoke approach means that the SSA activities are contextualised and tailored to the geography they are based in, without duplication across Newton Rooms.



- The SSA team is held in very high regard, with their approach to relationship-building and in-depth engagement recognised as critical to securing school participation, and their approach to teaching and delivery a vital part of the SSA's success in engaging pupils.

- SSA delivery is well-aligned with other STEM activity in Highland, and is considered to offer strong complementarity rather than competing for the same school audiences and pupil demographics.

- The evident demand for extra-curricular STEM activity to bolster in-class STEM education means that there is a strong rationale for the SSA's continuation, and the SSA project is well-placed to respond.

Introduction

4.1 The principal objective of the Science Skills Academy (SSA) project is to use its delivery model to increase the engagement of young people in STEM within Highland, thus building awareness and understanding. Ultimately, the intention is to ensure long-term engagement in STEM education and subsequently greater participation in STEM career pathways. The SSA project delivery has been tailored to the particular characteristics of the Highland area, and to the demands of FE and HE provision and of employers. This chapter explores the effectiveness that the SSA project in its management and delivery.

Management and delivery strengths and successes

4.2 Throughout its delivery, the SSA project has demonstrated a range of strengths and successes. This are discussed below.

Reach and encouraging engagement

4.3 Inclusion is a key strength of the design and delivery of the SSA and through its network of Newton Rooms and the pop-up Newton Room, the SSA has engaged with 94% of schools in the Highland Council Local Education Authority (LEA).⁴⁸ This is a significant degree of reach across the Highland area. Anecdotal evidence from consultations suggests that the small proportion of schools that have not engaged typically do not engage with many extra-curricular activities in general and could be considered 'hard to reach'.

4.4 Schools report that a key strength is removing cost as a barrier to schools and pupils participating. There is no charge for attending the Newton Rooms and there is financial support to cover transport costs. Chapter 6 further discusses the impact of the SSA on equalities, diversity and inclusion in STEM activities, subjects and careers. There was consensus amongst consultees that a strength of the SSA is its ability to help schools

⁴⁸ SSA monitoring data.

overcome expense as a barrier. Small budgets in schools are the biggest barrier to pupils and teachers engaging with STEM. The SSA has been very effective at helping schools to overcome this barrier. Schools typically would not be able to afford the equipment that the SSA can provide, and increasingly schools are finding it difficult to meet (or at least justify) transportation costs to travel to venues and events for extra-curricular activity. This means that some pupils would not be able to experience practical STEM classes without the SSA.

4.5 The pop-up Newton Room is particularly valuable in extending the geographic reach of the SSA. It delivers in the heart of the communities which raises awareness amongst local people and organisations. Importantly, it enables access to STEM education for young people in rural areas who generally have very limited access to such activities, opportunities and facilities.

4.6 Learning in the Newton Rooms is collaborative and co-operative, with pupils working in groups and through peer-to-peer learning, as illustrated by the following comments:

'we do it with pupils, not to them'

'pupils get ownership of the activities and take responsibilities'.

4.7 Co-operative learning is a significant component of primary school teaching and so the SSA aligns well with how pupils are taught in school and encouraged to learn and develop. The activities are encouraging and engaging, successfully engaging pupils from a range of backgrounds, both genders, and those who may generally be less enthusiastic about STEM subjects. One teacher summed this up with the following comment:

'[The most] striking thing is young people not excelling in the classroom, but excelling in the Newton Rooms'

4.8 A key principle of the SSA project is providing hands-on engagement in a live STEM environment within its Newton Rooms, and through a non-traditional mode of learning. Consultees consider that this is a key strength and USP for the project. This mode of delivery is considered more engaging and attractive for learners, thus helping to stimulate interest in STEM topics. This is also bolstered by the Learning Labs offered through the SSA, which was singled out by teachers as being of particular value.

4.9 The fact that the SSA engages with pupils across year groups at primary and secondary schools is important for maintaining engagement with STEM learning. This is particularly true as learners approach the transition to the senior phase of education. Teachers and stakeholders reported that many pupils have attended a Newton Room over at least two and sometimes three consecutive years and these multiple engagements add significant value. It builds and consolidates their knowledge, increases their understanding of the range of opportunities in STEM subjects and careers, gives them more exposure to different types of SSA activities and across topics, and helps to sustain and grow the benefits of sessions over time. Teachers in particular were very positive about the opportunity for multiple engagements and commented that pupils who had previously attended a Newton Room were always very enthusiastic about subsequent visits. They also reported that repeat visits benefited the teaching staff by building their engagement with the activities and developing their knowledge and skills which they can then deploy in the classroom.

Social capital and local relevance

4.10 The use of social capital in delivery was identified in the Interim Review as a strength of the SSA project, and this was again emphasised by consultees during the Final Evaluation. Stakeholders and teachers considered that the anchoring of delivery in a local context has helped to create better awareness of local industry within schools, as well as promoting STEM careers in Highland. This contributes to addressing misconceptions of STEM careers and

showcasing the variety of roles and careers available within Highland – a key challenge for STEM industries and the retention of young people in the region. This is considered essential to connecting STEM to local communities and demonstrating its ‘real-world’ relevance and application. In achieving this, the SSA has helped to build the science capital of the area by influencing and shaping attitudes and perceptions of STEM and supporting and encouraging engagement. Building science capital is likely to have a sustained impact on pupils, teachers and wider communities.

- 4.11 The tailored, localised and bespoke approach with high quality staff and locally specific modules (e.g. on peatland and space) means that the SSA activities are contextualised and tailored to the geography they are based in, and reflect local employers and sectors. The activities and approaches are not simply duplicated in each Newton Room. This supports teachers to better contextualise classroom teaching and make it more relevant and relatable for learners.
- 4.12 Importantly, the pop-up Newton Room has increased the visibility of the SSA in more remote parts of Highland, and in turn has raised the profile of STEM learning. This is particularly valuable for rural areas where access to STEM practitioners and teaching staff with sufficient STEM experience is much more limited, and thus impacts on learner choices and experiences regarding STEM.

SSA staff and co-ordinating team

- 4.13 Throughout its delivery, the SSA project team and ‘frontline’ Newton Room teaching staff have been held in high regard. They are considered by stakeholders, teachers and STEM practitioners to be a significantly valuable asset for the SSA project. Teachers who took part in the survey and qualitative consultation all agreed that the enthusiasm and knowledge of SSA staff is a major strength. Approximately 98% of the 734 teachers surveyed by the SSA after Newton Room sessions reported that their class had a positive, exciting and inspirational experience at the SSA with 99% reporting the SSA staff’s activities and teaching were organised and structured.
- 4.14 Qualitative findings from focus groups and consultations support this view. Teaching staff are considered to be of a very high quality, mixing technical skills and knowledge with the ability to engage pupils. The fact that the SSA staff have typically previously worked as STEM outreach officers or non-school STEM practitioners is considered to be beneficial. As well as their skills and knowledge, SSA staff reported to be responsive to need. For example by adjusting activities to take account of the age ranges in composite classes. It is important to be able to deliver to mixed age groups where schools have low rolls.
- 4.15 The SSA team’s strong approach to relationship-building and in-depth engagement was highlighted as a strength in the Interim Review and this has been built and capitalised on. Reflecting the continued work in this area, it was again emphasised as a strength by stakeholders and teachers in the Final Evaluation. Since its implementation, this focus on relationships and engagement has helped to ensure a deep understanding of teachers’ and learners’ needs on a school-by-school basis, and helps the SSA team better prepare sessions. As highlighted in the Interim Review, the high degree of personal contact and support delivered by the team to schools and teachers contributes to the excellent reputation the SSA has within Highland and is seen as a real strength of the project. Whilst this was impacted by the pandemic, contact was largely maintained, albeit it not face-to-face.

Alignment with STEM activity and education

- 4.16 There is a consensus amongst consultees that the SSA delivery is well-aligned with the Curriculum for Excellence. This serves to augment classroom delivery for schools. The value of this to teachers is widely acknowledged, as demonstrated by the following quote:

'The physical presence gives a continuity of engagement with schools year in and year out. It's almost integrated into the school curriculum and adds value.'

- 4.17 The SSA project continues to be well-aligned with other STEM activity in Highland. The STEM outreach landscape in the area continues to be complex, and some stakeholder consultees voiced concern about whether the SSA would either be distinguishable from other offers or would compete with other delivery.
- 4.18 There is some overlap with the ongoing STEM Outreach Programme being delivered by UHI (originally funded through SSE's Highland Sustainable Development Fund, and now being supported by funding from ScotWind⁴⁹). However, there is sufficient difference between the target audiences and modes of delivery between UHI's activity and the SSA for there to be real complementarity. The UHI Outreach Programme continues to focus on in-school outreach with early years settings and primary schools. Skills Development Scotland SDS also operate a physical space in Inverness (My World of Work Live!) for STEM-related activity. However, this has a narrower focus (typically more digital learning) and has a smaller staff resource dedicated to it.
- 4.19 In terms of distinguishability, the evaluation found no evidence to suggest that the SSA is confused with other offers. Rather, the combination of physical locations (and pop-up outreach), activities and reputation of the SSA mean that it is more than sufficiently distinct.

The Science Skills Academy's role in the regional STEM landscape

- 4.20 The SSA project is considered a vital component of wider STEM education delivery across Highland. Though there is a range of STEM learning offers available (some delivered nationally), the SSA project has established itself as a critical component of extra-curricular STEM learning for pupils in Highland.
- 4.21 Importantly, the SSA is considered to have brought real additionality to STEM delivery in the region. Many stakeholders and teachers consider that without it, there would be a considerably smaller and less co-ordinated STEM offer to pupils and schools in Highland:

'SSA has anchored the STEM offer and delivered directly to pupils, next to nothing would have happened without it'

Navigating challenges in delivery

Geographic location and proximity to schools

- 4.22 The ability of the SSA project to reach and serve the Highland-wide area is demonstrated by the proportion of Highland schools engaged, as discussed above. This is a key strength of the SSA project. Further, the engagement of schools across all areas of Highland (Caithness and Sutherland, Inner Moray Firth, Lochaber, Skye & Wester Ross) means that the SSA project has avoided appearing 'Inverness-centric'.
- 4.23 However, there is some sense that schools closer to Newton Rooms are better served. For example, schools located near a Newton Room and schools that engaged with the pop-up Newton Room cited location/accessibility as an important strength of the SSA, whereas schools located further away from a Newton Room cited location/inaccessibility as a significant challenge. This is mainly due to expensive travel costs and limited school budgets. Whilst the pop-up Newton Room has undoubtedly reduced this challenge for some schools, the nature

⁴⁹ <https://www.uhi.ac.uk/en/media/news/scotwind-developers-commit-900k-to-expand-uhi-schools-stem-engagement-programme.html>

and size of Highland's geography means that there will always be a degree of difficulty around accessibility for some schools within the project's available resource.

Overcoming the COVID-19 impact and other delays

- 4.24 Whilst the COVID-19 pandemic was undoubtedly a very challenging period, as the Interim Review indicated, an unintended benefit of the pandemic is that it enhanced levels of STEM engagement. SSA delivery shifted to online delivery and remote learning offered more opportunities for schools and learners to engage with the SSA project. There was of course a loss of hands-on learning that could be undertaken either by young people or by teachers but pivoting to the online approach was considered to be effective, positive and innovative. The SSA project was able to pivot its delivery effectively, and still deliver a valuable programme of engagement activity.
- 4.25 As the analysis of project monitoring information demonstrates in Chapter 2, the COVID-19 pandemic, along with some delays in early project delivery (documented in the Interim Review) served to impact on project progression. However, delivery since the easing of pandemic restrictions and a return to normal (intended) modes of delivery and engagement has been effective and has meant that the SSA project is close to target in terms of expected engagement levels overall.

STEM engagement officer availability

- 4.26 One additional though minor challenge is that, at the time of writing, the STEM Engagement Officers in the Fort William Newton Room work three days a week only. As such, activities are restricted to these three days. However, steps have been taken to address this, and a supply teacher will deliver on the other days of the week, so providing full time delivery from the Newton Room. In addition, it can be used to extend reach to other parts of the local community when schools are not using it. However currently, the Fort William school catchment may not be sufficient to require provision five days a week throughout the year, It will therefore be important that need and use is carefully planned and monitored and that there is the right balance between cost, access, and flexibility.

The Science Skills Academy and STEM in Highland

Meeting demand from Highland schools

- 4.27 A key finding of the evaluation is that there continues to be high demand for access to additional STEM learning and outreach opportunities to augment in-class teaching and learning. This reinforces findings from a wide range of other STEM education studies that point to a clear demand for more engaging and more relevant STEM teaching amongst learners, and also amongst schools.
- 4.28 There is also an aligned issue with the continued engagement of pupils as they transition from primary to secondary education and progress through the Broad General Education (BGE) phase. Other studies (including ekosgen's ongoing evaluation of the STEM Grants Programme and engagement with STEM education for Education Scotland) have demonstrated that it is at this point where challenges around confidence, perceptions of STEM and decisions around (not) continuing STEM subject study arise.
- 4.29 The SSA project is well-placed to respond to the evident demand and challenges regarding STEM engagement and is seen by stakeholders and schools alike as a key resource for STEM education. As such, there is a strong rationale for its continuation.

5 The Science Skills Academy experience

Key findings summary



- Students and teachers are both very positive about their experience of the SSA across all survey questions.

- Most pupils found SSA activities to be engaging and exciting.



- The Newton Rooms are effective at teaching pupils about STEM jobs and careers and they help to promote further study of STEM subjects.

- Pupils are less definitive about the long-term impacts of the SSA, than teachers, however pupils still indicate that they are more likely to study STEM subjects because of their experience.



- Most pupils found that SSA activities were taught at an accessible level of difficulty with few finding them too difficult and very few finding them too easy.

- Pupils and teachers agreed that SSA activities were well organised with enough time afforded to each activity.



- Whilst all teachers are overwhelmingly positive about their SSA experience, primary school teachers are typically more positive than secondary school teachers.

Introduction

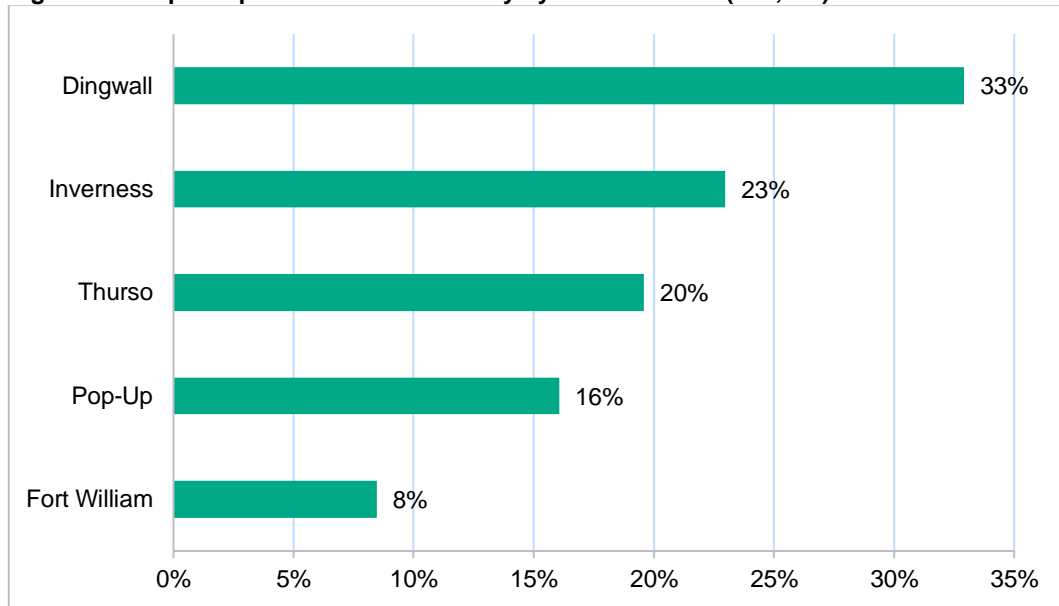
5.1 Following engagement with the SSA, pupils and teachers are asked to complete a survey about their experience of the session and the outcomes of the session. This chapter provides an analysis of the relevant data gathered through these post-event surveys.

Pupil experience in the Science Skills Academy

Profile

5.2 The most common Newton Room for pupils to have visited was Dingwall (33%) followed by Inverness (23%) and Thurso (20%). As shown in Figure 5.1, Fort William had the least engagements with only 8% of the sample.

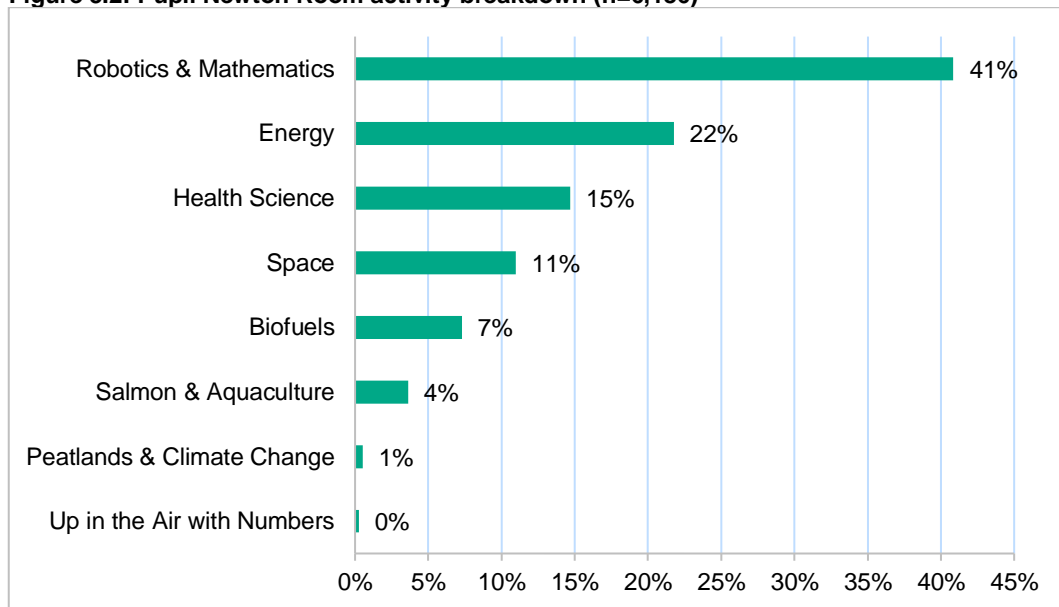
Figure 5.1: Pupil respondents to SSA survey by Newton Room (n=6,186)



Source: SSA Post-Event Pupil Survey

5.3 Figure 5.2 shows that the majority of respondents (41%) had participated in the Robotics and Mathematics session, followed by Energy (22%) and Health Science (15%).

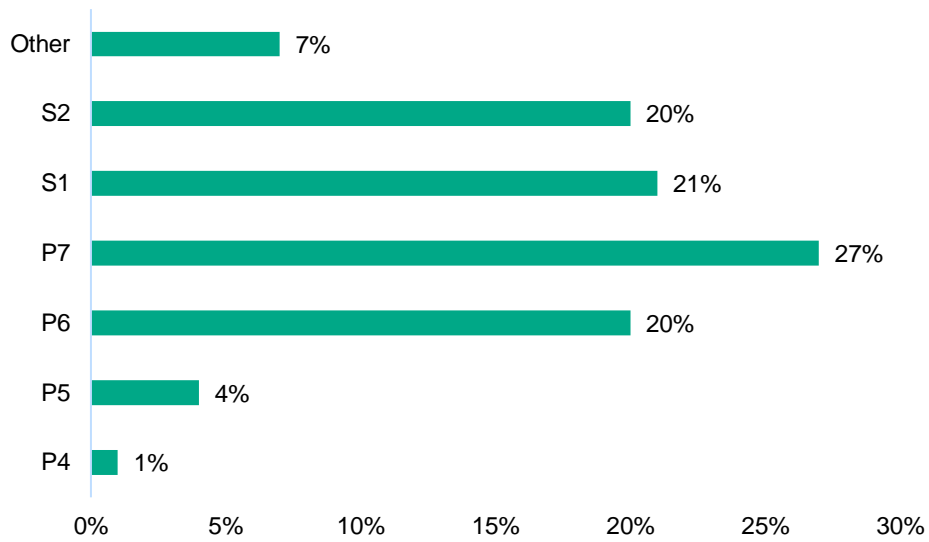
Figure 5.2: Pupil Newton Room activity breakdown (n=6,186)



Source: SSA Post-Event Pupil Survey

5.4 As Figure 5.3 shows, survey respondents were evenly spread across P6, P7, S1, and S2 with a small number of pupils from P4 and P5. For those that had selected other, there were small numbers of pupils who were in S3, S4, and S5, as well as a few children who were home schooled.

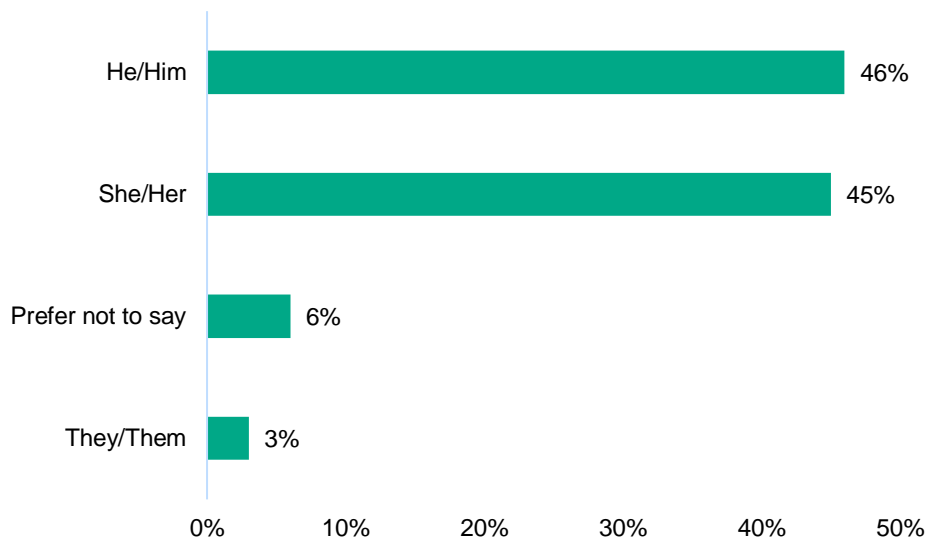
Figure 5.3: Newton room engagements by school year (n=6,186)



Source: SSA Post-Event Pupil Survey

5.5 Figure 5.4 shows that there were marginally more boys in the sample.

Figure 5.4: Newton Room engagements by gender (n=6,186)



Source: SSA Post-Event Pupil Survey

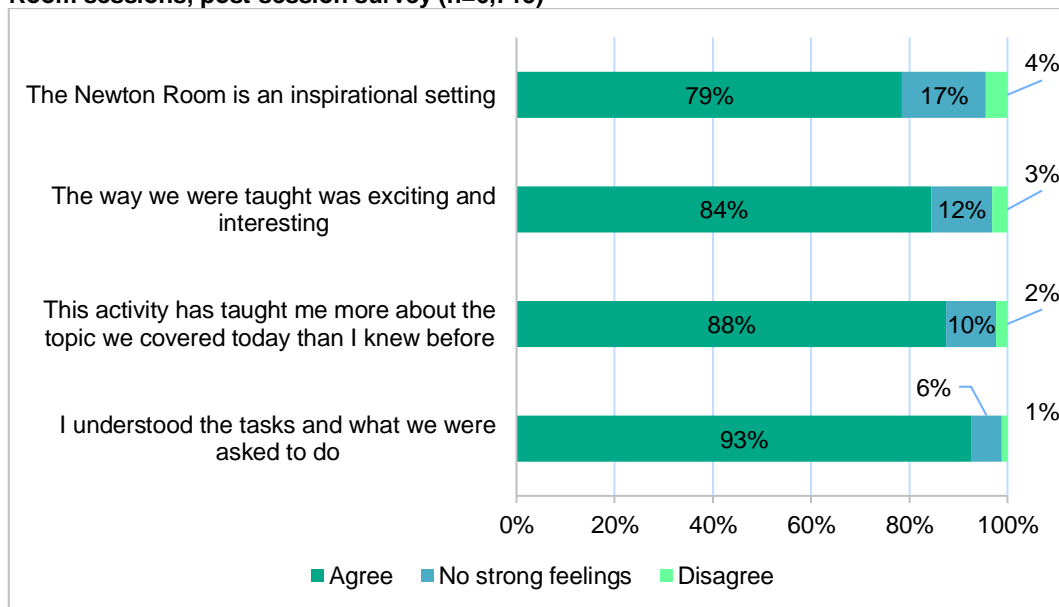
Delivery

5.6 Figure 5.5 shows pupil agreement and disagreement on several statements about their experience of an SSA session that they recently completed. Pupils that attended a Newton Room consistently agreed that their experience was a positive one.⁵⁰ Responding to a post-event survey immediately after their visit, the majority of pupils reported that the session taught them more than they already knew (88%), and that how they were taught was exciting and interesting (84%). This was also confirmed through ekosgen’s own survey of pupils that had attended the SSA, where 72% agreed that the SSA teaching methods were exciting and interesting.

Most pupils (84%) reported through the post-SSA survey that the subject matter taught during their SSA session was exciting and interesting. (n=6,715).

5.7 The majority of pupils (79%) considered the Newton Room an inspirational setting – this finding was backed up by the results of ekosgen’s own survey of pupils, where almost 60% reported that they found the Newton Room (or pop-up Newton Room) inspirational. Only one per cent of pupils didn’t understand the tasks that they were asked to undertake. These findings indicate that pupils had an overwhelmingly positive experience of their SSA Newton Room session, and the Newton Rooms were an effective method of learning.

Figure 5.5: Pupil agreement and disagreement with statements about their experience of Newton Room sessions, post-session survey (n=6,715)

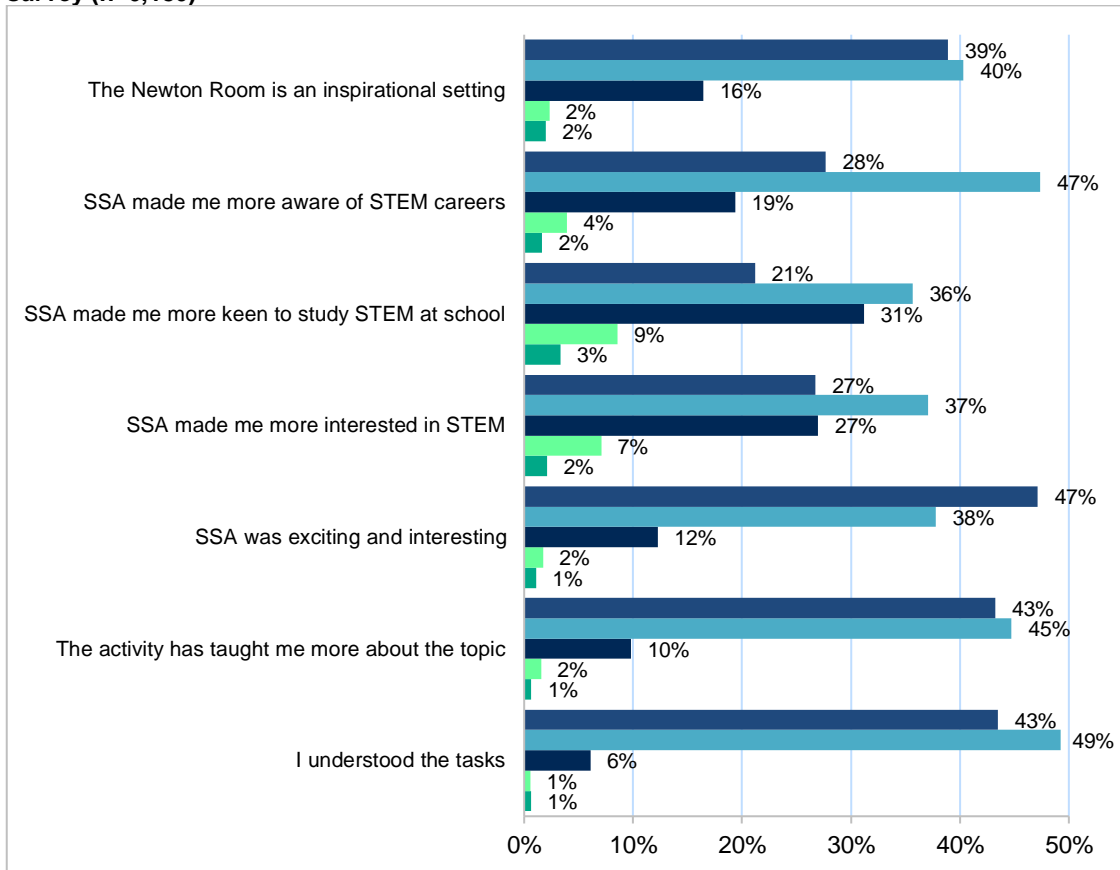


Source: SSA Post-Event Pupil Survey

5.8 Pupils were asked to rate their agreement with a set of questions surrounding their experience in the Science Skills Academy, as shown in Figure 5.6. The pupils largely agreed with every statement with the majority agreeing or strongly agreeing in every case. The statements which the pupils agreed with to the greatest extent were: that they understood the activities they were asked to do; and that the activities had taught them a lot about a specific STEM subject. On the other hand, less pupils agreed or strongly agreed that the SSA had made them more interested, or likely to study STEM.

⁵⁰ The use of agreed is equal to the combined survey response options ‘agree’ or ‘strongly agree’.

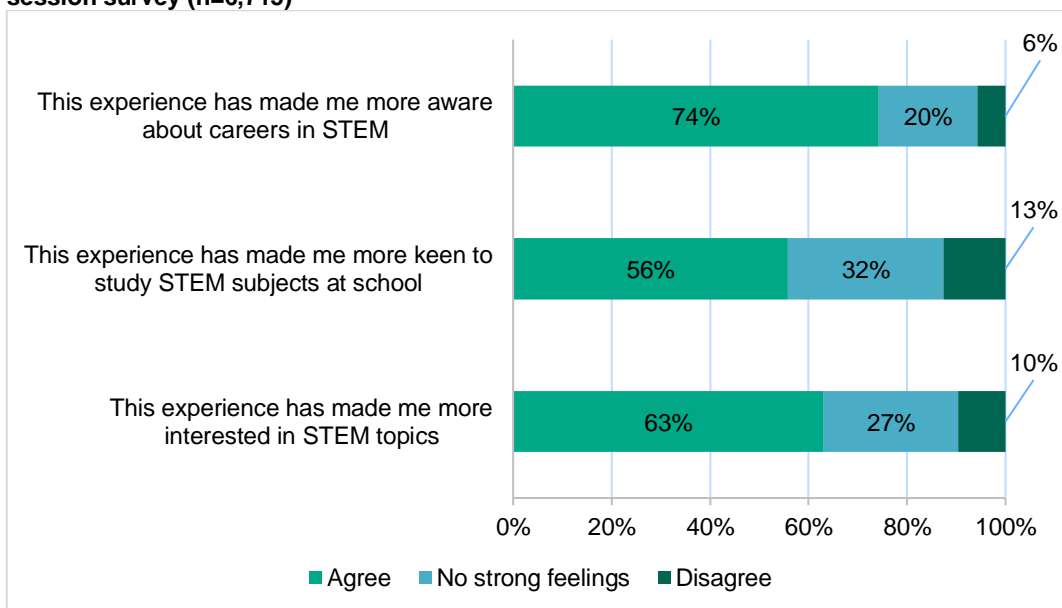
Figure 5.6: Pupil agreement and disagreement with statements about SSA impacts, post-session survey (n=6,186)



Source: SSA Post-Event Pupil Survey

5.9 Figure 5.7 shows pupil agreement and disagreement with several statements about the impacts of an SSA session that they recently completed. There was widespread agreement from pupils on the statements listed.⁵¹

Figure 5.7: Pupil agreement and disagreement with statements regarding SSA Impacts, post-session survey (n=6,715)

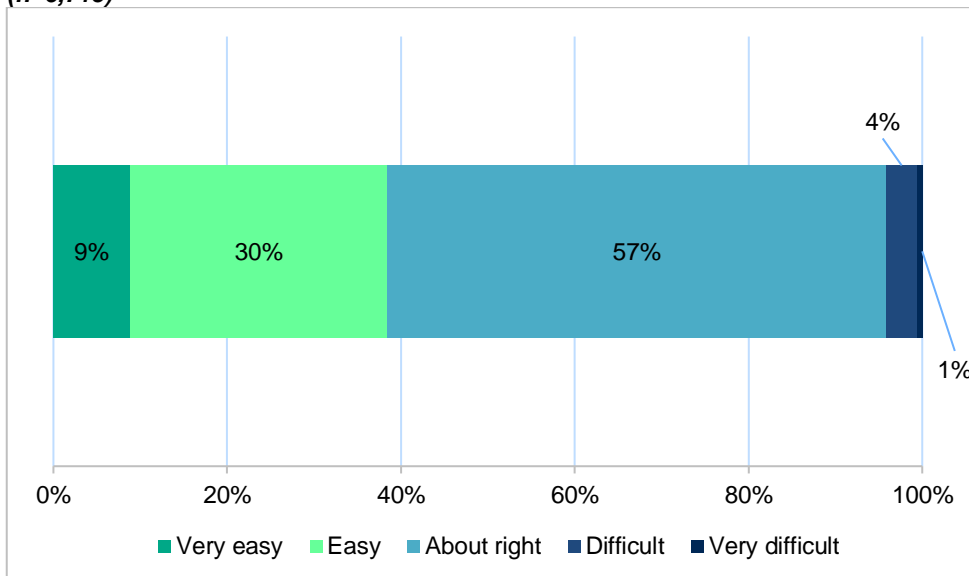


⁵¹ The use of agreed is equal to the combined survey response options 'agree' or 'strongly agree'.

Source: SSA Post-Event Pupil Survey

- 5.10 Interestingly, pupils were more likely to agree that their SSA session made them more aware of STEM careers (74%) and more interested in STEM topics (63%) than keener to study STEM subjects at school (56%). This may indicate that pupils are more likely to associate SSA activities and learnings to 'real-life' STEM applications than they are with school activities and learnings.
- 5.11 The findings from the ekosgen survey align with the SSA's own post-event survey. Figure 5.8 shows that 30% of pupils found that the content of their SSA session was 'easy' and 57% found that it was 'about right'. Only 5% of pupils found that the content of their SSA session was 'difficult' or 'very difficult'. This is a very encouraging finding and is likely to have a positive impact on STEM confidence.
- 5.12 It is positive that most pupils felt that the difficulty of their SSA session was 'about right'. However, given the proportion of pupils that found their session easy versus difficult, there may be scope to increase the difficulty level of the sessions or take a tiered approach to activities whereby there are varying levels of difficulty as pupils move onto different tasks.

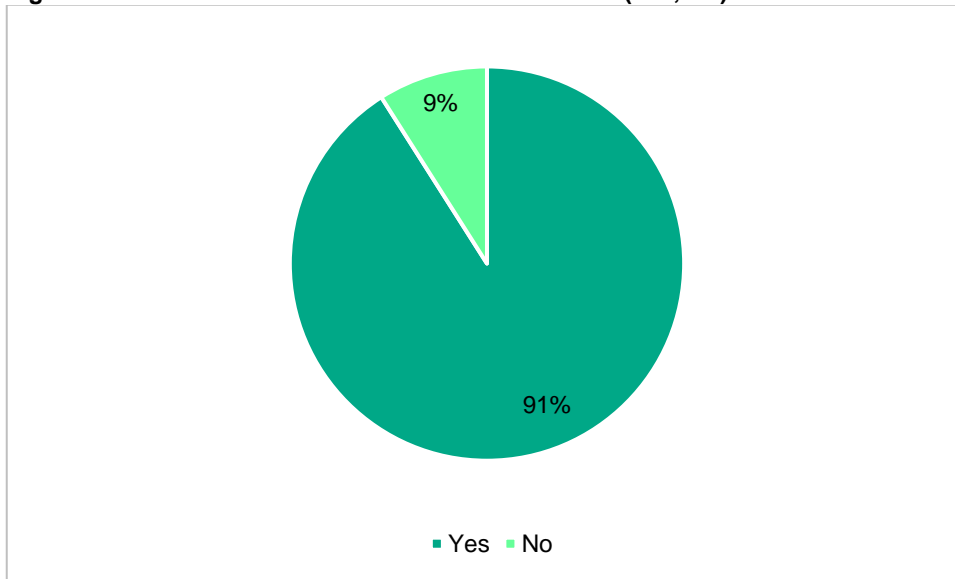
Figure 5.8: Pupil perspectives on difficulty of Newton Room activities, post-session survey (n=6,715)



Source: SSA Post-Event Pupil Survey

- 5.13 Pupils were asked if they believed they were given enough time to complete the activities, which the vast majority (91%) believed they did, as evidenced in Figure 5.9.

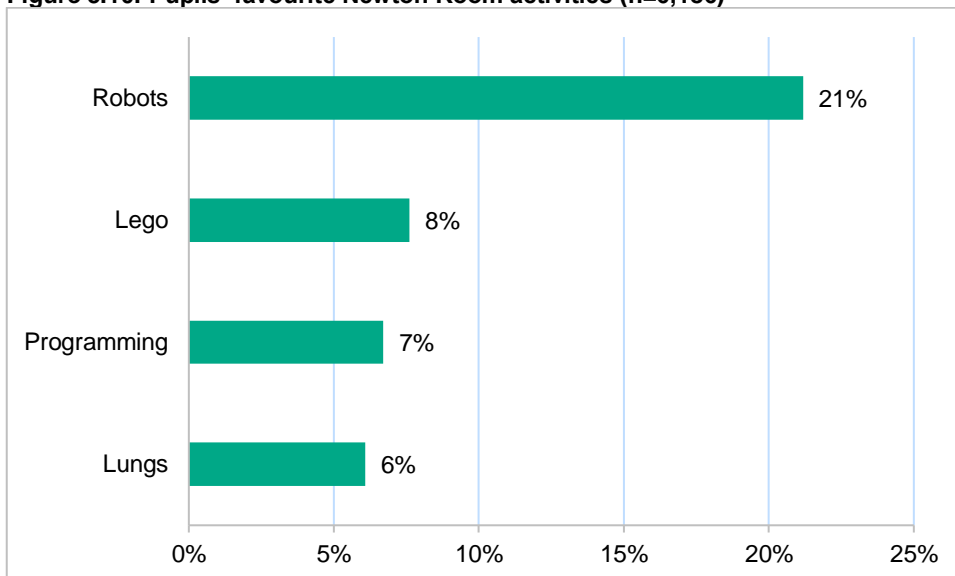
Figure 5.9: Time allocation of Newton Room activities (n=6,186)



Source: SSA Post-Event Pupil Survey

- 5.14 Pupils that responded 'No' to having enough time were then asked why. Some of the most common responses were that the robot activity, the animal dissection, the wind turbine activity, or the Lego activity had not been allocated enough time.
- 5.15 Pupils were asked what their favourite parts of the SSA were. As detailed in Figure 5.10, the most common answers were the robotics activity (21%) followed by the activity with the pig lung (8%). It should be noted that robotics is one of the longest-running modules and so it is likely that more pupils have engaged with it, and this may influence the number reporting it as a 'favourite'.

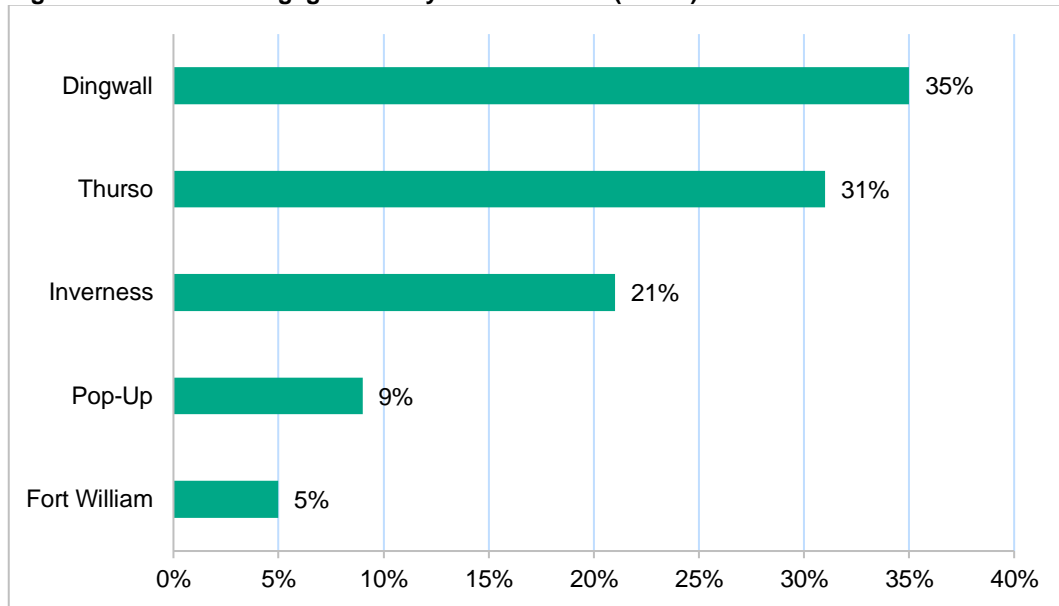
Figure 5.10: Pupils' favourite Newton Room activities (n=6,186)



Source: SSA Post-Event Pupil Survey

- 5.16 Even when asked for their least favourite part, the students were largely positive about the experience with almost a quarter (23%) suggesting there was nothing which they liked the least about the experience. Besides this, a small number of pupils (4%) struggled with the robotics activity. However, most were enthusiastic about the experience as a whole:

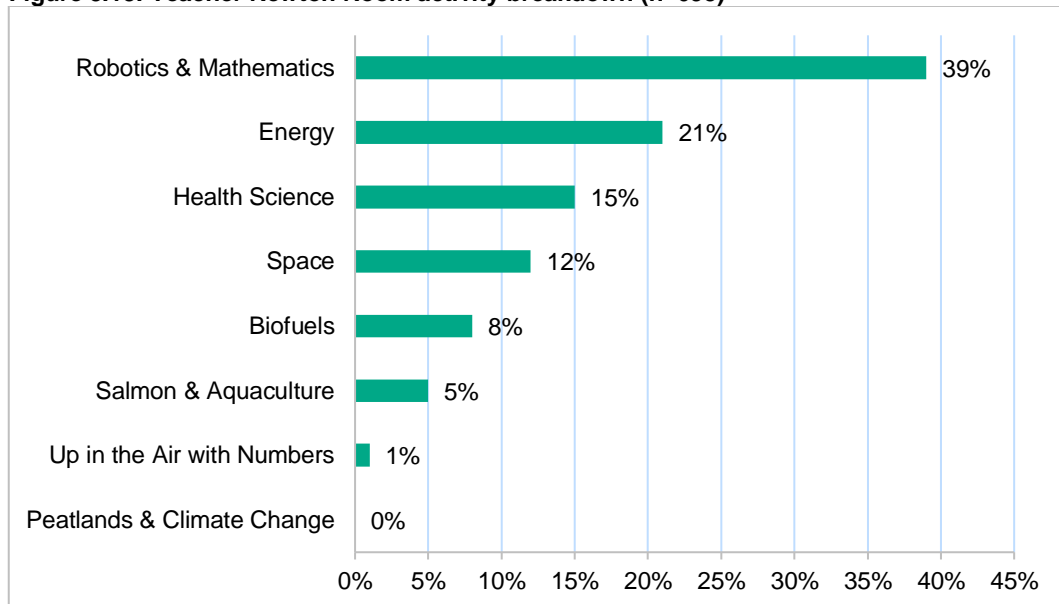
Figure 5.12: Teacher engagements by Newton Room (n=695)



Source: SSA Post-Event Teacher Survey

5.19 Figure 5.13 shows that most teachers in the sample had classes who participated in the Robotics and Mathematics activity (39%), followed by the Energy activity (21%) and the Health Science activity (15%).

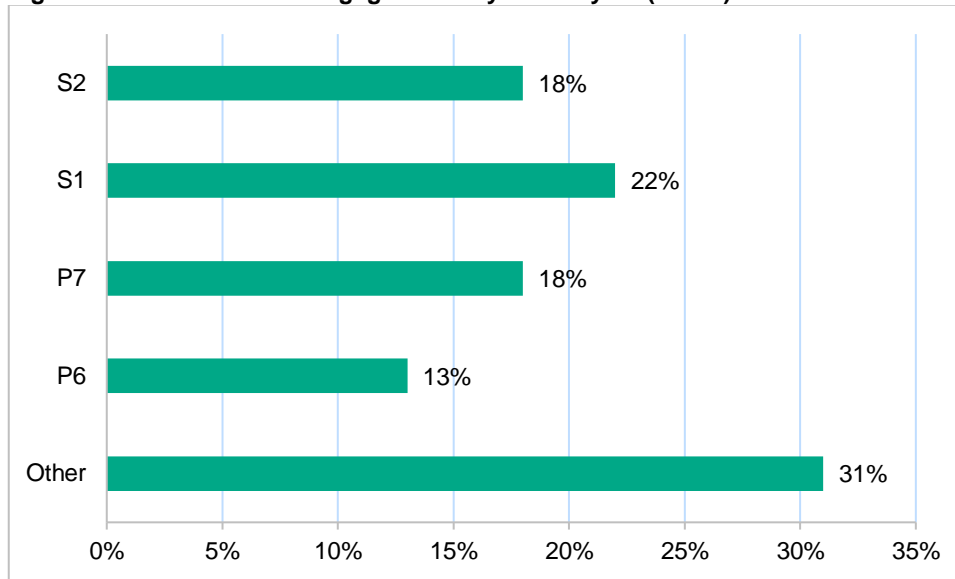
Figure 5.13: Teacher Newton Room activity breakdown (n=695)



Source: SSA Post-Event Teacher Survey

5.20 As Figure 5.14 shows, 40% of teachers in the sample engaged with the SSA with classes from S1 or S2. Around a third of the sample had Primary school classes, either P6 or P7, with around a third selecting other, which were commonly composite classes of multiple years.

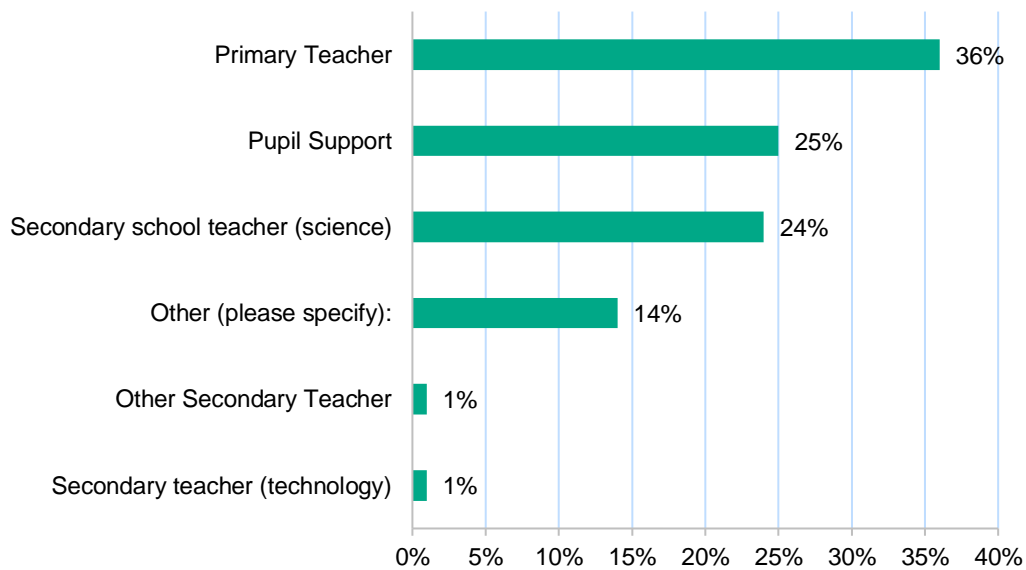
Figure 5.14: Newton room engagements by school year (n=695)



Source: SSA Post-Event Teacher Survey

5.21 Most of the respondents to the post event survey were teachers in either primary (36%) or secondary school (25%), or pupil support (25%) as shown in Figure 5.15.

Figure 5.15: Respondent sample by job role (n=695)

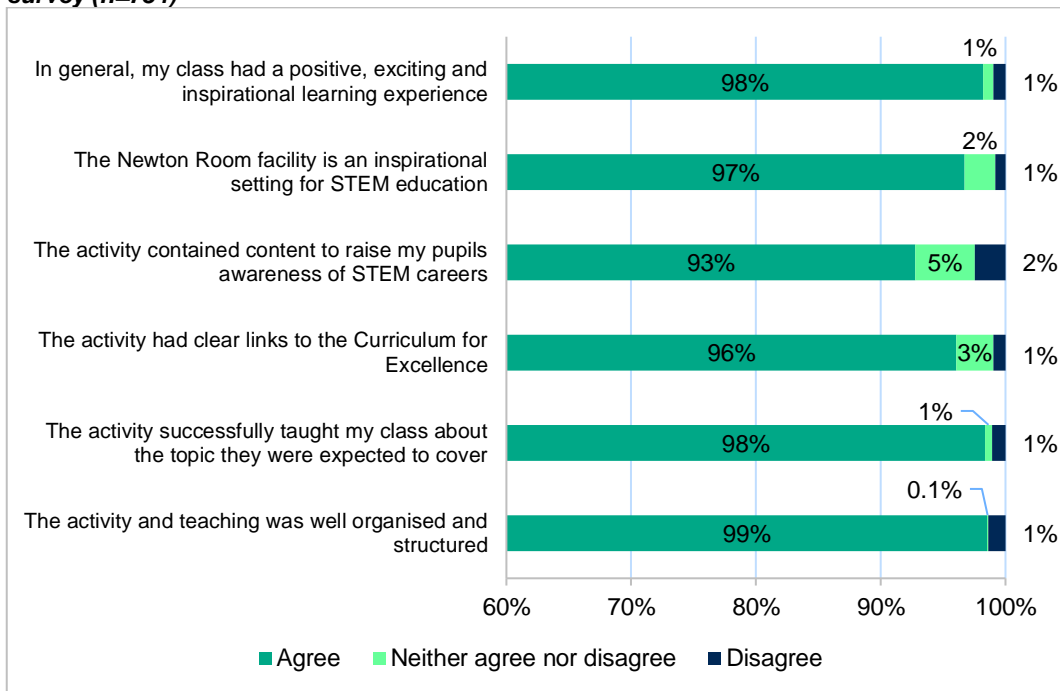


Source: SSA Post-Event Teacher Survey

5.22 Those who selected 'Other' were mainly parents, students, or volunteer helpers, technicians the SSA, or head teachers.

5.23 As Figure 5.17 shows, teachers overwhelmingly considered the experience as exciting, inspirational and informative for their pupils. However, they also found the Newton Room as inspirational from their own viewpoint (97%). Importantly, they also valued the teaching approach of the SSA, considering it well organised and structured (99%), and clearly aligned to the Curriculum for Excellence (96%). From this, it can be seen that teachers are thoroughly satisfied by the SSA experience, the inspirational element of the SSA, pupils' learnings and the delivery of SSA teaching. It is also worth noting that whilst all teachers are overwhelmingly positive about their SSA experience, primary school teachers are typically more positive than secondary school teachers.

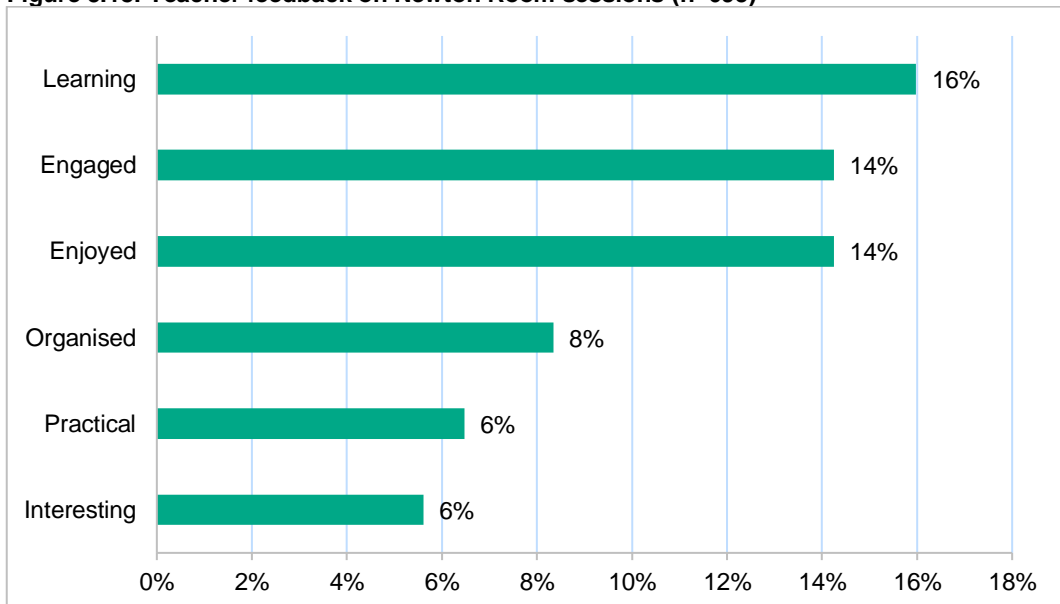
Figure 5.17: Teacher agreement and disagreement with statements on SSA impacts, post-session survey (n=734)



Source: SSA Post-Event Teacher Survey

5.24 Respondents were asked to give some written feedback on their experience in the SSA. Figure 5.18 shows that some of the most common responses were about the engagement of their class and how this facilitated learning.

Figure 5.18: Teacher feedback on Newton Room sessions (n=695)



Source: SSA Post-Event Teacher Survey

5.25 One teacher stated:

“The class thoroughly enjoyed their visit to the Newton Room. [SSA staff] delivered the lessons exceptionally and at a level for the children. She kept the pace to keep the children working and moving on to next subjects”.

- 5.26 When asked what could have been done better, the most common critique was that there could have been more time spent completing activities, and that occasionally some children struggled to cope with the amount of talking, as evidenced by one response:

“Maybe a little more time on activities (only 5mins-ish) [SSA staff member] did say she'd altered the delivery around a little to make it more active at the end of the day, this worked well and I'm glad she did, or they may have lost concentration”.

- 5.27 However, a large number of teacher respondents (35%) suggested that there was nothing that could be improved about the SSA, with many responding with further praise about the experience, for example, one response:

“I could not have wished for more as an introduction to STEM and robotics”.

- 5.28 Teacher respondents were then asked if they had taken anything away from the session which they could use in their own teaching. There was a lot of enthusiasm for the practical elements across the activities, with 10% mentioning robotics and programming, and 2% of the sample directly mentioning the Spheros activity and how this can be implemented in classroom learning:

“Yes, we plan to use Spheros this year”.

6 Science Skills Academy: Impacts and benefits

Key findings summary



- The SSA is an inspirational setting for STEM learning, with practical activities a key component of learning and enjoyment for pupils.
- Collaborative working is an important and enjoyable aspect of learning, with project work, group problem solving and team working all essential components of a positive learning experience.



- Whilst pupils of all ages typically report learning at least a moderate amount about STEM, primary pupils were more likely to report that they had learned a lot. Primary school pupils were also more likely to have had a positive learning experience.



- Almost half of pupils reported their SSA experience has improved their classroom learning, with similar proportions indicating a greater appetite to study STEM subjects at school, being more interested in STEM subjects, and having greater confidence in and enthusiasm for STEM learning.



- The SSA is having some impact in terms of contributing to longer term outcomes for pupils; however, this is an area where there is more scope for focus in future delivery.
- The SSA experience is also beneficial for teachers, with the Newton Room experience proving inspirational and engaging for teaching staff - and especially for non-STEM primary school teachers.
- As well as contributing to increased confidence and appetite for trying new things in lessons, the SSA gave teachers an opportunity to reflect on their own teaching abilities and delivery.

Introduction

- 6.1 The evaluation aimed to assess the impacts of the Science Skills Academy (SSA) on pupils and their teachers across the Highland council area. Given the aim of the SSA *to encourage more young people to study STEM in school and beyond, develop STEM skillsets and raise awareness of STEM careers*, this is arguably the most important aspect of the evaluation. This chapter draws on findings from qualitative research and surveys with pupils and teachers to set out the impacts and benefits realised. It builds on the analysis of SSA's own post-session evaluation survey delivered to pupils and teachers, as set out in Chapter 5.
- 6.2 The research was conducted through an online survey with pupils and teachers who had previously visited the SSA. This was supplemented with short focus group interviews with pupils and one-to-one consultations with teachers that had attended a Newton Room.
- 6.3 In total, eleven teachers responded to the survey, with one-to-one consultations held with thirteen teachers. The pupil survey received 176 responses in total, and pupils from six schools took part on the focus groups. A profile of the survey sample engaged through the research is set out in Appendix 1. Schools engaged through the consultations are included in Appendix 2.

The Science Skills Academy and pupils

Pupil experience

Delivery

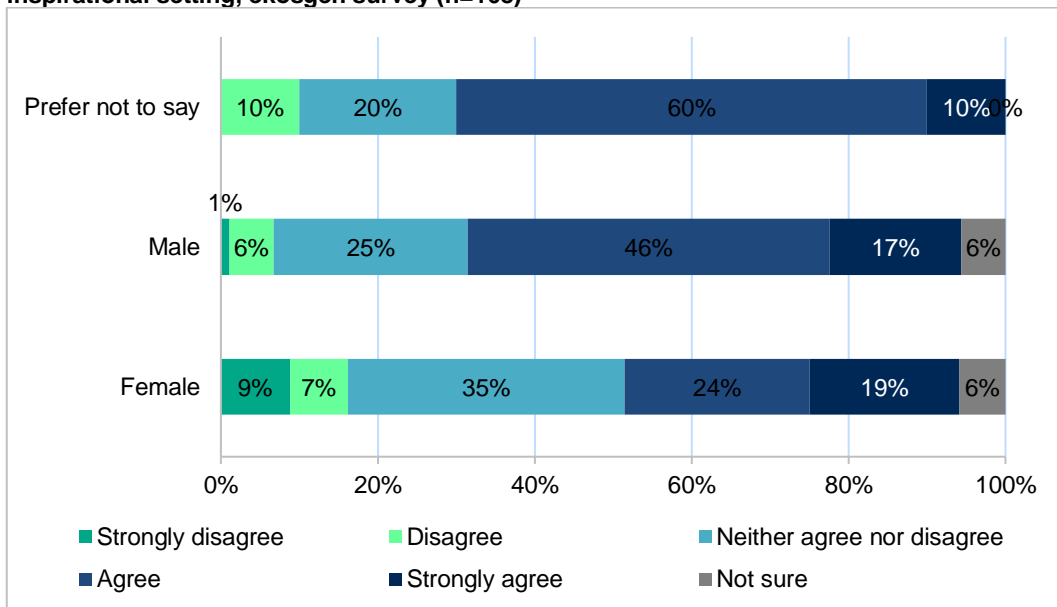
- 6.4 Pupils were asked a range of questions relating to their experience in the Newton Room or pop-up Newton Room, and their perspectives on the delivery of the session(s) that they attended. This included how they found the setting in which they learned, plus consideration of what they learned, and how.

6.5 A key aspect of SSA delivery is to create an inspirational setting for learning. This was the case for the majority of pupils, with two thirds of survey respondents agreeing that the Newton Rooms were an inspirational setting. One pupil in the focus groups strongly agreed that this was the case, stating:

“It was all awesome!”

6.6 Boys were more likely to report that the Newton Rooms provide an inspirational setting than girls, with almost three quarters of boys (71%) agreeing or strongly agreeing compared to 43% of girls, as Figure 6.1 illustrates. This suggests that there may be some challenges with engaging girls in the Newton Room. If the majority of girls do not find the setting inspirational, this may impact on their learning through the Newton Room session. However, this contrasts with findings from the SSA post-session evaluation survey, which found no difference between males and females. Feedback through the SSA survey indicates that around 79% of both males and females consider that the SSA’s Newton Rooms are an inspirational setting for learning. It may be that pupils responding to the ekosgen survey were influenced to a degree by the location or venue in which their SSA session was held (e.g. a pop-up Newton Room).

Figure 6.1: Pupil agreement or disagreement on the extent to which the Newton Room is an inspirational setting, ekosgen survey (n=168)



Source: ekosgen SSA Pupil Survey

6.7 The majority of pupils in the ekosgen survey sample enjoyed the Newton Rooms and valued the experience. Over half rated the experience as at least 4 out of 5 on every metric as set out in Figure 6.2. Doing practical experiments and activities was rated highest by pupils, with three quarters (75%) rating it as this at least 4 out of 5. The practical elements of the SSA Newton Room sessions were also highlighted through pupil focus groups as particularly engaging and informative for pupils.

More than half of pupils rated their SSA experience as 4 out of 5 or 5 out of 5.

6.8 Collaborative working was clearly an enjoyable aspect of the SSA sessions. Around two thirds of pupils also rated project group work (68%), group problem solving (67%) and learning from a STEM expert (66%) as either a 4 or 5 out of 5. Teamworking and completing tasks or projects in groups was also highlighted as positive in pupil focus groups. Pupils did not report very many, if any, negative aspects of their Newton Room learning experiences.

‘(I enjoyed) All of the group activities’

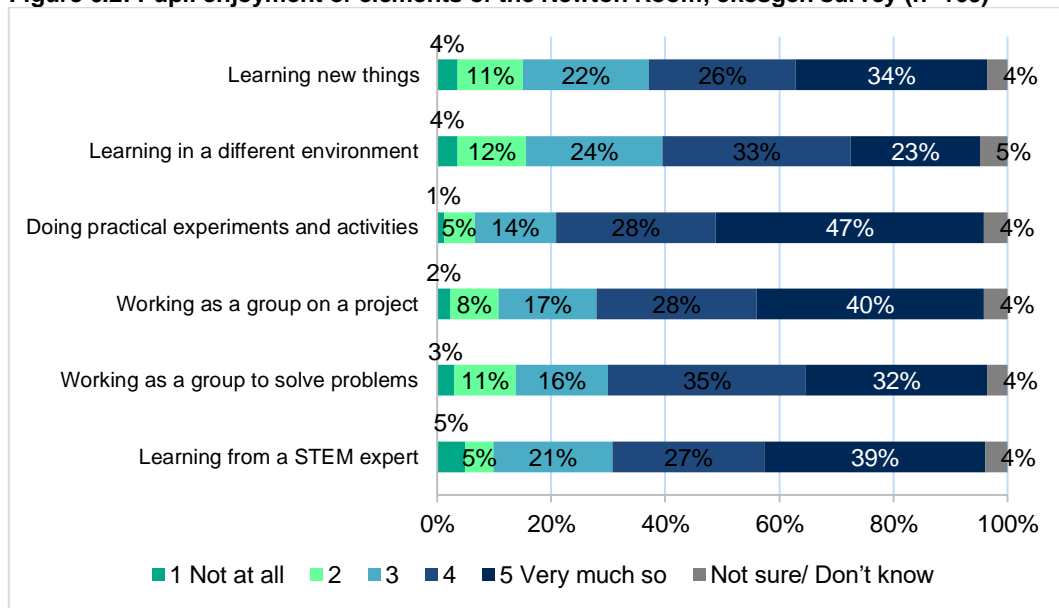
'The inclusive element of SSA Newton Room sessions was great and it broke down barriers to engagement for pupils.'

6.9 'Learning in a different environment' was rated at least 4 out of 5 by the lowest proportion of pupils. However, this was still the majority of pupils (56%).

'(I enjoyed) going out and learning in different places'

6.10 The only notable difference between genders is that girls appear to have been less enthused about learning from a STEM expert than boys, with 52% of girls rating this as a 4 or a 5 with 72% of boys giving it this rating. However, given the difference in findings regarding the Newton Room as an inspirational setting, this gender contrast may be influenced by the sample size.

Figure 6.2: Pupil enjoyment of elements of the Newton Room, ekosgen survey (n=169)

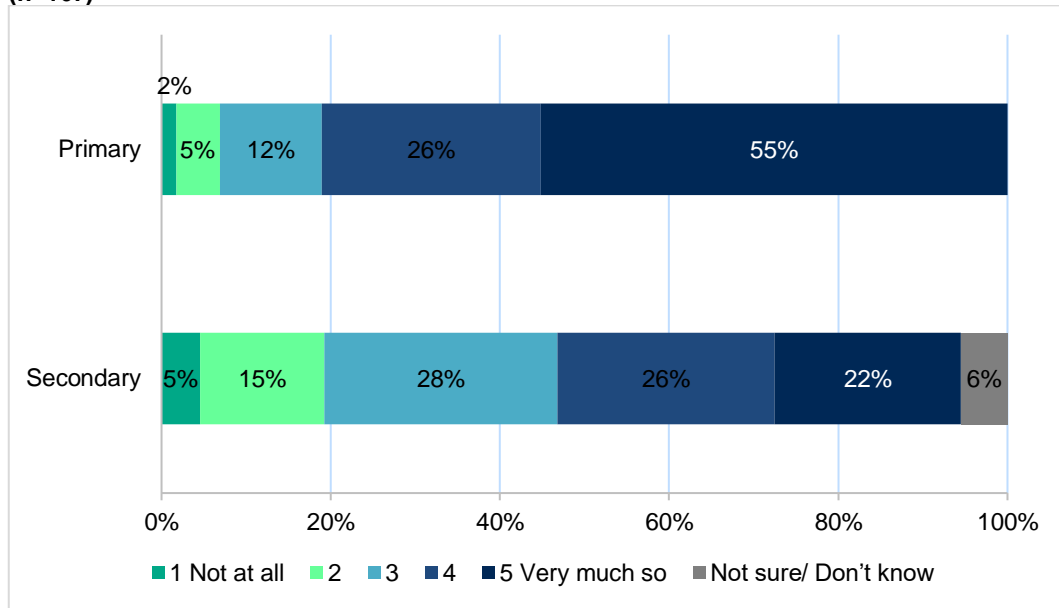


Source: ekosgen SSA Pupil Survey

6.11 Primary school pupils reported a significantly higher degree of enjoyment from learning new things than secondary pupils (Figure 6.3). Eighty-one per cent of primary aged pupils rated 'learning new things' at least a 4 out of 5, compared to just 48% of secondary pupils. It may be that this is related to the experience of being out of the classroom and experiencing learning in a different environment – and something that may be happening for the first time for a number of pupils. Thus the 'novelty factor' may be a factor in how primary school pupils have rated their enjoyment.

Primary pupils, in particular, enjoyed learning new things at the SSA.

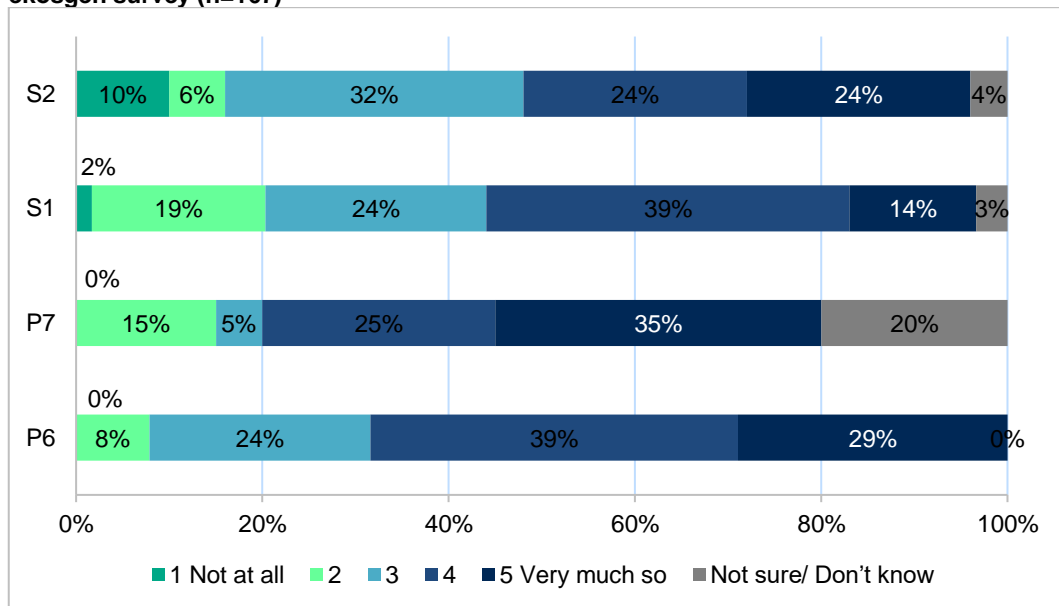
Figure 6.3: Extent to which pupils agreed that they enjoyed learning new things, ekosgen survey (n=167)



Source: ekosgen SSA Pupil Survey

6.12 Similarly, Figure 6.4 shows that 66% of primary children rated 'learning in a different environment' a 4 or 5, compared to half of secondary school pupils. Again, this could be the result of a 'novelty factor'.

Figure 6.4: Extent to which pupils agreed that they enjoyed learning in a different environment, ekosgen survey (n=167)



Source: ekosgen SSA Pupil Survey

6.13 Importantly, the SSA and the Newton Rooms were considered to be a significant learning opportunity at least in part driven by its inspirational nature, which has contributed to the interest and excitement, and arguably subsequent engagement. For example, Primary school pupils reported that their SSA Newton Room experience was their most significant (or indeed only) STEM learning experience, outside of being taught mathematics and numeracy at school. Therefore, the importance of the SSA's role in delivering inspiring STEM education cannot be understated.

The SSA delivers a significant learning opportunity.

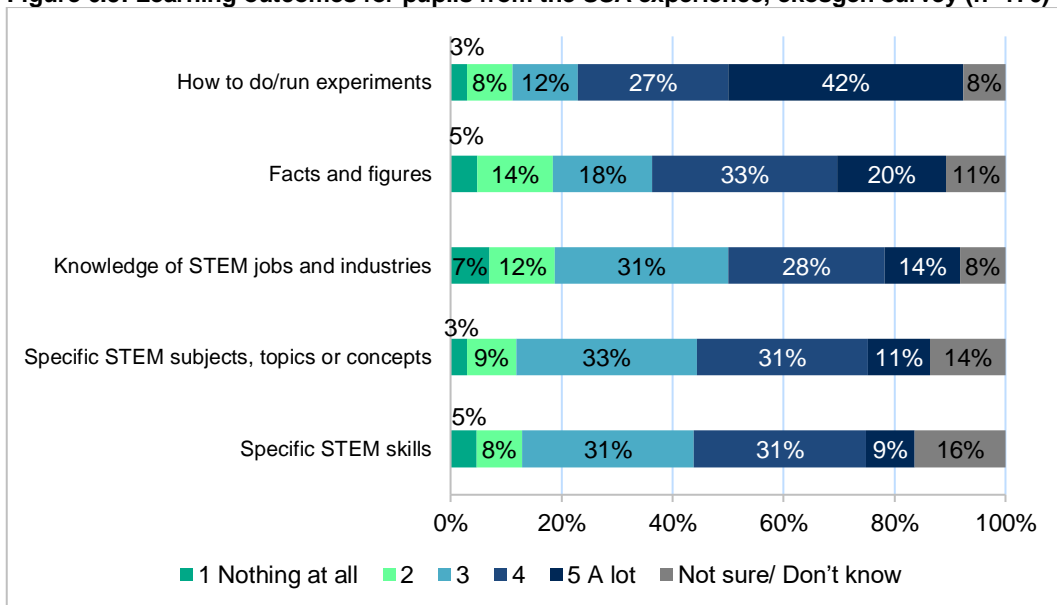
Learning outcomes

6.14 Figure 6.5 shows the majority of pupils who visited a Newton Room reported some degree of learning against all of the criteria (rating each at least 3 out of 5). For example, some 69% of students reported a 4 or 5 when asked how much they had learned about running experiments. Specific activities identified by pupils included the marble runs, building a car, and renewable energy generation. This latter activity is positive given the strong alignment with broader ambitions on Net Zero and energy transition:

'I enjoyed getting my hands on experiments and how to generate electrical power.'

6.15 Pupils learnt the least about facts and figures, however, over half (53%) still responded with a 4 or 5 when asked about it.

Figure 6.5: Learning outcomes for pupils from the SSA experience, ekosgen survey (n=170)



Source: ekosgen SSA Pupil Survey

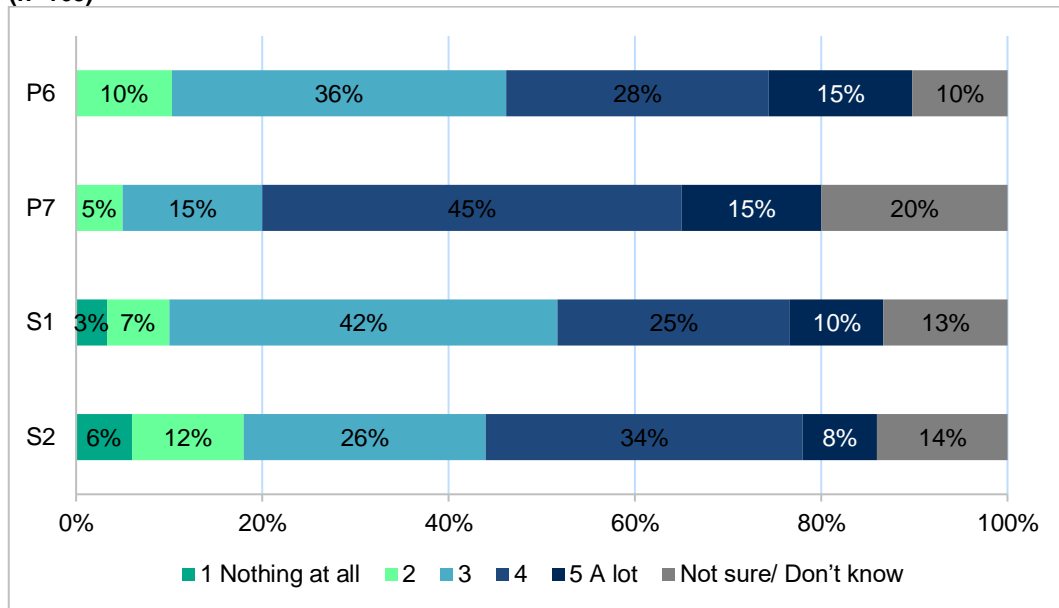
6.16 Boys were slightly more likely than girls to report having learned about STEM jobs and industries. Seventy-three per cent of boys versus 69% of girls reported at least three out of five in response to how much they had learned in this regard.

6.17 Figure 6.6 shows that primary pupils were more likely to report that they had learned a lot about specific STEM subjects, topics or concepts, with almost half (49%) rating it at least 4 out of 5 – though it is interesting to note the difference between P6 and P7 pupil responses; the reasons for this are unclear. The corresponding figure for secondary pupils was 38%. This suggests that primary pupils find the SSA a particularly valuable learning experience. As noted above, it may be that the newness of experiencing a very hands-on, interactive mode of

learning in a different environment and with a STEM expert external to their school environment is a strong positive influencing factor for primary school pupils.

- 6.18 In contrast, secondary school pupils are more likely to have had prior external learning experiences (possibly including previous SSA visits) and other non-classroom, hands-on learning experiences undertaken in school. However, the COVID-19 pandemic and subsequent restrictions will have undoubtedly reduced the scope for this to have happened as extensively as it may otherwise have done.

Figure 6.6: Extent of learning about specific STEM subjects, topics or concepts, ekosgen survey (n=169)



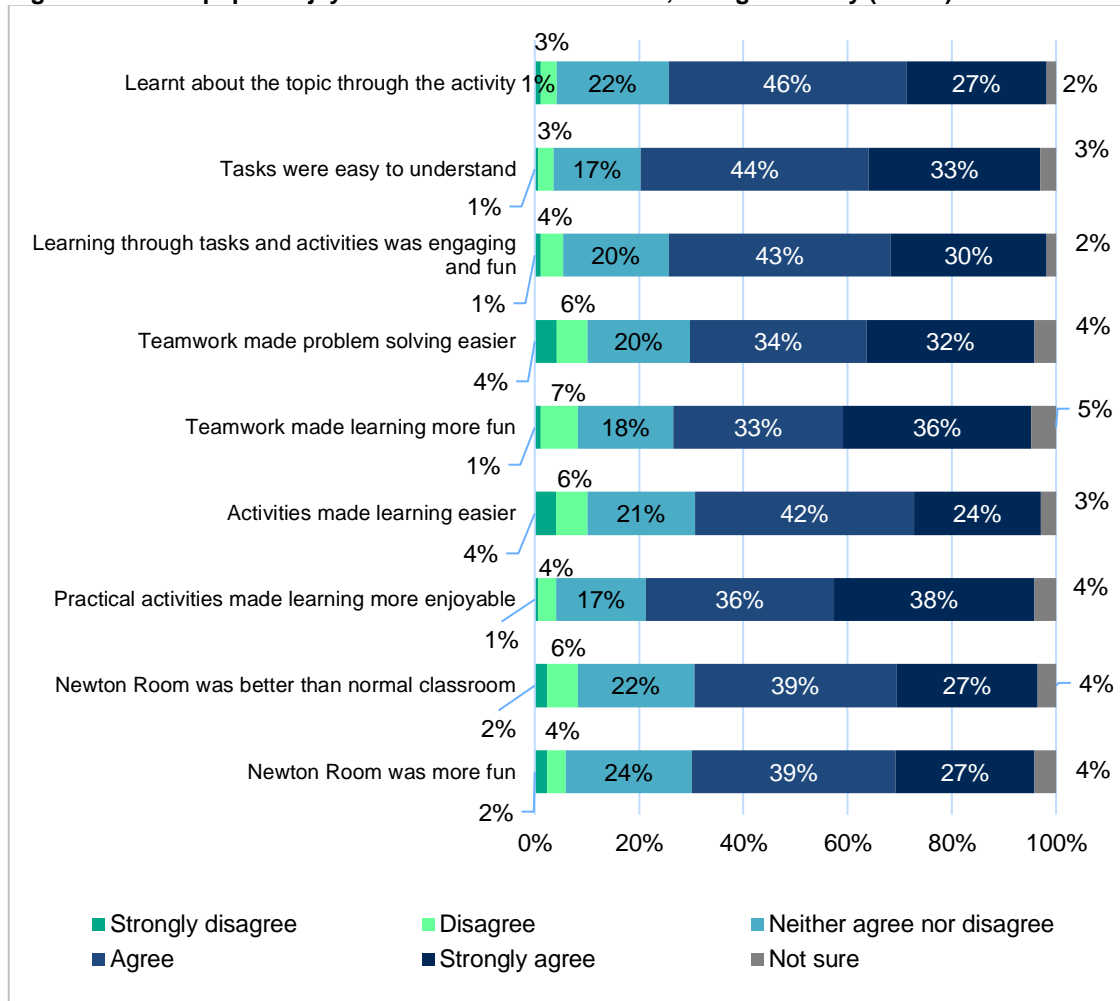
Source: ekosgen SSA Pupil Survey

- 6.19 Figure 6.7 sets out pupils' reflections on their SSA learning. The activities and the teamwork involved in the SSA sessions were essential to pupils' learning. Seventy-three per cent of pupils agreed that learning through tasks and activities was engaging, and 73% agreed that they learned through the activities. This is particularly promising given the increasing focus on non-traditional (non-academic or non-classroom-based) modes of learning for STEM.

- 6.20 In addition, almost three quarters (74%) stated that the practical activities made learning more enjoyable, and 66% reported that the practical activities made the learning easier. Consequently, pupils viewed the Newton Room experience as better and more fun for learning than normal classrooms. This underlines the effective nature of the SSA delivery, and the benefits that this has for pupil engagement. This aligns well with the findings from the SSA survey set out in Chapter 5 regarding how pupils found the level of difficulty of the activities undertaken.

Three quarters of pupils responded that practical activities at the SSA made learning more enjoyable.

Figure 6.7: What pupils enjoyed about the Newton Rooms, ekosgen survey (n=170)



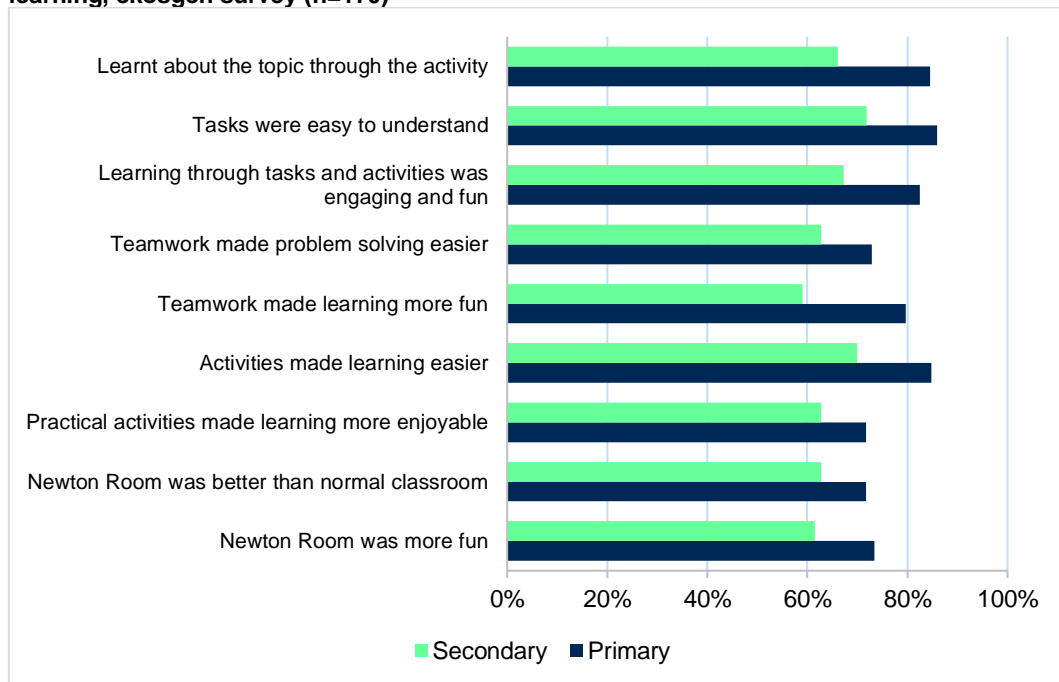
Source: ekosgen SSA Pupil Survey

6.21 Figure 6.8 highlights that on average, the primary pupils were significantly more likely to at least agree to all of the statements regarding their learning experience in the Newton Room than the secondary pupils.

6.22 While the level of positive learning experience and thus engagement with primary pupils is a significant strength of the Newton Rooms, there is clearly a challenge in securing a similar experience for secondary school pupils. Given that BGE is a key transition point for ensuring continued engagement in STEM learning, there is clearly a challenge here. Consideration must be paid to better ways to engage and enthuse secondary pupils to the same degree, and so that their learning experience is equally rewarding.

85% of primary pupils and 70% of secondary pupils thought that SSA activities made learning easier

Figure 6.8: Pupils who agree/strongly agree with statements regarding their SSA Newton Room learning, ekosgen survey (n=170)

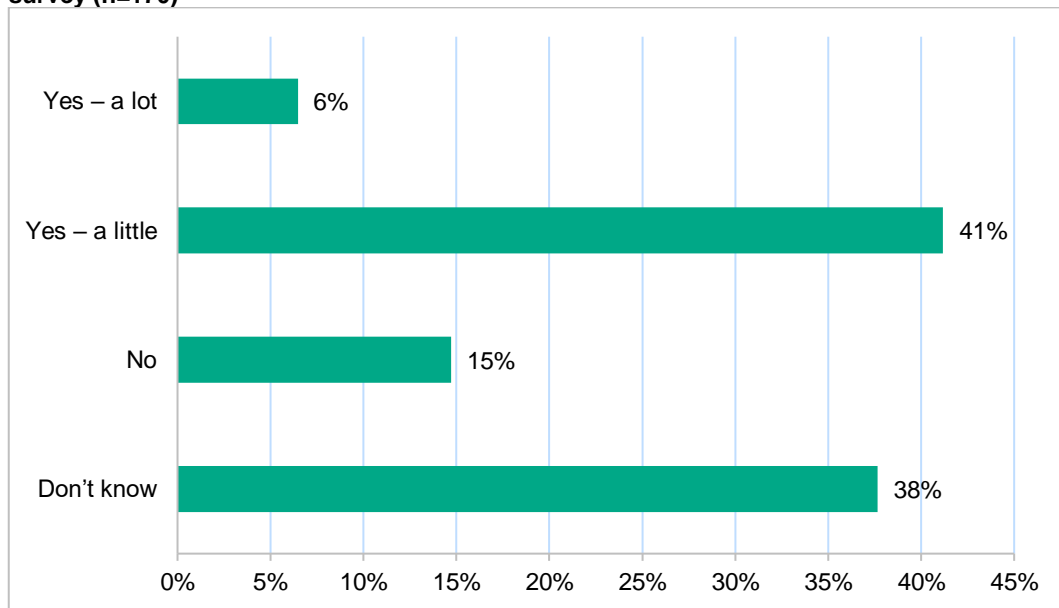


Source: ekosgen SSA Pupil Survey

- 6.23 Feedback from pupils in the focus groups indicated that they were surprised at how much they learned, and cited the interactive nature of SSA sessions as a factor in this learning.
- 6.24 Teachers typically agree that the sessions are pitched about right for their pupils' ability. However, given the feedback from pupils discussed above regarding the relative easiness for some pupils, it may be that some sessions, or content within sessions, needs to be more stretching or challenging.

Pupil impacts

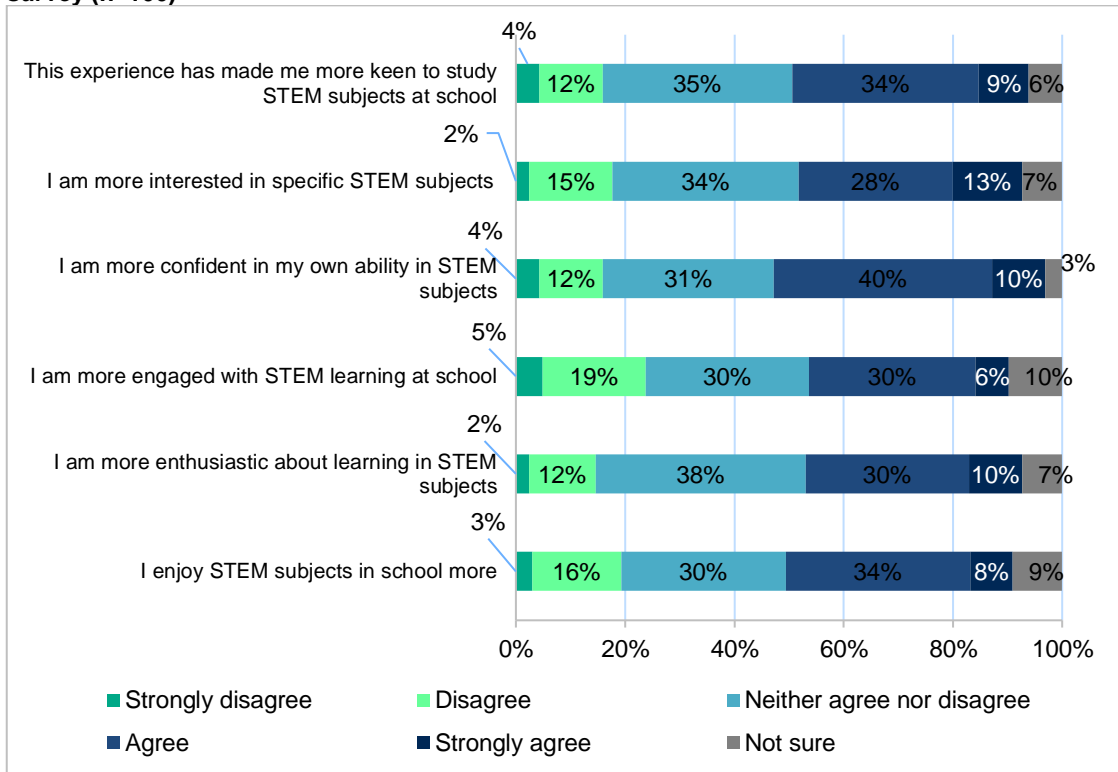
- 6.25 Pupils gave a mixed response when asked if the Newton Room had improved classroom learning. Nearly half of pupils still reported that it had, with 6% of these responding that it had helped a lot, shown in Figure 6.9. However, a considerable proportion (38%) reported that they were not sure whether it had improved classroom learning.

Figure 6.9: Extent to which pupils' SSA experience has improved classroom learning, ekosgen survey (n=170)

Source: ekosgen SSA Pupil Survey

- 6.26 The fact that almost half of the pupils recognise that the Newton Rooms had helped their classroom learning to some extent is a positive finding. However, there is a large portion who are not sure, and this is perhaps an area where pupils can be supported to reflect more on their experience. Pupils may not be able to recognise new skills and knowledge gleaned from the Newton Rooms, so there is possibly scope to help the pupils to understand the skills which they may have gained from spending time in the Newton Room. Secondary school pupils were slightly more likely to think that their classroom learning has been enhanced by their SSA experience.
- 6.27 Pupils reported a lot of positives from the Newton Rooms with regard to how they think about STEM subjects at school, with almost half responding that they are more likely to study STEM subjects as a result of the Newton Room, as Figure 6.10 shows. Moreover, the second most common answer was neither agree nor disagree with disagree/strongly disagree being the smallest portion of respondents across every branch of the question. Pupils were typically more confident in their own STEM abilities with half of the sample agreeing or strongly agreeing with this. These perspectives were echoed in the focus groups, with a number of pupils stating that they were more engaged in STEM learning, and also more likely to enjoy the topics covered.

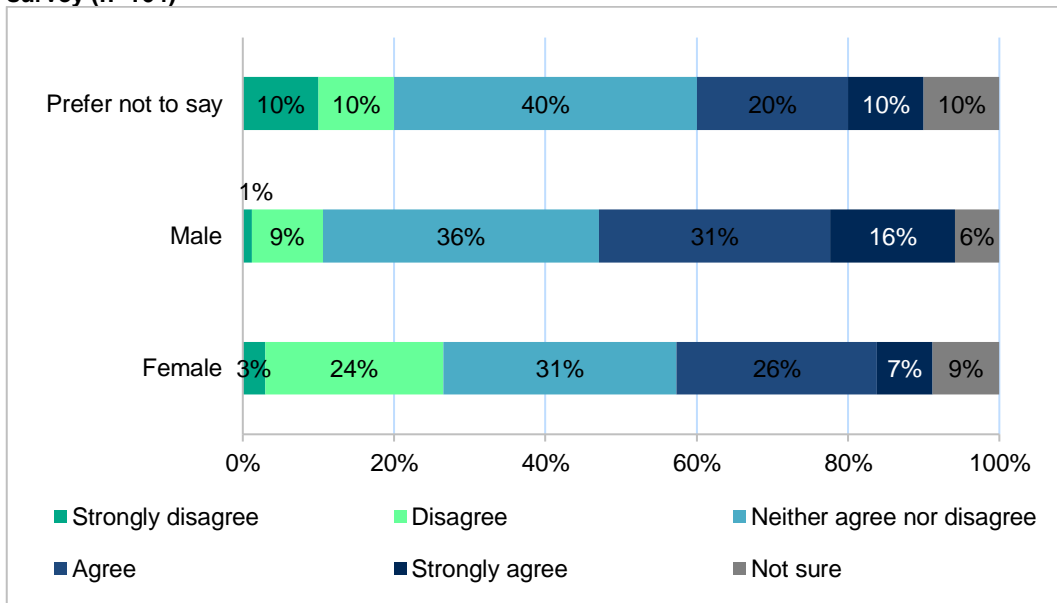
Figure 6.10: How taking part in the SSA has changed thinking about STEM subjects, ekosgen survey (n=166)



Source: ekosgen SSA Pupil Survey

6.28 Boys were more likely to be more interested in specific STEM subjects with almost half of boys agreeing or strongly agreeing with this (47%) compared to just over a third of the girls (34%) as shown by Figure 6.11. This contrasts somewhat with the SSA survey findings that show almost two thirds (64%) of pupils are more interested in STEM – though this is with regard to STEM in general rather than specific subjects.

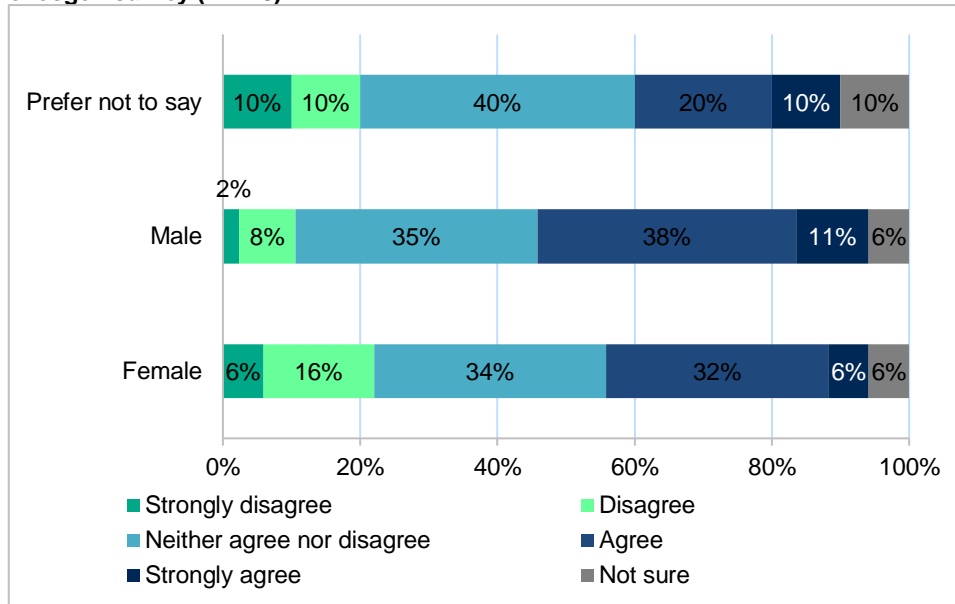
Figure 6.11: Impact of SSA experience on pupils' interest in specific STEM subjects, ekosgen survey (n=164)



Source: ekosgen SSA Pupil Survey

6.29 Boys were also ten per cent more likely to be driven by their SSA experience to study a STEM subject at school than girls, as highlighted in Figure 6.12. A smaller proportion overall state that their SSA experience has made them keener to study STEM at school versus the proportion reported through the SSA survey. However, this is likely the result of the smaller sample size in the ekosgen survey, and the positive result here corroborates those findings.

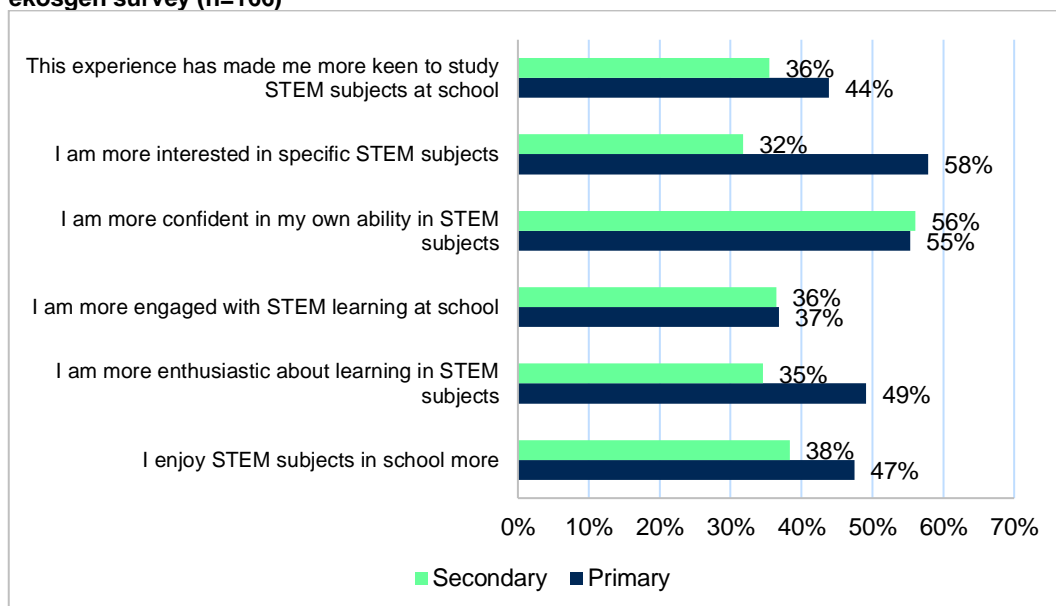
Figure 6.12: Impact of SSA experience on pupils' appetite to study STEM subjects at school, ekosgen survey (n=175)



Source: ekosgen SSA Pupil Survey

6.30 Primary school pupils were typically much more likely to agree or strongly agree with comments regarding the impact of the SSA on how they think about STEM subjects than the secondary pupils. As Figure 6.13 highlights, they were almost twice as likely to agree or strongly agree that they are now more interested in specific STEM subjects. Primary school pupils are also more likely to be enthusiastic about STEM learning, and enjoy it more as well.

Figure 6.13: SSA participation and thinking about STEM subjects: primary vs. secondary pupils, ekosgen survey (n=166)



Source: ekosgen SSA Pupil Survey

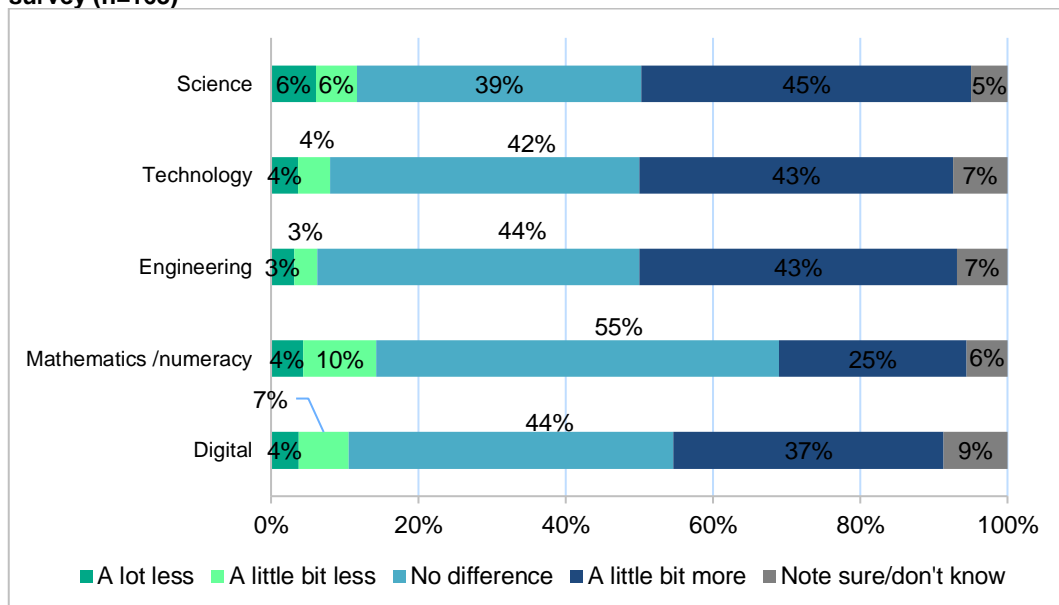
6.31 Primary pupils are much more positive about the impact and the experience of the Newton Rooms than secondary pupils, which may be down to a number of factors. Secondary pupils are more likely to be studying STEM subjects already, and at a more challenging level than primary pupils, which may have the impact that they are less excited by these subjects. This is corroborated by the majority portion of students who suggested the Newton Rooms were boring or had too much talking, being those from secondary school. Moreover, secondary pupils are also potentially more impacted by peer-pressure, causing them to be less likely to express interest in learning and the Newton Rooms in general.

'(I didn't enjoy) having to just sit in a room and listen to someone talk for one hour without a break' (Secondary school pupil)

6.32 However, findings from the pupil focus groups indicated that SSA Newton Room sessions made some primary school pupils feel like they were in high school and affirmed their aspirations of taking STEM subjects at high school. This is a strong positive finding in terms of inspiration for primary school pupils. It also suggests that perhaps a more challenging topic, approach or learning objectives may be more stimulating, engaging or inspiring for secondary school pupils.

6.33 The Newton Rooms had a slight impact on making some students want to study specific STEM subjects. As Figure 6.14 illustrates, in the majority of cases, the Newton Rooms had no difference on the pupils and, while there is a sizeable portion who suggest they now want to study STEM a little bit more, not one student wanted to study any subject a lot more as a result of the Newton Rooms. Mathematics/numeracy was by far the least popular subject with only a quarter of the sample wanting to study it a little bit more as a result of the Newton Rooms.

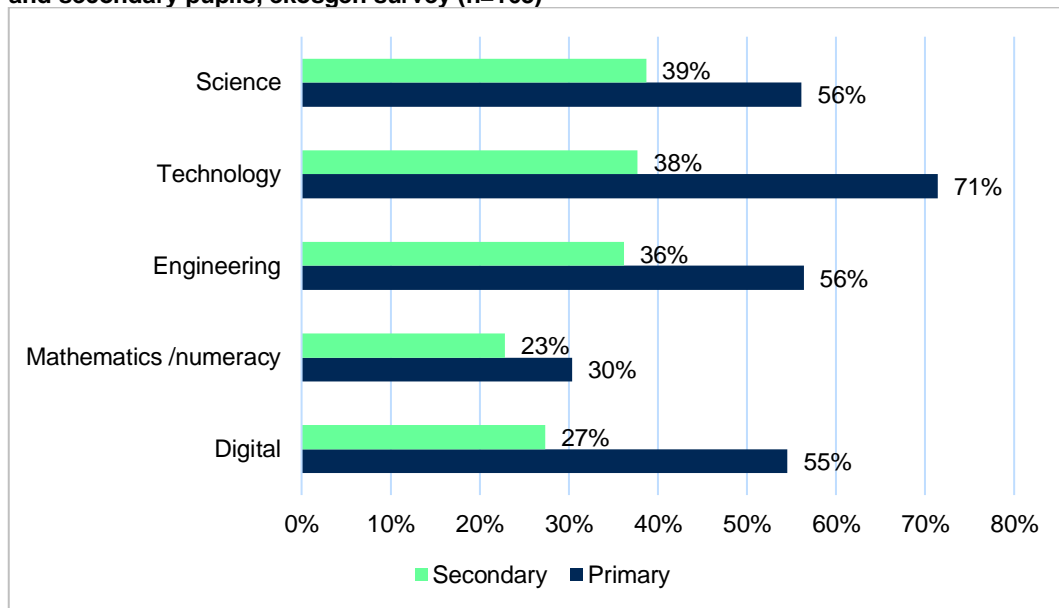
Figure 6.14: SSA experience and impact on pupils' appetite to study STEM subjects, ekosgen survey (n=163)



Source: ekosgen SSA Pupil Survey

6.34 Primary pupils were far more likely to want study all of the subjects as a result of the Newton Rooms than secondary pupils. The biggest differential between primary and secondary school pupils' reported desire to study specific STEM subjects was in Technology (+33 p.p.) and Digital (+28 p.p.) with roughly double the proportion of primary pupils being a little more likely to want study these than their secondary counterparts, as Figure 6.15 illustrates.

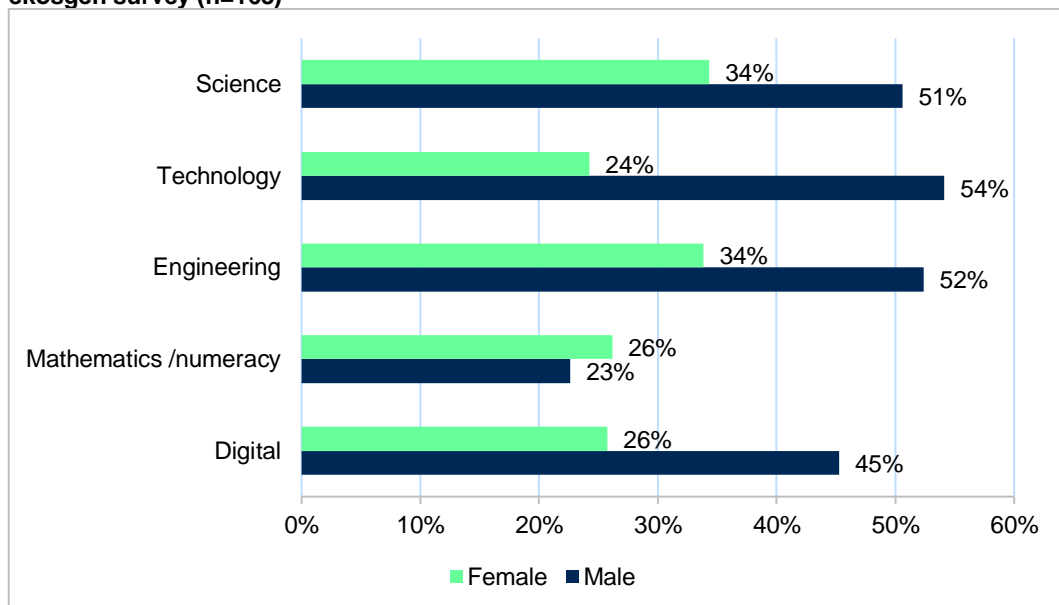
Figure 6.15: SSA experience and impact on pupils' appetite to study STEM subjects – primary and secondary pupils, ekosgen survey (n=163)



Source: ekosgen SSA Pupil Survey

6.35 Figure 6.16 shows that boys were far more likely to report wanting to study a STEM subject as a result of the Newton Rooms than girls. Boys were twice as likely to want to study Technology (+30 p.p.) and Digital (+19 p.p.). The only subject which girls were more likely to want to study than boys, following a Newton Room visit was Mathematics (+3 p.p.).

Figure 6.16: SSA experience and impact on pupils' appetite to study STEM subjects – by gender, ekosgen survey (n=163)



Source: ekosgen SSA Pupil Survey

6.36 It is possible that some secondary pupils have already disengaged from STEM subjects. Wider evidence indicates the BGE phase is a key transition point for engagement in STEM education, with Scotland-wide challenges for retaining pupil engagement through to senior phase.

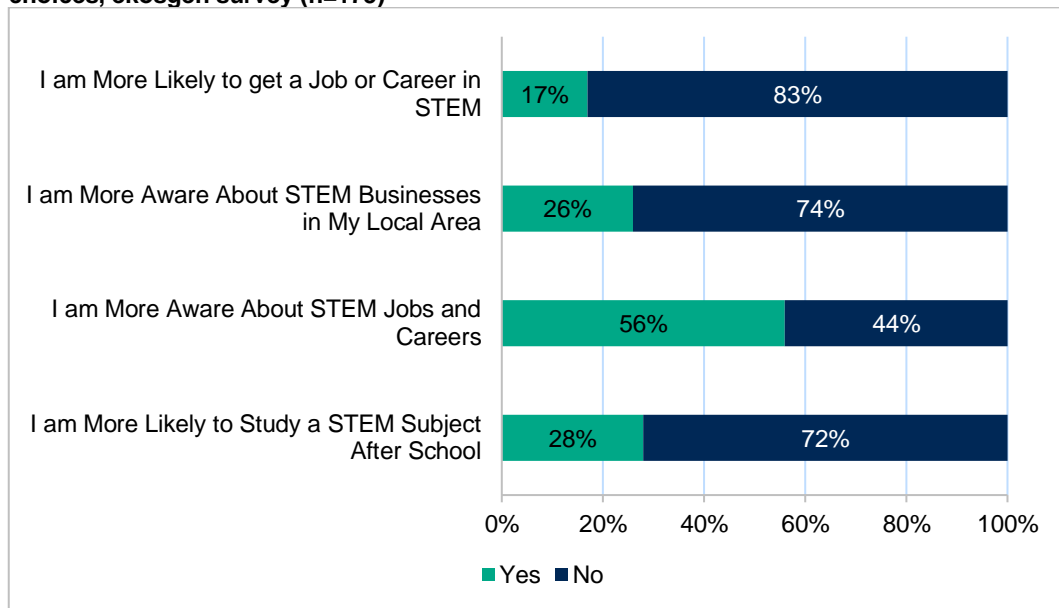
'(I enjoyed) nothing really...just not my thing'

'I didn't enjoy it very much because I don't like science'

- 6.37 Primary pupils will likely have less previous contact with STEM subjects and topics. Consequently, the novelty of new topics or subjects may be more appealing to primary aged pupils.
- 6.38 Most pupils, whether primary or secondary, had a better understanding of what STEM is and what jobs are out there following their Newton Room experience.
- 6.39 As identified through the focus groups, there was enthusiasm amongst pupils about the connection between the SSA Newton Room and STEM. Most pupils that participated in focus group sessions agreed that their interest in STEM has increased because of SSA sessions. Some pupils noted that their perspective of science was broadened by their SSA Newton Room session and that they previously hadn't thought of robotics/engineering tasks as specifically science-related.
- 6.40 However, the majority of pupil survey respondents reported that they were not more likely to pursue it in education or as a career. As Figure 6.17 shows, being more aware of STEM jobs and industries was the only factor which the majority of respondents agreed with. In contrast, despite the reported positive experience, the majority of respondents disagreed that they were more likely to study a STEM subject after school. In addition, almost three quarters (74%) reported that they were not more aware about STEM businesses in their local area. However, in contrast, pupils engaged through the focus groups reported that they were indeed more aware of STEM businesses and careers. It is likely therefore that the small sample size is influencing findings with regard to how pupils think about what they will do with STEM following their education. Therefore it can be argued that the SSA is 'shifting the dial' in terms of appetite to continue with STEM education, and pursue STEM employment pathways in future.
- 6.41 One pupil that participated in the focus groups reported that their SSA experience was very impactful with regard to the longer-term impact of their learning. In particular, they highlighted how it made them think about STEM not just in employment terms but in everyday situations too:
- "[It] opened my eyes about the applicability of STEM to real life and to jobs...it persuades you to go into STEM [careers] a lot more."*
- 6.42 Given the ambition of the SSA to fully engage employers in its delivery, raising awareness of local STEM businesses and employment options is perhaps an area where more attention is required in any future delivery. Particularly in light of findings regarding areas for improvement and linking to emerging or future jobs in the area, as discussed below. Ensuring greater links with local employers and securing local business buy-in to what the SSA project is trying to achieve will contribute to achieving longer term impacts and outcomes regarding STEM education and employment amongst pupils.

Pupils reported that there was a connection between their SSA experience and studying STEM.

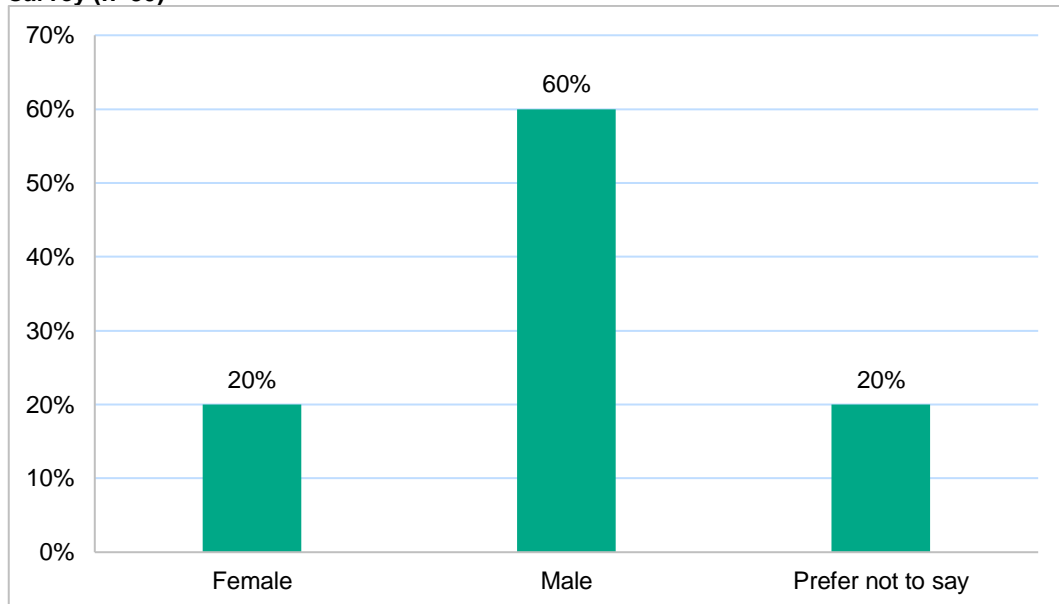
Figure 6.17: Longer term impact of the Newton Rooms on pupils' potential STEM pathway choices, ekosgen survey (n=175)



Source: ekosgen SSA Pupil Survey

6.43 There was little difference between boys and girls except with regard to whether they were likely to pursue a STEM career as a result of the Newton Rooms. As Figure 6.18 shows, from the relatively small number who responded yes to this question, only a fifth of these were girls, with the rest of these being boys (60%) and prefer not to say (20%).

Figure 6.18: Likelihood of pupils pursuing a job in STEM following SSA experience, ekosgen survey (n=30)



Source: ekosgen SSA Pupil Survey

6.44 SSA staff and teachers that accompany pupils during their Newton Room sessions also reported through the focus groups that they saw some strong positive impacts for pupil learners. There is a sense that the SSA sessions allow pupils to strategise, exercise creativity and problem solve under their own initiative, and therefore develop their own solutions to tasks. This can be considered pupil-led learning, and differs from conventional STEM teaching in a school setting – pupils are empowered to drive their own learning:

'Pupils get ownership of the activities and take responsibilities.'

- 6.45 SSA staff in particular report that they consider the pupils to have a very positive experience with STEM in the Newton Room. Over the course of the session, pupils are increasingly observed to demonstrate pride in what they achieve, enlightenment on their ability (i.e. surprise that they 'can do it'), and reconsider what they are allowed or supposed to do – effectively overcoming a mindset of 'not smart enough' or 'not for me'.
- 6.46 The overwhelming majority of teachers agree that pupil's engagement with STEM activities improved following their participation in the SSA. ekosgen teacher survey respondents at least agreed that their pupils were more engaged and enthusiastic as a result of their experience in the SSA. Teachers also reported through the ekosgen survey that the SSA experience also contributed to an increased confidence amongst pupils in their STEM learning. This indicates that the SSA positively influences engagement and confidence with STEM activities amongst pupils.
- 6.47 Additionally, teacher consensus is that the SSA sessions help to kickstart pupils' STEM career thinking, and in the case of secondary pupils, some planning on future education and career pathways. One teacher noted that two of their pupils that engaged with the SSA had chosen to pursue engineering after leaving secondary school. Primary teachers also consider the SSA sessions have been particularly impactful for primary school pupils, with the experience bound to be helpful when choosing secondary school subjects in years to come. The SSA is therefore a strong positive influence in terms of STEM choices for pupils.

The Science Skills Academy and teachers

Teacher experience

- 6.48 In the focus groups and consultations, teachers reported that pupils find the sessions engaging and interesting, and that they benefit from the enthusiasm and skills of SSA staff. Teachers note that they would like to have the resources available in the Newton Rooms in their classrooms, and appreciate having access to them.
- 6.49 The SSA and Newton Room experience undoubtedly benefits teachers as well as pupils. However, there was a more mixed picture regarding whether teachers found the Newton Room an inspiring or exciting setting for themselves despite thinking that this was the case for their pupils. Only three teacher survey respondents indicated that it was exciting and only one indicated that they felt the Newton Room was an inspirational setting, though it should be remembered that this is the findings from a small base. The SSA's own survey of teachers, which engaged almost 700 teachers, found that the vast majority agreed that the Newton Rooms are inspirational.

Differences between STEM learning offers

- 6.50 Most teachers that responded to the ekosgen survey had participated in other STEM learning offers for their pupils previously, including Lend-a-Lab and SSERC STEM support. Evidence suggests that the SSA and Newton Rooms are viewed more positively by teachers compared to other offers. The SSA and Newton Rooms are considered as more inspirational for learning, and as a vehicle to inspire pupils to pursue further STEM education.
- 6.51 Survey findings suggest that the Newton Rooms, when benchmarked against other STEM offers that the teachers had participated in (Lend-a-Lab and SSERC), is overall better or at least comparable. Although there was a relatively small sample size, the findings indicate that the SSA is better than their previous offers at inspiring the pupils and being an inspirational location where they can increase their knowledge in an exciting and engaging way.

- 6.52 More widely, the qualitative consultations identified that some teachers had engaged with other, different STEM education offerings in the Highlands, including through universities (UHI and Strathclyde were identified), and Lego Challenges. However, most teachers either hadn't engaged with alternative STEM offers in the Highlands or cited drawbacks and/or barriers around alternative STEM offers; such as a lack of time to access, and difficulties with inclusivity and accessibility for all pupils. The SSA sessions did not suffer from the same drawbacks and barriers cited by teachers with regard to alternative STEM offers.

Teacher and school impacts

- 6.53 As identified through teacher focus groups and consultations, teachers are more motivated and reinvigorated by their SSA Newton Room experience. Teachers are involved throughout the day, rather than being passive observers, and evidence indicates that they respond positively to playing an active role in the day. Teachers report that this helps to build their confidence, develops their capability with regard to delivering practical experiments and activities, and building in more innovative approaches in their teaching. This is particularly the case for non-STEM teachers, such as those teaching in primary schools. Teachers also felt that the SSA gave them confidence to formulate and teach more STEM lessons back in the classroom, drawing on their Newton Room experience to do so. However, some teachers noted that despite improvements in this regard, they are still constrained within their school setting by the resources available to them.
- 6.54 In addition, some teachers noted that watching and experiencing a STEM lesson (from a third person or viewing perspective), taught by the SSA staff, was very useful and insightful, and offered more opportunity to reflect on what they were able to do themselves. In this sense, attending the SSA may constitute an informal form of continuous professional development (CPD) for teachers that they otherwise may not usually have access to. Combining pupil-focused delivery with teacher-focused CPD is perhaps something that the SSA could explore going forward, to augment its delivery to schools across Highland.
- 6.55 The majority of respondent teachers agreed that the SSA has helped to address barriers and challenges to teaching STEM. Nine teachers indicated that their SSA experience had helped in this regard. Despite this, the majority of teachers indicated that the approach to teaching in the school would likely not change as a result of the SSA. Only a small number indicated that they would utilise any new approaches as a result of their SSA experience, with these teachers reporting that that technology and other resources would be used to a greater degree in their teaching approach going forward.
- 6.56 Some teachers also reported that following participation in the SSA, STEM learning has become more of a priority at the school level. Whilst there was no consensus amongst surveyed teachers on the extent of the change, there is nevertheless evidence to indicate that SSA participation is having a positive impact for schools as a whole in terms of increasing STEM engagement.

Areas for consideration

- 6.57 Despite the strengths of the SSA and Newton Rooms that the evaluation has very clearly evidenced, there are some areas that should be considered. These tend to be quite minor, cited by a small number, and in the overall balance of the findings, are worth noting but require no action. For example, one teacher felt concerned about the showcasing of specific STEM careers of relevance to the region, but these were very specific. They commented that there was:

'...no mention of future demand for wind turbine engineers, EV charging point installers heat pumps/ solar PV installers.'

- 6.58 The following comment from a teacher highlights the importance of active learning through the SSA, and it is very much a strength of the project:

'The salmon and aquaculture day was very active whereas the energy one required more listening and was less active⁵²'.

- 6.59 Related to this, the survey of teachers highlighted the value of demonstrations to make sessions as accessible as possible. As one noted:

'Some find it difficult to follow the steps on an experimental protocol and could do with a demo to see how to do something first. This is especially true for pupils who struggle with literacy.'

- 6.60 This can help students who had difficulty following experiment protocols and make the sessions even more engaging. Clarity in experiment instructions and protocols is important to ensure that the sessions are accessible to as many individuals as possible.

- 6.61 However, there was also much praise for the demonstrations and staff:

'[SSA staff member] makes the activities interesting, every pupil is important and involved. [SSA staff member] is professional, patient, and encourages pupils to share their ideas.'

'[SSA staff member] was an excellent facilitator of today's learning. They engaged all the children and supported their learning.'

- 6.62 From time to time there will inevitably be issues with kit, and whilst it will be disappointing for pupils affected, it is inevitable. As an example, during one session there was a technical malfunction with the 'Coca-Cola' experiment.

⁵² This was the first session delivering the energy module. Following feedback from the teacher, it was adjusted immediately.

7 Science Skills Academy wider impacts and future funding

Key findings summary



- The SSA has delivered a wide range of benefits that will have a sustainable impact over time.
- It is a vital partner and contributor to the Highlands and Islands STEM Partnership.
- There are links with employers which is very valuable, but these could be strengthened.
- Whilst economic impacts cannot currently be quantified, it is likely that it will contribute to the economic growth and resilience of the Highlands by supporting the pipeline of STEM skills.
- Qualitative evidence indicates that engaging in the SSA increases pupils' interest in STEM subjects and broadens their understanding of careers in STEM.
- If the Regional Transformation Opportunities are to be realised in the Highlands and Islands, there will be a strong need for STEM skills to develop the opportunities and attract inward investment.
- The 'whole-class' approach means that the SSA is inclusive of all pupils, regardless of characteristics such as gender, ethnicity, and socio-economic background.
- It removes barriers to participation in its activities and successfully reaches pupils and schools in rural areas.
- Through the SSA, all schools, teachers and pupils are able to use the high-quality facilities and equipment and participate in activities that would likely not be available to them without the SSA.

Introduction

- 7.1 The evaluation aimed to assess wider benefits accrued through the SSA activities and consider how these are impacting now, and are likely to impact in the medium and longer terms. The longer-term outcomes and impacts will only be evidenced over time, for example more young people studying STEM subjects, a STEM-enabled workforce, and an increase in STEM jobs in the area. These should be monitored over time but at this stage, and for the purpose of the evaluation, ekosgen undertook qualitative research to understand the potential medium and longer-term impacts based on the SSA activity at strategic and operational levels.
- 7.2 These impacts are discussed in this chapter. This discussion is followed by a consideration of the issues and opportunities for future funding for the SSA, so that the benefits and achievements of the project and its delivery are sustained and developed further.

Strategic impacts

- 7.3 The evidence shows that the SSA delivers strategic benefits as well as benefits to pupils, teachers and schools. It has added capacity to the Highlands and Islands STEM Partnership and provides a co-ordination role which is beneficial to the strategic development of STEM in the region. For example, the SSA has advised UHI Shetland and the Outer Hebrides to plan Newton Room provision. It was also noted in the research that HIE's strategic involvement in the partnership is very valuable. The strong linkages between the SSA, UHI, HIE and other providers allows for a more strategic approach to STEM education and learning. The following comment illustrates this point:

'SSA is helping to drive the STEM agenda forward and this is absolutely critical.'

Its close working with the Glasgow Science Centre levers in additional strategic benefits as well as access to some of the Science Centre's initiatives and resources, for example the Learning Lab.⁵³ Another example of a strategic partnership is with the Royal Zoological Society of Scotland which is running events through the pop-up Newton Room. To date, the SSA has been involved in some international networking and activities, for example the SSA presented at the annual Newton Room conference and supported Dublin City University in the planning stages of a Newton Room. The SSA is also planning to share some modules, including the Space module, with the International Network of Newton Rooms. This is very positive but there is scope for more international networking to be developed going forward.

- 7.4 The SSA has worked hard to engage with employers such as Mowi ASA, SPIRE, and AAC Clyde Space, in particular to develop the career modules. Another example is the involvement of SSE in the 'Industry Links' video. This is positive but the research highlighted that there is scope to build more continuous and sustained industry links, moving from what has been a largely transactional relationship, to closer collaboration and partnership working. Going forward the SSA is aiming to work more closely with STEM industries to deliver modules and activities which will help to consolidate and strengthen industry-engagement and illustrate the career opportunities, not just in sectors but with employers.
- 7.5 Crucially, the HIE-led SSA team is considered a key strategic partner by other STEM actors in the region. Their continued role in the regional STEM Partnership is valued given how the SSA team continues to help shape the STEM agenda in the Highland Council area. This is important not least because of the complexity of STEM activity generally. The SSA team is expected to continue to play a lead role given the breadth of STEM learning, ongoing demand for STEM skills and education, and the continued extent of activity required to deliver against the national STEM Education and Training Strategy.
- 7.6 An interesting impact that was noted in the qualitative research which demonstrates a level of strategic value is that teachers report the SSA has raised the STEM agenda and has increased awareness about the STEM career opportunities amongst non-STEM teachers. As one commented:

'There is now much more recognition that STEM is not something done by scientists.'

Economic impacts

- 7.7 STEM skills, knowledge and capabilities have become increasingly important across sectors and in a wide range of occupations. The STEM Education and Training Strategy recognises this, with two of its objectives focusing on enabling and stimulating participation, i.e. to close equity gaps in participation and attainment, and to inspire children, young people, and adults to study STEM. Similarly, the premise of the Digital Economy Skills Action Plan for Scotland⁵⁴ is the widespread need for digital knowledge and abilities in almost every workplace as well as in learning and development. More broadly, STEM skills are required across all sectors, from those in the foundational economy such as Retail, Health and Social Care, Housing, and Transport. They are also absolutely central to growth sectors such as Life Sciences, Food and Drink, Creative Industries, Energy (including Renewables), and Sustainable Tourism.
- 7.8 Applying technology is important to enhancing Scotland's productivity and achieving the efficiencies that are required to continue to deliver essential services. It is therefore important that there is a workforce with the STEM skills, confidence and abilities to support economic

⁵³ <https://www.glasgowsciencecentre.org/learn/education-programmes-for-schools/learning-lab>

⁵⁴ <https://www.skillsdevelopmentscotland.co.uk/media/pq5fwkcb/digital-economy-skills-action-plan.pdf>

development and drive growth. These skills do not need to all be at high levels or in specialist areas, although of course specialists will be needed.

- 7.9 Whilst it is not possible within the timescales and scope of the SSA Final Evaluation to quantify the current and likely economic benefits of the SSA, by engaging pupils and teachers in inspiring STEM activities, and demonstrating their applications in industry, it is likely that more pupils will feel confident and attracted to STEM subjects and jobs with a STEM component such as engineering, as discussed previously in Chapter 6.
- 7.10 In the qualitative research with pupils there was strong agreement that their interest in STEM has increased because of the SSA sessions. As demonstrated in Chapter 5, a number of pupils reported that it had made them more likely to take, or to continue with STEM subjects at secondary school, or had made them more interested in specific STEM subjects, and this is illustrated by the following comments from teachers, supported by pupils:

'Parents feedback how enthusiastic the kids are and how it can turn around their perspectives, ambitions and choices.'

'[Pupils'] perceptions of science have been broadened by the Newton Rooms.'

- 7.11 This is a significant strength of the SSA project. The target demographic for engagement through the SSA is at a critical phase for their ongoing participation in STEM education. Any positive impact with regard to interest in, and engagement with, STEM learning during latter primary school years and BGE at secondary school will undoubtedly positively impact on participation and engagement during the senior phase for pupils. This is vital for increasing the pipeline of STEM skills moving through the education system and entering the labour market.
- 7.12 In the absence of data to evidence longer term impacts and establish a causal link, it is also worth reflecting on demand and engagement and this is demonstrated in the data provided in Chapter 2. In total, 8,070 pupils participated in a Newton Room session in 2022 which is the highest yearly figure throughout the SSA's entire delivery of Newton Room sessions.⁵⁵ This is a clear indication of the value that is placed on the activities and the perception of the extent and range of benefits for pupils, as well as teachers and in time, the wider community and likely, the economy. As one stakeholder commented:

'There is a high demand for SSA which demonstrates its value, quality, and what people see as the benefits'

- 7.13 Added to this, STEM occupations tend to be relatively high value and so by equipping the future workforce in the Highlands with STEM capabilities, they are more likely to benefit from these higher value opportunities. Added to this, demonstrating a STEM-enabled workforce to potential investors will contribute to attracting inward investment and retaining high value talent.
- 7.14 The Convention of The Highlands and Islands identified a set of Regional Transformational Opportunities (RTOs) that are of national strategic importance, have the potential to be transformative and build on existing assets. A commitment to these is stated in HIE's Strategy and Operating Plan 2023-28.⁵⁶ Examples include Renewable Energy, Hydrogen, Aviation and Advanced Technologies (including Space); and Personalised and Precision Medicine. The RTOs will require planning and investment to realise the benefits, and they will require a

⁵⁵ The yearly figure for participations in 2023 has surpassed the 2022 total. At the time of writing (September 2023) there has been 8,206 participants in 2023.

⁵⁶ [Strategy and operating plan | Highlands and Islands Enterprise | HIE](#)

STEM-enabled workforce and the SSA is likely to be part of the solution to developing this pipeline of skills.

- 7.15 STEM skills and confidence are also likely to make the workforce more resilient to changes in the workplace and working practices, as well as building the resilience of individual employees. The evidence from the evaluation shows that the SSA is contributing to developing confidence and understanding of STEM, and so building resilience.

Equalities, diversity and inclusion

- 7.16 If there is to be an adequate STEM workforce in the Highlands, and for the local, regional and national economy, then more people from a wider range of backgrounds will have to be attracted and retained into STEM subjects and occupations. Recognising this, the STEM Education and Training Strategy aims to enhance engagement of under-represented groups and facilitate their access to STEM education and career opportunities.⁵⁷
- 7.17 STEM subjects and occupations have traditionally engaged more males than females due to an interplay of a number of factors. Children from less-affluent backgrounds are less likely to select STEM subjects and see STEM occupations as being achievable. Additionally, learners and schools in rural areas often have limited access to facilities, amenities and inspirational learning opportunities than those in more urban areas. Other characteristics that can impact on studying and working in STEM are age, ethnicity, and care experience.
- 7.18 Research conducted by Kings College London's ASPIRES research initiative highlights that some groups can be excluded or self-exclude due to a lack of 'science capital' in their households during their formative years.⁵⁸ An absence of science-related qualifications, understanding, knowledge, interest, and contacts significantly diminishes the likelihood of individuals pursuing STEM-related subjects and considering careers in STEM fields.
- 7.19 The SSA takes a 'whole class' approach to attending the Newton Room and engaging in the session, with no charge for the visit. Therefore, there are no barriers to attendance, and no 'self-selection' where some pupils may be more likely to attend than others. Some teachers reported that other STEM offerings were not as accessible or inclusive as the SSA. This is illustrated by the following comment from a teacher:

'The inclusive element of SSA Newton Room sessions was great and it broke down barriers to engagement for pupils.'

- 7.20 It was also viewed as a very positive opportunity for pupils to have time out of their communities, especially where they live in small, rural locations. It gives them experience of another area, and an understanding of the careers that exist in the wider region. In this respect, the SSA was considered to be:

'Horizon broadening for pupils.'

- 7.21 As discussed earlier in the report, the SSA gives schools, teachers and pupils access to high quality and inspirational facilities and equipment, along with skilled and knowledgeable SSA staff. This is a benefit for all schools, particularly with budget constraints. However, it is of particular benefit for pupils and schools in rural areas, and very small schools, where access to facilities can be even more limited. An example of how the SSA has levered in opportunities that may not otherwise be available in the area is the Royal Zoological Society of Scotland's events in the pop-up Newton Room.

⁵⁷ <https://www.gov.scot/policies/science-and-research/stem-education-training/ - Stem%20Strategy>

⁵⁸ <https://www.ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/aspires-research>

- 7.22 The SSA also seeks to reach into communities and deliver to a wider target group. As an example, it participated in a High Life Highland family-friendly STEM event in Dingwall. The event gave families an opportunity to learn new skills as a family in an accessible and self-directed way. The SSA offered Techno bots and Land Yachts workshops and challenges to encourage families to see how STEM skills are applied in practice, and demonstrating STEM can be fun. Through the SSA's involvement, families could access interactive displays and activities from the Glasgow Science Centre.

Funding future delivery

- 7.23 The SSA team is currently developing a plan to support future activity. This includes the development of a funding plan, initially for the short term to June 2024 (which has been secured), and then beyond. In some regard, that demand outstrips what the SSA project is able to supply (and arguably what other STEM education offers in Highland are also able to supply). As such, the case for continued intervention through the SSA project is a sound one.
- 7.24 Consequently, consideration should be given to a wide range of funding opportunities. For example, the previous Programme for Government published in September 2022 set out the Scottish Government's commitment to provide varied wrap around 'care' for school age children, not just through conventional out-of-school care or after-school care clubs and sessions. As such, there may be scope to pursue Scottish Government funding if this is considered a suitable opportunity for the SSA project. Similarly, there may be scope to access Shared Prosperity Fund (SPF) monies through Highland Council.
- 7.25 Additionally, there is an opportunity to influence the work of the recently established Highlands and Islands Regional Economic Partnership (REP). However, the regional focus of the REP may be problematic for a Highland-only project such as the SSA, particularly when other areas (e.g. Moray) are progressing their own STEM projects.
- 7.26 As shown by the SSA's current investment activity through OPTIO in the Learning Lab Programme, and more widely by through the funding of the UHI STEM Outreach Programme, there is potential for industry funders to get involved in supporting STEM activity. As other, similar, activity has shown (e.g. SDS activity in supporting the development of extra-curricular Tech clubs in schools across Scotland), there is certainly appetite amongst employers to get involved in such activity. The current and anticipated activity to support ScotWind and Innovation and Targeted Oil and Gas (INTOG) is one such area of opportunity. Carbon Sequestration and Peatland Restoration is also gaining traction as an area of activity in Highland and more widely across the Highlands and Islands region, and larger organisations involved in such activity may have appetite for supporting STEM activity to help stimulate the increased supply of STEM skills they would require access to in the future.

8 Conclusions and considerations

Introduction

- 8.1 The Final Evaluation of the SSA project has generated a great deal of evidence of its progress, achievements, impacts and areas to consider for the future. This chapter draws out the conclusions drawn from the evidence, considers the key factors contributing to the successes, and highlights some considerations for future provision.

Conclusions

- 8.2 In the context of a complex STEM education and learning landscape in Highland, and ever-increasing importance of STEM skills to support economic transformation and a Just Transition, the Science Skills Academy (SSA) has been successful in delivering against its stated objectives. The SSA has achieved a high level of engagement with Highland schools, reaching 94% of all schools, rising to 98% when those without pupils in P6 and P7 are discounted from the total. It has reached every geography in the area and during COVID-19, extended its geographical reach through online delivery. The pop-up Newton Room has proved particularly effective in overcoming typical geographical barriers to engagement in the Highland area. The 'whole class' approach, and the fact that there is no charge for attending means there are no barriers to attendance, and no 'self-selection' where some pupils may be more likely to participate than others. This ensures that it is inclusive and reaches a diverse range of pupils, including those in more rural areas where access to facilities and activities can be quite limited.
- 8.3 Its non-traditional mode of delivery with a high degree of practical activity and team working facilitated by dedicated, passionate and expert STEM engagement officers is a key strength of the SSA project. The SSA effectively demonstrates how the theory of learning STEM subjects is applied in practice. This is underpinned by the Newton Rooms (and pop-up Newton Rooms) as critical physical assets, providing an inspirational and engaging learning environment. The 'whole-class' approach is instrumental in delivering against the SSA's objectives of inclusion and equity of access and participation.
- 8.4 SSA delivery is well-aligned with other STEM activity in Highland. It demonstrates strong complementarity with other offers. Whilst this alignment and complementarity is positive, the evidence through the evaluation demonstrates that the SSA provides greater benefit and impact to pupils and teachers than comparable STEM delivery. It also supports delivery of the Curriculum for Excellence (CfE).
- 8.5 Pupils of all ages demonstrate considerable learning through their SSA experience. This is particularly the case for primary school pupils. For many, the SSA has improved their classroom learning, and stimulated a greater appetite to study STEM subjects at school, a greater interest in STEM subjects, and a greater confidence in and enthusiasm for STEM learning more generally. It broadens the understanding and knowledge of pupils – and widens their horizons with regard to future employment and industries, highlighting the wide range and types of STEM jobs, sectors and careers. The SSA is also having some impact in terms of contributing to longer term outcomes for pupils.
- 8.6 The SSA experience is also beneficial for teachers, with the Newton Room experience proving inspirational and engaging for teaching staff. It contributes to increased confidence and appetite for trying new things in lessons, and provides teachers opportunity to reflect on their own teaching approach.

- 8.7 The SSA team is held in very high regard, with their approach to relationship-building and in-depth engagement recognised as critical to participation and engagement. The SSA is also a vital partner and contributor to the regional STEM partnership, and to regional STEM activity. It adds capacity and strategic expertise to the Highlands and Islands STEM Partnership and the linkages between the SSA, UHI, HIE and other providers ensures that there is a strategic approach to STEM education and learning. It also links in with employers in key sectors although these relationships are sometimes quite time limited and transactional, for example to develop a module. The intention is that the SSA will build more sustained relationships with employers going forward and also build its international networks.
- 8.8 Despite this success, there remain some areas for improvement and consideration. Active relationships with employers could be strengthened, along with the promotion of – and links to – emerging roles and careers in sectors of strategic importance to Highland and the wider Highlands and Islands region. Ensuring the realisation of longer-term outcomes for pupils is also an important task for the SSA team going forward. Some areas for potential expansion have also been identified through the evaluation – including evening and weekend use of the Newton Rooms to support family, public and/or business events, and teacher training. The potential for incorporating wider CLPL activity alongside pupil-focused learning is also recognised. There is a link here with at least a perception that the SSA project resources are under-utilised, for understandable reasons such as the need for more than one appropriate adult to be present. Ways in which their use – and thus their potential impact – could be maximised should be explored.

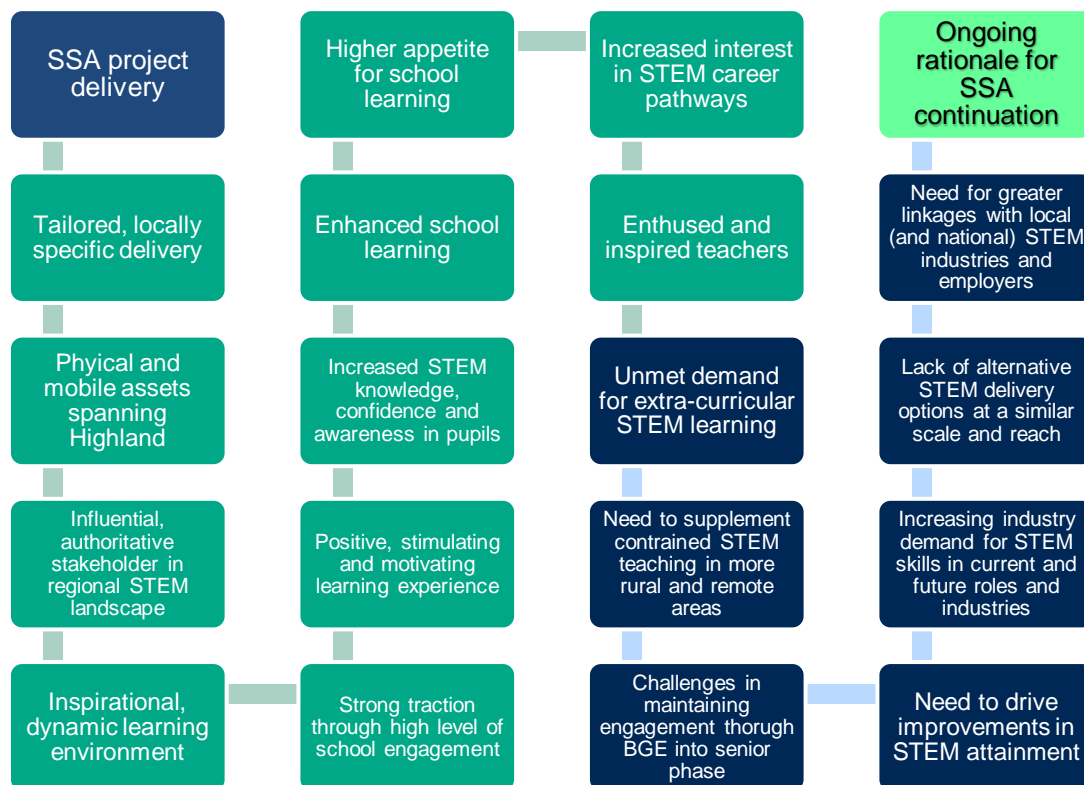
A continuing rationale

There is a clear and strong rationale for the SSA's continuation.

- 8.9 There continues to be high demand for access to additional STEM learning and outreach opportunities to augment in-class teaching and learning. There is also an aligned issue with the continued engagement of pupils as they transition from primary to secondary education and progress through the BGE phase.
- 8.10 The SSA project is well-placed to respond to the evident demand and challenges regarding STEM engagement and is seen by stakeholders and schools alike as a key resource for extra-curricular STEM education in Highland.
- 8.11 Strategically, if the identified Regional Transformational Opportunities are to be realised in the Highlands and Islands, there will be a strong need for STEM skills to develop the opportunities and attract inward investment. More broadly, STEM capabilities are increasingly in demand as essential skills across the economy.
- 8.12 If the SSA ceases delivery, a significant resource will be lost and there will be a sizeable gap in its absence. Despite there being a number of other STEM offers available in Highland, none are sufficiently resourced to meet the same level of demand, and are unlikely to be able to scale up quickly enough – particularly in a prolonged period of financial constraint.
- 8.13 The SSA fills a crucial gap with regard to the resources, equipment and activities available in and to schools. This is especially important in areas where it is more difficult to access these sorts of activities and facilities.

8.14 Figure 8.1 sets out a logic 'pathway' for the intervention rationale, demonstrating the effect that the SSA is already having. It highlights where there is still strong demand for delivery, as well as a need to provide a strong intervention to support STEM skills development and meet industry requirements.

Figure 8.1: SSA intervention logic pathway



Critical success factors

8.15 The evaluation has identified a set of factors that are key to the success of the SSA and should be integral to any future SSA provision. These are:

- High quality equipment and facilities that fill the gaps in what is available to schools;
- Skilled and enthusiastic staff deliver hands-on, practical activities;
- Application of the principles of collaborative learning;
- Proactive barrier removal to maximise participation e.g. cost, and transport;
- Alignment with CfE and provision of materials to support teachers to deliver the curriculum;
- Taking a 'whole class' approach so there is no selection or self-selection;
- Ability to take the Newton Room to where the schools and pupils are, through the pop-up;
- Creation of an inspiring, motivating and dynamic learning environment;
- Demonstration of how STEM subjects link to industry, occupations and careers;
- Modules that reflect industry opportunities;
- Activities and topics that are tailored to the local context;
- Industry engagement in developing and as appropriate, delivering activities;
- Active participation in strategic partnerships in the Highlands and Islands, and as relevant nationally; and
- Proactive monitoring and evaluation of process, delivery, outputs and outcomes.

Areas to consider

- 8.16 Whilst the scope of the Final Evaluation did not require recommendations for the SSA project, there are some areas that are worth highlighting that along with the critical success factors, should be considered for planning and delivery activities going forward. These draw on the Interim Review along with the evidence from this evaluation.

Consideration 1: Optimise SSA facilities

The SSA project provides access to a wide range of high-quality equipment, facilities and materials. These are primarily used during school hours and term time, although there are some examples of delivery in school holiday periods, albeit quite limited. The SSA project's resources could and should be used more effectively throughout the year and barriers to this must be understood and removed, for example staffing. Being able to demonstrate year-round use of the assets will likely enhance its impact and its attractiveness to funders.

Consideration 2: Extend reach through technology

During the pandemic, the SSA successfully delivered online activities. Whilst these are no replacement for hands-on, face to face sessions, online sessions extended the reach to more pupils and could be used to underpin and reinforce face-to-face learning in Newton Rooms and in classroom-based learning.

Consideration 3: CPD for practitioners

As identified in the Interim Review and reinforced in the Final Evaluation, teachers can struggle to find time to undertake CPD. There is scope for participation in Newton Room sessions to be counted as CPD and this would add value to the SSA project outcomes and its contribution to STEM teaching and learning. It would benefit the teachers and acknowledge the importance of their role in influencing STEM engagement and contextualising learning in the real world, and the world of work.

Consideration 4: Industry partnerships

An important USP of the SSA project is how closely it aligns its activities and content with industry, real-world applications and careers. It has successfully engaged with employers, but this has been limited and largely transactional. There is substantial scope to extend this in terms of the number of employers and crucially, to ongoing partnership and collaboration. This may be achieved through incorporating industry in the funding strategy.

Consideration 5: A strategic offer and strategic influence

The SSA plays an important role in the strategic planning and delivery of STEM education and learning in the Highlands. It also has established national strategic partnerships and has a strong local, regional and national profile. It is important that this is sustained and built on. Consideration should be given as to how this is integrated into the future funding of the SSA so that its strategic added value can be capitalised. This may be about identifying particular sectors to target, such as Renewable Energy, Food and Drink, Clean Transport, Advanced Aviation, and Life Sciences and Digital Health.

As part of this, there are a range of STEM education offers available to schools, pupils and in communities in the Highlands. In many ways, the sources of these opportunities do not matter, as long as they are available and accessible. However, it is important that they can be navigated, and that schools can draw on the various offers to maximise impact and achieve the aggregated added value. In preparing and implementing funding strategies, there must be clarity and transparency so that potential funders are not approached by different organisations for funding that may seem, to funders, to be similar or duplicate.

Consideration 6: An evolving offer aligned with the current and emerging context

The SSA project has successfully developed and delivered modules that take STEM 'off the page', into the workplace, and reflect the local sectors and employers. New modules have been added over the project period which keeps the offer fresh, and is highly valued by teachers and stakeholders. Pupils are motivated and enthusiastic about the 'green revolution' and so a module or series of modules reflecting this would be valued, for example conservation, carbon capture, and biodiversity. There is also scope for modules in areas such as Health and Social Care (HealthTech), and Agriculture (AgriTech).

Consideration 7: Capturing impacts

There is clear and robust evidence of the outputs and outcomes that have been achieved by the SSA project and it is likely that these will lead to longer term impacts and sustainable benefits for individuals, employers and the economy. At the time of the evaluation, there can only be limited evidence of this as the impacts will be accrued in the longer term for example through participation and attainment in STEM subjects in secondary and tertiary education, and in progression into STEM occupations. This in turn will be demonstrated by a STEM-enabled local workforce in the Highlands. It will be possible to use education participation and attainment data to track any changes in STEM subjects and also, potentially any equalities-related changes such as gender and socio-economic background.⁵⁹ It should also, in time, be possible to monitor employment data for the area to show any uplift in the number of people working in STEM occupations although attribution to SSA activities will be challenging. There may also be scope, for example through work with employers, and considering attracting inward investment, to understand how the workforce and pipeline are meeting the STEM-related needs of employers.

Consideration 8: Responding to an evolving STEM landscape

STEM has a high priority in Scotland and there is a supportive and proactive policy environment. Within this context there are a great deal of opportunities for the SSA project. Currently, there are constraints in public sector budgets locally, regionally and nationally. There is also forthcoming UK and then Scottish Government elections which may influence policy direction and priorities. However, it is likely that STEM will remain a key priority for Scotland's economic prosperity and resilience. It is an evolving landscape, and it is important that the SSA monitors this, is alert to the implications, and harnesses the opportunities, and demonstrates contribution to national and regional objectives.

There are opportunities that the SSA could tap into that are not directly STEM related but may be of benefit. For example, the Scottish Government's commitment to providing wrap around care and activities for school age children.

Consideration 9: Widening geographic coverage

As identified in the Interim Review and this Final Evaluation, there is some frustration within the Highlands and Islands that SSA delivery is confined to the Highland Council area. Taking a strategic and regional approach would be a positive development and is an opportunity given the cessation of Inverness and Highland City-Region Deal funding. There is now scope to extend the geographic boundaries of SSA delivery and this must be part of the funding strategy.

⁵⁹ Comprehensive equalities data is not always available across all education datasets.

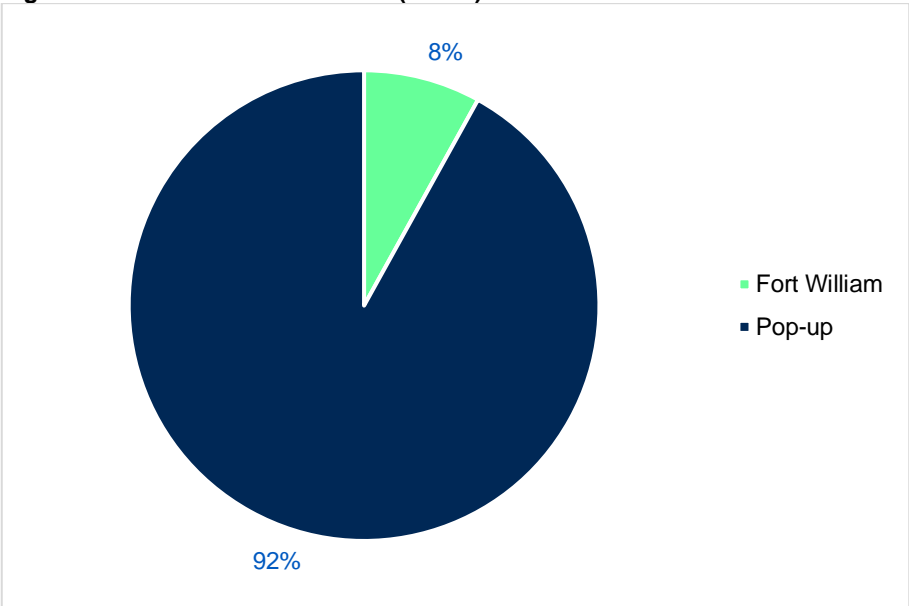
Appendix 1: Pupil and teacher survey respondent profile

Survey sample profile

Pupils

There was a total of 176 respondents to the pupil survey, the majority of whom attended a pop-up Newton Room with a small number attending one in Fort William shown in Figure A1.1.

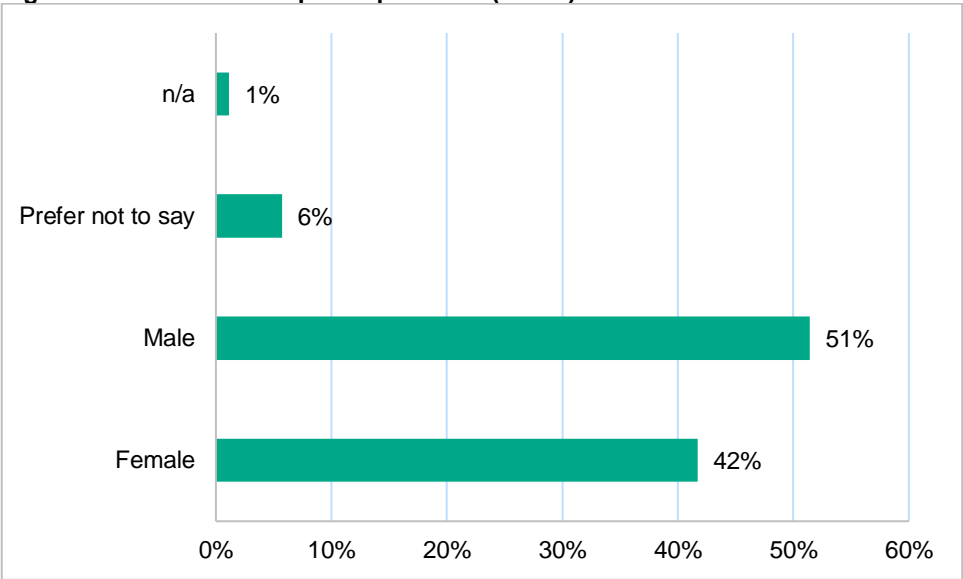
Figure A1.1: Newton Room visited (n=174)



Source: ekosgen SSA Pupil Survey

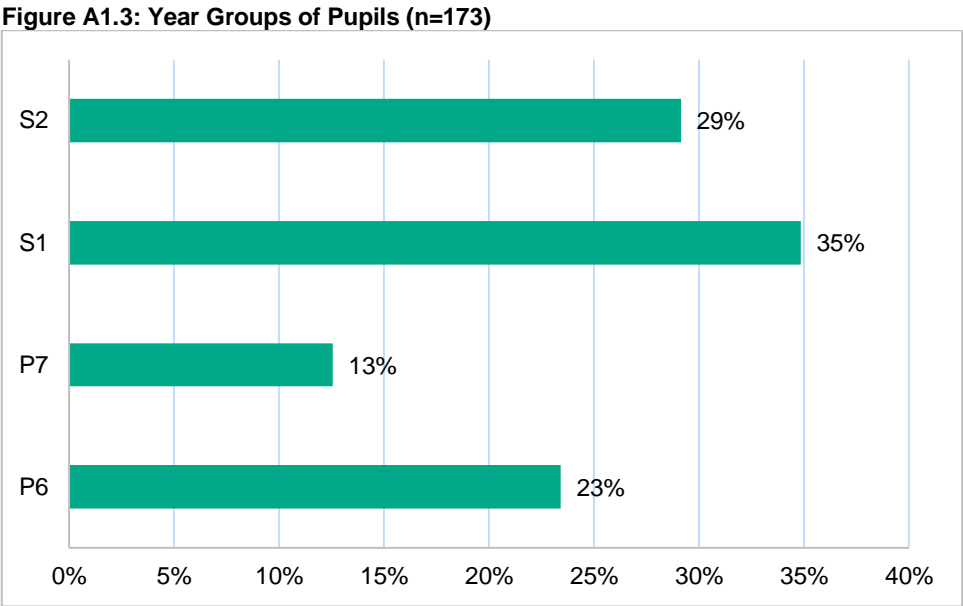
Figure A1.2 illustrates the gender composition of the sample which is balanced reasonably evenly at 51% boys, 42% girls and 7% who preferred not to say.

Figure A1.2: Gender of Pupil Respondents (n=175)



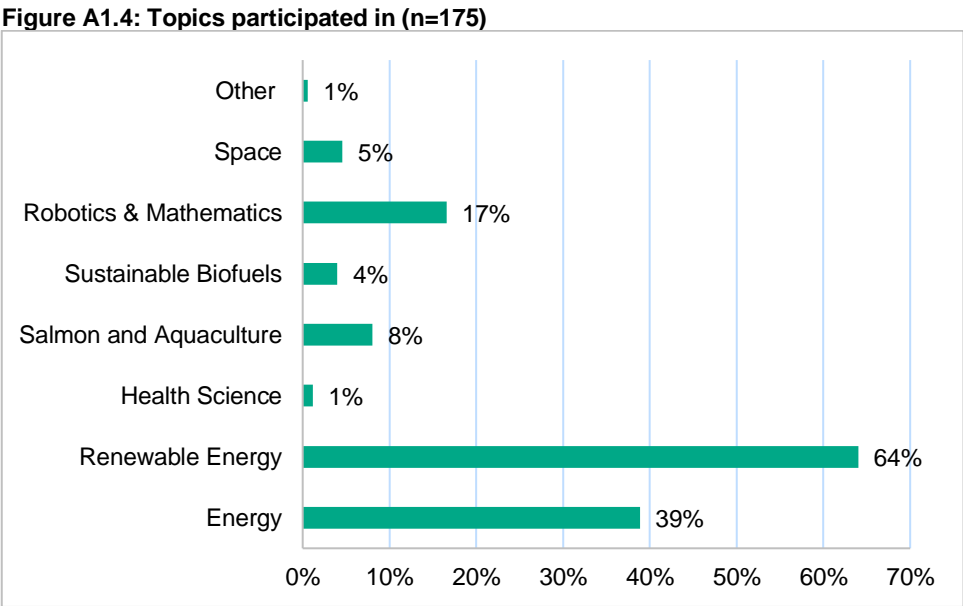
Source: ekosgen SSA Pupil Survey

Figure A1.3 shows that the majority of pupils in the sample (64%) were at secondary school, with 35% in S1 and 29% in S2. The remainder were at primary school, across year groups P6 and P7.



Source: *ekosgen SSA Pupil Survey*

As Figure A1.4 highlights, most of the pupils studied the topics of Renewable Energy (for secondary pupils) and Energy (for primary pupils).



Source: *ekosgen SSA Pupil Survey*

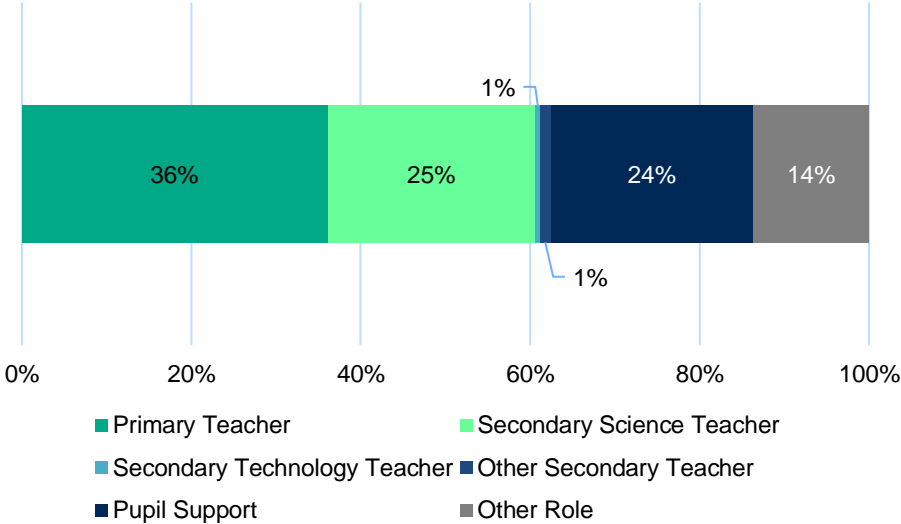
Teachers

A total of over half of respondents were from primary schools (6), and five respondents were from Secondary schools. The majority of respondents attended a pop-up Newton Room (N=9). Only two respondents attended a Newton Room in Fort William. Of those who attended a pop-up Newton Room, seven attended the Grantown on Spey Pop-up and two attended the Gairloch pop-up. The majority (7) of sessions covered Energy, followed by three sessions on Renewable Energy and sessions (2) covering both Robot & Mathematics and Salmon and Aquaculture. Sustainable Biofuels and Energy changes (at Secondary Level) were the subjects that teachers and their classes learned least, with one session each covering these topics.



Findings from the SSA's own post-session survey provide more detail on teacher roles. Figure A1.5, below, shows that teachers attending SSA sessions with their pupils have different roles in the classroom, with 36% being primary school teachers, some 25% being secondary school science teachers, and 24% being there for pupil support (at the SSA session or at school). A total of 15% were in another role (14%) or were a secondary school teacher of another discipline than science or technology (1%).

Figure A1.5: Post-Event Teacher Role (n=734)



Source: SSA Post-Event Teacher Survey

Appendix 2: Consultees

Table A2.1 presents a list of the organisations that were represented by stakeholders through consultations as part of this research.

Table A2.1: Stakeholder Consultee Organisation List

Stakeholder Consultee List
Education Scotland
Glasgow Science Centre
Highlands and Islands Enterprise
Highland Council
Skills Development Scotland
Science Skills Academy
University of the Highlands and Islands

Source: ekosgen

Table A2.2 presents a list of the schools that were represented by teachers and pupils through consultations and focus groups as part of this research.

Table A2.2: Teacher and Pupil Consultee School List

Teacher and Pupil Consultee List
Croy Primary School
Dingwall Academy
Dingwall Primary
Grantown Grammar
Grantown Primary
Invergarry Primary
Kilchuimen Academy
Kyleakin Primary School
Nairn Academy
Newton Park Primary (Wick)
Portree High School
St. Joseph's Primary School, Inverness

Source: ekosgen

