Evaluation of the STEM Grants Programme Round Two and Wider Education Scotland STEM Support

FINAL REPORT

for

Education Scotland

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ekosgen

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Contents

1 Introduction to the research

Introduction

1.1 Education Scotland appointed ekosgen in partnership with Context Economics in January 2019 as evaluator of the Enhancing Professional Learning in STEM Grants Programme (SGP), a key part of the strategy to build Scotland's capacity to deliver STEM learning and to close equity gaps in participation and attainment in STEM.

1.2 The SGP was launched in October 2018 to increase access to STEM learning opportunities, to build the capacity and confidence of practitioners, and to support the implementation of the STEM Education and Training Strategy for Scotland. The Programme has been delivered across all education sectors: early learning and childcare (ELC), primary, additional support needs (ASN) and secondary schools, community learning and development (CLD), and school-based technical support staff. It aims to deepen and extend subject knowledge to improve STEM learning and teaching and ensure that professional learning reaches new audiences and geographies and builds on existing STEM professional learning provision.

1.3 ekosgen evaluated **Round One** of the SGP which reported in April 2019. The evaluation found that the programme had improved access to STEM professional learning by removing barriers to CLPL. Funded projects had developed high quality content that had inspired STEM practitioners, notably in early learning and childcare, primary schools and community learning and development. Practitioner confidence had been boosted, however given low levels of prior confidence in STEM, it was recognised that ongoing support was needed to continue to improve practitioner skills and confidence. Awareness of the need to proactively address equity issues had also been increased amongst STEM practitioners supporting an improvement in equity and equality measures amongst learners. Evidence showed that projects had inspired learners to engage more with STEM learning, and this was driving more positive views and aspirations of STEM careers. Funded projects had also driven the design of new delivery models of CLPL and the development of practitioner networks.

1.4 A number of recommendations relating to further rounds of the SGP were made around: targeting and engagement, project scalability and innovation, project complementarity and project and programme level monitoring and evaluation.

1.5 **Round Two** of the SGP, a £2.1 million grant fund was launched soon after with successful organisations commencing project delivery in October 2020.

1.6 This report relates to the evaluation of the impact of the Round Two SGP. The programme consists of two funds: a Regional and National Partner fund and a Leadership and Collegiate Professional Learning fund. Across both funds grant funding was provided for 139 projects at local, regional, and national levels, some of which ran over a six-month period whilst others were funded from October 2019 to March 2021. This evaluation aims to evaluate and understand the impact of the programme on both practitioners and learners in relation to STEM and its contribution to the STEM Strategy's aims and objectives.

Evaluation objectives

1.7 The study aimed to evaluate the Round Two SGP's impact across all education sectors – ELC, primary, ASN, secondary and CLD – as well as support decision-making about future funding rounds.

1.8 Specifically, the evaluation was to establish to what extent the programme has helped to achieve the following outcomes:

- Increasing the confidence, skills, and capacities of practitioners in relation to STEM professional learning, teaching and assessment;
- Reducing equity and equality gaps in engagement, participation, and achievement in STEM professional learning; and
- Improving outcomes for learners in relation to STEM

1.9 It is important to highlight that the delivery of the Round Two programme was severely impacted by the COVID-19 pandemic and the accompanying lockdown restrictions and closure of schools and other delivery organisations. Engagement with programme grantees was therefore more problematic for the evaluators. This, in turn, led to the rescoping and reshaping of the evaluation approach over the course of the last year.

1.10 The scope of the evaluation was widened to gain an understanding of Education Scotland's sphere of influence in relation to the wider STEM landscape. This included the impact of Education Scotland's regional support and other wrap-around support provided through the STEM Strategy. This was done via a comprehensive stakeholder consultation programme conducted over the course of the period November 2020 to March 2021. This focus was deemed particularly important given the additional demands imposed on schools and practitioners and in turn, the Education Scotland Teams during the course of the pandemic.

Study methodology

1.11 The evaluation methodology has consisted of the following elements:

- A review of project documentation and programme monitoring information;
- An analysis of education enrolment and attainment data in STEM subjects;
- Consultation with a sample of 18 project Lead Grantees across both funding strands;
- The delivery of an online survey to beneficiary practitioners (237 responses with a 68% completion rate);
- The delivery of an online survey to end beneficiaries (210 responses with an 82% completion rate) i.e. school pupils, students, adult learners and parents;
- In-depth consultations with STEM and IGBE Team advisers;
- A consultation programme with Education Scotland's operational stakeholder partners. These have been delivered through a combination of online 1-2-1 interviews and focus groups. 17 organisations were consulted details of which are appended; and
- A consultation programme with Education Scotland's strategic stakeholder partners. These have also been delivered either online 1-2-1 or in group format. 19 organisations were consulted, details of which are appended.

1.12 In addition, a monitoring and evaluation framework was developed for use in measuring outcomes and impact of Round Two projects. Due to the disruption associated with the COVID-19 pandemic this was not launched and will now be tested and implemented as part of the Round Three SGP programme. This is detailed in **Appendix 7**.

How the report is structured

1.13 The report is structured in the following way:

- **Chapter 2** updates the policy and delivery context for the SGP and Education Scotland's support for the STEM Strategy implementation, an update of the STEM Strategy's achievements against targets to date, and the delivery challenges experienced as a result of the COVID-19 pandemic. It also discusses the current STEM delivery landscape and provides a summary of STEM education and attainment for 2017-2020.
- **Chapter 3** describes the STEM Grants programme, project profiling and funding; it also provides an analysis of programme performance against activity and outcome targets.
- **Chapter 4** draws on the findings from the in-depth consultations with project Lead grantees, and online surveys with practitioners and end beneficiaries, and reports on the benefits, challenges and impacts associated with the management and delivery of the Round Two programme.
- **Chapter 5** discusses the management and delivery arrangements of the SGP.
- **Chapter 6** considers the contribution and impact of the wider work of the Education Scotland STEM and IGBE Teams, drawing on findings from the strategic and operational stakeholder consultations.
- **Chapter 7** draws conclusions on the key learning from Round Two projects and makes recommendations to enhance the impact and effectiveness of future funding rounds of the SGP, as well as the wider work being taken forward by Education Scotland to support the implementation of the STEM Strategy.

1.14 Appendices include:

- **Appendix 1**: List of operational stakeholder organisations consulted
- **Appendix 2**: List of strategic stakeholder organisations consulted
- **Appendix 3:** List of Lead Grantees organisations consulted
- **Appendix 4**: Analysis of education and attainment in STEM for 2017-2020
- **Appendix 5**: School entries and passes by gender for 2017-2020
- **Appendix 6**: STEM education definition
- **Appendix 7**: Monitoring and evaluation framework and project self-evaluation toolkit
- **Appendix 8**: Beneficiary Practitioner survey analysis summary
- **Appendix 9**: End Beneficiary survey analysis summary

2 The current STEM context and delivery landscape

Introduction

2.1 This chapter provides a policy context update for STEM in Scotland. It discusses the impact of the COVID-19 pandemic on the delivery of STEM professional learning and the wider STEM support being provided by Education Scotland. It also considers changes to the delivery landscape since the last programme evaluation and presents a summary of the third annual STEM Strategy Update report.

Current policy context

2.2 The importance of STEM is evidenced in a number and variety of policy documents and initiatives dedicated to its development. Scotland's Economic Strategy (SES)[1] aims to create a more successful country and has four priorities to achieve this: investment, innovation, inclusive growth, and internationalisation. STEM industries and skills are particularly important for encouraging innovation and the development of business and are integral to improving digital skills and capacity.[2] The development and improvement of STEM education and training contributes particularly to innovation and inclusive growth

2.3 The Scottish Government's Education Governance: Next Steps[3] published in June 2017 outlines the vision and plans for a school and teacher-led system, recognising that to achieve this requires 'a world-class support system'. With specific reference to professional learning, Next Steps confirmed that Education Scotland leads the renewed focus on professional learning and leadership, bringing clarity and coherence to the national landscape. Central to achieving the vision is the national model of professional learning[4] which identifies the key principles and features of effective professional learning and offers strategic guidance for education professionals on how to support, structure and plan for professional learning.

2.4 The STEM Education and Training Strategy was published in 2017 by the Scottish Government and is integral to their broader economic strategy. It aims to build capacity to deliver *excellence* in STEM learning, close *equity* gaps in participation and attainment, *inspire* young people and adults to study STEM, and provide better *connection* between stem education and training in accordance with the labour market. The strategy seeks to address the way in which education and training can be improved to meet the growing demand for STEM skills and ensure that the STEM skills supply can meet the demand and contribute to growth.

2.5 The SGP, launched in October 2018 with the aim of building the capacity and confidence of practitioners across all education settings, directly supports the implementation of the STEM Education and Training Strategy. With its focus on the sciences, Numeracy and Mathematics, Digital Learning, Engineering, and Technologies the SGP is continually reviewed, and its funding priorities aligned with key developments in education policy.

2.6 A cross-cutting theme of the STEM strategy is to address inequalities in STEM, particularly around the participation of women, minority ethnic communities, disabled people, and those who are care experienced and from disadvantaged backgrounds. The Gender Pay Gap Action Plan[5] will

[1] Scottish Government (2015) *Scotland's Economic Strategy*

[2] http://www.gov.scot/Topics/Economy/EconomicStrategy

[3] https://www.gov.scot/publications/education-governance-next-steps-empowering-teachers-parents-communities-deliver-excellence/

[4] https://professionallearning.education.gov.scot/explore/the-national-model-of-professional-learning/

[5] Scottish Government (2019) *A fairer Scotland for women: gender pay gap action plan*

continue to reduce the pay gap for employees in Scotland and tackle labour market inequalities faced by women. Furthermore, the Scottish Attainment Challenge seeks to achieve equity in educational outcomes, focusing on closing the poverty-related attainment gap by ensuring every child has the same opportunity to succeed.

2.7 More recently, Education Scotland undertook a thematic review of current practice in numeracy and mathematics. The 2019 *Multiplying Skills, Adding Value*[6] report provided a national snapshot of practice and was published in response to one of the *Making Maths Count* report[7] recommendations. This has resulted in an increased focus on improving the quality of learning and teaching in numeracy and mathematics and the SGP in Round Two and the upcoming Round Three reflects this focus in terms of the projects it has/will fund.

2.8 In a similar way, current thinking and policy with respect to digital technologies has been embraced by Education Scotland and this will filter through to the SGP's priorities. A short-life review into how Scotland's technology sector can contribute to the country's economic recovery after the COVID-19 pandemic was commissioned by the Scottish Government in May 2020. The *Logan Report's*[8] recommendations are primarily concerned with stimulating and accelerating the maturity of Scotland's "Technology Ecosystem" which supports and nurtures technology businesses in Scotland, from the early start-up phase through to fully scaled maturity. The output of this ecosystem should be a stream of technology start-ups that can reach sustained profitability, including a significant proportion that do so at scale; with consequent benefits in opportunity for the people of Scotland in job creation and in tax revenues. The ecosystem's fundamental dependencies include: Education and Talent: at school level, at university (and parallel access paths), and at start-up/scale-up level. Delivering digital and technology learning and skills to school pupils will be a key focus of Education Scotland in the next couple of years.

2.9 Since the STEM Strategy was published, new steps have been set out in the Scottish Programme for Government for 2019-20 to address the climate emergency amidst the UK's exit from the European union and recovery from the COVID-19 pandemic. The STEM Strategy has a vital role in working towards these ambitions, driving innovation and growth for the present, near and distant future.

Impact of COVID-19 pandemic

2.10 The COVID-19 pandemic (from March 2020 to date) has put great pressure on the education system, and practitioners and learners alike. Periods of full lock down and restrictions have required high levels of adaptation and flexibility within education to allow as many people as possible to continue their STEM learning. This has affected the dynamic amongst partners within the current STEM delivery landscape and put new pressures on the numerous organisations therein. It has also created a need for the design of new learning and teaching delivery models to respond to high levels of remote working and restricted numbers in schools and on college and university campuses, which had the potential to adversely affect the delivery of learning and training.

2.11 Children and young people have been significantly affected by the COVID-19 pandemic, with some evidence to suggest home learning has been a challenge, particularly for those experiencing a socio-economic disadvantage[9]. Missed educational opportunities due to home learning difficulties or inconsistencies, or other factors heightening by the pandemic, such as poor mental health, are likely to perpetuate any economic disadvantages and lead to an increase in education inequalities for children and young people, including missing out on STEM engagement. Women have also experienced significant mental health impacts due to the pandemic. Research by Engender shows two-thirds of women said staying positive day-to-day has become harder throughout the pandemic, compared to over

[6] https://education.gov.scot/media/2ljhvxsl/multiplying-skills-adding-value-full-report.pdf

[7] https://www.wired-gov.net/wg/news.nsf/articles/Making+Maths+Count+final+report+12092016142000?open

[8] https://www.gov.scot/publications/scottish-technology-ecosystem-review/

[9] https://www.gov.scot/binaries/content/documents/govscot/publications/research-and-analysis/2020/09/the-impacts-of-covid-19-on-equality-in-scotland/documents/large-read-executive-summary/large-read-executive-summary/govscot%3Adocument/Large%2BRead%2BExecutive%2BSummary%2BCovid%2Band%2BEquality%2BScotland.pdf

one-third of men (36%), with younger women even more affected[10]. This can have a detrimental effect on practitioners and learners alike in term of STEM CLPL and STEM educational engagement and attainment. There are also indications that domestic abuse towards women increased and/or intensified during the pandemic, which may have negatively affected levels of engagement by children and young people in education and drive inequity, among other impacts.

2.12 The pandemic was expected to negatively impact both the delivery and level of uptake of practitioner CLPL. At the end of Phase One in March 2020, consultation with Lead Grantees suggested that of those projects forecast to proceed into Phase Two (c.100), a number of projects would be withdrawn, scaled down or temporarily put on hold. Of these, some 72 had the appetite to continue and delivery models were redesigned and many shifted to digital delivery platforms. However, whether this shift has maintained projects' original forecast levels of engagement and reach with practitioners is yet to be determined.

2.13 At this same time other organisations and Education Scotland's partners in the wider STEM landscape, which support both the delivery of SGP projects and other STEM activity, reviewed their ways of working as well, in response to the pandemic. The wider STEM delivery landscape has a set of reasonably established and embedded structures. These range from the three regional STEM Ambassador Hubs and six Regional Improvement Collaboratives to 13 Regional STEM Partnerships and 21 DYW groups. The role of Education Scotland's STEM and IGBE officers within these wider structures has been developed and strengthened since Round One of the SGP. Each officer works as an integral part of Education Scotland's Regional Improvement Teams and in close partnership with the Regional Improvement Collaboratives. The impact of the pandemic has changed the dynamic in this wider STEM landscape increasing the need for knowledge exchange between RICs teams for example, better communication and more collaboration and partnership working activity to address the challenges which have arisen.

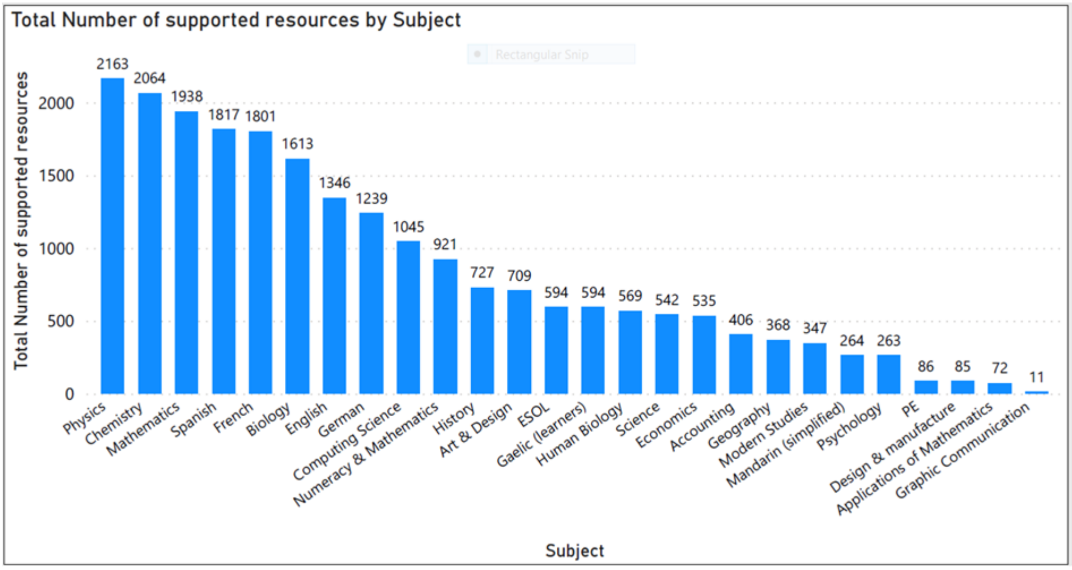
2.14 It is within this context that the education system in Scotland changed its approach to delivering education to learners. A move to digital learning and a blended approach for schools was inevitable and thus there was a need to quickly develop an e-learning offer focussing on digital/online learning, and blended resource development. The work of Education Scotland and both the STEM and IGBE teams, from April last year, turned to the development and delivery of online materials, the collation of a depository for these resources and those developed by partners, and importantly communication channels to inform and provide access for both learners and practitioners.

2.15 Over the course of the pandemic Education Scotland has been working in close partnership with practitioners through their national secondary science working groups and subject curation groups. They also worked with a range of partners to collate and curate resources including e-Sgoil, The West Partnership Online School (West OS), BBC, Scholar, and Edinburgh Napier University. This involved partnership working across a range of national partners, RICs, Local Authorities, and universities and in tandem with the teaching profession.

2.16 Education Scotland's National Improvement Hub became host to a National e-Learning Offer (NeLO). The NeLO is a range of resources available to practitioners preparing online remote learning for pupils. They are recorded and supported resources which are available for learners to use as directed by their teacher, in addition to a number of live learning sessions. Each format is provided by the West OS, Education Scotland and Western Isles Council's e-Sgoil respectively.

[10] https://www.engender.org.uk/content/publications/Close-the-Gap-and-Engender-Joint-briefing-on-the-impact-of-COVID-19-on-womens-wellbeing-mental-health-and-financial-security.pdf

Table 2.1: Supported Resources by Subject



Source: Education Scotland February 2021

2.17 As part of the supported aspect of the offer Education Scotland also produced a set of spreadsheets which map the curriculum, initially focused on National Qualifications and later on Broad General Education[11] (from ELC to S3), to the supported resources available. These include over 18,300 resource links, 22 subject spreadsheets, resource links being collated and curated by practitioners and BBC and scholar resources also linked to the curriculum. These spreadsheets pull all of these useful resources together into one convenient place for teachers so they can support remote learning. Current development work involves converting these spreadsheets into a national database of resources for teachers, learners and parents that will have a legacy beyond COVID: https://education.gov.scot/nelo/.

2.18 Education Scotland and partners also produced a significant number of practical video experiments as practitioner resource as shown at Table 2.2 below.

Table 2.2: Practical Video Experiment Resources

Produced by	Subject	Number of videos	Location of resource
ES/BBC/SSERC	Chemistry Biology Physics	11	BBC Bitesize
ES/BBC/SSERC	Chemistry Physics Biology	16	BBC Bitesize
ES/Napier University/Partners	Chemistry	34	STEM Nation YouTube Channel and West OS

[11] Broad general education https://education.gov.scot/education-scotland/scottish-education-system/broad-general-education/

Produced by	Subject	Number of videos	Location of resource
ES/Napier University	Physics	7	STEM Nation YouTube Channel and West OS
ES/Napier University	Chemistry	10	STEM Nation YouTube Channel and West OS
ES/STEM Ambassador	DYW	7	STEM Nation YouTube Channel and West OS
ES/BBC/Napier University	Chemistry	25	BBC Bitesize
ES/BBC/Glasgow University	Biology	14	BBC Bitesize

Source: Education Scotland February 2021

2.19 In summary, 61 live videos have been produced, with another 88 anticipated in the next batch giving a projected total content to date of **149** practical video experiments. The next phase of activity from March 2021 included the following:

- BBC Batch 2: Filming being organised with BBC and Strathclyde University for Physics content.
- BBC Batch 3: Further filming in discussion between Education Scotland & BBC for BGE (Primary and Secondary), NQ subjects (Biology, Chemistry and Physics).
- BBC Batch 4: Education Scotland & BBC in discussion regarding Learning for Sustainability[12] content to support COP26.

2.20 Within the NeLO there are 117 practical videos that are in addition to the 149 videos that have been produced by Education Scotland and partners.

STEM Strategy update

2.21 The STEM Education and Training Strategy was published in 2017 by the Scottish Government and is integral to their broader economic strategy. It aims to build capacity to deliver *excellence* in STEM learning, close *equity* gaps in participation and attainment, *inspire* young people and adults to study STEM, and provide better *connection* between stem education and training in accordance with the labour market. The strategy seeks to address the way in which education and training can be improved to meet the growing demand for STEM skills and ensure that the STEM skills supply can meet the demand and contribute to growth.

2.22 Key STEM achievements over the past year, and since the STEM Strategy was first introduced are listed below:

- The **National Improvement Hub** continues to offer a range of resources for primary, secondary, and early years with 580 engagements with 452 establishments undertaken by STEM Officers between January and December 2020.

- Between August and December 2020, there have been over 300 professional learning events running, delivering over 1,450 in total through the **RAiSE programme.** To date, 77% of teachers involved have noted an increase in pupil's STEM aspirations.

[12] https://education.gov.scot/improvement/learning-resources/a-summary-of-learning-for-sustainability-resources

- **SSERC** has continued to deliver a professional learning programme. It has provided over **3,400** CPD training days for Primary, Secondary, Early Years and school technicians.

- Dedicated support to **Digital skills development** has continued, the Digital tools for learning and teaching has been fundamental through COVID-19 and will continue as part of everyday to develop Digital literacy skills. Since March 2020, over 11,000 practitioners have engaged in 203 webinars.

- Through the **IGBE programme**, in 2019-20 there has been engagement with 279 establishments and over 2,100 practitioners to tackle gender bias and improve gendered participation and subject choice.

- **Science centre** funding levels for 2020-21 have been maintained with continued engagement with community groups. *Glasgow Science Centre* has developed 79 learning opportunities and been involved in a foundation apprenticeship programme, with 15 young people taking part virtually. *Dundee Science Centre* also reached 99,200 children with meaningful interaction through their Digital Home Learning Programme in March 2020.

- There are now 13 **Regional STEM Partnerships** to drive STEM progress and they have been part of upskilling the future ELC workforce on teaching STEM for very young children.

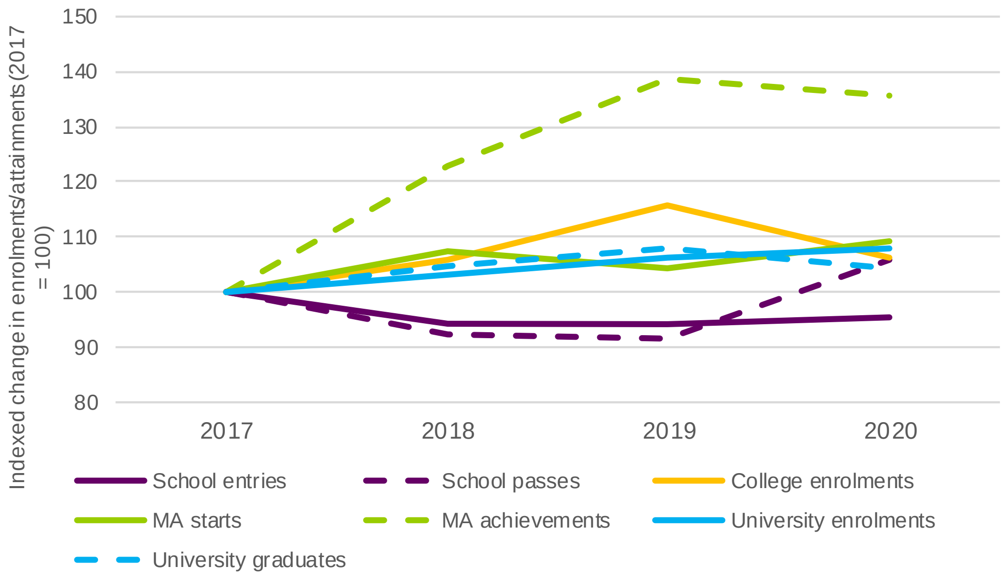
- There has been work to support improvements in Numeracy and Mathematics through the publication of the suite of **Professional Learning Resources** in August 2020, and the subsequent range of national, regional and local webinars also had a significant reach.

Summary of STEM education and attainment (2017-2020)

2.23 This section presents a summary analysis of education enrolment and attainment in STEM. Analysis is presented across a range of indicators (as far as possible as data will allow), including subject, gender, and institution. The detail can be found in **Appendices 4-6.**

2.24 Figure 2.1 shows the overall indexed trend in STEM education and attainment in Scotland between 2017 and 2020 (or equivalent latest year of data). There has been a fall in the number of entries across all school levels (National, Higher and Advanced Higher), but an increase in the number of passes, particularly at Higher and Advanced Higher. While the fall in entries may be partly explained by a decrease in school pupil population, and curriculum/examination changes (i.e. at National level), the rise in passes is almost entirely due to a change in the assessment process in 2020 as a result of the COVID-19 pandemic. There has been a significant rise in FE College STEM provision since 2017, despite entries falling 8% between 2019 and 2020. STEM provision has also risen at university and across the apprenticeship family.

Figure 2.1: Overall indexed trend in STEM education and attainment (2017 to 2020)



Source: SQA, SFC, SDS and HESA[13], 2021. Please note trends are indexed from 100 in 2017

2.25 Table 2.3 shows a simplified, summary view of overall STEM take-up, and by gender, across a range of education provision from school to university, as well as other provision such as apprenticeships and Skills for Work. The table shows the proportion of overall entries/enrolments that are in STEM subjects. It also shows the proportion of male and female learners that take-up STEM subjects. For example, 26% of overall college enrolments are in STEM subjects, while only 17% of female college enrolments are STEM and 35% of male college enrolments are STEM. Further details on the breakdown of STEM subjects by gender across school, college, apprenticeships, and university provision is given in **Appendices 4 and 5**.

Table 2.3: STEM share of overall provision, and by gender (2020)

Education	Total (%)	Female (%)	Male (%)
School – National level	**45**	41	48
School – Higher level	**34**	29	41
School – Advanced Higher level	**51**	41	63
National Progression Awards	**31**	28	72
Awards	**>1**	0	100
National Certificates	**34**	23	77
Skills for Work	**31**	25	74
College provision	**26**	17	35
Foundation Apprenticeships[14]	**42**	23	77
Modern Apprenticeships	**38**	4	48
University provision	**49**	45	56

Source: SQA[15], SFC[16], SDS[17] and HESA[18], 2021

2.26 There is a higher rate of male entries than female entries in STEM-related subjects at all school levels. Just under half of male Modern Apprenticeships are in STEM-related frameworks, while this is

[13] Scottish Qualifications Authority (SQA), Scottish Funding Council (SFC), Skills Development Scotland (SDS), and Higher Education Statistics Agency (HESA)

[14] Data provided is for the 2019/21 cohort

[15] https://www.sqa.org.uk/sqa/64717.8312.html

[16] https://stats.sfc.ac.uk/infact

[17] https://www.skillsdevelopmentscotland.co.uk/publications-statistics/statistics/modern-apprenticeships/?page=1&statisticCategoryId=4&order=date-desc

[18] https://www.hesa.ac.uk/data-and-analysis/students

only a small proportion for females. This is due to the high volume of starts on typically male-dominated frameworks such as construction and engineering. Around half of all university enrolments are STEM-related, although again there is a lower rate for females than for males.

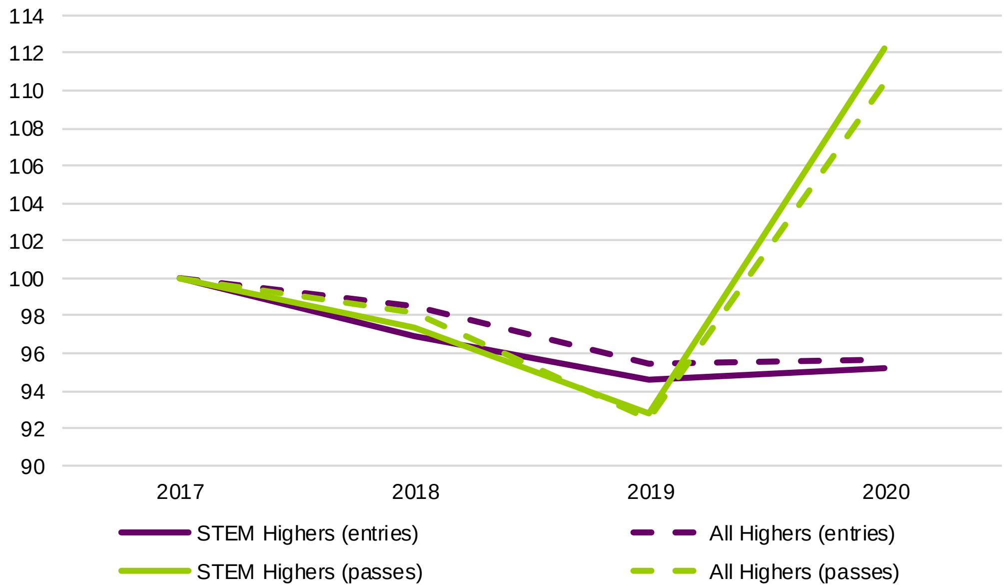
2.27 Within most education types and levels, there is an imbalance towards males. STEM provision is slightly more gender balanced at National level in school than at Higher and Advanced Higher level, albeit there is still an imbalance towards males across all three levels (between 53% and 55%). The vast majority of STEM MA starts were male in 2019/20 (94%). However, females made up a higher proportion of university enrolments (54%).

Schools

2.28 Between 2017 and 2020 there has been a fall in STEM entries (-5%) and a rise in STEM passes (+3%) at SCQF level 3-5 (National level). The fall in entries can in part be explained by changes in the number of qualifications being taken; however, the flexible senior phase is opening new learning pathways. The increase in passes is largely due to the changes in assessment criteria and process as a result of the COVID-19 pandemic.

2.29 At Higher level, there has been a 5% decrease in STEM entries over this period, whilst the number of STEM passes has risen by 12%, again due to the assessment changes in 2020 arising from the impact of the COVID-19 pandemic. This is slightly more pronounced than the overall decline in entries (down 4%) and rise in passes (up 10%) for all Highers in Scotland, as shown at Figure 2.2.

Figure 2.2: Index of total and STEM entries and passes for Highers, 2017-2020



Source: SQA, 2021

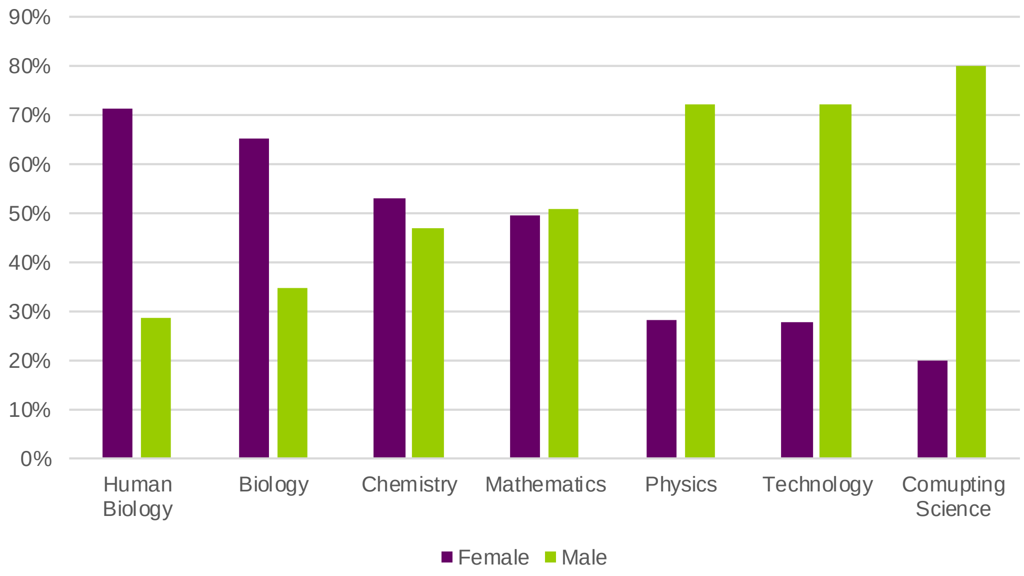
2.30 There has been relatively little change in the number of STEM Advanced Higher entries from 2017 to 2020 (down 1%). The pass rate has risen 18% over the period, again impacted by the pandemic assessment changes, and masking a 4% fall in passes between 2018 and 2019.

2.31 Overall, STEM passes have risen an average of 6% across all three levels during the period 2017 to 2020, despite a 5% fall in entries. Between 2017 and 2019, STEM passes fell 9%, highlighting the impact of COVID-19 on 2020 figures.

2.32 At school, males make up the majority of passes and entries for STEM-related subjects across all levels. However, the female pass rate is higher than the male pass rate at all levels and this is particularly marked at Advanced Higher level (2.4 percentage points higher) and Higher level (2.2 percentage points higher).

2.33 The gender split is more notable in certain subjects than others, as shown in Figure 2.3. Whilst Mathematics is broadly even at National and Higher level, a greater proportion of males make up the passes at Advanced Higher level (61%), due to a notably higher number of male entries at this level. Males make up around four-fifths of passes in Computing Science and over 70% of Physics passes across all levels, while females make up the majority of Human Biology and Biology passes at all levels, and particularly at Advanced Higher level in Biology.

Figure 2.3: Proportion of STEM attainment across Nationals, Highers and Advanced Highers by gender, 2020

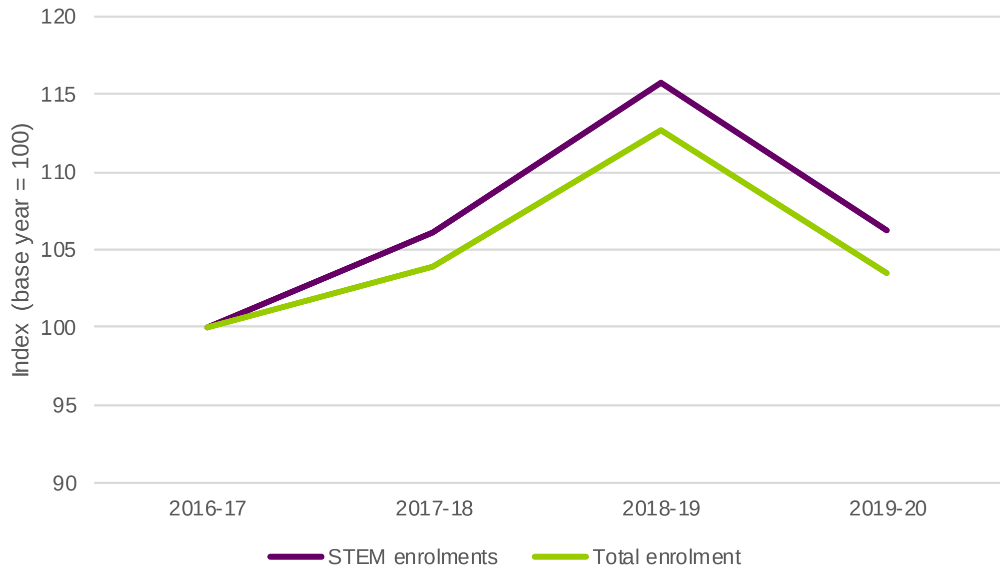


Source: SQA, 2021

College and Further Education

2.34 STEM-related subjects accounted for 26% of enrolments (77,931) in Scottish colleges in 2019/20. STEM enrolments grew between 2016/17 and 2018/19 before falling 8% in 2019/20 – falling at the same rate as all enrolments. This is shown in Figure 2.4.

Figure 2.4: Change in college enrolments in STEM-related subjects, indexed (2016/17-2019/20)



Source: SFC, 2021

2.35 As with the general trend for college enrolments, STEM enrolments had grown at a faster rate than overall enrolments between 2016/17 and 2018/19. The STEM share of overall enrolments has slightly increased from 25% in 2016/17 to 26% in 2019/20.

2.36 STEM college enrolments are concentrated in the Fife and Glasgow college regions, accounting for 38% of all STEM enrolments in Scotland. However, the share of STEM enrolments in Fife and Glasgow has fallen since 2018/19 when it was 45%. STEM accounts for 53% and 21% of all enrolments in those regions respectively. STEM enrolments are also high in Forth Valley (9,364 enrolments) and Aberdeen and Aberdeenshire (8,811 enrolments), with enrolments in the former rising 49% between 2018/19 and 2019/20.

2.37 Engineering accounted for the highest share of STEM college enrolments in 2019/20 at 50% and has been the highest over the last four years. There has been strong growth in *Sciences and Mathematics* enrolments over this time (up 37%) and some growth in Computing and ICT (up 9%), although enrolments in Engineering fell slightly (down 2%).

2.38 Over half (56%) of STEM college enrolments were by people aged 19 or younger in 2019/20, making the STEM student profile significantly younger, on average, than across all college enrolments (42%).

2.39 At college level, males are more likely to study STEM courses. Males accounted for around two-thirds of STEM enrolments (65%) in 2019/20, but only 48% of all college provision. This STEM gender gap has narrowed in recent years, with the number of females enrolled in STEM subjects rising at a greater rate than males (12% versus 3%), although Engineering subjects are still heavily dominated by males (78%), with males also more likely to study Information Technology and Information subjects (56%). More females enrolled in Sciences and Mathematics subjects in 2019/20 (55%).

Apprenticeships

2.40 There were 1,432 starts on STEM related Foundation Apprenticeship frameworks for the 2019-21 cohort, a significant increase from 710 starts on the previous cohort. The Foundation Apprenticeship STEM-related frameworks with the highest number of starts for the 2019-21 cohort were Engineering (469) and Creative and Digital Media (353). There were more males starts on all STEM-related frameworks with the exception of Scientific Technologies, where females accounted for 53% of starts in the 2019-21 cohort. Males dominated the Engineering (93% of starts), IT: Software Development (92%) and Civil Engineering (90%) frameworks in particular. Foundation Apprenticeships across the first three cohorts (2016-18 to 2018-20) are being delivered in at least 30 local authorities, with the most widespread provision for Engineering (22 local authorities) and Creative and Digital Media (20). Local authority data for the 2019-21 cohort was not available at the time of reporting.

2.41 In 2019/20 over 10,500 people registered for STEM Modern Apprenticeships (MA) in Scotland. Since 2016/17, STEM MA starts have grown faster than all MA starts (9% versus 6%). The STEM achievement rate stands at 77%, the same as the rate for all MAs. Construction: Building recorded the highest number of starts for STEM MAs in 2019/20, at just over 1,600, followed by Construction: Civil Engineering, Construction: Technical, Engineering, Automotive (each ranging from around 1,100 to 1,200 starts).

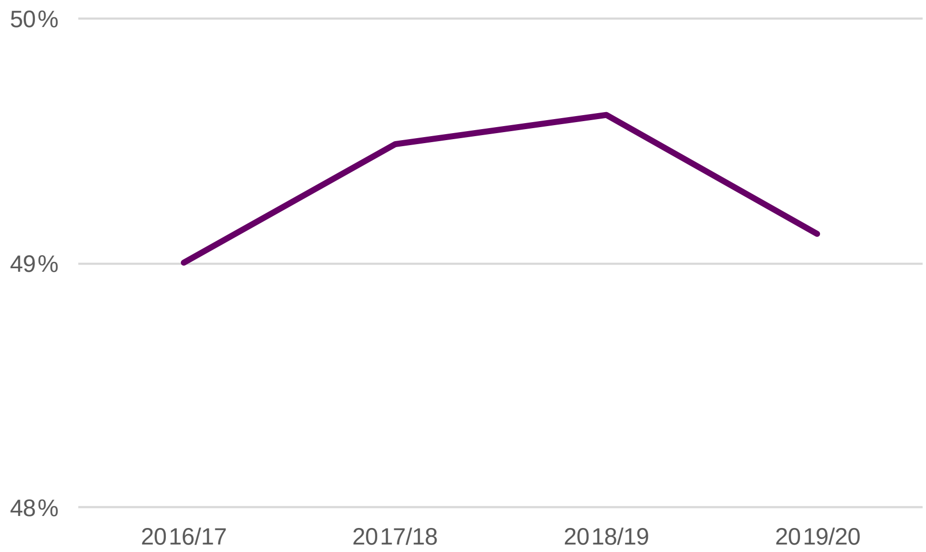
2.42 Males accounted for 94% of starts in STEM MAs, reflecting male dominance across most frameworks and the workforce (almost over 97% on the various construction frameworks). From the data available (i.e. not suppressed), only Creative and Digital Media had more female starts, however it is likely MAs such as Dental Nursing and Equine also had a higher number of female starts in 2019/20.

2.43 Graduate Apprenticeships (GAs) began in 2015/16, and in 2019/20 there were 1,160 starts. Nearly all of the current GA frameworks are in STEM related subjects.

University and Higher Education

2.44 In 2019/20 there were 127,950 enrolments in STEM-related subjects at Scottish universities. This accounted for 49% of total enrolments and the number has increased by 9,400 (8%) since 2016/17, with STEM's share of all enrolments remaining around 49% to 50% (see Figure 2.5).

Figure 2.5: University enrolments in STEM-related subjects as a share of total enrolments (2016/17-2019/20)



Source: SFC, 2021

2.45 For the academic year 2019/20, there have been changes in the definition for university subjects. For instance, Biological Sciences has become Biological and Sports Sciences, and Agriculture and Related Subjects is now Agriculture, Food and Related Studies. Three new overarching subject areas have also been established that relate to STEM: Psychology, Geographical and Environmental Studies (Natural Sciences), and General and Others in Sciences. Enrolments and qualifications for these new subjects were previously captured in the existing overarching subject areas presented in the last report. However, the changes mean enrolment and qualifications data for some overarching subject areas (i.e. Biological Sciences/Biological and Sports Sciences) cannot be directly compared between 2018/19 to 2019/20. The overall enrolment and qualifications figures are unaffected. See **Appendix 6** for the full definition of STEM subjects at university.

2.46 Taking this into consideration, subjects allied to Medicine had the highest number of STEM enrolments at 31,525 and a 25% share of total STEM enrolments.

2.47 Reflecting their overall status as the two largest universities in Scotland, the University of Edinburgh and University of Glasgow had the highest number of STEM enrolments in 2019/20 at 16,985 and 15,115, respectively. The STEM share of total enrolments was highest at Scotland's Rural College at 81%, reflecting its specialist nature. The biggest absolute increases in STEM enrolments from 2016/17 to 2019/20 were recorded at University of Edinburgh (+2,095), the University of Glasgow (+1,750) and the Open University (+1,725). At 10 of Scotland's 18 Higher Education Institutions, STEM growth outstripped overall growth in enrolments.

2.48 Across all STEM-related subjects 54% of enrolments were female. This is much lower than the 59% across all enrolments but it counters the trends in apprenticeship enrolments considered earlier in this chapter. Reflecting gender norms, women were more represented in subjects associated with care. They made up 84% of enrolments in Veterinary Science and 83% of enrolments in Subjects Allied to Medicine but just 22% in each of Engineering and Technology and Computing Science.

2.49 Overall, in 2019/20, just under 35,500 students qualified from Scottish Higher Education Institutions (HEIs) in STEM related subjects. This accounted for 47% of total qualifiers and the number has increased by almost 1,500 (4%) since 2016/17.

2.50 Over this period, the largest increase in absolute qualifiers has been in those studying Computing Science, an increase of over 800, while the largest proportional increase has been in Mathematical Sciences qualifiers, an increase of 35%. Apart from Biological Sciences/Biological and Sport Sciences, and Physical Sciences, where definitions have changed, there has been a decline in Architecture, Building and Planning qualifiers (down 8%).

3 The STEM Grants Programme Round Two

Introduction

3.1 This chapter examines the STEM Grants Programme in detail, with a summary of the programme and the 139 Round Two projects. It presents an analysis project funding and project delivery, including the number of sessions and hours delivered, as well as breakdowns by geography and sector.

Programme overview

3.2 The SGP was launched in October 2018 and continues to build the capacity and confidence of practitioners in its aim to support the implementation of the STEM Education and Training Strategy for Scotland[19]. Delivered by a range of partners to support practitioners across ELC, primary, ASN and secondary school, CLD, and school-based technical support staff, the focus is on the sciences, Numeracy and Mathematics, digital learning, engineering, and technologies. Round Two of the programme focused on regional and national partners and the projects funded were selected in response to the results of the 2018/19 Annual STEM Practitioner Survey[20] and the STEM Provider Survey 2017/18[21].

3.3 The key findings from the surveys which informed the project appraisal process and the projects funded included:

- Continued demand for a high standard of face-to-face learning and access to more online learning modes and resources;
- A demand for more localised learning and employer and college partnerships; and
- Greater opportunities for practitioners to work collegiately and collaboratively.

3.4 Projects funded by a STEM grant are eligible for Education Scotland Endorsement. A programme which has been endorsed by Education Scotland demonstrates that it is informed by the national model of professional learning and links effectively to the relevant professional standards and current policy context. These programmes are featured on the Education Scotland Professional Learning and Leadership website and are promoted through social media channels.

3.5 Round Two funded projects have been designed to: provide and improve opportunities for practitioners to upskill their STEM learning and teaching; build understanding to promote equity and equality through STEM learning, including access and provision; support development of effective professional learning models; create quality and responsive routes for a range of professional learning formats; increase opportunities to learn and share expertise and strong collaborative partnership working; enable effective engagement across all levels of delivery; and support the learning about STEM learner pathways.

3.6 The diversity of projects funded has enabled geographical coverage across almost all of the Scotland as well as a mix of themes throughout regions. This has allowed projects to be flexible and meet the needs of each local area.

3.7 A team of eight regional STEM Education Officers has been in place since January 2019, introduced midway through Phase One of the Round One projects. The team's work is aligned to the

[19] Education Scotland (2019) *Enhancing Professional Learning in STEM: Overview of grant funding 2018/19*

[20] https://education.gov.scot/media/g50hiodf/stem-professional-learning-survey-2018-19-findings-elc-primary-asn-and-secondary.pdf

[21] https://education.gov.scot/media/43uh34wd/providersurveyfindingsmay2019.pdf

work of the six Regional Improvement Collaboratives (RICs) and it plays a lead role in coordinating and leading the provision of STEM CLPL. Following a successful three-year pilot, the learning from the Improving Gender Balance Programme[22] was extended regionally to include an Improving Gender Balance & Equalities (IGBE) team of six officers whose role it is to lead and support this work in school, early learning and childcare settings.

Profile of Round Two projects

3.8 This section presents an overview of the 139 projects that have been and are being delivered in Round Two as part of the STEM Grants programme.

3.9 As part of the SGP, funding was split across two different funding streams in financial year 2019/20. The Leadership and Collegiate Professional Learning Fund was available to provide professional learning support to the practitioners within the key sectors. The Regional and National Partner Fund was open to organisations providing STEM professional learning at a regional and national level across key sectors.

3.10 Table 3.1 below shows the split of these funding streams across the successful projects. These figures were the same for Phase 1, whilst Phase 2 saw the Leader and Collegiate funding stream support 64% of projects, and 36% with Regional and National. This Phase 2 analysis is based on 101 projects overall. One project elected not to take up the funding and proceed with their project delivery, and so a total of 139 projects were progressed[23].

Table 3.1: Funding stream by successful projects

Funding stream	No.	%
Leadership and Collegiate	97	69%
Regional and National	43	31%
Total	**140**	**100%**

Source: Education Scotland (2021)

3.11 Original plans were to scope project content, engagement and targeting strategies between October 2019 to March 2020, and roll out professional learning activities from April 2020 onwards. Due to the COVID-19 pandemic and the subsequent lockdown and restrictions, many of the funded projects were put on hold and around 75% of projects had to rescope activities or change their delivery model.

3.12 The projects approved through the SGP in Round Two have reasonably good spread across most of the RIC areas, as Table 3.2 shows. In Phase 1, a large number of projects (32%) were delivered within the West Partnership, with nearly 70% of these being within schools. Over one-fifth (22%) of Phase 1 projects were delivered in the Northern Alliance and just under one-fifth (18%) in the South East Collaborative. The Tayside Collaborative and the National Offer account for the lowest number of projects across both Phases. There is a slightly higher proportion of projects in the South East Collaborative for Phase 2 than Phase 1 (+3 percentage points).

[22] https://education.gov.scot/improvement/learning-resources/improving-gender-balance-3-18

[23] Note: One project in North Ayrshire has been excluded as they received the award but chose not to progress with the project.

Table 3.2: Round Two projects by RIC area[24], for Phase 1 and 2

RIC area	Phase 1		Phase 2	
	No. projects	% of total projects	No. projects	% of total projects
West Partnership	44	32%	32	32%
Northern Alliance	30	22%	16	16%
South East Collaborative	25	18%	21	21%
South West Collaborative	16	12%	13	13%
Forth Valley and West Lothian Collaborative	11	8%	9	9%
National Offer	7	5%	5	5%
Tayside Collaborative	6	4%	5	5%
Total	**139**	**100%**	**101**	**100%**

Source: Education Scotland (2021)

3.13 Each project sought to deliver CLPL against one primary STEM theme; however, some projects cut across multiple themes. Across all the Round 2 grants, most projects had a strong focus on either STEM or Numeracy and Mathematics. The stronger focus on Numeracy and Mathematics within Round 2 of the SGP was made possible through additional funding from the Learning Directorate in the Scottish Government. Of the 56 Numeracy and Mathematics projects delivered in Phase 1, 36% were delivered in the West region and 32% in the South East region. Of the 40 STEM projects in Phase 1, 35% were delivered in the West region and 23% in North region. Around a quarter of Phase 1 projects have either a Digital theme (13%) or a Science theme (12%), whilst only 6% cover Technologies and Engineering. Across both Phases, only one project had Improving Gender Balance and Equalities as its primary theme (IGBE). It is however important to again acknowledge that multiple themes will be woven through or cross over in project delivery. Digital has been less prominent so far in Phase 2 than Phase 1 (-3 percentage points).

Table 3.3: Round Two projects by theme, for Phase 1 and 2

Main theme	Phase 1		Phase 2	
	No. projects	% of total projects	No. projects	% of total projects
Numeracy and Mathematics	56	40%	42	42%
STEM	40	29%	31	31%
Digital	18	13%	10	10%
Science	16	12%	13	13%
Technologies	4	3%	1	1%
Engineering	4	3%	3	3%
IGBE	1	1%	1	1%
Total	**139**	**100%**	**101**	**100%**

Source: Education Scotland (2021)

3.14 In both Phase 1 and 2, the majority of projects (65%) have been delivered in schools, with 33% of school project delivery within the West Partnership and 23% in the Northern Alliance. This is followed by cross sector delivery, covering a fifth of projects in Phase 1 and 2, of which 29% has been in the South West Collaborative and 25% each in the West Partnership and Northern Alliance. ELC was part of the delivery for just 10% of projects in Phase 1, particularly within the West Partnership and South East Collaborative. Just 4% of projects were within the CLD, ASN and Technicians sectors for Phase 1 and 2.

[24] Please note, figures have been rounded for reporting.

Table 3.4: Round Two projects by sector, for Phase 1 and 2

Sector	Phase 1		Phase 2	
	No. projects	% of total projects	No. projects	% of total projects
School	91	65%	66	65%
Cross sector	28	20%	20	20%
ELC	14	10%	11	11%
CLD	3	2%	2	2%
ASN	2	1%	2	2%
Technicians	1	1%	0	0%
Total	**139**	**100%**	**101**	**100%**

Source: Education Scotland (2021)

3.15 Over two thirds (70%) of the projects in both Phase 1 and 2 have been led by organisations in clusters and school settings and are the primary source of delivery for all RIC areas. However, on a national level, partner organisations have been the main delivery source, which covers 6 of the 7 national projects. For Phase 1 and 2, around one-fifth (19%) of projects have been led by local authorities, and just 3% by multi-authority/RIC areas, or universities.

Table 3.5: Round Two projects by organisation type

Organisation type	No.	%
Cluster/school/setting	97	70%
Local authority	26	19%
Partner organisation	11	8%
Multi Authority/RIC	3	2%
University	2	1%
Total	**139**	**100%**

Source: Education Scotland (2021)

Project funding analysis

3.16 The SGP was organised into two distinct phases, with a total of £2.46 million of funding awarded across the two funding streams to enhance professional learning and delivery in STEM. Overall, there were 140 projects awarded funding. The total funding offer across both streams was £1.38 million for Phase 1 in 2019/20, with a total underspend of just over £104,000. For Phase 2 this offer was slightly lower at £1.1 million, with a total anticipated funding underspend of just over £105,000. In both phases, underspend was mainly due to projects not being able to proceed, or proceed fully as planned, due to changing priorities locally or local capacity issues. For Phase 2 funding, the COVID-19 pandemic was a significant factor given the disruption to many professional learning activities scheduled for March 2020.

Table 3.6: Funding offer and underspend for Phase 1 and 2

Funding stream	Phase 1 offer 19/20	Actual project expenditure 19/20	Total underspend 19/20	Phase 2 offer 20/21	Anticipated project expenditure 20/21	Total anticipated underspend 20/21
Regional and National	£700,791	£593,285	£32,840	£652,908	£381,210	£58,596
Leadership and Collegiate	£675,229	£668,311	£71,504	£431,391	£594,312	£46,702
Total	**£1,376,020**	**£1,261,596**	**£104,344**	**£1,084,299**	**£975,522**	**£105,298**

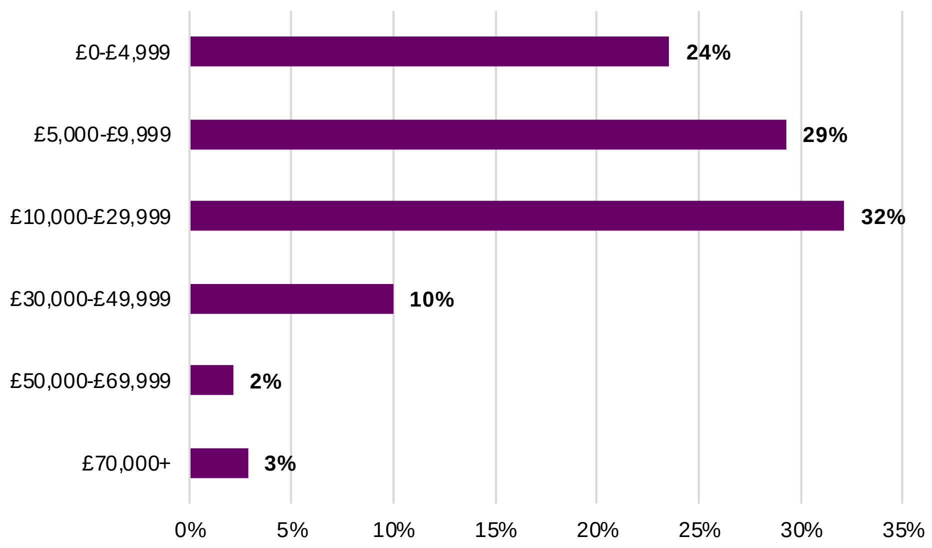
Source: Education Scotland (2021)

3.17 Whilst Table 3.6 above sets out allocated funding, project expenditure and the total underspend (actual and anticipated), the analysis presented in the following sections takes into account the levels of project expenditure (actual and anticipated) across Phase 1 and Phase 2 for the 139 projects, totalling £2.24 million across Round Two of the SGP.

3.18 Across the 139 projects, £1.26 million of funding was spent by organisations in Phase 1 in 2019/20 to support STEM professional learning. Approximately 73% projects progressed into a second phase of funding in the financial year 2020/21 with an anticipated spend of £976,000 to extend and further develop their projects in Phase 2.

3.19 Figure 3.1 shows the spread of total actual and anticipated expenditure combined for both Phase 1 and 2 across all projects. The average project expenditure was at just over £16,000, and the majority of projects (85%) spent up to £29,999. In Phase 1, the highest proportion of projects (42%) spent up to £4,999 and this increased to 61% of projects in Phase 2 anticipated expenditure.

Figure 3.1: Round Two projects by total expenditure size band



Source: Education Scotland (2021)

3.20 Table 3.7 below shows the breakdown of expenditure for the top ten highest funded projects, which accounts to 31% of expenditure overall on the programme. The project with the greatest actual and anticipated expenditure across both Phase 1 and 2 on the programme was delivered by e-Sgoil, Comhairle nan Eilean Siar, at £102,427 in total, to support their online STEM experience for primary school learners. Renfrewshire Council had the second highest amount of funding provided, 4% of overall funding at £96,062, to support a Modelling and Coaching Officer to build capacity in context.

3.21 All of the projects listed in Table 3.7 received additional funding for Phase 2, which likely attributed to the high level of overall expenditure. It is also worth noting that organisations such as Renfrewshire Council and South Lanarkshire Council had other projects with lower expenditure levels, in addition to that shown in Table 3.7, meaning they will have received a greater amount of funding and expenditure overall as an organisation. Winning Scotland Foundation has two projects which are both in the top ten projects with the highest expenditure, addressing maths and science themes (4% of overall expenditure).

3.22 For comparison, those with lowest project expenditure were around the region of £700-900. Alford Academy spent £702 to help provide deeper understanding of maths for those with visual impairments. The Community School of Auchterarder spent just under £800 to create a virtual reality in the classroom, and Neilson Primary School spent £840 to upskill staff. These projects were all delivered in Phase 1 only.

Table 3.7: Phase 1, Phase 2, and total expenditure across top ten projects with highest expenditure

Projects (lead)	Phase 1	Phase 2	Total	% of overall expenditure
e-Sgoil, Comhairle nan Eilean Siar	£51,213	£51,213	£102,427	5%
Renfrewshire Council	£36,472	£59,590	£96,062	4%
South Lanarkshire Council	£47,293	£46,070	£93,363	4%
The Highland Council	£36,135	£56,163	£92,298	4%
Argyll and Bute Council	£58,325	£6,800	£65,125	3%
The City of Edinburgh Council	£21,572	£40,622	£62,194	3%
Winning Scotland Foundation	£20,278	£30,315	£50,593	2%
Bo'ness Academy	£21,850	£26,600	£48,450	2%
Winning Scotland Foundation	£18,246	£27,892	£46,138	2%
Glasgow's Improvement Challenge	£22,867	£21,781	£44,648	2%
Total (top ten)	**£334,251**	**£367,047**	**£701,298**	**31%**
Remaining projects	*£927,345*	*£608,475*	*£1,535,820*	*69%*
Total (overall)	*£1,261,596*	*£975,522*	*£2,237,118*	*100%*

Source: Education Scotland (2021)

3.23 Table 3.8 shows the breakdown of expenditure across each RIC area for both Phase 1 and 2 of the programme. The West Partnership spent the highest amount (30%) which reflects the region having the greatest number of grant-funded projects (32%). South Lanarkshire had one of the highest expenditures in this area at £93,363, to deliver the Froebel Certificate in Childhood Practice to staff. The Northern Alliance also spent and was anticipated to spend a significant amount of funding, totalling just under £600,000 and 26% of overall project expenditure for the two phases. These two areas also had the greatest number of Phase 2 funding.

3.24 The South East Collaborative accounted for 17% of overall project expenditure. This included spending to support a project by the City of Edinburgh Council (£62,194 total expenditure) to enhance professional learning in Mathematics, and Fife Council (£35,011 total expenditure) in conceptional Numeracy.

Table 3.8: Phase 1, Phase 2, and total expenditure across each RIC area

RIC area	Phase 1	Phase 2	Total	% Total
West Partnership	£372,825	£304,314	£678,139	30%
Northern Alliance	£332,538	£239,235	£571,773	26%
South East Collaborative	£208,700	£160,704	£369,404	17%
Forth Valley and West Lothian Collaborative	£101,150	£102,255	£203,205	9%
South West Collaborative	£110,817	£68,456	£179,273	8%
National Offer	£91,326	£58,260	£149,586	7%
Tayside Collaborative	£43,240	£42,498	£85,738	4%
Total	**£1,261,596**	**£975,522**	**£2,237,118**	**100%**

Source: Education Scotland (2021)

3.25 Phase 1 and 2 expenditure, as well as overall expenditure across both phases, is shown across the different target sectors identified earlier in the chapter. For each of the sectors, a lower amount of funding was spent for Phase 2. Schools spent 64% of funding overall, as well as the most spend across both phases, totalling over £1.42 million. Projects crossing over multiple sectors spent nearly a quarter of overall funding in both Phase 1 (23%) and anticipated a similar figure in Phase 2 (18%). ELC also spent a reasonable amount of the budget, at 12%.

Table 3.9: Phase 1, Phase 2, and total expenditure across each target sector

Target sectors	Phase 1	Phase 2	Total	% Total
School	£777,293	£644,483	£1,421,776	64%
All (cross sector)	£286,474	£179,892	£466,366	21%
ELC	£145,733	£119,954	£265,687	12%
CLD	£34,383	£24,521	£58,904	3%
ASN	£12,913	£6,672	£20,585	1%
Technicians	£3,800	£0	£3,800	<1%
Total	**£1,261,596**	**£975,522**	**£2,237,118**	**100%**

Source: Education Scotland (2021)

3.26 As shown in Table 3.10, the 56 Numeracy and mathematics projects accounted for the largest amount of funding for Phase 1 and Phase 2, accounting for nearly half (47%) of overall project expenditure. As part of this, Highland Council spent £92,298 to provide training and support for numeracy progression. Projects covering STEM as a whole (40 projects) accounted for 31% of overall expenditure. Projects with their main theme as Digital accounted for 9% of overall project expenditure, with the UK Safer Internet Centre spending £30,470 as part of this to support practitioners in helping young people to be safe and empowered online. Only one project, delivered through East Ayrshire Council, has been categorised as IGBE with the primary aim of having 16 IGBE champions leading change within the Kilmarnock Education Group, working with 300 practitioners in total.

Table 3.10: Phase 1, Phase 2, and total expenditure across main themes

Main theme	Phase 1	Phase 2	Total	% Total
Numeracy/Mathematics	£561,155	£425,417	£1,017,572	47%
STEM	£399,287	£304,136	£703,423	31%
Digital	£131,642	£70,695	£202,337	9%
Science	£106,990	£89,052	£196,042	9%
Engineering	£31,931	£18,896	£50,827	2%
Technology	£18,324	£2,160	£20,484	1%
IGBE	£12,267	£4,166	£16,433	1%
Total	**£1,261,596**	**£975,522**	**£2,237,118**	**100%**

Source: Education Scotland (2021)

Project activity[25]

Round Two Phase 1

3.27 Ongoing monitoring of the Round Two Phase 1 projects has been undertaken to help build a picture of what has been delivered within projects and understand where the greatest impact may be. Due to COVID-19 restrictions affecting much of the project delivery and recording of progress made (i.e. number of practitioners), this section will underpin project activity based on data accumulated through 58 out of the 139 projects (42% of total projects).

3.28 From the projects that have reported their activity, the Leader and Collegiate funding stream represents 66% of these (38 projects) and the Regional and National funding stream represents 34% (20 projects). This aligns with the greater number of projects delivered by clusters, schools or settings and higher level of engagement in schools, as highlighted earlier on in the chapter.

3.29 Of the 58 projects monitored, there were just over 10,000 attendees in 588 STEM professional learning sessions, totalling nearly 44,000 hours. Table 3.11 shows the total number of attendees, sessions, and hours against the two funds. The Regional and National fund has had a greater number of hours (82%) and attendees (68%), albeit a lower number of sessions. The greater level of reach that

[25] Please note data included in this section contains predicted numbers for Phase 2, as actual information was not available at the time of reporting.

the projects on this stream has achieved is most likely due to larger potential practitioner audiences, rather than the smaller number of practitioners at school or cluster level that may be participating in professional learning support at a more local level.

Table 3.11: Phase 1 actual project delivery against funding streams

Funding stream	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
Leadership and Collegiate	3,177	32%	336	57%	7,819	18%
Regional and National	6,844	68%	252	43%	36,140	82%
Total	**10,021**	**100%**	**588**	**100%**	**43,959**	**100%**

Source: Education Scotland (2021)

3.30 There were some key projects in Phase 1 that delivered high levels of activity. The largest project in terms of overall activity was delivered by the Scottish Borders Council in the South East Collaborative, involving an immersive professional learning experience to promote consistent and positive attitudes to Numeracy and Mathematics. It was awarded a total of £30,900 over both phases from the Regional and National funding stream, providing 28 sessions with 1,863 attendees over 14,826 hours.

3.31 Awarded funding through the same stream, Glasgow City Council followed with the second highest activity levels. The project sought to develop local sustainable professional development opportunities in Mathematics and Numeracy in the West Partnership. It received £24,000 funding and provided 15 sessions with 1,559 attendees over 12,291 hours.

3.32 The Inverclyde Attainment Challenge Team's Digital project also delivered the greatest number of sessions at 36, accounting for 6% of total sessions delivered. The project was part of the Regional and National funding stream and was awarded £4,853 overall for practitioners to develop and deliver authority-wide professional learning on Microbits.

3.33 Table 3.12 shows the number of attendees, sessions, and hours by RIC area. Half of the Phase 1 attendees were from the West Partnership, and as a collective this had the largest number of sessions (42%) and hours (49%). The South East Collaborative also had a high number of hours delivered in projects for Phase 1, at just over 16,500 hours (38%) along with around a quarter of total attendees and sessions. These align with the previous discussed projects with high activity.

Table 3.12: Phase 1 attendees, sessions and hours by RIC area

RIC area	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
West Partnership	5,006	50%	249	42%	21,557	49%
South East Collaborative	2,508	25%	103	23%	16,501	38%
Northern Alliance	1,052	10%	135	18%	3,429	8%
National Offer	952	10%	53	9%	1,566	4%
Forth Valley and West Lothian Collaborative	338	3%	28	5%	591	1%
Tayside Collaborative	124	1%	12	2%	193	0.4%
South West Collaborative	41	0.4%	8	1%	122	0.3%
Total	**10,021**	**100%**	**588**	**100%**	**43,959**	**100%**

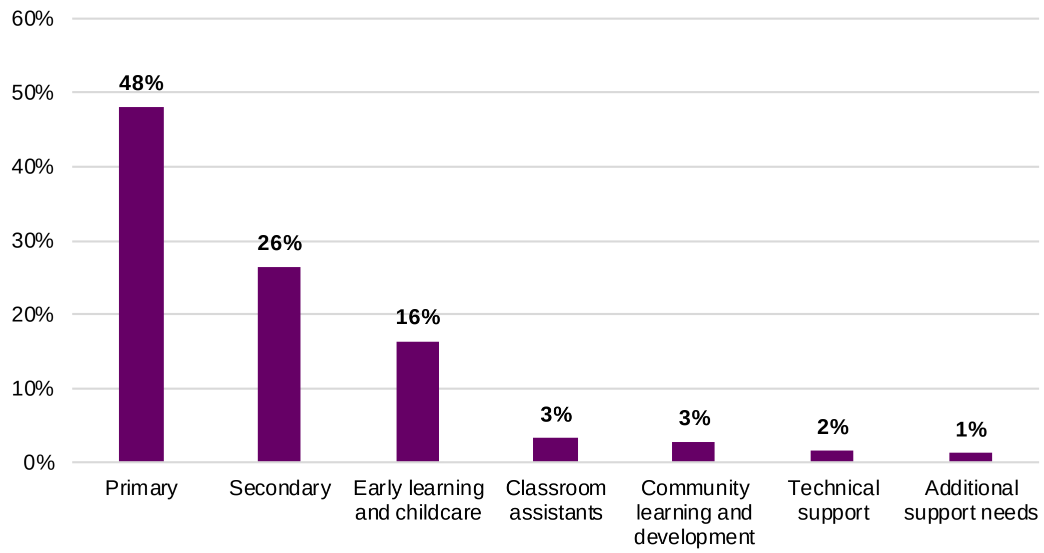
Source: Education Scotland (2021)

3.34 As displayed in Figure 3.2, a significant proportion of attendees were from the Primary school sector (48%), a slight increase from the previous year. Secondary school (26%) and early learning and childcare (16%) were the next most common sectors based on number of attendees. There were fewer attendees across classroom assistants, community learning and development, technical support, additional support needs and college/further education, with between 15 and 325 attendees.

3.35 Schools also had the highest number of sessions delivered at nearly 70% (405 sessions) and hours at 54% (23,871 hours). This was followed by cross sector delivery at 22% (130 sessions) and

33% (14,711 hours). Collectively, ELC, CLD, ADS and school-based technicians delivered around 9% (53) of sessions and 13% (5,377) of hours.

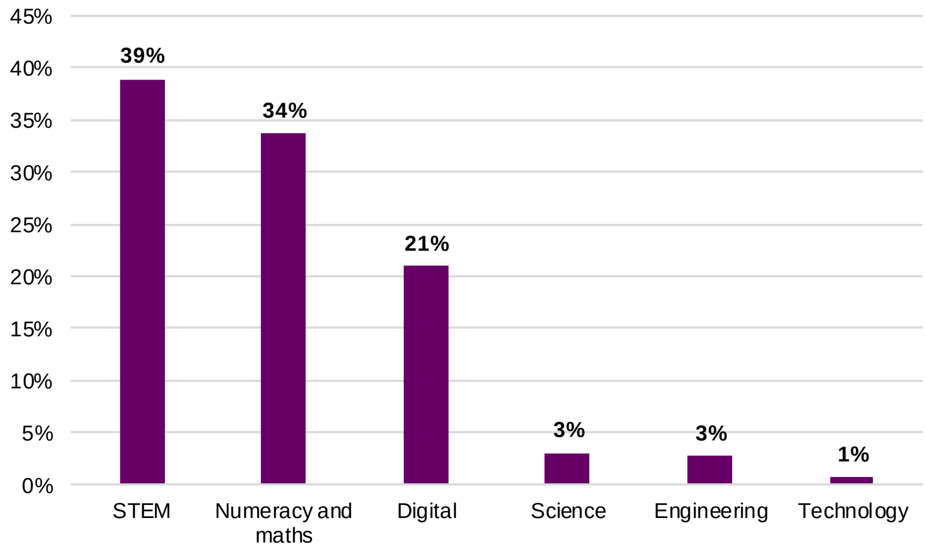
Figure 3.2: Number of attendees across education sectors



Source: Education Scotland (2021)

3.36 39%, or 229, of sessions delivered, as shown in Figure 3.3 were within a project with a STEM theme. Just over a third of sessions were delivered by projects leading on Numeracy and Maths (34%; 198 sessions), with Digital projects accounting for around a fifth (21%; 123 sessions). Science, Engineering and Technology led projects delivered fewer sessions accounting for 7% (38) of sessions.

Figure 3.3: Project themes and number of sessions



Source: Education Scotland (2021)

3.37 Available data on where the sessions were delivered across local authorities indicates that Glasgow accounts for the highest proportion at 16% (up four percentage points from last year) with 2,852 attendees. This was followed by the national delivery which accounted for 13% and 1,203 attendees, likely to be associated with online sessions. Aberdeenshire (11%), Argyll and Bute (8%), Scottish Borders (8%) and Inverclyde (8%) followed thereafter. This reflects a broader distribution of session delivery compared to the previous year which was mostly in and around the more densely populated cities.

Table 3.13: Geographical spread of STEM learning sessions

Local authority	No.	%
Glasgow	119	20%
Aberdeenshire	63	11%
Argyll and Bute	47	8%
Scottish Borders	47	8%
Inverclyde	45	8%
Midlothian	37	6%
South Lanarkshire	27	5%
North Lanarkshire	22	4%
Edinburgh City	19	3%
East Renfrewshire	17	3%
Clackmannanshire	15	3%
Falkirk	13	2%
East Dunbartonshire	12	2%
Moray	11	2%
Dumfries & Galloway	8	1%
Na h-Eileanan Siar	5	1%
Highland	2	<1%
Renfrewshire	1	<1%
West Dunbartonshire	1	<1%
National	*77*	*13%*
Total	**588**	**100%**

Source: Education Scotland Data (2021)

Round Two Phase 2

3.38 Whilst Phase 1 had reduced monitoring of project activity, no activity has yet been collated for Round Two Phase 2 activities for similar reasons. Many projects have been unable to deliver their projects or had to alter or delay projects. Priorities have also changed over the past year meaning tracking of project activity possibly not being carried out as planned. The following section looks at the anticipated project activity for Phase 2, based on data collected from 139 initial project applications.

3.39 The available data shows that around 17,200 practitioners and 525 schools or centres were expected to be engaged in the projects. Table 3.14 shows the total number of practitioners and schools and centres against the two funding streams. The Leadership and Collegiate fund has reached a greater number of schools and centres (66%), whilst the Regional and National fund has engaged a greater number of practitioners (62%).

Table 3.14: Phase 2 anticipated project delivery against funding streams

Funding stream	Anticipated No. Practitioners	%	Anticipated No. Schools/Centres	%
Regional and National	10,742	62%	176	34%
Leadership and Collegiate	6,491	38%	349	66%
Total	**17,233**	**100%**	**525**	**100%**

Source: Education Scotland (2020)

3.40 The South Ayrshire Council cross sectoral project seeking to provide immersive citizen science professional learning with P5 practitioners and learners was expected to have the higher number of engagements with practitioners. This was 1,366 practitioners, at 8% of total expected engagement in Phase 2, across 2 schools. The project was awarded a total of £31,220 of funding through the Regional and National fund and 40% of the funding was due to support this second phase.

3.41 With the greatest number of anticipated establishments for Phase 2, the Glasgow's Improvement Challenge planned to reach 80 schools/centres, at 15% of the total number expected. It also sought to engage 400 practitioners, compared to the 282 actual practitioners engaged with in Phase

1. The project aimed to build capacity through a network of practitioners to design dynamic learning spaces and experiences to develop STEM literate citizens. The project was awarded £44,648 of funding, with nearly equal amounts for both Phases.

3.42 Table 3.15 shows the anticipated number of practitioners and schools and centres engaged in projects by RIC area. The South East Collaborative was to have one of the larger numbers of practitioners engaged, at 28% of the total, and 61% of these were part of the Leadership and Collegiate funding stream. This was followed by the South West Collaborative (22%) and the West Partnership (21%). The West Partnership was expected to have the greatest number of engagements with schools and centres (41%), and almost a quarter were to be in the Northern Alliance. This lines up with the projects discussed in the South and West that had the highest expected numbers overall for Phase 2.

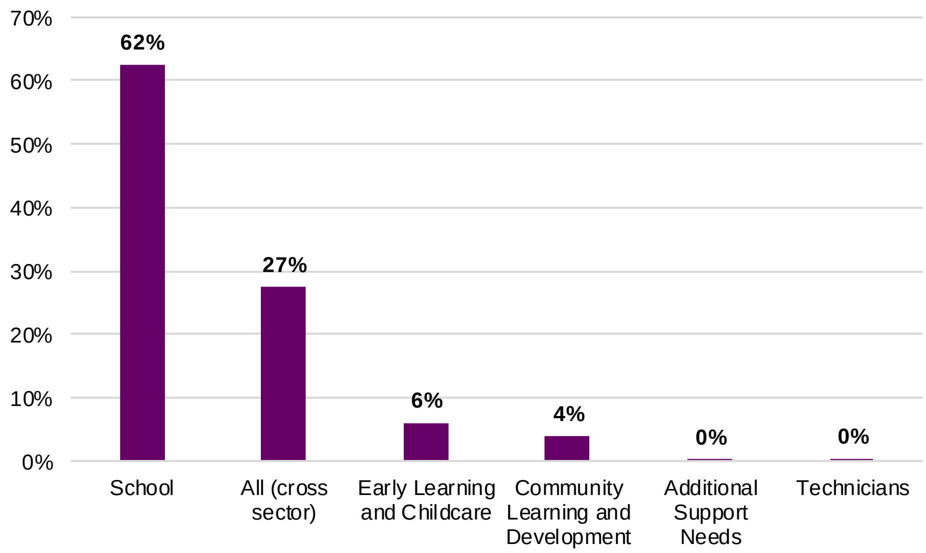
Table 3.15: Phase 2 anticipated practitioners and schools/centres by RIC area

RIC area	Anticipated No. Practitioners	%	Anticipated No. Schools/Centres	%
South East Collaborative	4,837	28%	73	14%
South West Collaborative	3,709	22%	39	7%
West Partnership	3,642	21%	216	41%
National Offer	2,120	12%	11	2%
Northern Alliance	1,511	9%	121	23%
Forth Valley and West Lothian Collaborative	1,186	7%	39	7%
Tayside Collaborative	228	1%	26	%
Total	**17,233**	**100%**	**525**	**100%**

Source: Education Scotland (2020)

3.43 The majority of practitioners were anticipated to be engaged from schools (62%) and more than a quarter (27%) of cross-sectoral practitioners (see Figure 3.4). Far fewer practitioners were predicted for ELC (6%) and CLD (4%). Just 75 practitioners were anticipated for ASN and technicians. Schools were also anticipated to have highest number of establishments at 344 (66%), followed by early learning and childcare at 90 establishments (17%) and cross sectoral at 80 establishments (15%). Just 11 establishments were anticipated for the remaining sectors.

Figure 3.4: Anticipated number of practitioners engaged: proportions by education sector

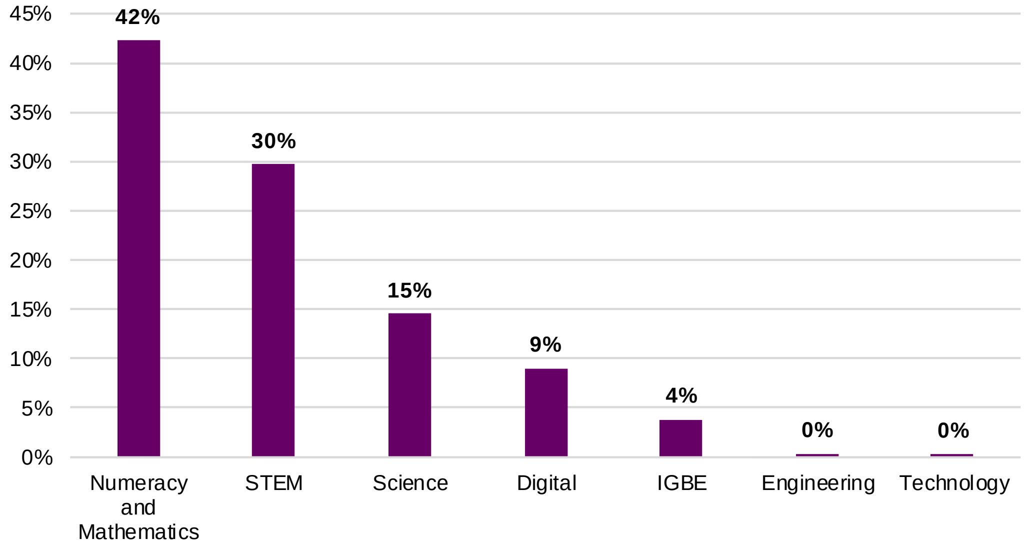


Source: Education Scotland (2020)

3.44 Similar to Phase 1, albeit slightly lower, Numeracy and Mathematics was anticipated to engage the highest number of practitioners, accounting for 42% (or 7,279 practitioners). Around a third (30%)

of practitioners were expected to engage with STEM as a whole, and 15% with Science. Unlike Phase 1, 664 practitioners (4%) were expected to engage in IGBE.

Figure 3.5: Anticipated number of practitioners engaged: proportion by key STEM theme



Source: Education Scotland (2020)

3.45 Available data on where the STEM learning establishments were anticipated to be delivered across 29 local authorities shows that these were to be well spread throughout Scotland. As Table 3.16 shows, South Lanarkshire would have accounted for the highest proportion at 17% (88 establishments). Seventy-seven percent of these were from the Regional and National funding stream. This was followed by Glasgow, accounting for 12% and 64 establishments, with nearly all of these from the Leadership and Collegiate fund.

Table 3.16: Anticipated geographical spread of STEM learning establishments

Local authority	No.	%	Local authority	No.	%
South Lanarkshire	88	17%	South Ayrshire	14	3%
Glasgow	64	12%	Fife	10	2%
Aberdeenshire	27	5%	North Ayrshire	9	2%
Falkirk	26	5%	North Lanarkshire	8	2%
Na h-Eileanan Siar	26	5%	East Lothian	7	1%
Highland	23	4%	Stirling	6	1%
East Renfrewshire	22	4%	Argyll and Bute	4	1%
Orkney Islands	22	4%	East Dunbartonshire	4	1%
Scottish Borders	21	4%	Angus	3	1%
Inverclyde	20	4%	Clackmannanshire	3	1%
Moray	19	4%	West Dunbartonshire	3	2%
Perth and Kinross	19	4%	Renfrewshire	2	<1%
Midlothian	18	4%	West Lothian	2	<1%
Edinburgh City	17	3%	East Ayrshire	1	<1%
Dumfries & Galloway	15	3%	*National*	*22*	*4%*
			Total	**525**	**100%**

Source: Education Scotland Data (2020)

Summary

3.46 Round Two of the SGP saw a range of projects developed around professional learning in STEM and delivery across 30 local authorities in Scotland between 2019/20 and 2020/21. Most of these projects are funded through the Leadership and Collegiate funding stream, with others through the Regional and National funding stream.

3.47 Projects are delivered across all RIC areas, with over half spread through the West Partnership and the Northern Alliance. Around 40% of projects focus on Numeracy and Mathematics in their professional learning, and 65% deliver through schools. Over 58 reporting projects in Phase 1 with each, on average, reaching 173 practitioners, over 10 sessions and providing 758 cumulative hours of professional learning. Each Phase 2 grant project is expected to deliver professional learning to 124 practitioners in 4 establishments, on average.

3.48 Around one-third of projects (32%) have an actual or anticipated spend of between £10,000 to £29,000. The average spend for Phase 1 was £9,100 and the average anticipated spend for Phase 2 is just over £7,000.

3.49 Despite COVID-19 severely affecting delivery for Phase 2, STEM professional learning is reaching practitioners across the whole of Scotland. The anticipated reach is greater in Phase 2, reflecting a greater volume of online learning on offer, engaging practitioners regardless of location.

4 Programme benefits, challenges, and impacts

Introduction

4.1 This chapter draws on the findings from the online surveys with practitioners (237 responses) and end beneficiaries (210 responses) and draws from a sample of consulted projects and reports on the programme's benefits, challenges and impacts thematically following the STEM Strategy's key aims of **Excellence, Equity, Inspiration and Connection**.

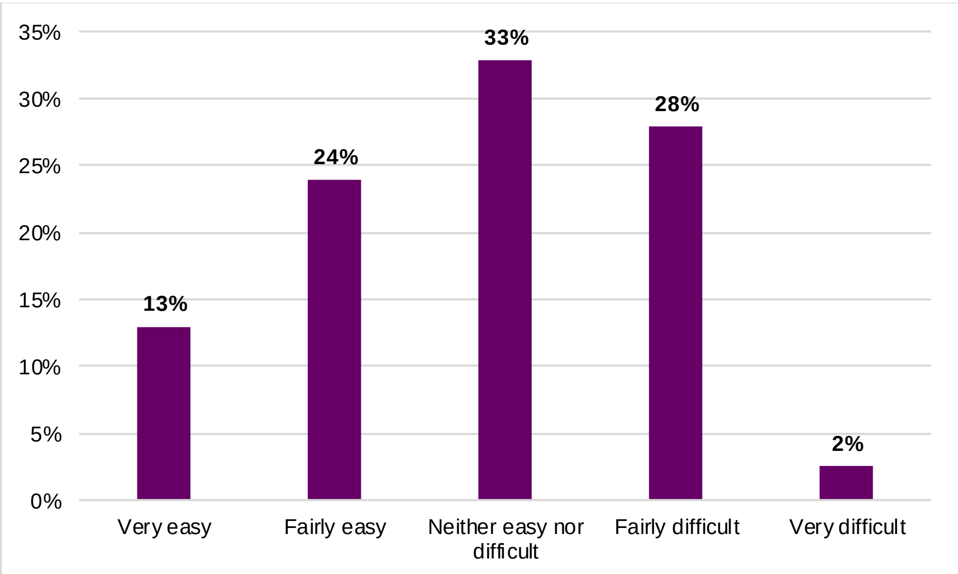
4.2 Where possible, and where there are differences to be highlighted, the chapter compares 2021 survey data from practitioners and learners with those from 2020. In several areas, this points to positive progression from the last programme to this one, despite the challenges presented by the COVID-19 pandemic. There is evidence that recommendations from the last evaluation report are being implemented and, in many instances, the latest programme has built on the first, with growing awareness, skills and attainment in STEM across practitioners and learners.

Improving access to STEM professional learning

Prior professional learning

4.3 As with the findings from the last evaluation report, prior to undertaking the STEM professional learning supported by Education Scotland, many STEM practitioners found it difficult to access professional learning, although the proportion was lower in the 2021 survey compared to 2020. In all, 30% of respondents reported difficulty in accessing CLPL (which compares to 40% of 182 survey responses the year previously), positively suggesting that the overall availability of CLPL has increased despite the COVID pandemic.

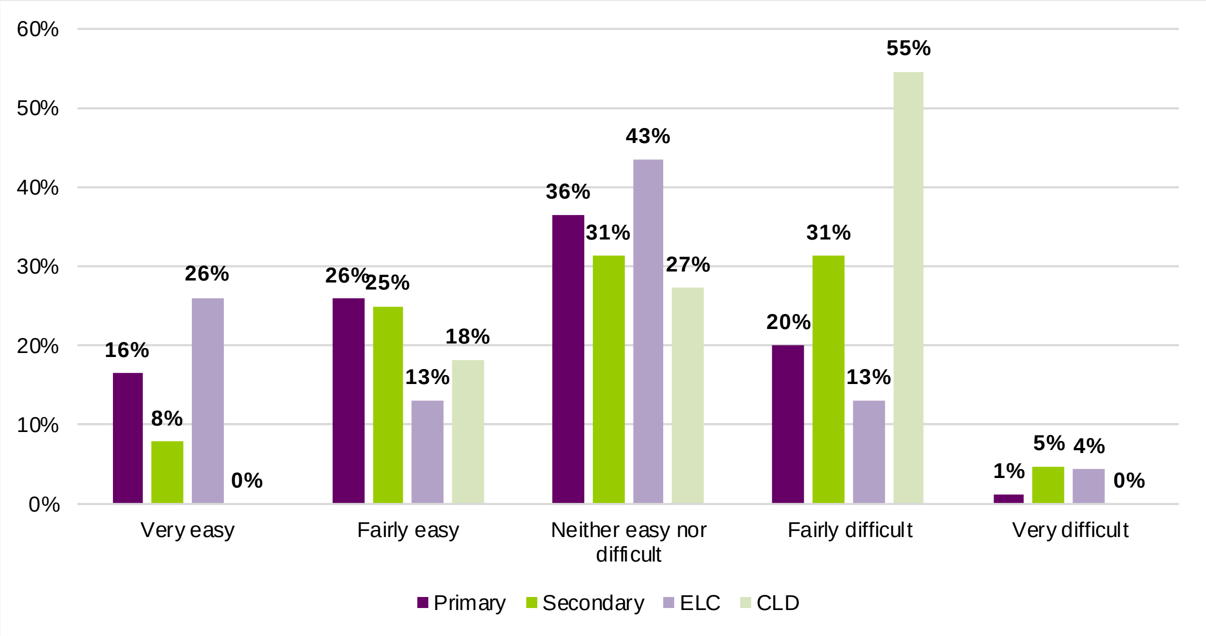
Figure 4.1: Ease of access to STEM professional learning prior to Education Scotland-supported training



Source: ekosgen Survey Data (2021), N=203

4.4 Considering access to professional learning by sector, those in the CLD sector found it most difficult to access STEM CLPL (55% found it fairly difficult) showing still more can be done to connect this sector with STEM professional learning. This was followed by those in the secondary education sector with more than a third (36%) reported that it had been difficult to access STEM CLPL prior to this current STEM CLPL round.

Figure 4.2: Ease of access to STEM professional learning prior to Education Scotland-supported training, by sector



Source: ekosgen Survey Data (2021), N=190

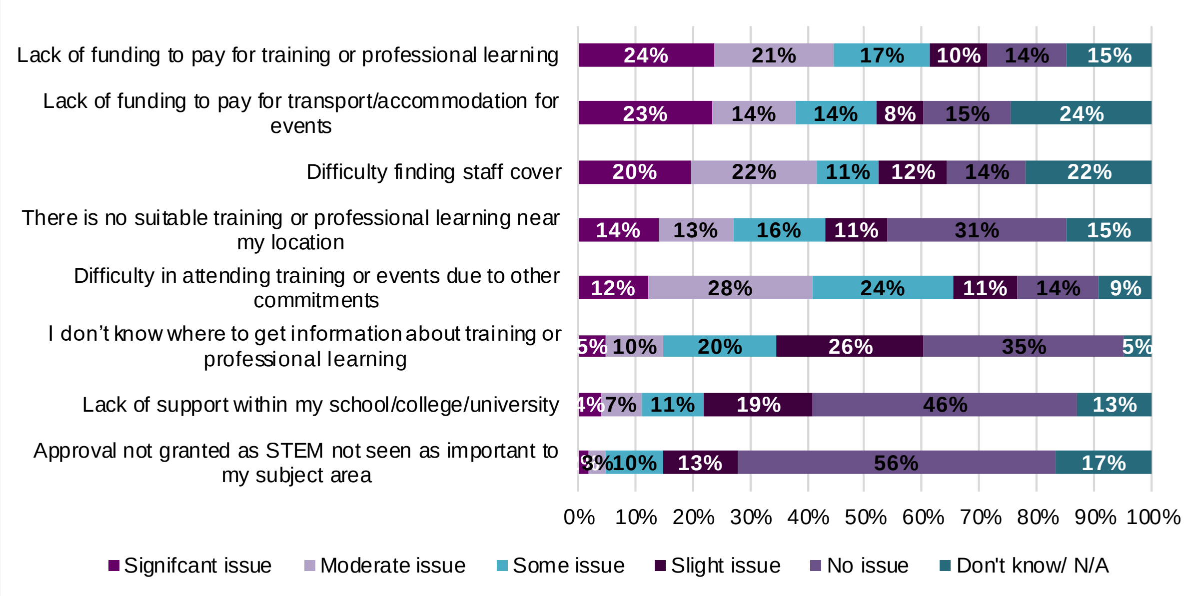
4.5 Finding staff cover remains a barrier to accessing STEM CLPL, with 43% identifying this as a barrier (significant or moderate issue). The consultations indicate that this is particularly acute in rural areas where there is shortage of cover and lower availability of supply teachers.

> *"We find it extremely difficult to release staff for training [including STEM CLPL] given that there just is not the cover the staff, including for technicians. I don't think this is unique to Argyll and Bute and that other rural areas in particular find this to be the case too".*

4.6 Four in 10 also said other work commitments was a barrier, similar to the 2020 survey.

4.7 Funding difficulties remain the largest barrier to accessing STEM CLPL (as was the case in 2020). Lack of funding to pay for transport/accommodation for events was reported as a barrier (by 38%, similar to 39% in 2020), despite the fact that a lot of event activity could not take place, or moved online, as a result of COVID-19. Encouragingly, a smaller proportion found 'not knowing where to get information about training or professional learning' as a barrier to access, down to 15% from 21% in the 2020).

Figure 4.3: Barriers to accessing prior STEM professional development



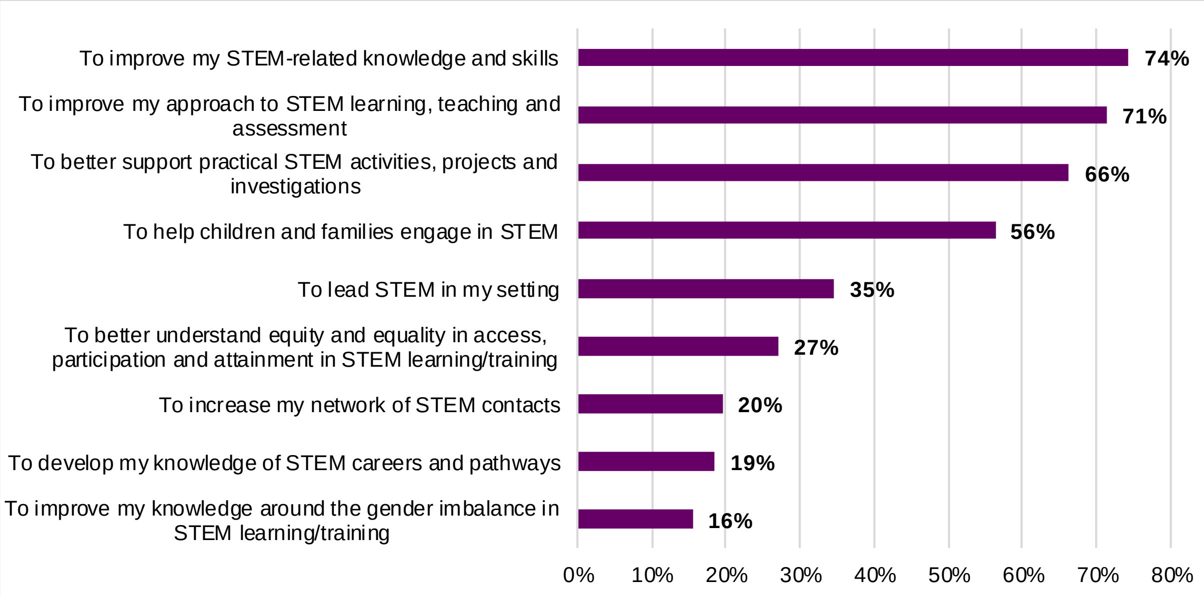
Source: ekosgen Survey Data (2021), N=202

4.8 Frequency of training tended to be once or twice a year at most (35% of respondents), or every few months (19%). Those saying never in the 2021 survey was 16%, down from 27% in 2020. A slight increase (14%, up from 12%) accessed training every few weeks or more, so that the general picture is of increased take up of STEM training in the last year.

Motivation

4.9 Improving capability, skills and expertise remain the major drivers for undertaking the Education Scotland-supported STEM CLPL. Almost three in four (74%) reported that their motivation was to improve their STEM-related knowledge and skills (up from 67% in 2020). Improving approaches to learning, teaching, and assessment (71%) and the ability to support practical STEM activities (66%) were also important.

Figure 4.4: Motivations for engaging with Education Scotland-supported STEM professional learning



Source: ekosgen Survey Data (2021), N=199

4.10 Compared to last year, a greater proportion were motivated by helping children and families engage in STEM (56%, up from 50%) and this is not explained by slight variations in the respondents by sector. Encouragingly, there was also a marked increase in those motivated "To better understand equity and equality in access, participation, and attainment in STEM learning/training", 27%, up from 19% in 2020.

4.11 By sector, secondary school practitioners were more motivated (12%) by leading STEM in their setting (12%) than other sectors (7% or lower) and by increasing their network of STEM contacts (8%) than other sectors. The ELC group were least motivated by improving their approach to STEM learning, teaching, and assessment (14% vs 18-21% for others).

Prior skills and capabilities

4.12 The greatest self-assessed abilities prior to STEM CLPL, taken across the sectors, were in 'leaning, teaching and assessment', with an average score of 3.2 out of 5, 'teamwork and collaborating with peers to share practice and learn with each other', 3.2 out of 5 and in 'creating engaging and motivating learning experiences for learner', also 3.2 out of 5. These were followed by 'developing learners' skills in a progressive way', 3.1 out of 5 and 'improving learner attainment and outcomes', also 3.1 out 5.

4.13 At the other end of the scale, self-assessed abilities were lowest in 'Leading STEM in your settings', 2.5 out of 5 and in 'engaging parents, families and communities', also 2.5 out 5. Relatively low scores were also for adaptability and innovation in approaches to teaching STEM (2.7 out of 5) and bringing knowledge of STEM careers and pathways into learning (2.7 out of 5).

Table 4.1: Skills, knowledge and practice prior to STEM CLPL learning

	Average Score – out of 5 (5 = very good)				
	All	**Primary**	**Secondary**	**ELC**	**CLD**
Learning, teaching and assessment	3.2	3.3	3.2	2.7	3.6
Teamwork and collaboration with peers to share practice and learn with each other	3.2	3.3	3.3	2.5	3.5
Creating engaging and motivating learning experiences for learners	3.2	3.3	3.2	3.1	3.6
Developing learners' skills in a progressive way	3.1	3.2	3.1	3.0	3.6
Improving learner attainment and outcomes	3.1	3.2	3.3	2.5	4.0
Knowledge and access to resources and support	3.0	3.0	3.1	2.7	3.0
Critical thinking and problem-solving to overcome STEM teaching challenges	3.0	3.1	3.1	2.8	3.0
Supporting practical enquiry, investigative work and STEM projects	2.8	3.0	2.7	2.8	2.5
Improving progression in learning across transitions and sectors	2.8	2.9	2.8	2.5	3.5
Adaptability and innovation in approaches to teaching STEM	2.7	2.9	2.8	2.5	2.6
Bring knowledge of STEM careers and pathways into learning	2.7	2.8	2.8	2.2	2.5
Leading STEM in your settings	2.5	2.4	2.7	2.7	1.7
Engaging parents, families and communities	2.5	2.5	2.3	2.5	3.4

Source: ekosgen Survey Data (2021), N=184

4.14 There were considerable differences in self-assessed learning by sector. ELC practitioners assessed their prior abilities to be lower than for the other sectors in almost all categories, with the exception of engaging parents, families and communities (in line with the average, but still low at 2.5 out 5) and Leading STEM in your settings (above average, but again still low at 2.7).

4.15 CLD practitioners, by contrast, typically self-assessed their prior abilities to be above average in most categories, highest in improving learner attainment and outcomes (4.0 out of 5). However, the

CLD sector practitioners rated their ability to Lead STEM in their settings as particularly low, at just 1.7 out of 5. Secondary and primary school practitioners self-assessed their abilities closer to the 'all' sector averages.

4.16 There is some evidence that the starting point for STEM learning was higher in 2021 than in 2020. For example, 42% for example rated their prior learning, teaching and assessment abilities as good or very good, compared to 40% in 2020. Improving learner attainment and outcomes, similarly, increased from 38% to 40% for self-assessment as good or very good. Collaborating with peers increased from 33% in 2020 to 37% in 2021. The trend is not universally true, however, with a fall in prior confidence for example with respect to engaging, parents and families (falling from 22% to 13%) and Leading STEM in your settings (falling from 31% to 23%).

4.17 Before CLPL learning, *confidence* was lowest in strategies to close equity gaps in participation and attainment, and this applied across all sectors, especially for ELC, CLD and primary schools practitioners (with the self-assessment much higher for secondary school practitioners). This is an important finding with respect Education Scotland's overall drive to close equity gaps.

4.18 By sector, prior confidence in delivering 'excellent, high quality STEM learning' was lowest in the ELC sector, and by a considerable distance, rated at just 1.8 out of 5 (the lowest confidence rating of all categories and sectors). Prior confidence for all categories was highest amongst secondary school practitioners. Lead Grantees consulted reflected on variations within sectors, for example in relation to digital literacy, younger practitioners were typically more confident prior to learning and easier to engage.

Table 4.2: Confidence in delivering STEM learning prior to STEM CLPL learning

	Average Score – out of 5 (5 = very good)				
	All	**Primary**	**Secondary**	**ELC**	**CLD**
Confidence in inspiring young people to develop STEM skills	2.9	3.0	4.1	2.7	2.8
Confidence promoting awareness of STEM learning	2.9	2.9	4.1	2.7	3.1
Confidence delivering excellent, high quality STEM learning	2.8	2.8	3.9	1.8	3.0
Confidence promoting awareness of STEM career pathways	2.5	2.6	3.5	2.3	2.3
Confidence in strategies to close equity gaps in participation in STEM	2.4	2.5	3.4	2.4	2.5
Confidence in strategies to close equity gaps in attainment in STEM	2.4	2.5	3.3	2.4	2.5

Source: ekosgen Survey Data (2021), N=183

4.19 The key summary points in relation to access to STEM CLPL learning and motivation for take up are:

- A lower proportion in 2021 reported difficulty in accessing CLPL training than the previous year – 30%, down from 40%. This is positive. It is the CLD sector that still finds access most difficult;
- Finding staff cover remains a significant barrier to accessing STEM CLPL (43%) – particularly acute (and a real problem) in rural areas;
- A smaller proportion in 2021 found it difficult 'not knowing where to get information about training and professional learning', another positive finding, down to 15% from 21% the previous year;
- Fewer reported 'never' accessing CLPL training than the year before, and more report very regular uptake, although for the largest proportion access is once or twice a year;

- Improving STEM-related knowledge and skills remains the main motivation for accessing STEM CLPL, but 2021 saw an increase in motivation to help children and families and – positively - to understand equity and equality issues; and
- Before CLPL learning, confidence was lowest in strategies to close equity gaps in participation and attainment, and this applied across all sectors.

Excellence

We will promote **Excellence** by:

- Improving the supply of STEM talent into the profession
- **Improving STEM learning and teaching, and delivering enhanced professional learning**
- Prioritising STEM in the expansion of apprenticeships
- Maintaining our research excellence in our universities

4.20 The STEM Round Two projects have extended the promotion of Excellence. The greater volume of activity has led to an increase in STEM learning and teaching and increase in delivering enhanced professional learning.

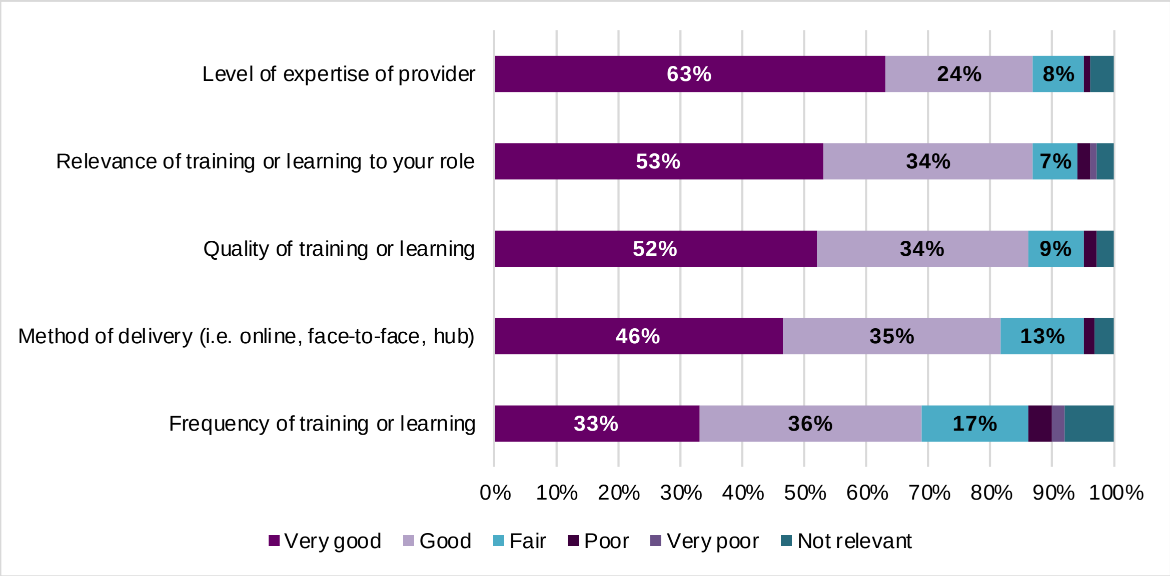
4.21 Practitioners rated the level of expertise of the STEM CLPL provider highly, with almost two thirds (63%) rating this very good (close to the 67% in 2020). Almost nine in 10 also rated the relevance of training to their role as good or very good (87%, up from 83% in 2020) and the quality as good or very good (86%, up from 85% in 2020).

4.22 The practitioners' views represent very positive feedback. The 2020 evaluation reported that the STEM CLPL grants had improved the quality of learning materials (including new content) and there is evidence that this has continued in Round Two. Lead Grantees of Round Two projects report an increase again in the quality and preparation of online resources (video lessons, video voiceovers in terms of content) as well as a huge increase in the use of online for the STEM CLPL delivery itself (online tutorials etc.).

4.23 Lead Grantees frequently comment on the benefits of the SGP in giving them time out of the classroom (for those in schools) for planning and delivering STEM CLPL. This undoubtedly helps to increase the quality of the STEM CLPL provision.

4.24 Lower ratings applied to the method of delivery where almost one in five (19%) rated this as no more than fair, and for frequency (31% rated this no higher than fair). The former will have undoubtedly been a result of the move to learning online as a result of COVID-19 pandemic (in 2020 just 10% rated this as no more than fair), although the fact that 81% still rated the delivery method as good or very good suggests the vast majority were happy with learning delivered online. Some Lead Grantees, however, commented that online training delivery is less effective where the practitioners are not confident at the outset (i.e. a face-to-face approach can be more beneficial for the least confident).

Figure 4.5: Rating of STEM CLPL



Source: ekosgen Survey Data (2021), N=178

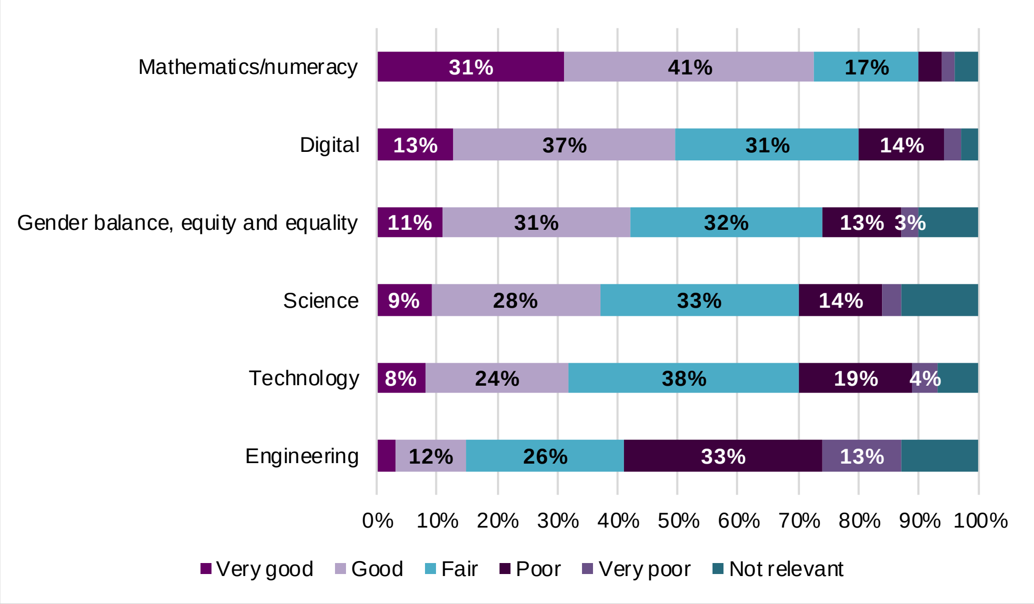
4.25 The following two charts (4.6 and 4.7) show practitioner self-assessment before and after engagement with their STEM CLPL learning. Across all elements there has been an increase in self-assessed skills. Those rating their skills as very good have:

- Increased in Maths from 31% saying their skills were very good prior to learning to 41% after learning;
- Increased in Digital from 13% saying very good to 28%;
- Increased in Technology from 8% to 22% saying very good;
- Increased in Science from 9% to 15%; and
- Increased in Engineering from 3% to 12%.

4.26 These are all positive findings and the benefits of the CLPL learning for practitioners was echoed by Lead Grantees consulted (for a wide range of practitioners, not just teachers, but technicians, ELC and CLD). The findings are particularly impressive for Digital and for Technology – for Digital 28% saying very good after CLPL learning in 2021 compares to 16% after learning in 2020; for Technology 22% compares to 11% in 2020. For Digital in particular, the emphasis (and need) for practitioners to have good Digital skills during COVID-19 lockdowns/blended learning has been very high (which has driven increases in capability).

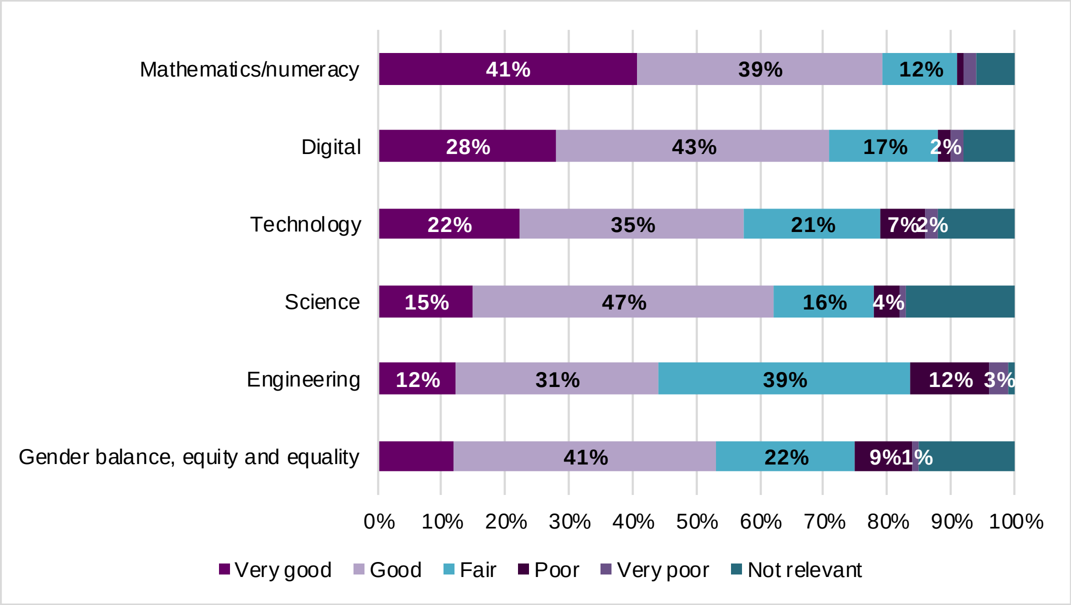
4.27 The one area in the SGP where there was more slightly limited progress was in relation to ‘Gender balance, equity and equality’ where the increase in those saying very good was very modest, from 11% to 12% although there was an increase in those self-assessing their skills as good, from 31% to 41%. Again, this points to the need for further work and emphasis in this area.

Figure 4.6: STEM skills rating <u>prior</u> to engagement



Source: ekosgen Survey Data (2021), N=184

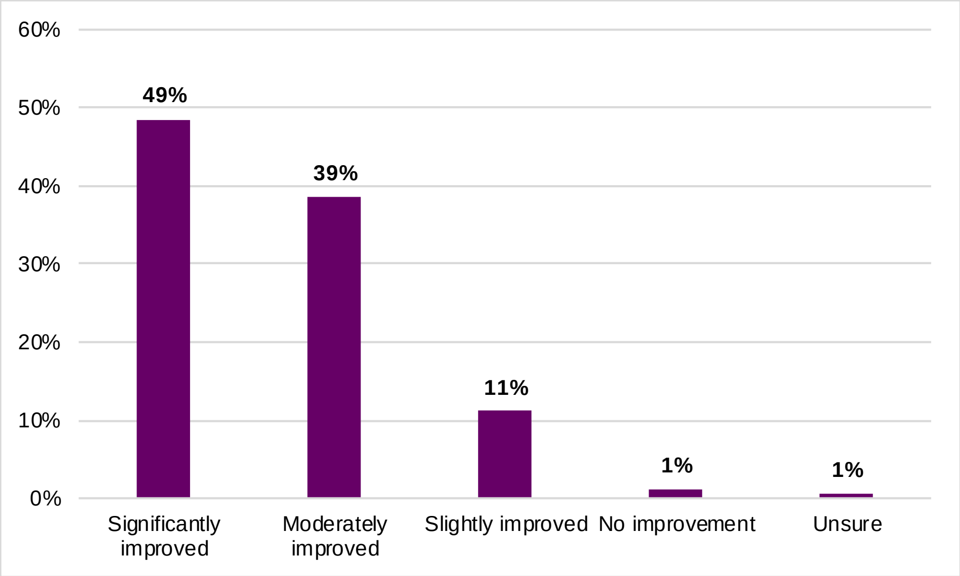
Figure 4.7: STEM skills rating <u>after</u> engagement



Source: ekosgen Survey Data (2021), N=171

The following chart (Figure 4.8) illustrates how beneficial practitioners consider their STEM CLPL learning to have been on their learning and teaching capabilities. Almost half say their STEM learning and teaching capabilities have increased significantly (49%) compared to just one third saying this in 2020. The quality of provision will have had a positive bearing on this, including access to knowledge and new resources (see 4.32 below).

Figure 4.8: Professional learning effect on STEM learning and teaching capabilities



Source: ekosgen Survey Data (2021), N=171

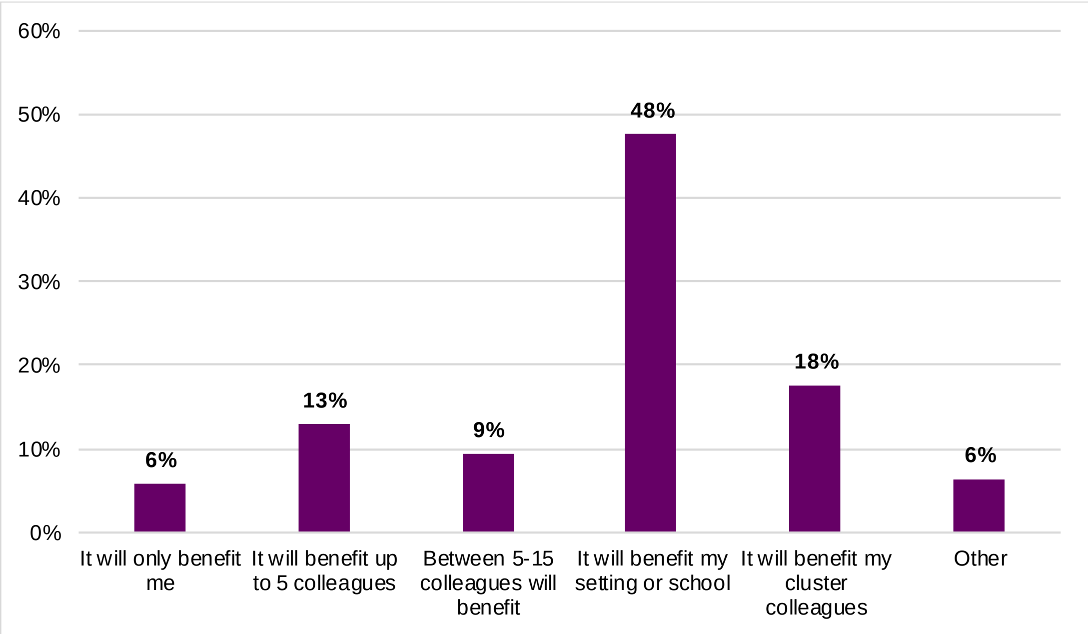
4.28 One way excellence is demonstrated is through endorsement. The last evaluation report highlighted projects/programmes are able to apply for Education Scotland Programme Endorsement. Endorsement provides those who commission programmes, as well as those engaging in professional learning, assurance that programmes offer relevant, significant and sustained quality learning. Such experiences develop depth of professional learning, knowledge, skills and understanding which ultimately impacts on the quality of learning.

4.29 Encouragingly, there has been a substantial increase in the extent to which STEM learning has been cascaded by practitioners. Almost half (48%) said their STEM CLPL learning will benefit their whole setting or school, compared to 37% in 2020 and 18% said their learning will benefit cluster colleagues, compared to just 6% in 2020. The corollary is that just 6% think their CLPL learning will benefit only themself, compared to 13% in 2021; 13% say it will benefit 1-5 colleagues, compared to 24% in 2020.

4.30 Some projects have secured an impressive reach. The STEM CLPL Maths project in the City of Edinburgh, for example, had reached 580 primary school teachers at the time of the consultation, and so if these practitioners are in turn cascading their learning, then the reach of the project is very considerable indeed. Here the grant programme was highly valued, with the Lead Grantee going on to be employed two-days a week by the Local Authority:

> *"[The STEM CLPL grant project was]* ***phenomenal****…it really allowed me to really think, reflect, make contacts, build relationships, build trust and purchase resources for training"*

Figure 4.9: Wider benefit from cascading of knowledge gained through supported professional learning



Source: ekosgen Survey Data (2021), N=170

4.31 The following Table (4.3) shows practitioner self-assessment of skills, knowledge and practice **after** their CLPL learning. For all categories, there has been an increase following CLPL learning.

4.32 Encouragingly, knowledge and access to resources and support is one of the categories which scores highest (4.0 on average out 5), a key objective of STEM CLPL learning, highest for secondary school practitioners. Also scoring 4.0 out of 5 were 'Teamwork and collaboration with peers to share practice and learn with each other', 'Developing learners' skills in a progressive way' and 'Creating engaging and motivating learning experiences for learners-, highest for CLD practitioners.

4.33 At the other end of the spectrum, practitioners self-assessed their abilities as lowest for 'Leading in your STEM setting', 3.4 out of 5 (lowest for CLD practitioners), 'Bringing knowledge of STEM careers and pathways into learning, also 3.4 out 5 (including a relatively low self-assessment amongst secondary school practitioners here of 3.2 out of 5), and 'Engaging parents, families and communities', 3.3 out of 5.

Table 4.3: Skills, knowledge, and practice after STEM CLPL learning

	Average Score – out of 5 (5 = very good)				
	All	Primary	Secondary	ELC	CLD
Knowledge and access to resources and support	4.0	3.9	4.2	3.9	4.3
Teamwork and collaboration with peers to share practice and learn with each other	4.0	3.9	4.4	3.3	4.0
Developing learners' skills in a progressive way	4.0	4.0	4.1	4.2	4.1
Creating engaging and motivating learning experiences for learners	4.0	4.1	3.8	4.2	4.5
Improving learner attainment and outcomes	3.9	3.9	4.0	3.8	4.2
Learning, teaching and assessment	3.8	3.9	3.9	3.6	4.1
Adaptability and innovation in approaches to teaching STEM	3.8	3.9	3.5	4.0	3.8
Critical thinking and problem-solving skills to overcome STEM teaching challenges	3.8	3.8	3.9	3.8	3.7
Supporting practical enquiry, investigative work and STEM projects	3.8	3.9	3.8	3.8	3.0
Improving progression in learning across transitions and sectors	3.5	3.5	3.6	3.6	3.3
Leading STEM in your settings	3.4	3.2	3.6	4.0	2.3
Bring knowledge of STEM careers and pathways into learning	3.4	3.6	3.2	3.5	3.3
Engaging parents, families and communities	3.3	3.2	3.1	3.9	3.9

Source: ekosgen Survey Data (2021), N=163

4.34 The following Table (4.4) shows the difference in scores after STEM CLPL learning when compared to before their learning. There are increases for all categories and across all sectors, bar one. The greatest increases were for 'Adaptability and innovation in approaches to teaching STEM', an average increase of +1.1 (highest for ELC, +1.5 and for CLD +1.2) and for Knowledge and access to resources and support (+1.0, highest again in ELC and CLD) and for 'Supporting practical enquiry, investigative work and STEM projects', also plus +1.0. These findings are reinforced by the Lead Grantee consultations and qualitative responses given in the practitioner survey.

4.35 Although scores were lowest in for 'Leading STEM in your setting', 'Bringing knowledge of STEM careers and pathways into learning, and 'Engaging parents, families and communities', all three showed notable increases in self-assessment scores post learning.

Table 4.4: Difference in scores for skills, knowledge, and practice in STEM CLPL learning

	Average Score – out of 5 (5 = very good)				
	All	Primary	Secondary	ELC	CLD
Adaptability and innovation in approaches to teaching STEM	1.1	1.0	0.7	1.5	1.2
Knowledge and access to resources and support	1.0	0.9	0.9	1.2	1.3
Supporting practical enquiry, investigative work and STEM projects	1.0	0.9	0.9	1.0	0.5
Leading STEM in your settings	0.9	0.8	0.9	1.3	0.6
Developing learners' skills in a progressive way	0.9	0.8	1.0	1.2	0.5
Teamwork and collaboration with peers to share practice and learn with each other	0.8	0.6	1.1	0.8	0.5
Critical thinking and problem-solving skills to overcome STEM teaching challenges	0.8	0.7	0.8	1.0	0.7
Creating engaging and motivating learning experiences for learners	0.8	0.8	0.6	1.1	0.9
Engaging parents, families and communities	0.8	0.7	0.8	1.4	0.5
Improving learner attainment and outcomes	0.8	0.7	0.7	1.3	0.2
Bring knowledge of STEM careers and pathways into learning	0.7	0.8	0.4	1.3	0.8
Improving progression in learning across transitions and sectors	0.7	0.6	0.8	1.1	-0.2
Learning, teaching and assessment	0.6	0.6	0.9	0.9	0.5

Source: ekosgen Survey Data (2021), N=184

4.36 The **key points** in relation to **excellence**:

- There continues to be strong practitioner feedback on the quality of STEM CLPL learning provision, even with the increase in project activity in Round Two compared to Round One;
- The satisfaction with the delivery method, whilst lower than in 2020, has held up pretty well, despite moving online in many cases due to COVID-19 related restrictions;
- There are very strong self-assessment improvements amongst practitioners in Technology, rising from 8% to 22% saying their skills are very good, and also in Digital, rising from 13% to 28%. COVID-19 lockdowns appear to have been a strong driver of Digital skills update (even without STEM CLPL);
- Strong improvements in the extent to which learning has been cascaded to others in 2021, and this is a really positive finding;
- More limited self-assessed improvements in 'gender balance, equity and equality' – with little change in those saying their skills are very good in 2020 (although there was an increase in those saying good). Nonetheless, the findings suggest that more can still be done within SGP here to increase skills; and
- The greatest increases in self-assessed capabilities are for adaptability and innovation in approaches to teaching STEM and knowledge and access to resources and support, both highest in ELC and CLD, indicating effective project activities.

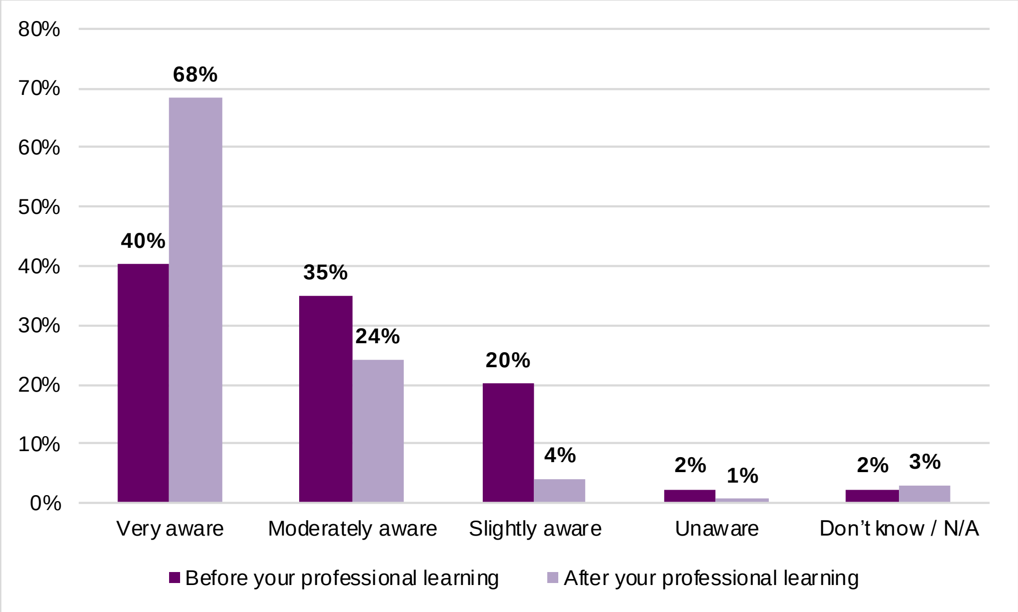
Equity

We will promote **Equity** by:

- Tackling inequity in STEM learning and careers
- **Improving participation in STEM further and higher education courses and apprenticeships**
- Increasing access to public science engagement events

4.37 Round Two projects have again made a difference to the equity agenda, with some activity building on Round One project activity. Across Round Two, STEM CLPL learning has made practitioners much more aware of the need to ensure equity and equality in STEM. Prior to learning, 40% were 'very aware' and this increased to 68% post learning. The increases (for 'very aware' and 'moderately aware') increased most for secondary school practitioners (+27 percentage points), followed by ELC (17%) and for primary (16%), whilst there was no change for CLD.

Figure 4.10: Awareness of need to ensure equity and equality before and after professional learning



Source: ekosgen Survey Data (2021), N=171

4.38 Practitioners were asked, as a result of your STEM professional learning, how many STEM sessions have you delivered to learners that have been specifically designed to address the gender imbalance in STEM? The following Table (4.5) shows this. The greatest number of sessions have been delivered in primary schools, which may align with the greater survey sample from this education sector (42%), and then secondary, ELC and CLD. Primary schools also had the lowest proportion (25%) saying no sessions had been delivered, compared to 64% in CLD.

Table 4.5: STEM sessions delivered to specifically address gender imbalances

Sessions delivered	Primary		Secondary		ELC		CLD	
	No.	%	No.	%	No.	%	No.	%
1-5	32	47%	22	44%	4	17%	4	36%
6-10	9	13%	5	10%	6	26%	0	0%
11-20	5	7%	1	2%	4	17%	0	0%
21-30	0	0%	1	2%	0	0%	0	0%
Over 30	5	7%	2	4%	2	9%	0	0%
None	17	25%	19	38%	7	30%	7	64%
TOTAL	**68**	**100%**	**50**	**100%**	**23**	**100%**	**11**	**100%**

Source: ekosgen Survey Data (2021), N=161

4.39 A wide variety of project activity has therefore been delivered, although in most cases the number of sessions has been modest. Some of the activity that has specifically targeted gender issues (e.g. LE Bankhead Nursery, working with Cathkin nursery) has been particularly successful. Here the nursery is part of a gender equality network:

> *"Our outputs have included STEM cards, building STEM labs (although delivery of this was challenging with COVID-19 because of the pod working) and a pre-recorded engineering academy. We are having gender inequalities week in the school. The project has really boosted Confidence, in STEM and gender equality; awareness of unconscious bias too – we are really pushing things. Other schools not in that frame of mind – and you can see the difference"*

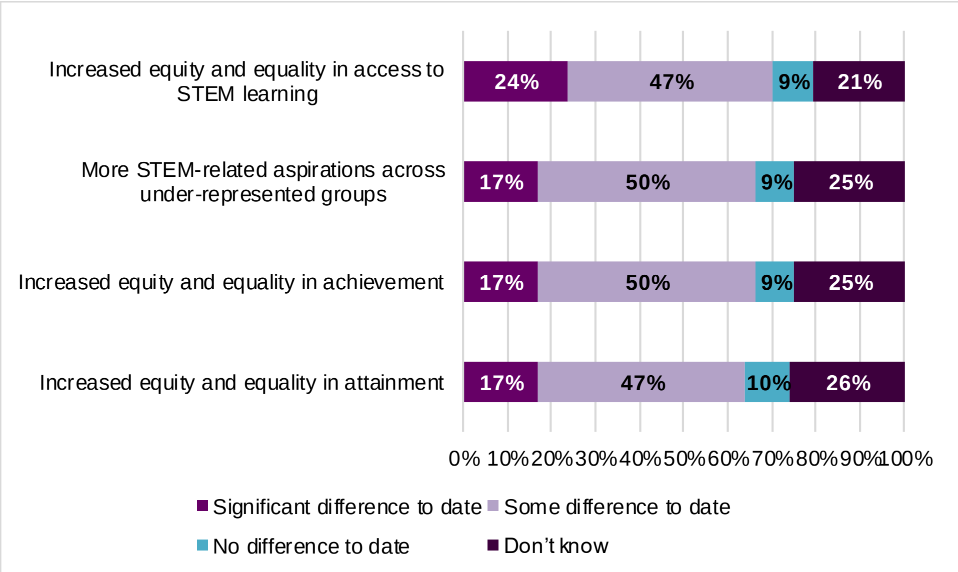
4.40 As the previous section under 'excellence' reported, there is still a need to give practitioners the skills to address equity issues. However, there is evidence that Round Two project activity has positively built on a Round One project. An example of this is the Scottish Childminders' Association, highlighted in the 2020 report as a predominantly female profession made more aware of STEM, which has gone on to build up further their portfolio of STEM e-learning professional courses (developed with SSERC) so that childminders (CMs):

> *"….are now amongst the market leaders in STEM in early years …we get great feedback from CM practitioners on their (STEM) support, and what it enables them to do – confidence, activities, hands on delivery, using everyday advantages that CMs have to deliver STEM – and do so with little or no cost to CM, using home and natural environment as basis to embrace STEM"*

4.41 The practitioner surveys asked, "In your role, what changes have you observed in the last two years with respect to equity and equality around access, participation and attainment in STEM learning?". Practitioners do think that there has been increases in access, participation and attainment, with around or just under 1 in 10 (9-10%) not thinking that is the case. Reported increases are greatest in terms of access, and almost one in four (24%) have seen a significant increase in the last two years. Reported significant increases were 17% for STEM-related aspirations across under-represented groups, achievement and attainment. Around half (across each) consider there has been some improvement.

4.42 That said, around a quarter report they do not know, so that combined with those saying 'no difference', a third do not report improvements in equity and equality in STEM access, participation and attainment, suggesting further emphasis in these areas continue to be required.

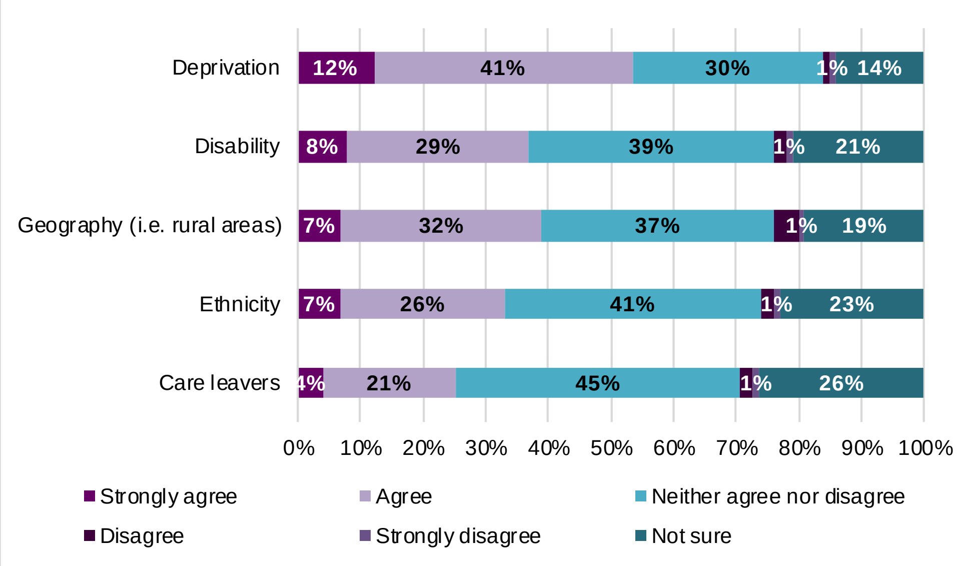
Figure 4.11: Equity and equality changes in STEM learning observed in role



Source: ekosgen Survey Data (2021), N=163

4.43 As a result of their STEM CLPL learning, practitioners report some increase in confidence in tackling equality issues in STEM, greatest for issue in relation to deprivation, but lower for issues related to disability, rurality, ethnicity and care leavers. Just over half (53%) have some increase in confidence in relation to deprivation issues. For the other issues, the proportion is closer to one third: disability, (37%), ethnicity (33%), geography (39%) and care leavers (25%). This reinforces the picture of some improvements in confidence levels, but with more that can be done in this regard.

Figure 4.12: Increased confidence tackling equality issues in STEM



Source: ekosgen Survey Data (2021), N=161

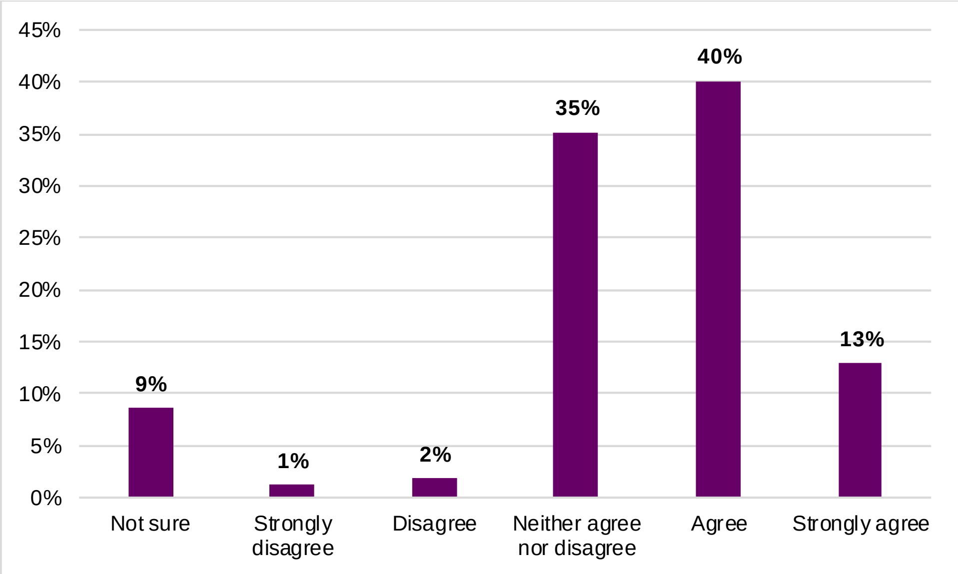
4.44 In relation to gender, the picture is similar to the findings with respect to deprivation inequality. Just over half (53%) report increased confidence in tackling gender stereotypes and unconscious bias, and there was evidence of this across sectors. An example from ELC is the following Family Centre, where, as well as increase in practitioner confidence, further actions were taken building on the STEM CLPL project:

> *"We delivered a number of workshops for and with parents and families that were very hands-on around food education and using natural materials that really built the confidence of practitioners in our cluster. The STEM family learning project has been the basis of us moving on to look at equity and equality issues and training including the development of an Action Plan and resources".*

4.45 Whilst positive, the findings however also indicate that 47% of practitioners did not report an increase in confidence, again showing that more can be done to increase practitioner confidence.

4.46 By sector, progress is certainly being made with regards the ELC, where 71% report increased confidence. For primary, the proportion is in line with the average (53%). The sectors least likely to report increased confidence in tackling gender stereotypes and unconscious bias are secondary and CLD (both 45%).

Figure 4.13: Practitioner increased confidence in tackling gender stereotypes and unconscious bias



Source: ekosgen Survey Data (2021), N=162

4.47 One of the objectives under equity is improving participation in STEM further and higher education courses (FE/HE) and apprenticeships. There is evidence of this, not just amongst learners progressing into participation in FE/HE and apprenticeships (such as Fraserburgh Academy training practitioners to deliver Foundation Apprenticeships in Mechanical Engineering) but amongst practitioners too, several of whom have taken higher education courses as part of, or following, their involvement in their STEM CLPL project.

4.48 The **key points** in relation to **equity** are

- STEM CLPL has made practitioners much more aware of the need to ensure equity and equality in STEM in all sectors bar CLD, and greatest for secondary school practitioners;
- Practitioners have observed some positive changes in relation to equity and equality issues in the last two years, greatest in terms of access but most in terms attainment, achievement and aspirations in under-represented groups;
- There is some uplift in practitioner confidence too in tackling equality issues, greatest in relation to deprivation and gender, but lower for disability, rurality, ethnicity and care leavers; and
- Whilst there are improvements in confidence to tackle equality issues, particularly in the ELC sector, more can be done in this regard. Overall, just over half felt more confident to address gender stereotypes and unconscious bias post STEM CLPL (53%), but the corollary is that just under half (47%) did not feel more confident.

Inspiration

We will promote **Inspiration** by:

- **Creating positive STEM role models, mentors and coaches**
- **Promoting the opportunities and benefits of STEM learning and careers**
- Recognising and celebrating success

4.49 The Round Two projects have continued to inspire practitioners to become STEM role models, mentors and coaches. There was evidence of the STEM CLPL grants inspiring leadership of and for learning in the Round One projects – a core feature of the national model of professional leaning – and this has increased and been enhanced in Round Two. Many practitioners are inspiring others (as already evidenced by the extent to which learning is being cascaded widely through schools, clusters and other settings).

4.50 There are many ways in which practitioners are inspired, ranging from events, to external expertise, to peer inspiration and combinations of these. The Digital project of the South West Education Improvement Project was one of the last to run a large event before the March 2020 COVID-19 lockdown. Held in February 2020 and including the STEM magician, key speakers and training the trainer with Prometheon, the project inspired practitioners and created an ongoing network across the three local authorities, even if operationalising the CLPL was partially hampered by the subsequent lockdowns.

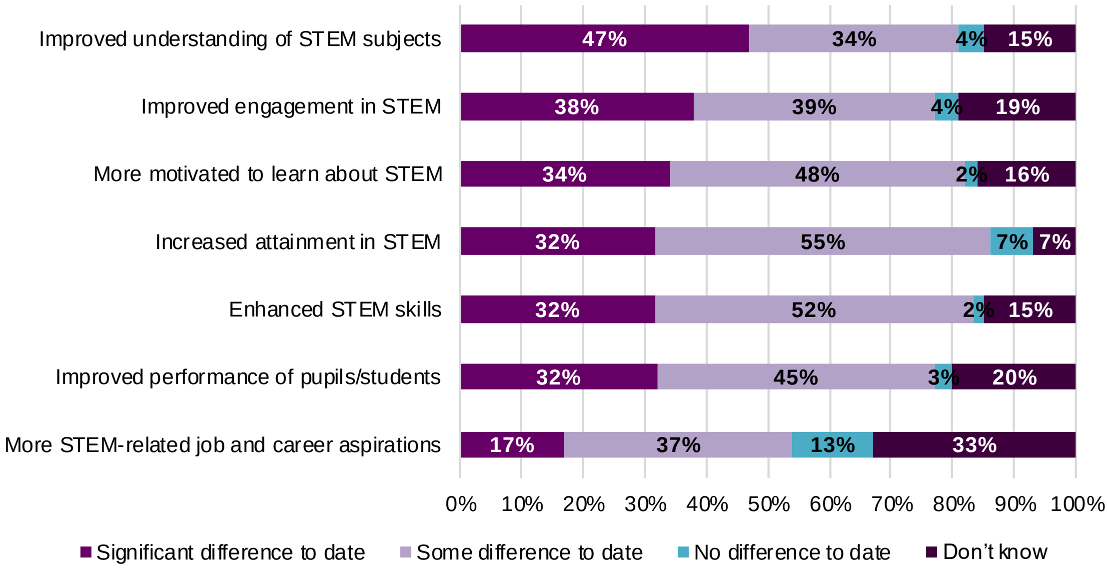
4.51 An excellent example of inspiring learners and practitioners is the example of Fraserburgh Academy that has taken the lead on the development of a 3-18 STEM strategy there. This is directly 'promoting the opportunities and benefits of STEM learning and careers' by augmenting the STEM offer available in the Academy and by creating strong links with the College and University. The Academy has supported learners through new provision in Level 5 Maths, and Foundation Apprenticeship in Mechanical Engineering and Digital Tech. The STEM CLPL project creating attractive pathways using craft/applied maths for those wishing to progress in STEM but lacking their Nat 5 in Maths which is preventing them doing so. They are also looking at Tech Maths too.

> *"Some may have been trying for years to get their Nat 5 in Maths. So we have worked with NESCOL (North East Scotland College) to provide craft maths units as an alternative pathway that benefits the learner and allows progression. The STEM CLPL grant has given us the people and time to coordinate this and it has been great for learners. It has also developed our relationship with the College. We really want to join all the excellent practice up and are actively developing an overarching STEM strategy from 3-18yrs which we are very excited about".*

4.52 Practitioners consider that their STEM CLPL learning has led to substantial improvements amongst learners. Almost half (47%) report significant improvements in the understanding of STEM subjects in learners (compared to 33% in 2020), with 81% reporting some improvement. This is translating into improved engagement in STEM (77%, 38% significantly so) and increased motivation in learners (72%, 34% significantly so). Encouragingly, 77% also report increased attainment in STEM (32% significantly so) – which compares to 61% in 2020 - and 74% reporting enhanced STEM skills in learners (70% in 2020).

4.53 Although the proportion is lower (with far more 'don't knows') it is also positive that more than half (54%) report that learners have improved STEM-related job and career aspirations.

Figure 4.14: Improvements amongst STEM learners as observed by practitioners



Source: ekosgen Survey Data (2021), N=162

4.54 There are positive views from the learners themselves, with the 180 learners responding to the survey, 150 of whom were of primary school age drawn from schools across Scotland. Just under seven in 10 were involved in classroom learning and more than a third in practical activities. This year, due to the COVID-19 pandemic, more than half (52%) were also involved in online learning. The majority said they were involved in STEM learning fairly or very often (55%).

4.55 Prior knowledge was greatest in Numeracy and Mathematics (45% said they 'knew a lot'), much lower in Digital (14%) and lowest in engineering (8%) and science (6%).

4.56 Learners say that their main reasons for studying STEM is that they enjoy it (43%) and that they are good at it (20%) and thinking it useful for their future career/job (31%) and subjects they want to study (17%). Encouragingly, given that most learners surveyed were of primary school area, what they enjoyed most was 'learning new things' (43%). 'Knowing that I am building my skills and knowledge for a future job/career' was what 38% enjoyed, and 37% enjoyed 'Working in a group to solve a problem. Solving'.

4.57 The following illustrates the benefits to learners from STEM:

> *"The project has been hugely successful – the children have all said they would like more STEM lessons. They are able to engage better, and recall learning more effectively, and to demonstrate their understanding of learning. It is also helping to enhance their learning across curriculum".*

4.58 Almost a third (32%) stated what they enjoyed was that their 'teacher was encouraging and helpful', a similar proportion to those that enjoyed practical activities. Teachers are clearly inspiring learners, and less than 1% said that 'my teachers do not encourage me'. There remains a stubborn minority (20%) that said they 'don't feel they are good at STEM', with females feeling stronger about this than males (23% vs 17%). 9% 'do not enjoy STEM subjects', and this is as high as 14% for males only, compared to 6% for females.

4.59 As a result of their STEM activities, learners felt they knew more about the types of jobs involved in STEM (although still lowest for Digital and science) and a half felt they had some (37%) or a lot of awareness of the relevance of STEM to their life and the job they would like to do. Encouragingly, more than half (52%) felt a little more enthusiastic and engaged (40%) or a lot more enthusiastic and engaged

(12%), with 27% saying there was no change (22%) or they were less enthused and engaged. In all, 46% said they were more likely to take STEM subjects in the future, compared to 30% saying no change or less likely (23% did not know).

4.60 The **key points** in relation to **inspiration** are:

- Positive findings about the extent to which STEM CLPL is being cascaded through sectors are translating into practitioners feeling there are substantial improvements amongst learners;
- Almost half of practitioners reported significant improvements in the understanding of STEM subjects in learners (compared to 33% in 2020);
- Practitioners report strong improvements in learner motivation and engagement, which they say are leading to increased attainment in learners (and well above 2020 levels);
- Learners themselves report positively on their STEM learning, with the majority of learners responding to the survey being of primary school age;
- Primary school learners have been very positive about the role of their teachers in encouraging them and helping them, with learners enjoying STEM and learning new things;
- Learners, even young learners, have a greater awareness of STEM careers/jobs and the relevance STEM may have on their lives. Around 50% more learners are more likely to take STEM in the future, as a result of taking part in STEM learning.

Connection

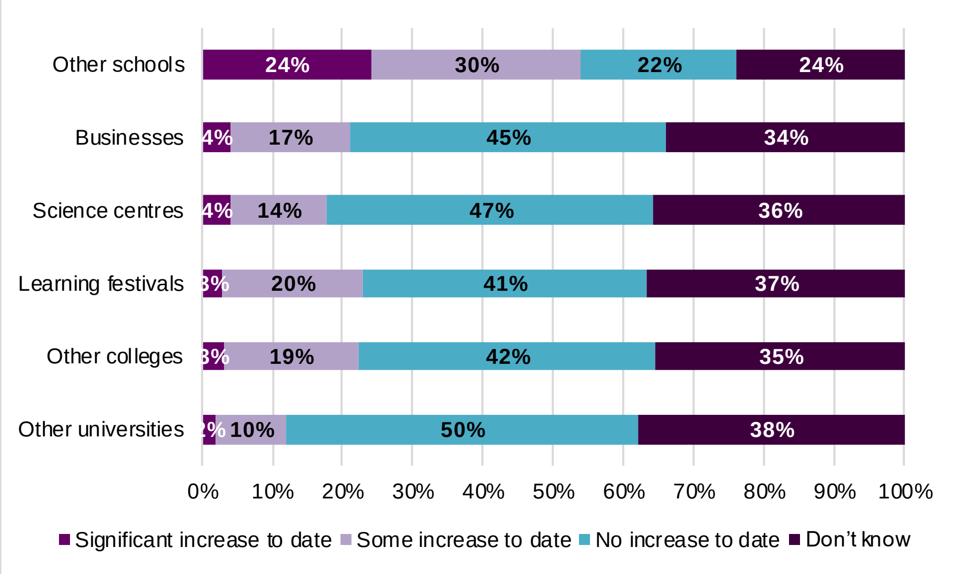
We will promote **Connection** by:

- **Improving the support available to schools**
- **Delivering up to date advice and information on STEM careers**
- Increasing the responsiveness of colleges, universities and the apprenticeship programmes to the needs of the economy

4.61 The 2020 report noted that there was an increase in the support available to schools but that in general the connections with STEM-related partners was relatively modest. This time, the engagement with STEM-related partners has been on a much greater scale, in no small part due to the increase in the size of the programme. However, there is also evidence that relationships with STEM-partners is broadening and deepening, as new projects are developed and delivered. Some of these directly build on earlier STEM CLPL projects.

4.62 The 2021 practitioner survey asked whether practitioners felt there was an increase in the quality of engagement with various STEM-related partners. Connections with other schools was most frequently reported, and more than half (54%) that there was an increase in the quality of engagement with other schools (24% saying significantly so). Whilst more modest, the proportion reporting an increase in the quality of engagement with learning festivals (23%), other colleges (22%, businesses (21%), Science Centres (18%) and universities (12%) is also encouraging feedback.

Figure 4.15: Increase in the quality of engagement with STEM-related partners



Source: ekosgen Survey Data (2021), N=161

4.63 By sector, there are some interesting variations. Primary schools were most likely to report an increase in quality of engagement with businesses (29%), ahead of secondary schools (25%). Secondary schools reported the greatest increase with other schools (75%) and with colleges (36%) and universities (22%). Primary schools were most likely to report an increase in quality of engagement with learning festivals (37%) and science centres (28%). Early years were also more likely to report increased quality engagement with science centres (19%) than secondary schools (12%). Across the board, CLD practitioners reported the fewest increases in quality of engagement (highest for Colleges, 14%, and Universities, 10%).

Table 4.6: Increase in the quality of engagement with STEM-related partners

Some/Significant increase	Secondary	Primary	ELC	CLD
Businesses	25%	29%	10%	10%
Other schools	75%	63%	39%	0%
Other colleges	36%	22%	5%	14%
Other universities	22%	8%	0%	10%
Science centres	12%	28%	19%	0%
Learning festivals	20%	37%	19%	0%

Source: ekosgen Survey Data (2021), N=152

4.64 It is clear that the SGP is enabling new connections to be made, and there are many examples of this. One is the connection made by St Luke's High (and cluster) in East Renfrewshire with the NuVu studio of the innovation school at Kelvinside Academy, Glasgow. The project enabled the creation of a curriculum design team looking at project-based learning working with the innovation school (for example in relation to new materials for prosthetics, music in the future). The school benefited from the helpful and supportive role of Education Scotland in the project.

4.65 **The key points** in relation to **connection** are:

- There is evidence that the connections and quality of engagement with STEM-related partners is increasing and deepening;
- The most significant increases are in the quality of engagement with other schools, and a quarter say this has increased significantly;

- However, there are also increases in the quality of engagement with businesses – particular between schools and businesses – and between secondary schools and colleges and universities;
- Primary schools and ELC have increased the quality of their engagement with science centres and learning festivals;
- Good connections are being forged between ELC and other schools; and
- Where connections are still weak is between CLD and other STEM-related partners.

5 The STEM Grants Programme: observations for future delivery

Introduction

5.1 This chapter draws on consultations with the sample of Lead Grantees, Education Scotland's Regional Teams and operational and strategic stakeholders. It focuses on various aspects of the programme's management and delivery arrangements.

Programme observations

5.2 There are some particular observations drawn from the study's practitioner survey reviewed in the previous chapter which are especially worth highlighting and may influence future programme delivery. These are as follows:

- There is evidence of significant increases in practitioner confidence in **Digital** and **technologies** thematic areas from a low starting point compared to other thematic areas and thus may benefit from a continued focus for future project activity.
- Survey feedback shows that although there have been some signs of improved knowledge and awareness of issues of **equity and equality** amongst practitioners, more must be done to further engage practitioners across all settings (secondary schools to a lesser extent) to build confidence in this area. There has been progress – but not as much as there could or should be.
- Some target groups which **would normally have little access to CLPL**, e.g. school technicians, have benefited in particular from the training available through the SGP.
- However, some settings, CLD in particular, **are least likely to be engaged with STEM-related partners** - businesses, science centres, festivals – and although there is some engagement with colleges this sector needs to be better integrated into the programme.
- The greatest increases in self-assessed capabilities are for the following, suggesting that projects focussed in these areas have worked especially well:
  - **Adaptability and innovation in approaches** to teaching STEM (highest scores for ELC, and for CLD)
  - **Knowledge and access to resources and support** (highest again in ELC and CLD)
  - **Supporting practical enquiry, investigative work** and STEM projects' (across all settings)

5.3 In addition, as with some University Grantees in particular in Round One, Round Two projects also included some **interesting new and innovative learning** which took a longer time to develop and therefore had less opportunity to deliver in practice (especially due to COVID-19). These have some interesting facets (e.g. embracing new thinking, challenging or breaking down more traditional understanding) and so this may need to be considered in a different way, for example, as part of a learning/research/innovation strand of the programme. This would be akin to a Research and Development programme which may not be expected to deliver in the traditional sense (aside from testing and pilot learning), but which if shown to work could be developed in future projects/Rounds.

5.4 In terms of the grant process, amongst consultees there is a lot of positive feedback with respect to the grant funding approach. A small amount of grant monies can go a long way (especially in schools); it frees up school resources (staff time) to develop content and deliver/cascade learning. The approach also helps to develop the skills to disseminate new learning and resources (digitally) are increasing thus enabling more practitioner reach:

> *"Grants are not huge, but they allow schools to make a huge difference - £6k buys time, but it also buys good will – grants really are enabling, and think that they are really positive; doesn't need to be massive investment in a particular project to allow LGs to deliver and realise what they want; proportionally, scale of impact is important"*

5.5 One project had reached 580 primary school teachers at the last count (City of Edinburgh) and now employs a staff two days a week to deliver the project, so significant reach is achievable, particularly with increasing awareness and use of Digital technologies both as a means to develop new content and resources, but also as a means of accessing CLPL and engaging learners. Indeed, awareness, skills and use of Digital by practitioners (content and delivery) has increased massively as a result of COVID-19, and this should not be lost going forward (but rather built upon in the future).

Complementarity of projects

5.6 The Round One evaluation highlighted the need to recognise the importance of project complementarity and to allow for the co-ordination of CLPL activity and minimise duplication of project content and delivery to the same practitioner groups. However, the extent to which this is considered at a national, regional or local level is still debatable.

5.7 National projects can achieve greater reach (and at no extra cost) but only where the national lead grantee has appropriate and effective dissemination/engagement routes and good links with schools. This was evident in Round One and remains the case now, although some organisations have successfully increased their links into schools, Science Centres being an example. If this is not the case and school links are weak then a national project may not be as effective and impactful as, say, a well-connected Local Authority led regional project.

5.8 The evidence indicates well-connected Local Authority led regional projects exists, particularly where the regional partnership is strong and cross-LA working is commonplace and effective. However, consultees still felt that engagement and delivery at the local school level can still be problematic when driven from a regional level (top down) and not directly with local resource.

Project application and support

5.9 A number of aspects of the programme's application and other processes were highlighted for review and/or refinement.

5.10 The competitive nature of the SGP lends itself to schools that either have resource, or expertise in writing funding bids, or both. It is felt that there is a danger of excluding those that don't and those may be the schools that need application support most or perhaps have the best project ideas. It is important that the SGP really reaches those practitioners/learners where STEM is not high on the agenda and thus those schools or organisations need to be proactively encouraged to engage and in turn supported in bidding into the SGP should they wish to apply.

5.11 Similarly, some national organisations with little core funding and/or resources would benefit from application support from Education Scotland. There could even be a small 'capacity building' pot of funding as part of the SGP programme management budget.

5.12 Many consultees highlighted that the bid appraisal process could be usefully reviewed. Conducted at a national level by Education Scotland regional staff previously, there are now a number of interested and willing individuals with in-depth knowledge of the local/regional STEM landscape and activities who could add value to the process. This could include members of the RIC teams who are better placed to know the regional or local context. However, there could be a conflict of interest if RIC or other STEM partners were also submitting bids for consideration

5.13 Lead grantees report that not being able to pay for external supply cover for practitioners attending sessions remains a challenge, especially in rural areas. There may be merit, therefore, in allowing some flexibility in rural areas (for example in allowing funding to cover additional costs and/or increased access externally) in rural areas. There are also some frustrations that funding for more costly (above the £500 limit) STEM resources are ineligible costs. One example of this given was that if, for example, resources are not created within the project then the expertise to develop the resources may be lost if the upskilled project lead subsequently leaves the school/organisation.

5.14 Delays in approving grants, have compressed delivery timeframes in some cases and, COVID-19 aside, it would have been helpful if project delivery and funding could have been extended into the next financial year.

5.15 The amount of administration time associated with managing Round Two projects has taken up a lot of STEM Team resources especially given the number of Round Two projects, a threefold increase on Round One numbers. Online management of Round Two projects via a Teams page was introduced as both a new and effective model of engagement with Lead Grantees and necessary due to the pandemic and the need to consult with project leads as to their ability to continue with project delivery. Some projects withdrew after Phase 1 and some re-scoped activities e.g. put their CLPL online and recorded sessions in order to build CLPL resources. There should be recognition that managing a grants programme has significant resource implications – typically up to 10% of a programme – so Education Scotland should cost this (in terms of staff time) and check if their resource is adequate and/or sufficient.

5.16 The majority of stakeholders felt that the resources to administer and manage the SGP including appraisal processes and governance matters needed to be increased and importantly should be separate from the wider work of Education Scotland's Regional Teams.

Sustainability

5.17 Study evidence suggests that sustained investment in STEM CLPL across Rounds One and Two of the SGP is now bringing benefits to bear. A good example of this is the Scottish Childminders' Association, grant recipients in both Round One and Two so that childminders are now considered to be 'leading the charge' for STEM in the ELC setting. Round One funding allowed the organisation to gain some traction with their membership with a reasonable level of e-learning take-up. This has subsequently been built upon and augmented in Round Two.

5.18 Another project type worthy of mention is STEM learning events, which can inspire a large number of practitioners and learners, and where learning can be subsequently cascaded and embedded. In terms of sustainability, projects which make further use of professional learning training kits purchased and assembled as part of earlier project Rounds (e.g. VR headsets, coderpillars etc.) can also be viewed positively. This has been reused for project delivery during Round Two.

5.19 However, there is still the consideration as to what extent SGP funded activity is sustained beyond the one-year grant funding period. The project activity ideally, to have any sustained impact requires to be part of a school or organisation's wider STEM Strategy or Plan. Good practice project examples are building their SGP project into a broader approach to embedding STEM (see for example Fraserburgh Academy highlighted in Chapter 4). In addition, consultees felt that there was a 'stop/start' approach to Education Scotland's funding of STEM CLPL and thought that schools and other organisations would benefit from at least two years investment to maximise delivery effectiveness, however, some understood that the Scottish Government only approve budgets annually. If the programme funding and delivery period were longer it would allow for embedded outcomes thus maximising impact and would allow for the ability and time to effectively evaluate projects.

Innovation in delivery models/new approaches to increase engagement and reach

5.20 In Round Two of the programme the strengths of the projects have been the diversity and range of different delivery models. Particularly:

- Strong cluster approaches (schools) across sectors e.g. nursery, primary, secondary. This gives practitioners and other staff the chance to learn from one another, share resources, build leadership capacity and maximise reach.
- Local Authority joint bids providing economies of scale and better value for money.
- Innovative bids involving rural communities, for example in the Western Isles, Orkney and Argyll and Bute. Western Isles council's E-Sgoil project was extended nationally in June 2020.

5.21 Importantly, the programme has favoured those projects with delivery models which have developed from Round One to Round Two (and possibly into Round Three) of the programme.

5.22 The pandemic has pushed the work of Lead Grantees, schools themselves and Education Scotland online; there have been more webinars and a new delivery model which has dramatically increased the level of reach. It is hoped that this will become the new norm increasing value for money and hopefully accelerate impact of STEM CLPL. Education Scotland's STEM and IGBE Teams' engagement with schools and partnership working has also moved online and will remain a communication channel going forward allowing Co-ordinators/Officers to work more directly and less through intermediary organisation.

5.23 Where a delivery model has been successful locally, careful consideration should be given before rolling it out nationally. Feedback suggests that a focus on the principles that are successful is what is important and not the specific approach. What works in one place does not necessarily work well in others, the approach to science in rural schools being a good example. Schools have been empowered to tailor delivery to suit their local context.

Monitoring and evaluation of programme impact

5.24 Critical to the success of any programme is understanding the difference the funding is making in terms of impact and this similarly applies to the SGP. Ideally, this requires a consideration of additionality (what the programme has achieved over and above what would have been achieved anyway) and attribution of impact (the extent to which impact is because of the SGP funding).

5.25 For some of the impacts in particular (career pathways for example), measuring success for STEM/IGBE is problematic, given the long time period over which the impacts are realised. This is especially true of activities at the ELC stage which may help to change perceptions and decision-making many years in the future. Measuring behavioural change in the learner is likely to be an incremental change only.

5.26 The impact of the SGP on practitioners is far more readily assessed and the practitioner survey shows a wide range of benefits and impacts from the programme. Practitioners are also key for achieving attitudinal change in learners, including the subject choices of learners and their skills pathways to related jobs.

5.27 In terms of both STEM and IGBE in schools, a 'whole school' approach is key to maximising impact: practitioners' actions, department actions, school actions, together there should be an entire ethos about STEM and/or IGBE. Longer term impacts and change relate to: awareness of opportunities; subject choices of young people; and aspirations. Short term impacts and change include: change in attitudes and knowledge of barriers amongst practitioners and young people.

5.28 Many of the Round Two projects have undertaken some form of evaluation and/or feedback gathering, and there is learning being taken from this to be applied in future activity. This monitoring and evaluation activity is, however by no means universal and so Lead grantees/projects would usefully benefit from guidance on how to monitor and measure progress for subsequent funding rounds. In addition, an increased focus on identifying the direct impact that professional learning has on improving outcomes for learners, should be a core element of future evaluative work.

Future areas of focus

5.29 There is consensus that post pandemic a national conversation about funding priorities will be needed; this may be part of a review of the STEM Strategy which will be undertaken at some point later this year and will likely be impacted by the OECD Review of Curriculum for Excellence and Qualifications.

5.30 In a context of learners who have received good STEM learning and those who haven't there will still be challenges to be addressed. Numeracy and Mathematics in STEM will likely require more funding going forward as part of COVID-19 recovery (and this is already evident as it is a Round Three programme priority) but planning for positive destinations for school leavers over the next few years, in terms of employability and jobs, will also require focussed STEM learning. Science, Technology, and engineering need to be at the centre of this and so funding needs to continue to be directed to these particular STEM themes.

5.31 Future funding allocations across STEM themes need to be driven by STEM priorities. These could therefore perhaps be considered within the following broad categories:

- Core knowledge & resources in Digital/ Technology/ Maths/ Science and Engineering;
- Equity/equality;
- Innovation/R&D; and
- National activity.

Funding

5.32 Stakeholder consultees were asked to consider a future funding approach to STEM CLPL and whether funding should be made up of project grants, core funding, development monies or a combination of all three.

5.33 A competitive funding approach fits with the Scottish Government's approach of empowering schools, but arguably this approach better suits schools with ideas, and resources to pursue, and skills to write funding bids. A more collaborative approach, i.e. working together across school clusters or even RICs may be a better use of money, in essence, adopting a strategic commissioning approach to funding rather than a competitive bidding approach.

5.34 There is a desire to drive more localised solutions, and this could still be achieved even if activity was commissioned at both national and regional level. RICs or Local Authorities could potentially co-ordinate and effect greater change. Larger Round Two projects led by regional partners have already begun to demonstrate this.

6 Education Scotland wider STEM activity: benefits, challenges, impacts

Introduction

6.1 As well as managing the delivery of the SGP, the Education Scotland's Regional Teams engage in a range of strategic and operational activity supporting the delivery of STEM professional learning, and also supporting the provision of STEM education and training more generally. This chapter explores the role that Education Scotland's STEM and IGBE officers play (whilst working as part of regional team delivery model) in the STEM education landscape in Scotland. This chapter also examines the effectiveness of and the challenges encountered by the teams in fulfilling strategic and more operational roles, and the ways in which Education Scotland can continue to support the STEM Education and Training Strategy.

The strategic STEM landscape and partnership working

Position in STEM landscape

6.2 The STEM and IGBE teams play an important role in the STEM education and training landscape in Scotland. It is a role, positioned at the interface of national, regional and local structures, that covers support, networking, co-ordination, integration of activity and provision of professional learning. One stakeholder felt that:

> *"Without the STEM team, there would not be joined up national thinking, still collaboration but ad-hoc and sparse."*

6.3 With both the STEM and IGBE teams now having been in place for some time, they are seen by many strategic and operational stakeholders as well-established, and increasingly more active. Both teams are perceived to be well linked into the regional structures within Education Scotland itself, and also with external organisations that operate in the STEM education and training space. Staff within the STEM and IGBE teams are considered to be receptive and willing to listen to the perspectives of different stakeholders and take those views on board in their decision-making processes. As a group, they are seen as proactive are felt to bring a considerable degree of energy, skills and expertise to the Scottish STEM education and training arena.

6.4 Importantly, there is a consensus across all partners that the STEM and IGBE teams are fulfilling a role that wasn't fulfilled previously. In this sense, the teams are considered to be playing a very valuable role in supporting STEM education and training, through strong engagement with different education sectors and settings overall. There is a strong perception that they have driven efforts at a strategic level to facilitate the improvement and development of STEM professional learning, and in turn STEM education.

Effectiveness in partnership working

6.5 Whilst the STEM and IGBE teams are viewed very positively overall by stakeholders and strategic partners, there is a perception amongst some that some improvement is possible in terms of the teams' partnership working. This is for a number of reasons.

6.6 First, some stakeholders reported that engagement with particular groups could be done in a more strategic, co-ordinated way. This was true for a number of representative organisations and membership bodies, where there was a perception that engagement with Education Scotland and the STEM team was more difficult to access because they were "not an educational setting" and part of that landscape. This experience also holds true for participation or lack of it in the SGP.

6.7 Second, and similarly, some consultees reported that Education Scotland engagement with colleges should be enhanced to match its levels of engagement with school settings. This may in part be explained by the way in which the STEM Education and Training Strategy and thus the Grants Programme is targeted at earlier stages in the education pathway, particularly through the *Leadership and Collegiate* strand of the Grants Programme although colleges can bid for either funding stream of the SGP. It may be also affected by how regional STEM partnerships and RICs align, or not (see below). However, Education Scotland staff do attend most, if not all, regional and national college STEM partnership meetings

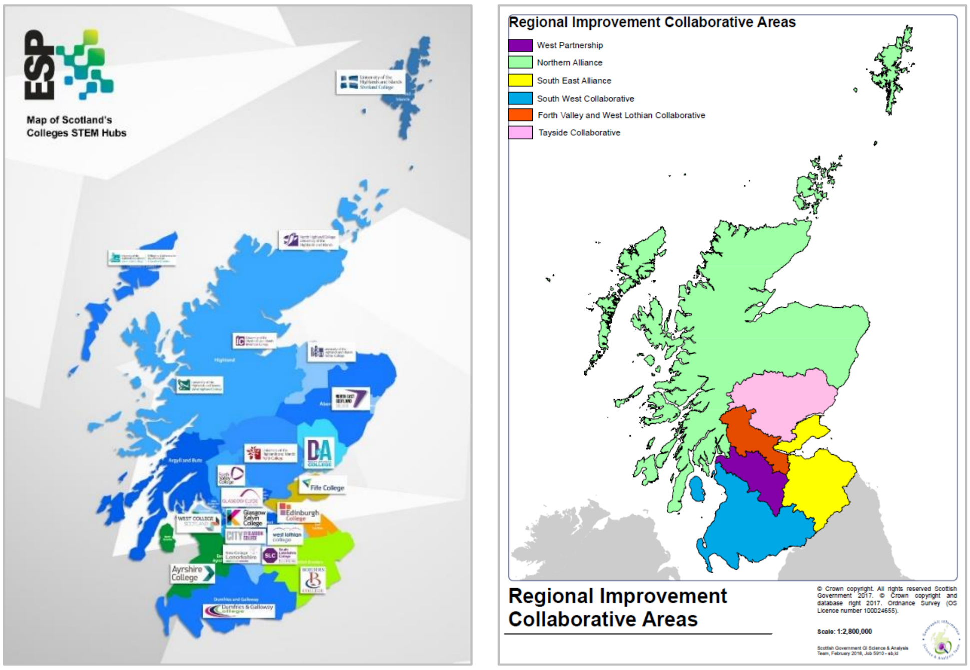
6.8 Third, there was a sense amongst some consultees that the STEM team could further maximise the benefit of capacity and capability in their wider strategic partnerships. This is particularly the case where partner organisations are expanding teams, and are in a better position to build links to strengthen strategic delivery.

6.9 For some consultees, where there is a perceived gap in collaborative partnership working, this is the result of a lack of capacity within the STEM and IGBE teams, rather than anything else. As a result, team members are seen by some to operate in established relationships to maximise their impact, rather than stretching resource further and potentially not achieving the same degree of effectiveness. However, it is recognised that the STEM landscape consists of potentially hundreds of partners nationally, and partner engagement is a constant process for the Education Scotland regional teams, which demands a significant investment of time.

STEM team and regional STEM structures

6.10 A common thread in consultation with strategic partners was that of clarifying the role of regional structures and roles. For example, a number consultees pointed to the existence of the six RICs, as well as 13 regional STEM partnerships (previously college STEM hubs), three STEM ambassador hubs, and the 21 DYW groups also delivering STEM activity. One consultee also noted the existence of (informal) sub-regional partnerships.

Figure 6.1: College STEM Hubs vs. RICs in Scotland



Source: ESP/Scottish Government, 2021

"There is a challenge in getting everyone working in this sphere aligned and pulling in the same direction."

"There is a lack of alignment. Duplication and overlap of activity happens frequently – targeting same audiences, same type of events."

6.11 This mix of structures is seen as challenging, with alignment across Education Scotland and RIC structures, STEM Ambassador Hubs and Regional STEM partnerships sometimes presenting issues. The result is a blurring of roles and responsibilities, and a potential disconnect between the different structures. Thus there is an argument amongst stakeholders for fewer and better fora and groups, with less overlap. This would address structural issues and help to streamline sometimes differing agendas.

6.12 This clarity on functions and responsibility includes that of the RICs themselves. For some strategic informants, whilst the value of the RICs in beginning to co-ordinate strategic STEM actors was acknowledged, it was felt that RICs need to be positioned to better engage with local geographies, rather than simply operate at a somewhat-removed regional level. This includes devolving some of the decision-making around targeting of spend through the SGP and other mechanisms to address local challenges and taking a less centralised and more empowered approach – with centralised co-ordination through Education Scotland.

"Understanding the local context and boosting local capacity is all important."

"The RIC structure does allow some local-ish work, but it is still a bit removed."

6.13 Importantly, there is a need for clearly defined remits of each actor in the STEM landscape, including that of Education Scotland's STEM team. The STEM team are considered effective in terms of getting the relationships right across organisations and structures, but there is arguably a question of what the role of the STEM team should encompass, with consultees noting that some STEM officers appear more embedded than others. Some also thought that the distribution of STEM officers across RIC areas would benefit from being reviewed. Some stakeholders felt that a minimum of two Education Officers to support the STEM Strategy implementation per RIC was a minimum resource requirement.

6.14 For some stakeholders, the benefits of increased support from Education Scotland as a result of enhanced STEM resourcing was noted. It was suggested that enhanced capacity would include taking greater responsibility for influencing the work of the Regional College STEM Partnerships in its position as a high-profile, visible influencer. However, it should be noted that the National College STEM Partnership Steering Group, led by the Scottish Funding Council, is responsible for leading the network of partnerships.

6.15 For others, the clarification of roles and responsibilities means a tighter remit for the existing team, with greater responsibility given to other partners in co-ordinating and contributing to strategic activity. This would entail a clearer mission statement for the team, and ways through which to better evidence output and impact. It would also allow Education Scotland to give an indication of expectations and asks of strategic partners.

Equity and equality

6.16 Education Scotland's IGBE team are seen as engaging and influencing widely in addressing equity and equality issues in STEM education and professional learning, at all levels of STEM-related activity. This is evidenced by recent work with the STEM Ambassador Hubs in Scotland, and collaborative work with SDS on equalities. Many consultees report that the team provide high-quality input to equality and equity matters, and value their approach. Though there is a perspective within the team itself about needing to increase the awareness of the relevance and work of the IGBE team, consultees reported that they felt that settings and practitioners were buying into the work of the IGBE team and that of wider Education Scotland targeting of equity and equality issues.

6.17 The IGBE officers are also considered to be influential at the national strategic level. Their work with the Scottish Government on wider issues relating to equality and equity was highlighted as an example of this.

6.18 Recognising the challenge in tackling gender balance and other equalities issues in Scotland, there were differing views from consultees in terms of where attention should be placed in addressing equity and equality issues. Some consultees considered that effort should continue be front-loaded in the education pipeline, e.g. in early years and primary, to tackle the 'leaky pipeline' early on. Others were of the view that equality- and equity-related activity needs to go wider.

Operational considerations

Supporting STEM education and professional learning

6.19 From an operational point of view, the work of Education Scotland's Regional Officers in raising the profile of STEM in educational settings is seen as successful overall. There is a consensus that the teams' work is contributing to increased engagement of teachers and practitioners, and a growing appetite to take up professional learning opportunities. In RIC areas such as the Northern Alliance, the teams are considered knowledgeable and adept at networking and facilitating knowledge exchange.

6.20 Their activity is perceived to be complementary to that of SSERC and the RAiSE programme, amongst other initiatives. However, for some the latter is better engaged with DYW groups and has wider industry awareness – seen as the result of the localised support provided to build teacher confidence, and considered sustainable as a result of the number of local authorities choosing to self-fund Primary Science Development Officers (PSDOs) beyond the lifetime of the initial RAiSE funding.

Gaps in support

6.21 Some gaps in overall support were identified, which the STEM team could move to support. For example, some consultees suggested there may be a gap in terms of headteachers and their knowledge of STEM, and their ability to champion it. This is important for all schools, not least for smaller (primary) schools where the number of STEM teachers would undoubtedly be limited.

6.22 Additionally, there is a perception that a greater degree of support generally is required in supporting the transition of pupils from primary, through the broad general education phase delivered in S1-3, and into the senior phase of secondary school. This is required to sustain the engagement with STEM subjects that is increasing in primary school and retain pupil participation in STEM subjects at the senior phase. The adoption of a cluster approach to SGP project design and delivery has been a response to this challenge and continues to be a focus for Education Scotland.

6.23 Some consultees pointed to a need for greater cascading of knowledge. In these instances, there is a perceived lack of (facilitating) sharing of knowledge more widely, through networks, and across RIC boundaries. There is a need here to ensure that this take place, and the Education Scotland STEM team is well-placed to facilitate wider sharing of knowledge and expertise.

"Sharing of learning and knowledge across clusters or regions is important, how do you reach those parts where STEM is not high on agenda for learners, or for practitioners?"

Developing a broader understanding of STEM

6.24 One area where consultees felt that further support could be provided by the Education Scotland STEM team was in connecting STEM education to other parts of the curriculum: bringing other subjects into STEM, and also in bringing STEM into other subjects. Some stakeholders reported that they felt the STEM team was working to achieve this, though the overall perception was that more could be done. These perspectives were often provided in the context of a wider discussion about building scientific literacy, and ensuring that scientific understanding could be readily applied and related to the real world, and to societal challenges – developing an interest in the impact of science on society, and critical engagement in thinking about science, rather than teaching of science in a more abstract way.

"We need to be ensuring that understanding in context is being developed – not just raising numbers of participation."

6.25 One suggested approach for achieving this was through provision of increased support for work-based learning. Such an approach would help to develop cross-cutting and meta-skills (e.g. analytical capability, critical thinking, problem-solving, collaboration, etc.), which are central to scientific enquiry. However, there was some debate as to whether this was a role for Education Scotland to fulfil, or for Skills Development Scotland (who are already undertaking significant development of work-based learning pilots, and are considering additional ways in which to develop cross-cutting and meta-skills) and others able to align training with industry-focused opportunities.

6.26 One consultee in particular felt that the STEM team would benefit from the addition of different skills sets – e.g. social scientists, behavioural scientists. This would help to broaden Education Scotland's STEM support offer, and help practitioners to broaden their understanding of societal demands and applications of STEM.

Operating in a crowded landscape

6.27 One particular challenge highlighted through consultations was that of the crowded landscape in STEM education and professional learning support provision. One consultee noted that a particular challenge for organisations involved in the provision of support, particularly through the COVID-19 pandemic, was engaging and competing for an often common audience:

"A general issue for all organisations is competition for online air-time – the whole world is online and competing for space."

6.28 This crowded landscape is in part considered to be the case because of the wide-ranging nature of STEM. It was felt that there was need for an approach that best taps into alternative/supplementary approaches, and maximises the learning potential for wider benefit to settings and practitioners.

6.29 As such, there was a strong feeling amongst some consultees that Education Scotland should use its market position and responsibility as a public sector body to help those seeking support to navigate the provision available, and direct practitioners towards the most appropriate support.

6.30 In some ways, the Education Scotland work in pulling together the online directory NeLO can be seen to be achieving this. However, there was some suggestion from a small number of consultees that additional resource would be required to keep the online directory up-to-date, to avoid it becoming obsolete or out-dated.

Responding to challenges of COVID-19 pandemic

6.31 One of the features of Education Scotland's STEM delivery over the past year or so is the way in which the team has responded to the challenges of the COVID-19 pandemic, and supported the change in the delivery of professional learning. On the whole, there is acknowledgement amongst stakeholders of the scale of the task, and high standard at which the STEM and IGBE team responded to it. However, a small number of consultees felt support could have gone out quicker during lockdown or in a more coordinated way to support online and remote teaching.

6.32 Nevertheless, there is a consensus amongst consultees that the way in which Education Scotland has supported the transformation of professional learning delivery during the pandemic means that providers can continue to meet changing professional learning demands. The way these challenges have been faced and overcome will arguably become the norm for future professional learning delivery, and as a result the team have realised an opportunity that has arisen from the circumstances surrounding the COVID-19 lockdown, and the acceleration of online engagement and delivery. It is likely that there will be no return to the same level of face-to-face professional learning delivery, with the use of digital platforms for professional learning delivery likely to continue in future. This can support an increase in professional learning uptake, particularly in rural areas – opening up greater access, providing extended reach, and helping to reduce geographical disparity in provision.

Resourcing and co-ordinating the Education Scotland STEM team

6.33 The majority of stakeholders highlighted the challenges that current resource levels within the Education Scotland STEM team was having on operational delivery and support. There is a perception that this constrains the extent to which the team can effectively support professional learning in STEM education, and that the range of activities that the STEM team are involved in means that "*they are spread too thinly over too many activities*".

> *"It's almost impossible for them to do their job…[they are often] relying on teachers, people to do things on good will."*

6.34 There is a similar view about current resourcing levels within the IGBE team. Consultations highlighted a perceived need to provide additional focus and support in IGBE, e.g. related to equalities and equity issues within grant programme applications, but it was felt by some that this not being possible through current resourcing levels.

> *"It seems to be asking a lot to cover the whole of Scotland with six IGBE staff."*

6.35 This resourcing challenge has at times been exacerbated by the COVID-19 pandemic, which has seen STEM team members being diverted to other activity to support practitioners, e.g. to help develop blended/online content and materials.

6.36 An additional challenge viewed by stakeholders is the volume of administrative tasks currently undertaken by the team. There is a perspective that the role fulfilled by the STEM team is being taken up by too much administration. Whilst there is some evidence of Education Scotland trying to streamline administrative processes, it is felt that more could be done to free up staff time to focus on the core remit of their role.

6.37 An additional challenge was also noted by a number of consultees regarding the way in which the STEM and IGBE teams are co-ordinated. Whilst the STEM Senior Education Officer fulfils the leadership role within the team, formal line management of the STEM education officers is done by regional officers within Education Scotland's Regional Improvement Teams.

Supporting the delivery of the STEM education and training strategy

6.38 Though somewhat outside the scope of the evaluation, consulted stakeholders made a number of relevant observations regarding the STEM and IGBE teams in relation to the STEM Education and Training Strategy. There was a consensus that Education Scotland is helping to drive the implementation and direction of the Scottish Government policy agenda on STEM education. It was considered that professional learning is critical to the Strategy, since it covers all education sectors/settings.

6.39 Whilst many felt the overall aims and objectives of the strategy were still appropriate, some consultees questioned how they could be kept relevant, rather than becoming 'business as usual parlance', and thus subsumed by other issues. It was suggested by one consultee that this might be achieved by continually reviewing and refreshing roles and responsibilities (in line with the clarification of roles, as discussed above).

6.40 However, it should be noted that the Scottish Government mid-point review originally intended for the Strategy was not conducted, as a consequence of the COVID-19 pandemic. It is planned to take place this autumn. There was some concern from consultees that the Strategy needed to be more flexible and responsive to current and emerging needs, in light of the impact of the pandemic and lockdown. Many consultees felt that in order to achieve this, the STEM Education and Training Strategy needed to be better aligned to Curriculum for Excellence and each of the four capacities (enabling children and young people to be: successful learners; confident individuals; responsible citizens; and effective contributors). This would better equip the Strategy to ensure that educational recovery was at the heart of pandemic recovery.

6.41 Therefore, there is a need to consider how the current emphasis of the Strategy should shift from the original pre-pandemic aims and objectives established in 2017, to what is needed now in a post-pandemic Scotland.

Summary

6.42 Professional learning in STEM education is central to the STEM Education and Training Strategy. Though the aims and objectives are still appropriate, the changing context since the Strategy's launch in 2017, not least as a result of the COVID-19 pandemic, has highlighted the need for greater flexibility and responsiveness to current and emerging needs. This is particularly important given that the planned mid-point review of the Strategy was not undertaken due to the pandemic.

6.43 Education Scotland's STEM and IGBE teams play and important role in Scotland's STEM landscape. They fulfil a very valuable role at the interface of national, regional and local the STEM education and training structures, influencing both professional learning in STEM education and training, and efforts to address challenges in equity and equality. At the operational level, the work of the team is helping to better engage practitioners in STEM professional learning. During the COVID-19 lockdown, Education Scotland has supported the transformation of professional learning delivery, which can be seen as a step-change in the way professional learning for STEM practitioners is and will be delivered.

6.44 Given the mix of national, regional and local STEM education structures that may not align in terms of geography and remit, there needs to be greater clarity on functions and responsibility, including that of Education Scotland's STEM and IGBE teams, and the RICs. An explicit mission statement for the STEM and IGBE teams would help in this regard, setting out specific areas of delivery for the STEM team as well as expectations of partner organisations.

6.45 Though viewed positively by the majority of stakeholders, there is a perception that the engagement and collaboration of the STEM and IGBE Teams with some partner organisations can be improved, from both a strategic and operational viewpoint. Partners outside of certain educational settings feel peripheral to Education Scotland's activity, and more can be done to maximise the capacity and capability of experts in their wider strategic partnerships. This includes Education Scotland helping practitioners to navigate a crowded landscape, and co-ordinating across competing offers to maximise the learning potential for wider benefit to settings and practitioners.

6.46 Support gaps were identified in terms of developing headteacher understanding, whilst the transition of pupils from primary, through the broad general education phase delivered in S1-3, and into the senior phase of secondary school is a critical area of focus demanding additional attention. As well as ensuring greater cascading of knowledge from professional learning, actions to help broaden STEM understanding and link STEM knowledge to societal demands and challenges are required.

6.47 However, in order to achieve the maximum impact and fully support the delivery of professional learning in STEM education in future, enhanced levels of resourcing within the STEM and IGBE Teams should be considered.

7 Conclusions and recommendations

Conclusions

7.1 Delivery in Round Two of the SGP has covered a wide range of project types and delivery modes. The two strands of funding have been used to support a total of **139** projects delivered across a range of settings and geographies, and targeting a number of different practitioner groups. Funding in this round has been particularly concentrated in projects supporting professional learning in Numeracy and Mathematics, Digital and Science, with projects supporting professional learning for STEM as a whole also accounting for a significant proportion of delivery. Projects supporting professional learning in Technologies and Engineering are considerably under-represented in Round Two projects; whilst improving gender balance and equalities is an objective of the programme overall, only one project focused explicitly on this. Phase 1 projects engaged over **10,000** attendees, and it is anticipated that Phase 2 projects will engage over **17,000** practitioners in total. Demand and engagement has been particularly high amongst early years and school STEM practitioners. Projects have also developed a wide range of Digital and classroom resources.

7.2 The COVID-19 pandemic had a significant impact on the delivery of Round 2 projects. Though some projects were postponed or did not proceed, many others were re-scoped to provide professional learning remotely and via Digital platforms. The scale of this transformation in response to pandemic-related restrictions should not be under-estimated: as a result, there has been a fundamental change in the provision of professional learning for STEM practitioners, to what can arguably be considered the new 'normal'. Increased availability of and capacity for Digital delivery is also broadening the accessibility of professional learning. Whilst there has been a shift away from face-to-face delivery of professional learning, it must be borne in mind that as restrictions ease there will likely be an increase in demand for 'live' professional development sessions. However, it is anticipated that there will not be a return to in-person professional learning on the same scale as pre-pandemic, and there are many benefits brought by Digital delivery, at the very least in accessibility terms, that must be retained going forward.

7.3 Strong practitioner feedback, and improvements in self-assessment by practitioners demonstrate that the SGP is having a positive impact on the capacity and capability of STEM practitioners. Evidence from learners also indicates that the programme is starting to generate the intended learner outcomes of the SGP. As a result, the importance of professional learning to the ambitions of the STEM Education and Training Strategy is being demonstrated.

7.4 Education Scotland's Regional Teams play an important role in Scotland's STEM landscape. They fulfil a very valuable role at the interface of national, regional and local STEM education and training structures.

7.5 However, some challenges remain. There needs to be greater clarity on functions and responsibility across the mix of national, regional, and local STEM education structures. Engagement and collaboration with partner organisations can be improved. This will help Education Scotland maximise the effectiveness of its STEM team, and also the expertise and knowledge of partners can be deployed to enhance professional learning.

7.6 A number of support gaps remain, which must be addressed by future rounds of the Grant Programme. This includes developing headteacher and other leaders' understanding to be able to champion STEM learning across whole settings. The transition of pupils from primary, through the broad general education phase delivered in S1-3, and into the senior phase of secondary school is also a critical area of focus demanding attention. In addition, as well as ensuring greater cascading of knowledge from professional learning, actions to help broaden STEM understanding and link STEM knowledge to societal demands and challenges are required.

7.7 However, in order to achieve the maximum impact and fully support the delivery of professional learning in STEM education in future, additional resourcing to drive the STEM strategy and support with the administrative aspects of the STEM grants process should be explored.

Recommendations

7.8 This section presents our recommendations as areas for consideration for both further rounds of the SGP and Education Scotland's wider work in the STEM landscape.

STEM Grants Programme

Recommendation 1: **Target groups**: Evidence from the practitioners' survey shows there has been some improvement in awareness and better understanding of the importance of gender balance and equality of access to STEM learning. However, progress in this area of the SGP is not as marked as in other aspects of STEM professional learning which suggests that more can be done. To this end, Education Scotland should consider allocating a certain proportion, for example, of Round Three funding to projects which specifically aim to address the **IGBE** theme and objectives.

Other target groups worthy of a similar focus are the **CLD and ELC sectors**. Connections are still weak between the CLD sector and other STEM-related partners for example. A particular concern is that over the next year or so as teaching returns to 'normal', there will be a shift in focus in many EY and primary settings towards core literacy and numeracy curriculum topics, as well as health and wellbeing. Supporting the continued delivery of STEM and gender equality capacity, capability and understanding in classrooms will thus become even more important. Having the correct mindset, awareness and confidence levels to 'make a start' are big challenges in the EY sector.

Schools and/or organisations operating predominantly in **rural and remote geographies** which have additional delivery challenges must also be a continued target of support as **are school-based technical support staff and the additional support needs sector** whose training needs are often overlooked. They also merit continued focus and support.

Recommendation 2: Project mix: There was an increased focus on Numeracy and Mathematics in Round 2 funding as result of increased funding for Numeracy and Mathematics provided by the Scottish Government Learning Directorate and also given the importance of mathematics in underpinning STEM learning. This will remain a focus in Round 3 of the SGP given that 50% of the funding being provided is to support Numeracy and Mathematics.

However, with the recent pandemic and the necessary shift to online/Digital learning for pupils and practitioners, there will be a continued need for improved Digital skills in STEM teaching. With the Education Scotland Digital Team available to support practitioners and other teams (STEM, RAiSE Officers), the funding of more projects, which have a focus on upskilling practitioners in using Digital Technology to bring science and STEM to life for learners, is recommended. A focus on improving the quality of **Digital** projects is also recommended as is support to make the best use of Digital resources for practitioners, especially important given the prospect of future blended learning (and possible future spells of remote-only learning).

Support for more **Technology** focused projects referencing the aims of the Logan Review as data, digital skills and computer science become increasingly important in the curriculum, is also recommended. Working with partner Skills Development Scotland may be also be useful to better understand the skills pathways into Digital Technology careers and jobs**.**

Funding to support **coaching and mentoring** for 'trained' teachers/practitioners, as access to (and awareness of) online resources increases, will also be an emerging requirement.

Recommendation 3: Project appraisal processes: A **greater role for RICs** in determining future priorities for funding. The RIC teams are well-placed to understand local (and regional) need and challenges, and working closely with wider partners and organisations may have a more complete view of the local STEM landscape and activities.

Recommendation 4: Sustainability: There is a need to build on resources and expertise developed through Rounds One and Two of the programme in order to build sustainability into STEM CLPL. Providing further funding for particular organisations or partners, whose **projects have demonstrated cumulative outcomes** and impact should be a considered part of the project appraisal process and be part of project scoring criteria.

Some projects are part of, or lead to a wider suite of actions/strategy. This is good practice and should be encouraged. Schools or organisations that **use their STEM grant project as the basis for a wider Action Plan** (which includes equity/equality training for practitioners and learning around leadership/employability) should be favoured. If a STEM project is situated more widely (like in an Action Plan) it can have greater reach.

Schools and other organisations would benefit from **at least two years investment to maximise delivery effectiveness**. If the programme funding and delivery period were longer it would allow for more embedded outcomes thus maximising impact and would allow for the ability and time to effectively evaluate projects.

Recommendation 5: Consider alternative funding approaches: Consider using a *demand-led* approach to influence and stimulate funding bids. The current system is supply-led, i.e. a set of funding criteria and project eligibility, albeit based on data/demands identified through surveys, local networks and evaluation activity, but for schools and other organisations delivery is effectively what they 'want to do'. Education Scotland, and/or RICs, could explicitly define the challenge(s) to be addressed.

This, however, would require a national consultation about STEM funding priorities, perhaps as part of the STEM Strategy review when it takes place. Education Scotland and Scottish Government specifying a range of funding priority areas, themes, settings or even geographies and making a financial allocation to each of these. The current Round 3 programme guidance has gone some way towards this by specifying a menu of areas which can be considered for funding but with only one specific allocation to Numeracy/Mathematics projects of 50% of the total available funding. Grant funding submissions may be more relevant if in response to a defined challenge or identified need; this approach is used effectively in innovation programmes, and could be adapted for the SGP.

Commissioning is another approach where Education Scotland could directly commission at least some of the supported projects from key delivery organisations, potentially for larger scale delivery, or for rolling out examples of successfully delivered local projects at a national level, e-Sgoil is perhaps a previous example. Another example could be for Science Centres to work as a group with (almost) national coverage. Science Centres have stated they would prefer to be part of a joined up 10-12 week programme of activity which would allow them to develop a better/ongoing relationship with schools.

Another approach to be considered is different/additional funding streams within the SGP to support more core or development activity, where upskilling and professional learning is a key component of an organisation's operation. *Core funding* could be provided to national organisations or RICs allowing them to decide on what is developed and delivered; *top slicing* a proportion of funding for RICS to decide on and address local priorities in each region and then submit project bids accordingly; and finally allocate a proportion of funding for *developmental* project activity, e.g. projects which would benefit from a longer funding period to design and pilot new approaches adopting a 'test and learn' approach for potential future mainstreaming of activity.

Recommendation 6: Implementing a robust monitoring and evaluation system: Lead grantees and projects would usefully benefit from guidance on how to monitor and measure progress for subsequent funded projects and for their other STEM/IGBE activities. This will necessarily require a mix of both quantitative and qualitative research. The refinement and implementation of the Monitoring and

Evaluation framework (and accompanying toolkit) developed as part of this assignment, is recommended as part of the SGP's Round Three delivery. This framework should take cognisance of the results of Education Scotland's pilot practitioners' self-evaluation toolkit and be refined accordingly. (**see Appendix 7**)

Education Scotland operational considerations

Recommendation 7: STEM Officer role: more clarity is needed within Education Scotland and across the RICs of the role and responsibilities of STEM and IGBE officers. This is understood to be a combination of facilitation, CLPL delivery and programme/project administration and management. Terms of reference or a mission statement setting out the remits of the STEM and IGBE officers is recommended. There is a need for Education Scotland to continue to make the best use of wider resources; draw upon educationalists, subject experts and academics to support officer activity.

Recommendation 8: Resources to support STEM Strategy: The benefits of enhanced resourcing has been outlined. The roles and responsibilities of supporting officers working within each RIC should be outlined to ensure maximum impact in light of the differing resources and priorities within each collaborative. Managing a grants programme has resource implications and part of the additional resource should include programme and project administration support – typically up to 10% of a programme fund.

Education Scotland strategic considerations

Recommendation 9: Reviewing the STEM Strategy: Given the absence of a mid-point review for the STEM Education and Training Strategy as a result of the COVID-19 pandemic, Education Scotland, in collaboration with strategic partners, should work with Scottish Government officials to support the intended refresh of the Strategy in light of some of the challenges identified in this evaluation (the scope of the research notwithstanding), and also the fundamental changes in STEM professional learning and wider STEM education landscape post-pandemic. There are changing needs for STEM education, and the strategy must be attuned to this. It must also be able to demonstrate the flexibility to respond to such changing circumstances in future.

Recommendation 10: Partnership working: Education Scotland should continue to seek opportunities to maximise the expertise and knowledge embedded within partners organisations, including professional bodies and learned societies. Taking a more collaborative approach to supporting professional learning in STEM and supporting STEM education can only serve to strengthen the offer to STEM practitioners across Scotland. It will also better integrate partner organisations that currently feel on the periphery of STEM professional learning provision.

Recommendation 11: Improving alignment in the STEM landscape: Education Scotland should continue to work closely with strategic partners to enhance connections between the various structures in STEM education and professional learning. The current array of partnerships, hubs and collectives could create a degree of confusion in the roles of various actors, and the remit of different bodies. It also raises questions regarding the degree to which regional groupings such as RICs are well-placed to address local-level issues. It is possible that work in this regard could feature as part of a STEM Education and Training Strategy refresh, as set out in Recommendation 9 above.

Next steps

7.9 The SGP's Round Two projects delivered have helped to realise some strong and tangible benefits. Learning from this round of delivery and from the challenges posed by the COVID-19 pandemic has already been reflected in preparations for Round Three of the programme. The wider work of the Education Scotland STEM and IGBE teams throughout the pandemic period has also been recognised and highly valued.

7.10 It is anticipated that the key findings, observations and recommendations in this evaluation report will be built into Education Scotland's future approach for supporting the delivery of practitioner STEM professional learning, promoting improvements in gender balance and equality of access for learners, and in working with partners and stakeholders in the wider STEM landscape.

7.11 The ekosgen team will work with the Education Scotland team to scope and agree the focus for the next reporting period.

Appendices

Appendix 1: Operational stakeholder consultees

Consulted
Edinburgh Napier University
University of Edinburgh
University of Glasgow
University of the Highlands and Islands
University of St Andrews
University of Stirling
University of Strathclyde
7 organisations: 7 consultations

Focus Groups
Education Scotland (3 attendees)
RAiSE Officers (6 attendees)
Science centres (8 attendees, 7 organisations) *Aberdeen Science Centre* *Dundee Science Centre* *Dynamic Earth* *Edinburgh International science Festival* *Glasgow Science Centre* *Scottish Schools Education Research Centre* *Tech Fest*
STEM Ambassador Hubs (4 attendees)
10 organisations: 5 focus groups

Appendix 2: Strategic stakeholder consultees

Consulted
Association for Directors of Education in Scotland
Association for Science and Education
Dumfries & Galloway Council
Early Years Scotland
Education Scotland
Energy Skills Partnership
Equate Scotland
Food and Drink Federation
Institute of Engineering and Technology
Institute of Physics
Learning for Sustainability Scotland
Learning Link Scotland
Scottish Technicians Advisory Council
Scottish Qualifications Authority
Skills Development Scotland
West College Scotland
Wood Foundation
Zero Waste Scotland
RSE Learned Society Group (Focus Group)
19 organisations: 28 consultations, 1 focus group

Appendix 3: Lead grantee consultees

Schools/ELC	Local Authority	Organisation/RIC
Bankhead Nursery	Argyll & Bute Council	Field Studies Council
Canobie Primary School	Clackmannanshire Council	Royal Highland Education Trust
Ellon Primary School	Edinburgh City Council	Scottish Childminding Association
Fraserburgh Academy	Glasgow City Council	South West Education Improvement Collaborative
Hazeldene Family Centre	Midlothian Council	Winning Scotland Foundation
Port Ellen Primary School	South Lanarkshire Council	
St Luke's High School		

Appendix 4: Education and attainment in STEM

Overview

This appendix presents and analyses data regarding education and enrolment in STEM. Where possible, data is analysed by indicators such as gender, subject, and institution. As such, it provides an overview of STEM education and skills provision in Scotland, using definitions consistent with those contained within the STEM Education and Training Strategy and its supporting Evidence Base (the latter was prepared by ekosgen in 2017, and refreshed in 2019), as well as ekosgen's previous evaluation of professional learning in STEM, developed in 2020. It considers current levels of provision in key areas of school and college provision, apprenticeships, and university provision.

The analysis set out in this appendix draws on data from the Scottish Qualifications Authority (SQA), Scottish Funding Council (SFC), Higher Education Statistics Agency (HESA), and Skills Development Scotland (SDS) regarding provision, as well as desk research into the range of qualifications available.

There are recognised limitations on education and training data, such as its retrospective nature, and the fact that data is collated for policy development and for a greater understanding of sectors rather than specifically to identify skills supply and demand mismatches. Further, it should be recognised that there is a wide variety of qualifications being delivered through various teaching/training modes, and as such any comparison is not like-for-like.

It should also be noted that there will be a degree of overlap across the various levels of education. For example, college data will overlap with MA data to an extent, since much SVQ delivery for MAs will be college-based. School college provision may also be counted twice. Associate students will also be counted at both college and HEI.

Significantly, data presented for the most recent year (i.e. 2020 or 2019/20) must be considered within the context of the COVID-19 pandemic. This is especially critical in terms of school attainment given the school assessment model was altered in 2020. The pandemic led to the cancellation of 2020 National 5 (SCQF Level 5), Higher (SCQF Level 6), and Advanced Higher (SCQF Level 7) exams. Coursework could also not be collected or assessed by the SQA. Grades awarded in these qualifications were instead based on teacher estimates, therefore care must be taken when comparing 2019/20 school attainment data with previous years where exams did take place[26].

The chapter has been prepared recognising these limitations to provide an overview of education and training activity within STEM-related subject areas at a variety of qualification levels. It does not attempt to present a total potential pipeline figure for STEM at this stage.

Education overview

There are a range of qualifications and awards which can be undertaken by individuals to support the development of the STEM skills required specifically in STEM sectors and for application across the economy. Due to the wide range of STEM-related roles available and the specialised skills required for many of these, many qualifications are tailored to specific skills or job roles. There is however an increasing focus on transferable numeracy, analytical and problem-solving skills within STEM-related subjects and qualifications. The core qualifications offer is summarised below with details of the scale of provision and subject areas covered later in the chapter. A number of these qualifications – SVQs, HNQs and PDAs – are not specifically identified within the rest of this chapter. This is because they are subsumed within the wider college data.

[26] https://www.gov.scot/news/school-leaver-attainment-and-destinations-4/

National, Higher, and Advanced Higher-level qualifications

National, Higher and Advanced Higher qualifications are secondary level education qualifications. For STEM-related subjects, these are offered within the broad fields of Mathematics, Sciences, and Technology. National level qualifications are offered at Scottish Credit and Qualifications Framework (SCQF) Levels 1 to 5, Higher level subjects are offered at SCQF Level 6, and Advanced Highers are offered at SCQF Level 7.

Scottish Vocational Qualifications (SVQs)

Scottish Vocational Qualifications (SVQs) are accredited qualifications based on National Occupational Standards (NOS) and result in a certificate of vocational education. They provide practical, vocational skills for both people already working in the sector and those looking to move into it. For STEM-related subjects, they are developed by the relevant Sector Skills Council, informed by industry and the awarding body. SVQs are provided by colleges and training providers and assess workplace competencies in relation to a specific job role.

SVQs are available at SCQF levels 4 to 11 (SVQ 1-5), meaning they are suitable for learners in a variety of job roles within STEM industries. The qualifications and their content are split by the purpose of the qualification and the needs of the learners, ranging from ‘users’ to ‘professionals’. SVQs are designed to be undertaken by people working or seeking to work in STEM occupations.

National Qualification Group Awards (NQGAs)

National Qualification Groups Awards (NQGA) encompass both National Certificates (NC) and National Progression Awards (NPA). They are designed to prepare people for employment or progression to study at HNC/HND level and aim to develop transferable knowledge, including core skills. They are aimed at 16 to 18-year olds or adults in full- or part-time education and are available at SCQF levels 2-6. Because of the limited availability of detailed data on subject specific NQGAs, these have been excluded from the definition.

Higher National Qualifications (HNQs)

HNQs provide practical skills and theoretical knowledge that meet the needs of a specific sector. They are awarded by the Scottish Qualification Authority (SQA). Higher National Certificates are at SCQF level 7, and Higher National Diplomas at SCQF level 8. They are available in several STEM-related subjects.

HNCs and HNDs are suitable for those in technical-level and first-line management roles, and some HNDs enable learners to progress into the second or third year of university degrees. They are delivered by colleges, some universities, and many independent training providers, and many enable learners to progress from HNC or HND provision onto a degree course, either at college or at university, to further their studies.

Apprenticeships

Apprenticeships are a key part of the Scottish Government’s strategy to tackle the skills gap in Scotland. They enable employers to develop their workforce and allow individuals to gain qualifications whilst in paid employment. The training provided prepares learners for a role in the sector and equips them with the skills required by employers to work in a range of roles. Individuals learn on-the-job and undertake off-the-job learning, usually through colleges or training providers.

Apprenticeships are available at a variety of SCQF levels. Modern Apprenticeships (MAs) are typically available at SCQF levels 5-7, with some elements ranging from SCQF levels 5 to 12. Technical Apprenticeships are available at SCQF level 8-9 and Professional Apprenticeships at SCQF level 10 and above[27]. Graduate Apprenticeships have also recently been launched, providing learning up to SCQF level 11. In addition, Foundation Apprenticeships are a work-based learning qualification for pupils in S4 to S6 to complete elements of a MA while they are at school.

Apprenticeship frameworks are developed for STEM sectors by Sector Skills Councils in partnership with employers and awarding bodies. Modern Apprenticeship frameworks include Engineering, Construction, IT and Telecommunications, Life Sciences and Related Science Industries, and Rail Engineering. Foundation Apprenticeship frameworks include Civil Engineering, Hardware and System Support, Scientific Technologies, and Software Development. Graduate Level Apprenticeship frameworks include IT Software Development and Civil Engineering.

Diplomas are developed in line with apprenticeship frameworks to provide competence-based qualifications in line with apprenticeship learning in the workplace.

Professional Development Awards (PDAs)

PDAs provide qualifications for individuals already working within the sector to enhance their skills. The qualifications are delivered by colleges, training providers and some employers. They include Higher National units and are delivered through a variety of learning mechanisms which can include taught learning, self-directed study, research, and practice-based learning. The inclusion of HN units means that candidates can progress from PDAs to complete full HN or SVQ qualifications.

Reflecting the wide range of STEM occupations, many PDAs are available, providing specialist skills in a number of areas and supporting continuous professional development and improved professional practice. PDAs are available at SQCF levels 6-12, with credit values ranging from 16-64 credits, reflecting the level of content in each PDA and the number of learning hours required to complete them.

Degrees

There is a vast array of degree subjects which can lead into a career in STEM roles and industries, with most of these courses available at both undergraduate and (taught) postgraduate level. These include degrees in Medicine and Allied Subjects, Biological, Physical and Chemical Sciences, Mathematics and Computer Sciences, Engineering, and Architecture and Planning.

Higher level qualifications enable individuals within STEM sectors or seeking employment in a STEM sector to significantly enhance their knowledge and specialist skills and Higher Education Institutes (HEIs) provide valuable skilled workers required by the sector.

Schools

Entries and passes

Table A4.1 sets out STEM entries and qualifications for Scottish school pupils from 2017 to 2020[28]. In 2020, there were 164,000 passes at SCQF Levels 3 to 5 (National level), 55,000 at SCQF Level 6 (Higher) and 11,000 at SCQF Level 7 (Advanced Higher). Between 2017 and 2020, there has been an increase in the number of passes at National level (particularly for SCQF Levels 6 and 7) and the pass rate has also increased. However, it is important to highlight the impact the COVID-19 pandemic has had on a higher number of passes and higher pass rates for 2020, particularly as entries have fallen at all levels between 2017 and 2020. In 2018, Scotland's scores in the PISA assessments were similar to the OECD average in science and maths, but above the OECD average in reading[29].

[27] https://www.skillsdevelopmentscotland.co.uk/what-we-do/apprenticeships/modern-apprenticeships/modern-apprenticeship-group-mag/information-on-technical-and-professional-apprenticeships/

[28] Analysis throughout this section draws on SQA data, which includes state and private schools

[29] Scottish Government (2019) *Programme for International Student Assessment (PISA) 2018: Highlights from Scotland's Results*

At National level (SCQF Level 3-5), changes to subject choices, qualifications and examinations implemented through Curriculum for Excellence have meant that, while there is a greater focus on blended and interdisciplinary learning, pupils are taking a more focused number of subjects[30] (generally one fewer). As learners are being entered for fewer subjects in S4 overall this is likely to have had an impact on the numbers taking and attaining qualifications in STEM-related subjects at National level, though will of course not wholly explain the change in the STEM cohort. It should be noted that some schools are moving to National 5 and Highers over two years for some learners. The latter may involve a bypass of National 5 completely, for some learners. Additionally, there has been a historic trend of declining secondary school pupil population (around 1-2% per annum), though latest data indicates a modest increase in 2018 and 2020[31]. Comparing a single year (2020) with a previous single year (e.g. 2017) is not necessarily that helpful and will be increasingly inappropriate in years to come. Some schools are offering students the opportunity to undertake non-traditional awards and courses, such as Skills for Work, NPAs and Foundations Apprenticeships, a positive in terms of increasing variety and achievement – albeit not counted in traditional STEM National Qualification pathways.

The number and proportion of passes in STEM-related subjects at Advanced Higher level remained fairly steady between 2017 and 2019, before increased in 2020. At Higher level, the number of passes had fallen overall between 2017 and 2019, and at a greater rate than the decrease in the size of the STEM Higher cohort, before rising in 2020.

The pass rate at Higher level fell from 2017 to 2019 before increasing in 2020. Entries at both Advanced Higher and Higher level fell between 2017 and 2020. For Higher the subjects that have seen an increase in entries were Music Technology, Human Biology and Mathematics, where entries increased by 31%, 18% and 2% respectively. For Advanced Higher the largest increases in entries took place in Mathematics of Mechanics (17%) and Biology (12%), with Mathematics also increasing (1%).

Table A4.1: STEM entries and qualifications for Scottish school pupils, 2017-2020

	2017	**2018**	**2019**	**2020**	**% or p.p.[32] change 2017-2020**
SCQF 3-5					
Entries	198,802	184,456	186,425	189,069	-4.9%
Passes	158,682	143,394	144,036	163,713	3.2%
Pass rate	79.8%	77.7%	77.3%	86.6%	6.8 p.p.
SCQF 6[33]					
Entries	67,239	65,172	63,598	63,978	-4.8%
Passes	49,217	47,899	45,667	55,246	12.2%
Pass rate	73.2%	73.5%	71.8%	86.4%	13.2 p.p.
SCQF 7					
Entries	12,065	12,328	11,883	11,930	-1.1%
Passes	9,187	9,438	9,051	10,847	18.1%
Pass rate	76.1%	76.6%	76.2%	90.9%	14.8 p.p.

Source: SQA, 2021

[30] On average, this is just above six subjects, although some schools still offer seven or eight subjects at National level

[31] Scottish Government (2018) Pupils in Scotland, 2018; also Scottish Government (2020) Summary statistics for schools in Scotland 2020 edition

[32] Percentage point

[33] Human Biology only available at SCQF level 6

Table A4.2 shows the change in entries and attainment across non-traditional STEM subjects at SCQF Levels 3 to 6. Over the period, 43% more pupils undertook STEM-related Skills for Work courses, with 73% more pupils completing NPAs in STEM subjects. STEM-related National Certificate attainment fell by 30% across the period, however overall entries/attainment in non-traditional STEM qualifications grew by one-quarter (25%) between 2017 and 2020. Although there had been a decline in entries and attainment in National, Higher and Advanced Higher qualifications between 2017 and 2019 pre-COVID, the 12% increase in entries and attainment across non-traditional STEM qualifications subjects across that period suggests a proportion of pupils are still studying STEM subjects. A full list of non-traditional STEM subjects and qualifications can be found in **Appendix 6**.

Table A4.2: Non-traditional STEM entries and attainment for Scottish school pupils, SCQF 3-6, 2017-2020[34]

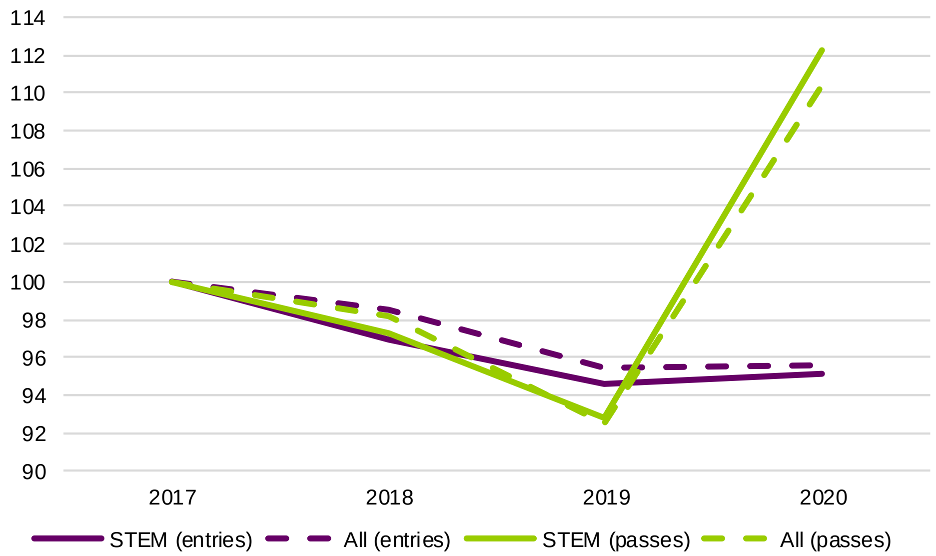
Qualification Type	2017	2018	2019	2020	% Change 2017-20
Skills for Work[35]	3,147	3,372	3,896	4,491	42.7%
NPAs[36]	3,557	4,122	4,880	6,135	72.5%
Awards	0	4	47	30	650.0%
National Certificates	4,179	3,924	3,313	2,916	-30.2%
Total	**10,883**	**11,422**	**12,136**	**13,572**	**24.7%**

Source: SQA, 2021

STEM's relative performance

In line with the overall SCQF Level 6 entry and pass trends in Scotland over the period from 2017, STEM Higher entries and passes have followed a similar trend, as shown at Figure A2.1. STEM entries at Higher level fell by 5% between 2017 and 2020, over a period when the number of all Higher entries has fallen by 4%. For STEM and all subjects, passes fell between 2017 and 2019 (7% and 8% respectively), but rose 12% and 10% across the full period.

Figure A4.1: Index of total and STEM entries and passes for Highers, 2017-2020



Source: SQA, 2021

[34] Figures are higher here than in the previous report due to the inclusion of SCQF 6 data in this table, as well as a range of new STEM-related provision listed in the Appendix 6 subject definitions tables

[35] Skills for Work entries are shown

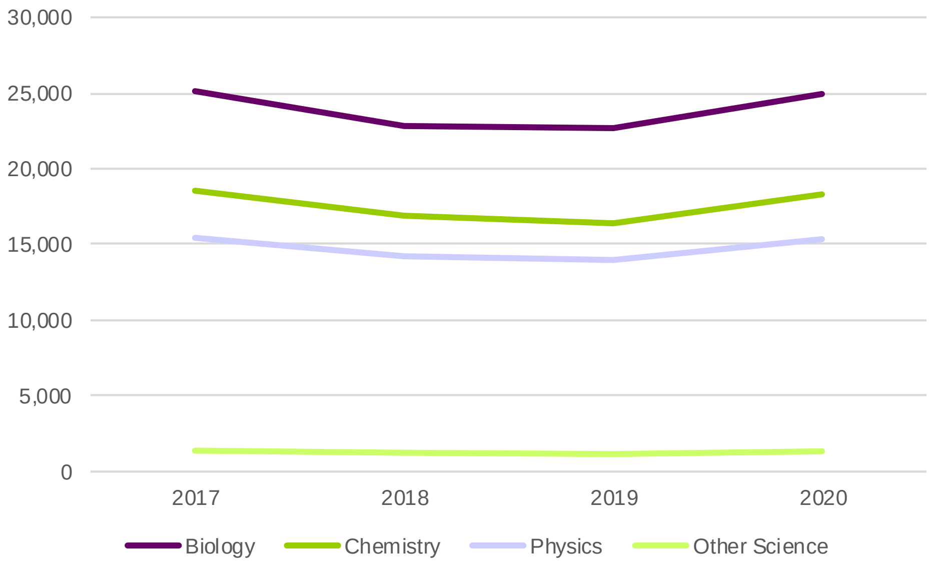
[36] NPA, Award and National Certificate attainment is shown

Contributors to change – SCQF Level 3-5 (National level)

Changes to assessment processes have been the most significant contributing factors to the 3% rise in STEM passes at National level between 2017 and 2020, with passes in Mathematics (21%), Biology (19%) and Chemistry (13%) at SCQF 5 all up over this period. Between 2017 and 2019, these were down 1% and 2% for Biology and Chemistry, respectively, and up 1% for Mathematics.

In terms of Science subjects, as shown in Figure A4.2, following a decline between 2017 and 2019, there has been an increase in each of Biology (10%), Physics (10%) and Chemistry (12%) between 2019 and 2020, largely due to a the COVID-19 pandemic.

Figure A4.2: STEM passes for Science subjects at National level, 2017-2020[37,38]



Source: SQA, 2021

It is more difficult to draw specific trends from National level passes in Technology subjects as there have been several curriculum changes, including the withdrawal of some subjects and others being newly introduced. However, the overall trend is a decrease in the number of passes in Technology subjects between 2017 and 2019 of around 13% (25,000 to 22,000), followed by a rise between 2019 and 2020 of around 20% (to 26,000).

There has been a notable decline in Computing Science[39] passes at National level from 2017 to 2020, over 350 in absolute terms and 4% proportionally.

Not considered in the analysis at this stage is the number of school pupils leaving school without a STEM qualification. Given the trends in STEM passes for school pupils in Scotland discussed above, and the implications and impact of COVID-19, this may be something worthy of consideration in future research.

Contributors to change – SCQF Level 6 (Higher level)

A closer look at the data for Science and Mathematics Higher level subjects suggests that, between 2017 and 2019, there was not been a great deal of change, with small fluctuations for all subjects (Figure A4.3). Between 2019 and 2020, i.e. the pandemic year, there has been an increase in passes for all

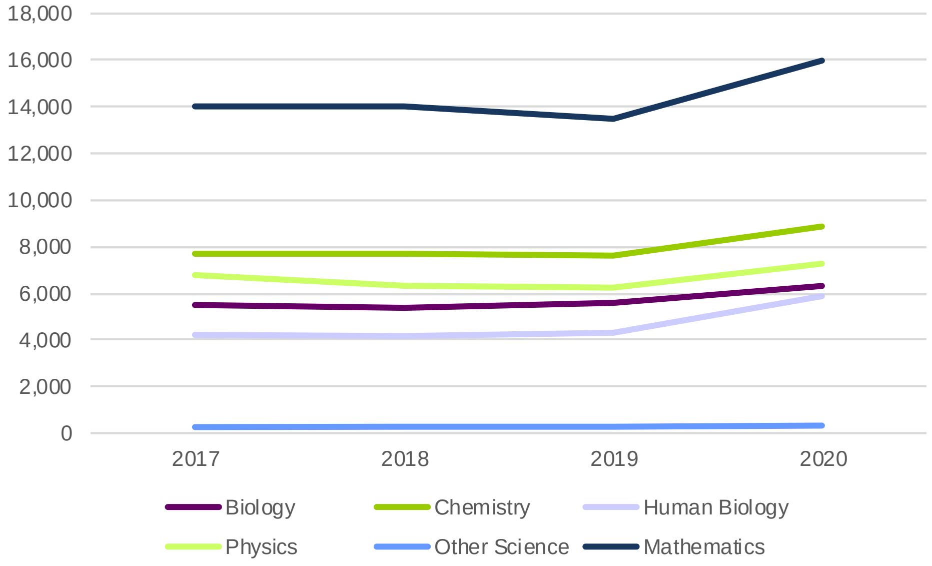
[37] It should be noted that Human Biology is not offered at National level

[38] Correction: This figure in the last report double counted SCQF level 4 passes for all subjects listed – the correct numbers are now shown

[39] This includes Computing, Computing Science, Computing Studies, and Information Systems

listed subjects: Human Biology (+35%), Other Science (+20%), Mathematics (+19%), Chemistry (+16%), Physics (+16%), and Biology (+13%).

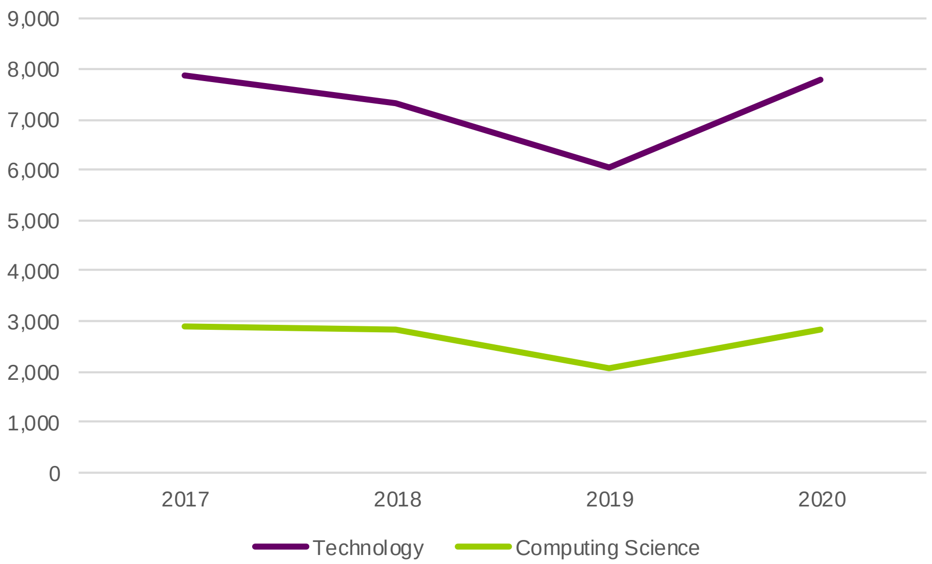
Figure A4.3: STEM passes for Science and Mathematics subjects at Higher level, 2017-2020



Source: SQA, 2021

As with National Level, it is more difficult to draw out subject level trends with Higher Technology passes due to changes in subject provision. Figure A4.4 shows that passes for both Technology and Computing Science have declined slightly over this period (1% and 3% respectively), with a particularly stark decline for Technology between 2017 and 2019 (from 7,900 to 6,000).

Figure A4.4: STEM passes for Technology subjects at Higher level, 2017-2020

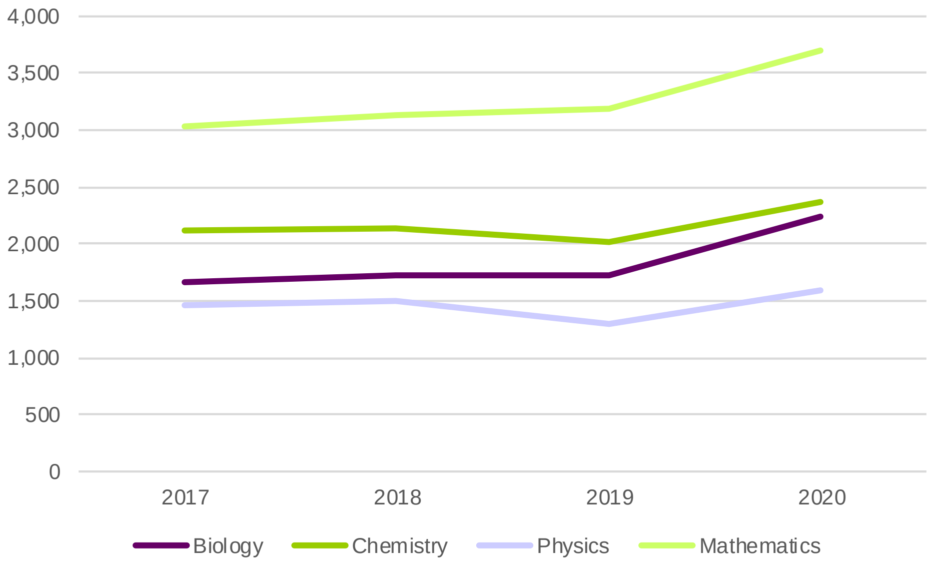


Source: SQA, 2021

Contributors to change – SCQF Level 7 (Advanced Higher level)

As shown in Figure A4.5, there has been an increase in passes for Mathematics at Advanced Higher level over the period 2017 to 2020 (a 22% increase, or around 700). There were also increases in Advanced Higher passes for all other science subjects, notably Biology (35%).

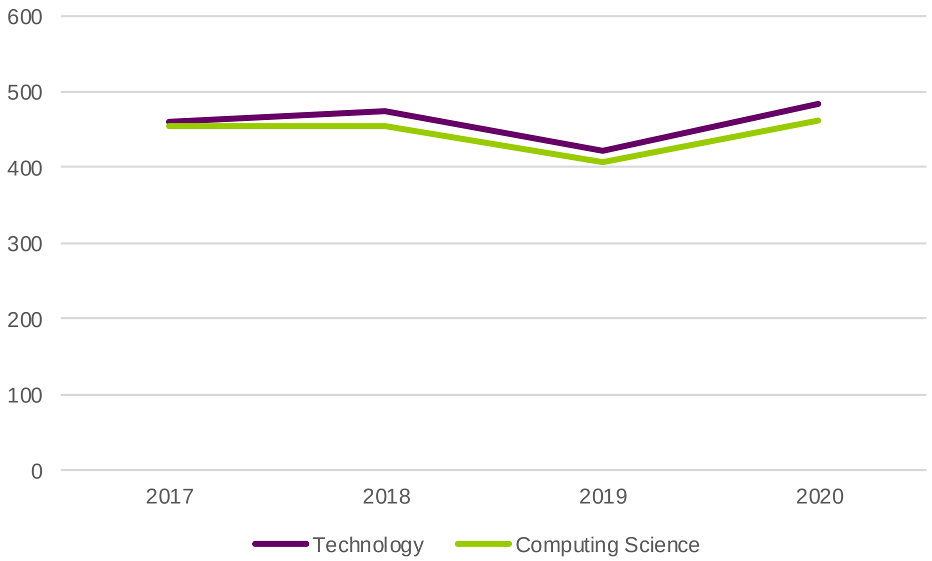
Figure A4.5: STEM passes for Science and Mathematics subjects at Advanced Higher level, 2017-2020



Source: SQA, 2021

As shown in Figure A4.6, there have historically been fewer passes in Computing Science subjects than Technology subjects at Advanced Higher. There was been a notable decline in passes across both between 2018 and 2019, however passes in each grew between 2019 and 2020: 15% for Technology and 14% for Computing Science.

Figure A4.6: STEM passes for Technology subjects at Advanced Higher level, 2017-2020



Source: SQA, 2021

Profile of learners

Table A4.3 shows that females continue to be under-represented in STEM-related subjects at school. In 2020, 44.9% of STEM entrants were female at National level, 47.5% were female at Higher level, and 45.5% were female at Advanced Higher level. This is lower in comparison to the female entry share for all school subjects at these levels, where female entrants were 48.8%, 55.8% and 56.0%, respectively.

Where females engage in STEM-related subjects, data suggests that they secure a higher success rate than males. Females make up a higher percentage of STEM passes than STEM entrants. This reflects their higher pass rate across all levels, with the difference in pass rate being highest at Advanced Higher level in 2020. It may also reflect the likelihood that only females who are confident and committed to STEM subjects will choose to undertake them. In 2020, the female pass rate in STEM-related subjects at Advanced Higher level was 2.4 percentage points higher than that for males, it was 2.2 percentage points higher at Higher level and 0.2 percentage points higher at National level. The breakdown of STEM entries, passes and pass rate by gender and over time is given at **Appendix 5**.

Table A4.3: STEM school entries and passes, by gender, 2020

Level	STEM entries		STEM passes	
	Female share	Male share	Female share	Male share
SCQF 3-5	44.9%	55.1%	49.9%	55.1%
SCQF 6	47.5%	52.5%	48.1%	51.9%
SCQF 7	45.5%	54.5%	46.1%	53.9%

Source: SQA, 2021

The differences in gender representation between subjects are also notable. For example, females made up 65% of Biology passes at National level in 2020. This compares with females accounting for just 21% of passes in Computing Science, 25% in Technology and 28% in Physics. At the National level, there is a fairly even gender split in Chemistry and Mathematics. These trends are similar to the data for 2019.

This pattern largely persists through Higher and Advanced Higher passes, for example males account for over 71% of Physics passes and 82% of Computing Science passes at Higher, and 76% of Physics and 82% of Computing Science passes at Advanced Higher. The exception is Mathematics. Although the gender split in Mathematics is very equal at National and Higher levels, males make up 61% of passes at Advanced Higher. These trends match those in 2019.

Colleges and further education

Colleges in Scotland deliver a wide range of education provision relevant to STEM employers and occupations. This section provides an analysis of the College provision in Scotland according to the FE College definition detailed in **Appendix 6**[40]**.**

Overall college provision in STEM

STEM enrolments at Scottish colleges have grown in recent years, however there was a decline in enrolments between 2018/19 and 2019/20. Table A4.8 below shows the total number of enrolments on STEM-related qualifications as a proportion of total provision in Scottish colleges in from 2016/17 to 2019/20.

Table A4.8: College enrolments in STEM-related subjects (2016/17-2019/20)

	2016/17	2017/18	2018/19	2019/20
STEM enrolments	73,383	77,824	84,938	77,931
STEM share of all enrolments	25%	26%	26%	26%

Source: SFC, 2021

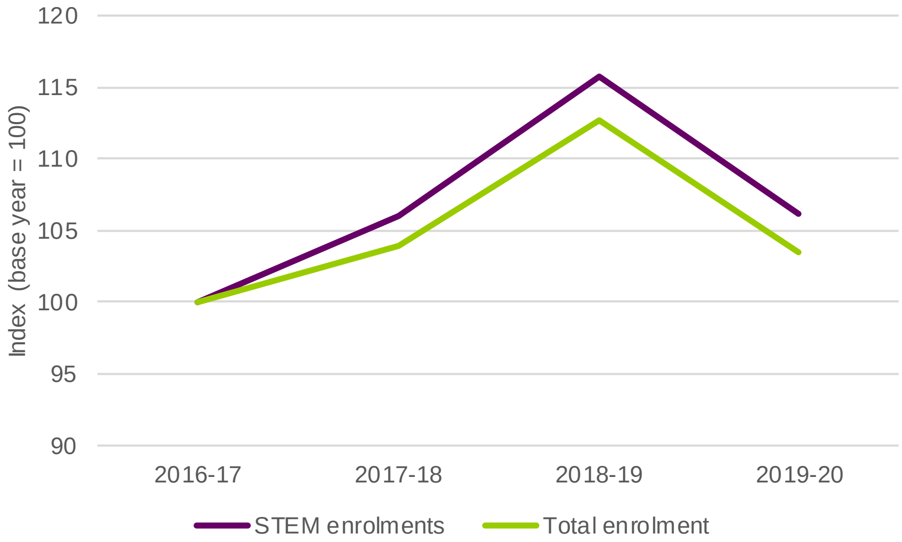
STEM-related subjects contribute a significant proportion of college enrolments in Scotland, accounting for 26% of the total in 2018/19, with almost 78,000 enrolments. As shown at Table A4.7, this rose year-

[40] This includes SFC, SDS, private and ESF funded college provision

on-year until 2018/19, to almost 85,000 enrolments, before falling 8% in 2019/20 (at the same rate as all subject enrolments).

As shown in Figure A4.7, this growth in STEM college enrolments is greater than overall college enrolments over the period between 2016/17 and 2019/20 (6% growth, compared to 4% growth).

Figure A4.7: College enrolments in STEM-related subjects (2016/17-2019/20)



Source: SFC, 2021

Provision by region

Across Scotland, 25 colleges are delivering STEM-related subjects. This includes all of Scotland's regional colleges and the SRUC specialist rural college.

Whilst STEM-related courses are delivered in all 13 college regions (plus by Scotland's Rural College (SRUC), it is geographically concentrated (Table A4.8). In 2019/20, provision was greatest in the Fife region (Fife local authority) with over 16,000 enrolments, 53% of the total in Fife, followed by the Glasgow region (East Dunbartonshire, East Renfrewshire and Glasgow City local authorities) with almost 14,000 enrolments, 21% of the total in Glasgow. This was followed by provision in the Forth Valley (over 9,000 enrolments), Aberdeen and Aberdeenshire (almost 9,000 enrolments), and Dundee and Angus (just under 7,000 enrolments). The gap in the share of STEM enrolments between Fife and Glasgow narrowed in 2019/20 to three percentage points (from five in 2018/19). The share of enrolments in each of Forth Valley and Dundee and Angus has grown in the last year, by five and six percentage points, respectively. Annual changes in the share of STEM enrolments are in part driven by variations in subject choices by college. Some colleges in Scotland have more limited STEM offerings than others, and this should be borne in mind. For instance, the actual number of STEM enrolments in Dundee and Angus has grown 162% since 2016/17, while the number of STEM enrolments in Dumfries and Galloway has fallen 31%.

In comparison with overall enrolments, the high number of STEM enrolments in Glasgow region reflects the region's high number of overall enrolments – around 66,000, over double the number of any other region. However, the prevalence of STEM enrolments in Fife and Aberdeen and Aberdeenshire reflects the higher share of STEM enrolments at these institutions. The top four college regions[41] for number of overall enrolments are: Glasgow (66,000), Fife (30,000), Edinburgh and the Lothians (29,000), and the West (28,000).

[41] It should be noted that Glasgow and the Highlands and Islands are multi-college regions

As shown in Table A4.9, regions that have amongst the largest number of STEM enrolments are not necessarily amongst the regions with the highest share of STEM as a proportion of all enrolments. For example, although Fife has the highest number of STEM enrolments and by far the highest STEM share of all enrolments, at 53%, Aberdeen and Aberdeenshire and Forth Valley also have high proportions of its enrolments being in STEM subjects, at 38% and 41% respectively. In Dundee and Angus, 38% of all enrolments are in STEM-related subjects. Over one-fifth of all enrolments in Glasgow and Edinburgh and the Lothians are in STEM-related subjects. Similarly, although it has a fairly high number of STEM enrolments, the West region has a relatively low STEM share of all enrolments, at just 16%.

Table A4.9: College enrolments in STEM-related subjects by college region (2016/17-2019/20)

College region	2016/17	2017/18	2018/19	2019/20	STEM % of all enrolments (2019/20)
Fife	19,332	20,232	21,096	16,071	53%
Glasgow	17,204	17,922	16,852	13,711	21%
Forth Valley	4,945	5,071	6,276	9,364	41%
Aberdeen and Aberdeenshire	5,624	5,219	9,814	8,811	38%
Dundee and Angus	2,567	2,694	2,734	6,714	31%
Edinburgh and Lothians	4,047	6,423	8,064	6,432	22%
West	5,392	5,649	4,875	4,394	16%
Highlands and Islands	5,019	4,813	4,802	3,902	15%
Lanarkshire	3,741	3,530	3,803	3,741	19%
Ayrshire	2,563	3,423	3,909	2,520	17%
Dumfries and Galloway	1,391	1,214	1,076	958	17%
West Lothian	1,022	1,050	1,052	893	13%
Borders	416	506	498	349	9%
Landbased (SRUC)	120	78	87	71	2%
Total	**73,383**	**77,824**	**84,938**	**77,931**	**26%**

Source: SFC, 2021

Please note, this data includes HE provision in colleges

Full-time/part-time split

In 2019/20, approximately 18% of enrolments in STEM-related subjects were full-time, whilst the remainder of enrolments were studying STEM-related subjects part-time (part-time day release/day course or other part-time modes). This is lower than the full-time rate for all enrolments at college in the same year, which was 25%.

Since 2016/17, there has been a fall in the proportion of enrolments in STEM-related subjects which are full-time, falling eight percentage point from 21% to 18%. This is similar to the overall trend at college level, where full-time study fell two percentage points from 27% to 25%.

Enrolments by subject

College programme data shows provision according to its general subject grouping. There are a wide range of college superclasses (individual subjects) included in our definition of STEM-related subjects (see **Appendix 6** for details). Table A4.10 presents the subject groupings with the number of STEM enrolments within each for 2019/20.

Table A4.10: College enrolments by STEM subjects, 2019/20

Subject	No.	% of total	Change from 2016/17
Engineering	39,917	50%	-2%
Computing and ICT	26,593	34%	+9%
Sciences and Mathematics	12,012	15%	+37%
Total	**77,931**	**100%**	**+6%**

Source: SFC, 2021

Engineering has the highest STEM enrolments of the subject groupings, accounting for half (50%) of enrolments (around 40,000) in 2019/20.

Comparing the 2019/20 enrolments to 2016/17, the STEM subject groupings were in the same order by number of enrolments, although there have been changes in the number of enrolments. Changes to note include a strong growth in enrolments in Engineering between 2016/17 and 2018/19, from around 40,000 to around 47,000, a 16% rise. However, Engineering enrolments in 2019/20 fell to around 39,000 (down 2% since 2016/17). There has been strong growth in Science and Mathematics enrolments over the period, from around 9,000 to around 12,000, an increase of 37%. The number of enrolments in Computing and ICT also rose during this time, from around 24,400 to 26,600, an increase of 9%.

FE/HE split

Table A4.11 shows that most college enrolments are at Further Education level, accounting for 87% of student enrolments in STEM-related subjects compared to 13% for Higher Education. This is broadly consistent with all college enrolments in Scotland (85% v 15%).

Table A4.11: College enrolments on STEM qualifications by FE/HE split (2019/20)

Level	Enrolments	
	No.	% of total
Further Education	68,112	87%
Higher Education	9,809	13%
Total	**77,931**	**100%**

Source: SFC, 2021

Between 2016/17 and 2019/20, the trend of Further Education dominating STEM college provision increased from 84% to 87%. This is set in the context of the proportion of Further Education provision across all college enrolments also rising slightly from 83% to 85% over the period.

Profile of learners

The age profile of the STEM student cohort is varied and has become younger over the last four years. The STEM student cohort is, on average, younger than the overall college student cohort, with well over half (56%) of the STEM cohort aged 19 or under, compared to 42% for all college enrolments, as shown at Table A2.12. In 2019/20, 30% of enrolments on STEM-related qualifications were aged under 16 and 27% were aged 16-19 years old. Older learners continue to account for a significant proportion of enrolments, with 29% of enrolments in STEM-related subjects by learners aged 25 or over, although this is significantly below 43% for all college enrolments.

Table A4.12: College enrolments on STEM qualifications by age (2019/20)

Age group	% of STEM total	% of total enrolments
Under 16	30%	15%
16-19	27%	28%
20-24	14%	14%
25 and over	29%	43%
Total	**100%**	**100%**

Source: SFC, 2021

Males are much more likely to study STEM-related subjects at college. Table A4.13 shows that males accounted for around two-thirds (65%) of college enrolments on STEM qualifications in 2019/20, despite only accounting for 48% of all college enrolments in that year. However, the STEM gender gap has narrowed slightly over the last four years, with female enrolments in STEM-related subjects rising from 32% in 2016/17 to 34% in 2019/20 (an overall rise of almost 3,000 enrolments).

Table A4.13: College enrolments on STEM qualifications by gender (2019/20)

Subject	Gender		
	Female	Male	Other
Engineering	22%	78%	>1%
Computing and ICT	43%	56%	1%
Sciences and Mathematics	55%	45%	>1%
Total	**34%**	**65%**	**>1%**

Source: SFC, 2021

As expected, the gender variation differs significantly by subject grouping. For example, in 2019/20, female enrolments were more common in Science and Mathematics (55%) subjects, which was the most gender-balanced subject grouping. However, male enrolments were much more prevalent in Engineering (78%) and also more common in Computing and ICT subjects (56%).

Apprenticeships

Foundation Apprenticeships

Total starts

Foundation Apprenticeships (FAs) are two-year programmes developed during an early pathfinder design and development stage from 2014-17. The early pathfinders for the period 2014-16 and 2015-17 engaged a range of lead partners in the design and development of FA frameworks and pathfinder delivery models to capture insight and learning to inform future design, development, and delivery. The period 2016-18 is the first time that FA starts and cohorts participated in the fully designed and certified FA frameworks[42]. Data is reported on here starting from 2016/18 and includes subsequent cohorts for 2017/19, 2018/20, and 2019/21, where data allows. Data for the 2020/22 cohort was not available at the time of report.

Table A4.14 shows STEM FA starts across the four current cohorts. There has been an increase of starts to over 1,432 in the 2019-21 cohort. Mirroring the trend in STEM college enrolments, there is a

[42] Frameworks falling under the STEM definition are outlined in **Appendix 6**

clear gender imbalance, with males accounting for most of the STEM FA starts, however this gap is closing.

Table A4.14: STEM Foundation Apprenticeship starts (2016/18-2019/21)[43]

Academic Year	Starts[44]			Currently in Training	Completers
	Total	Female	Male		
2016/18	161	9%	91%	-	124
2017/19	552	14%	86%	-	371
2018/20	722	21%	79%	536	66
2019/21	1,432	23%	77%	1,859	-

Source: SDS, 2021

Starts by framework

As Table A4.15 shows, across all cohorts, the Engineering framework accounted for the largest proportion of STEM starts (between 33% and 44%). Creative and Digital Media accounted for one-quarter of 2019/21 STEM starts (25%). Civil Engineering and IT: Software Development each accounted for 13% of STEM starts in the 2019/21 cohort.

Table A4.15: STEM Foundation Apprenticeship starts by framework (2016/18-2019/21)

Framework	2016/18		2017/19		2018/20		2019/21	
	No.	%	No.	%	No.	%	No.	%
Civil Engineering	47	29%	87	16%	95	13%	184	13%
Creative and Digital Media	0	0%	43	8%	135	19%	353	25%
Engineering	71	44%	232	42%	304	42%	469	33%
Food and Drink Technologies	0	0%	0	0%	10	1%	60	4%
IT: Hardware Systems Support	13	8%	40	7%	35	5%	69	5%
IT: Software Development	30	19%	130	24%	104	14%	189	13%
Scientific Technologies	0	0%	20	4%	39	5%	108	8%
Total	**161**	**100%**	**552**	**100%**	**722**	**100%**	**1,432**	**100%**

Source: SDS, 2021 Percentage is as a percentage of starts on STEM frameworks, rather than overall

As Table A4.16 shows, gender imbalance is apparent across most of the STEM frameworks, with most skewed towards male starts of between 54% (Creative and Digital Media) and 93% (Engineering) in 2019/21. Females account for 53% of Scientific Technologies starts, the only framework in the 2019/21 cohort with more female starts than males. This reflects traditional gender patterns evident in the economy. There has been a slight improvement over time across the Food and Drink Technologies FA.

[43] Female and male starts percentages are based on incomplete data due to an element of data suppression. Currently in Training and Completers data is also based on incomplete data. Social Services and Healthcare FA data was included in the previous report but has been removed to avoid any confusion with STEM frameworks. Source: https://www.skillsdevelopmentscotland.co.uk/media/45251/fa-report.pdf

[44] Female and male starts percentages are based on incomplete data due to an element of data suppression. They also do not include data for the Social Services and Healthcare FA

Table A4.16: STEM Foundation Apprenticeship starts by framework (2016/18-2019/21)

Framework	2016/18		2017/19		2018/20		2019/21	
	%M	%F	%M	%F	%M	%F	%M	%F
Civil Engineering	87	13	89	11	84	16	90	10
Creative and Digital Media	-	-	44	56	64	36	54	46
Engineering	93	7	94	6	87	13	93	7
Food and Drink Technologies	-	-	-	-	20	80	53	47
IT: Hardware Systems Support	*	*	*	*	*	*	*	*
IT: Software Development	*	*	90	10	87	13	92	8
Scientific Technologies	-	-	50	50	46	54	47	53

*Source: SDS, 2021 * denotes disclosure data*

Provision by geography

Table A4.17 shows provision by local authority, grouped under the Scottish Government's RESAS definition. Data for the 2019/21 cohort was not available at the time of reporting. This shows the provision under each STEM framework has either grew or stayed the same over the first three years. For the 2018/20 cohort, STEM FAs were being delivered in 30 of Scotland's 32 local authorities, with Scottish Borders and Shetland being the only exceptions.

In 2018/20, as well as having the greatest uptake in starts, the Engineering framework was also the most geographically widespread, being delivered in 22 local authorities. Creative and Digital Media was being delivered in 20 local authorities. Food and Drink Technologies is the newest STEM FA framework, and as such, was being delivered in four local authorities.

Table A4.17: STEM Foundation Apprenticeship provision by local authority (2016/18-2018/20)

Local authority	Civil Engineering			Creative and Digital Media			Engineering			Food and Drink Technologies			Hardware and Systems Support			Scientific Technologies			Software Development		
Cohort	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Larger cities																					
Aberdeen City					X	X	X	X	X					X	X						
Dundee City			X			X															
Edinburgh, City of		X			X	X		X	X						X					X	X
Glasgow City	X	X	X		X	X	X	X	X			X		X				X	X	X	X
Urban with substantial rural areas																					
East Dunbartonshire	X	X			X		X	X	X					X				X	X	X	X
East Renfrewshire	X	X	X		X	X		X	X									X	X	X	X
Falkirk			X			X	X	X	X												
Fife	X	X	X					X	X			X			X		X		X	X	X
Inverclyde	X	X	X						X						X			X		X	X
Midlothian						X		X												X	
North Ayrshire			X				X	X	X											X	
North Lanarkshire	X	X			X	X	X	X	X			X		X	X				X		X
Renfrewshire	X	X						X						X						X	
South Lanarkshire		X			X			X						X						X	
Stirling																					
West Dunbartonshire		X			X			X											X	X	
West Lothian	X	X						X											X	X	
Mainly rural																					
Aberdeenshire					X	X	X	X	X					X	X					X	
Angus		X	X			X		X												X	
Clackmannanshire			X				X		X												
Dumfries and Galloway								X	X						X						
East Ayrshire			X					X	X											X	
East Lothian						X			X						X			X			X
Highland	X	X	X		X	X							X	X	X		X	X	X	X	X
Moray						X															
Perth & Kinross		X					X	X													
Scottish Borders																					
South Ayrshire							X	X												X	
Islands and remote																					
Argyll and Bute						X	X	X													
Na h-Eileanan Siar						X															
Orkney Islands																					
Shetland Islands							X	X													
Total	**9**	**14**	**18**	**0**	**10**	**20**	**12**	**22**	**22**	**0**	**0**	**4**	**1**	**8**	**12**	**0**	**2**	**9**	**8**	**18**	**12**

Source: SDS, 2020

Modern Apprenticeships

The number of starts on SDS-funded Modern Apprenticeships in STEM-related subjects in Scotland increased from 2016/17 to 2019/20, rising 9% to 10,507. The number of achievements has increased over time despite a slightly fall between 2018/19 and 2019/20, with the achievement rate[45] averaging at 77%, with minor fluctuations (see Table A4.18).

During 2019/20, there were 10,507 starts on SDS-funded Modern Apprenticeships in STEM-related subjects in Scotland[46]. In the same year, there were 8,239 achievements against 10,755 leavers, equating to an achievement rate of 77%, the same as the overall MA achievement rate.

Table A4.18: Starts, achievements, leavers and success rate for MAs in STEM-related subjects 2016/17 to 2019/20[47]

Year	Starts	Achievements	Leavers	Achievement rate
2016/17	9,619	6,076	8,033	76%
2017/18	10,325	7,473	9,487	79%
2018/19	10,038	8,427	10,754	78%
2019/20	10,507	8,239	10,755	77%
Total	**40,489**	**30,215**	**39,029**	**77%**

Source: SDS, 2021

Based on available data, the vast majority of STEM starts in 2019/20 were males at 94%[48]. This compared to 60% of males starts across all MA provision during this period.

Modern Apprenticeships by framework

STEM-related Modern Apprenticeships (MAs) are provided across 34 different frameworks in Scotland (see **Appendix 4** for the definition applied). As presented in Table A4.19 below, Construction: Building was the most popular MA in 2019/20, with over 1,600 starts. This is followed by Construction: Civil Engineering, Construction: Technical and Engineering (1,200 starts each), and Automotive (1,100 starts).

The top 10 frameworks by starts have not shifted greatly from 2017/18 to 2019/20 (the most recent data available). In all three years, Construction: Building was the most popular MA, followed by Construction: Civil Engineering, Construction: Technical, Engineering, Automotive, and IT and Telecommunications, albeit with slightly shifting rankings.

In line with the overall profile of STEM apprenticeship provision, the majority of framework areas are dominated by males, which is in line with the overall STEM workforce, and contrasting with university enrolments – in part due to the lack of availability of apprenticeships in Medicine, and conversely degree-level Construction courses. However, there are a small number of frameworks (not shown in Table A4.19 due to relatively low numbers), in which females make up the majority of starts including Creative and Digital Media.

[45] Note: achievers can occasionally relate to prior years' leavers

[46] Please note that some Modern Apprentices will necessarily also be included in the FE College provision given earlier in the chapter and this figure excludes privately funded training

[47] Note: only presents MA provision which is SDS funded and does not include any privately funded apprenticeship training and is therefore likely to underrepresent the number of apprenticeships being delivered across Scotland

[48] Some start data for both females and males across a several frameworks was not available due to suppression

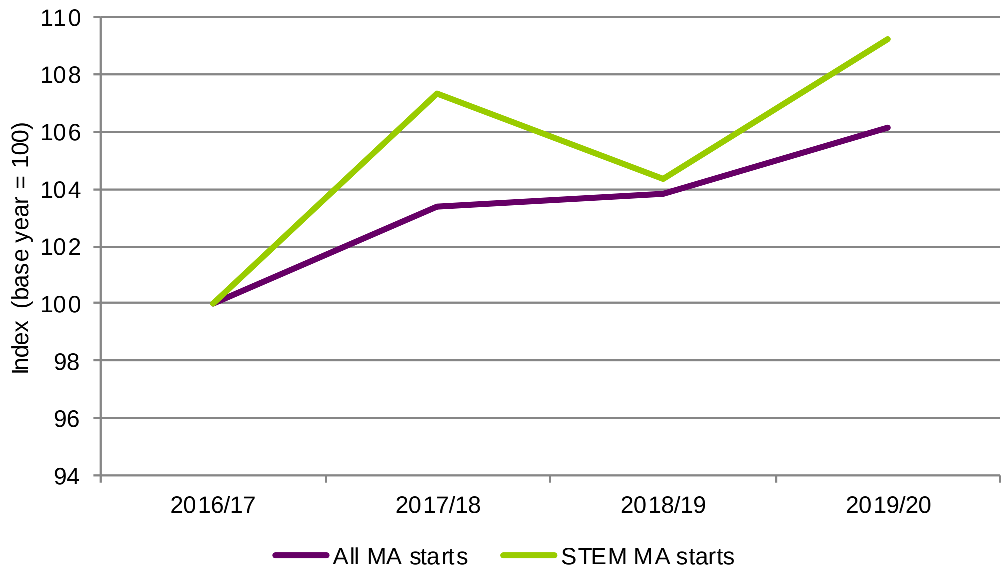
Table A4.19: Top 10 MA frameworks in STEM-related subjects (2016/17-2019/20)

Framework	2017/18			2018/19			2019/20		
	No.	%F	%M	No.	%F	%M	No.	%F	%M
Construction: Building	1,608	1%	99%	1,620	2%	98%	1,612	3%	97%
Construction: Civil Engineering	1,125	-	-	1,242	-	-	1,193	-	-
Construction: Technical	1,145	3%	97%	1,115	4%	96%	1,166	5%	95%
Engineering	924	5%	95%	1,039	5%	95%	1,160	7%	93%
Automotive	1,035	4%	96%	1,151	2%	98%	1,123	5%	95%
IT and Telecommunications	1,052	13%	87%	923	16%	84%	740	16%	84%
Construction: Technical Apprenticeship	557	1%	99%	522	3%	97%	719	3%	97%
Electrical Installation	763	-	-	739	1%	99%	716	2%	98%
Dental Nursing	^	-	-	251	-	-	350	-	-
Construction: Professional Apprenticeship	^	-	-	^	-	-	266	3%	97%
All other STEM frameworks							1,728		
Total	**10,325**	**11%**	**91%**	**10,038**	**5%**	**95%**	**10,507**	**6%**	**94%**

Source: SDS, 2021. ^ These figures are included in 'All other STEM frameworks' in these years as they were not in the top 10

STEM MA provision has grown between 2016/17 and 2019/20, as more STEM-related frameworks have come on stream. Starts have grown by 9% over this period, from 9,600 in 2016/17 to 10,500 in 2018/19. The number of frameworks has varied between 34 and 39. As shown at Figure A4.8, this is a faster rate of growth than overall apprenticeship provision, which grew by 6% over the period.

Figure A4.8: Change in all and STEM MA starts, indexed (2016/17-2019/20)



Source: SDS, 2021. Please note trends are indexed from 100 in 2016/17

Apprenticeships by geography

MAs for learners in STEM-related subjects are provided across Scotland, although to varying extent, as shown at Table A4.20. Data was not available for 2018/19 or 2019/20. Scotland's urban areas (the larger cities and urban with substantial rural areas) accounted for nearly seven in 10 (69%) MA STEM starts in 2017/18. This is driven by particularly high provision in Glasgow City and North and South Lanarkshire local authorities, which together account for 28% of all STEM MA starts. Provision of STEM MAs in more rural areas is low.

Table A4.20: Provision of MAs in STEM-related subjects by RESAS geography (2017/18)

RESAS geography	No.	% of total
Larger cities	1,931	20%
Urban with substantial rural areas	4,755	49%
Mainly rural	2,749	28%
Islands and remote	246	3%
Total	**9,681**	**100%**

Source: SDS, 2020. Please note, MA data by local authority is only currently available for 2017/18.

Graduate Apprenticeships

Graduate Apprenticeships (GAs) continue to expand and roll out across Scotland, and volumes are expected to continue to grow in future years. Since 2018/19, GA starts are included in the apprenticeship total and contribute towards the Scottish Government commitment[49].

During 2019/20, a total of 1,160 learners started Graduate Apprenticeships (GAs)[50]. This is up 26% from 921 starts in 2018/19 and is a significant increase from 278 starts in 2017/18, 13 in 2016/17 and 14 in 2015/16. The number of learning providers offering GAs was 15 in 2019/20, up from 13 the previous year. Over 500 employers are now GA employers, a 46% increase on 2018/19, many of which are engaged in STEM frameworks. As follows, nearly all of the 14 current GA frameworks are related to STEM subjects:

- Accounting (currently a pilot, SCQF Level 10/11)
- Business Management (SCQF Level 10)
- Business Management: Financial Services (SCQF Level 10)
- Civil Engineering (SCQF Levels 8 and 10)
- Construction and the Built Environment (SCQF Level 10)
- Cyber Security (SCQF Levels 10 and 11)
- Data Science (SCQF Level 10)
- Early Learning and Childcare (currently a pilot, SCQF Level 9)
- Engineering: Design and Manufacture (SCQF Level 10)
- Engineering: Instrumentation, Measurement and Control (SCQF Level 10)
- IT: Management for Business (SCQF Level 10)
- IT: Software Development (SCQF Level 10)

[49] https://www.skillsdevelopmentscotland.co.uk/media/44711/modern-apprenticeship-statistics-quarter-4-2017-18.pdf

[50] https://www.skillsdevelopmentscotland.co.uk/media/45882/ga-report-2020-final-v2.pdf

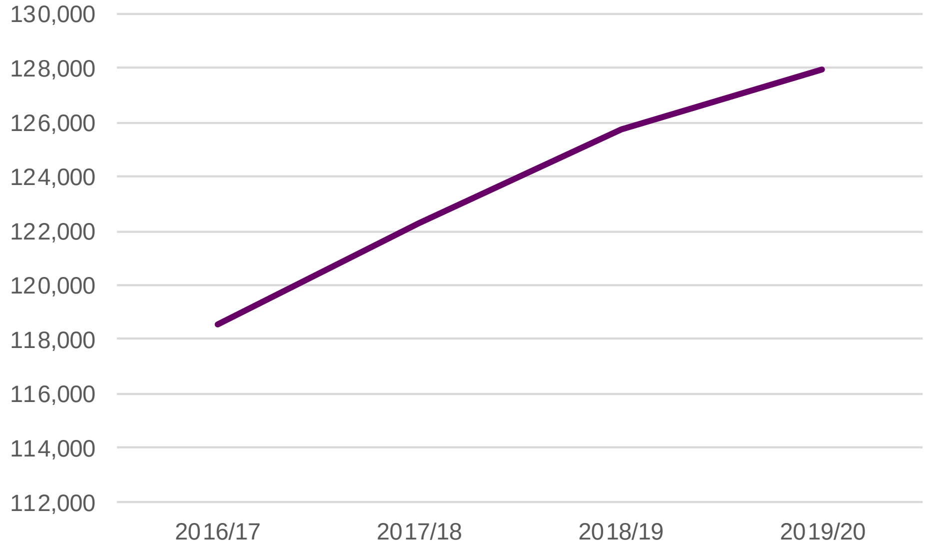
University and higher education[51]

Overall university provision in STEM

For the academic year 2019/20, there have been changes in the definition for university subjects. For instance, Biological Sciences has become Biological and Sports Sciences, and Agriculture and Related Subjects is now Agriculture, Food and Related Studies. Three new overarching subject areas have also been established that relate to STEM: Psychology, Geographical and Environmental Studies (Natural Sciences), and General and Others in Sciences. Enrolments and qualifications for these new subjects were previously captured in the existing overarching subject areas presented in the last report. However, the changes mean enrolment and qualifications data for some overarching subject areas (i.e. Biological Sciences/Biological and Sports Sciences) cannot be directly compared between 2018/19 to 2019/20. The overall enrolment and qualifications figures are unaffected. The full definition of university subjects is presented at **Appendix 6.**

During the 2019/20 academic year there were a total of 127,950 enrolments across full-time and part-time undergraduate and postgraduate courses in STEM-related subjects at Scottish universities, accounting for 49% of total enrolments. Between 2016/17 and 2019/20 total enrolments in STEM-related subjects at Scottish universities increased by 8% (+9,400 enrolments), as shown at Figure A4.9. The STEM share of total enrolments has remained between 49%-50% since 2016/17, as shown at Figure A4.10. The growing level of STEM enrolments reflects the recognised importance of STEM-related subjects and the prevalence of initiatives encouraging the study of STEM-related subjects. It is worth noting that this is within the wider context of an increase in enrolments at Scottish universities (8% since 2016/17).

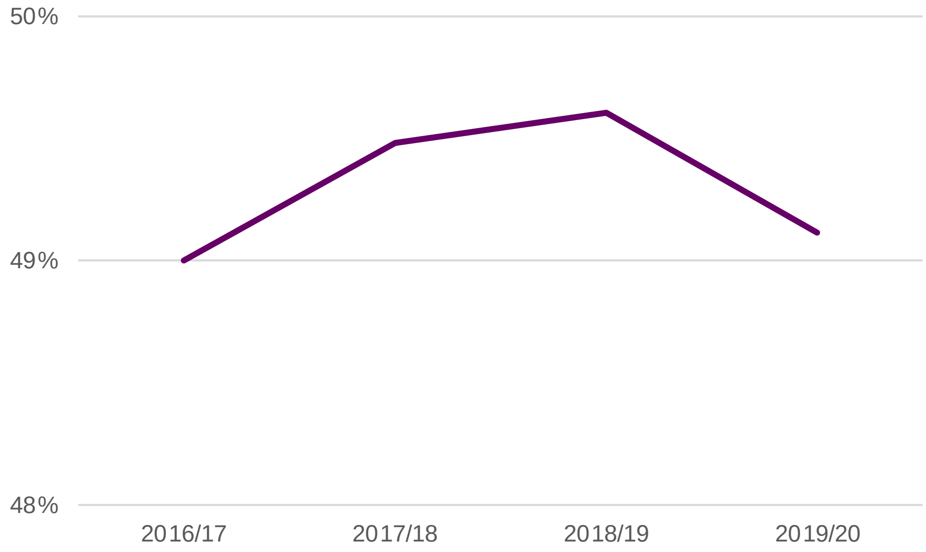
Figure A4.9: University enrolments in STEM-related subjects (2016/17-2019/20)



Source: HESA, 2021

[51] Please see https://www.hesa.ac.uk/data-and-analysis for the data used in this section

Figure A4.10: University enrolments in STEM-related subjects as a share of total enrolments (2016/17-2019/20)



Source: HESA, 2021

Provision by subject

As shown in Table A4.21, Subjects Allied to Medicine accounted for the highest number (31,525) and share (25%) of STEM enrolments at Scottish universities in 2019/20. This is followed by Engineering and Technology which had 21,180 enrolments and a 17% share of total STEM enrolments. In comparison with 2016/17, the popularity of STEM-related subjects has stayed fairly stable with the order of preference remaining the same, with the exception of Biological Sciences/Biological and Sports Sciences where enrolments have fallen due to the change in definition between 2018/19 and 2019/20.

Table A4.21: University enrolments by STEM-related subject (2016/17 and 2019/20)

Subject	2016/17		2019/20		Change in enrolments	
	Count	Share %	Count	Share %	Count	%
Subjects Allied to Medicine	30,165	25%	31,525	25%	1,360	5%
Engineering and Technology	20,620	17%	21,180	17%	560	3%
Computing Science	11,600	10%	15,515	12%	3,915	34%
Biological Sciences/Biological and Sports Sciences	22,935	19%	12,160	10%	-10,775	-47%
Psychology	-	-	10,855	8%	-	-
Physical Sciences	11,770	10%	8,460	7%	-3,310	-28%
Medicine and Dentistry	7,640	6%	8,185	6%	545	7%
Architecture, Building and Planning	5,820	5%	6,340	5%	520	9%
Mathematical Sciences	4,330	4%	5,360	4%	1,030	24%
Geographical and Environmental Studies (Natural Sciences)	-	-	2,720	2%	-	-
Agriculture (Food) and Related Subjects	2,125	2%	2,425	2%	300	14%
Veterinary Science	1,545	1%	2,105	2%	560	36%
General and Others in Sciences	-	-	1,120	1%	-	-
Total	**118,550**	**100%**	**125,780**	**100%**	**9,400**	**8%**

Source: HESA, 2021

Points to note include:

- With the exception of Biological Sciences/Biological and Sports Sciences and Physical Sciences, where there were changes in subject definitions, there were no declines in enrolments in any STEM subjects between 2016/17 and 2019/20.
- The biggest absolute increase in enrolments was recorded against *Computer Science*, which saw a total increase of 3,915 and a growth in share from 10% to 12%.
- The largest proportional increase in enrolments between 2016/17 and 2019/20 took place in Veterinary Science at 36% and Computer Science at 34%. Mathematical Sciences also saw a large proportional increase, at 24%.

Full-time/part-time split

In 2019/20, 80% of enrolments in STEM-related subjects at Scottish universities were for full-time programmes and 20% were part-time. The STEM full-time enrolment rate was slightly higher than that across all subjects which stood at 77%. From 2016/17 there has been no change in the proportion of full-time enrolments in STEM-related subjects. Reflecting the length of the course and its vocational nature, the full-time enrolment rate was high in Veterinary Science at 90%, with Physical Sciences also highest at 94%. With the exception of General and Other in Sciences where 81% of enrolments were part-time, part-time enrolments were most common for Subjects Allied to Medicine and Psychology where the share of part-time enrolments was 29%.

Provision by level

In 2019/20, 76% of enrolments in STEM-related subjects at Scottish universities were for undergraduate programmes and 24% were for postgraduate programmes. The share of postgraduate enrolments for STEM-related subjects was slightly lower than that across all subjects where postgraduate enrolments accounted for 26% of total enrolments. The share of postgraduate enrolments for STEM-related subjects increased slightly from 2016/17 to 2019/20 (23% to 24%). Again, with the exception of General and Other in Science, Veterinary Science had the lowest rate of postgraduate enrolments at just 16%. This likely reflects the length and vocational nature of the course. The share of postgraduate enrolments was highest for Architecture, Building and Planning at 31%.

Provision by institution

As shown in Table A4.22, in 2019/20 STEM enrolment was highest at the University of Edinburgh with 16,985 enrolments. This was followed by the University of Glasgow with 15,115. This is to be expected as these are the two largest HEIs in Scotland.

The STEM share of total enrolments was highest at Scotland's Rural College where STEM-related subjects accounted for 87% of enrolments, reflecting the specialist nature of this institution. Abertay University (73%), Glasgow Caledonian University (64%), and Heriot-Watt University (62%) had the next highest shares of STEM enrolments. Again this likely reflects the focus these institutions have on scientific and technical subjects.

From 2016/17 to 2019/20 the biggest absolute increase in STEM enrolments was seen at the University of Edinburgh (2,095), University of Glasgow (1,750) and the Open University (1,725). Again, this reflects the size and reach of these institutions and, at the University of Edinburgh, strong overall growth in enrolments. The largest proportional increase was at the Open University and Abertay University (both 33%).

The smallest enrolments in STEM at Scottish universities in 2019/20 were at Glasgow School of Art (595) and Scotland's Rural College (1,370). This can be attributed to the small size of these institutions. In terms of STEM share of total enrolments, this was smallest at Glasgow School of Art (25%), which is to be expected due to the specialism of this institution. The Open University, University of the Highland Islands and University of St Andrews also reported low STEM shares, at 39%, 38% and 42% respectively. It should be noted that this still reflects a growth in STEM's share of overall enrolments at these institutions.

Whilst overall there has been absolute and proportionate growth for STEM-related subjects from 2016/17 to 2019/20, this has not been reflected across all institutions. The University of Dundee saw a fall in STEM enrolments of 555 (down 6%) during this time. Similarly, Queen Margaret University saw a slight fall in STEM enrolments over this period of 145 (down 1%).

Table A4.22: University enrolment in STEM-related subjects by institution (2016/17 and 2019/20)

Institution	2016/17		2019/20		Change in Enrolments		Change in STEM share of total enrolments
	STEM enrolment	STEM share	STEM enrolment	STEM share	Count	%	
The University of Edinburgh	14,890	13%	16,985	13%	2,095	14%	+1pp
The University of Glasgow	13,365	11%	15,115	12%	1,750	13%	No change
The University of Strathclyde	10,615	9%	11,615	9%	1,000	9%	+1pp
Glasgow Caledonian University	10,890	9%	11,220	9%	330	3%	-2pp
The University of the West of Scotland	8,040	7%	8,400	7%	360	4%	+2pp
The University of Dundee	8,610	7%	8,055	6%	-555	-6%	-6pp
Edinburgh Napier University	7,380	6%	7,710	6%	330	4%	-2pp
Heriot-Watt University	6,560	6%	6,910	5%	350	5%	-1pp
The Open University	5,180	4%	6,905	5%	1,725	33%	+5pp
The University of Aberdeen	6,840	6%	6,795	5%	-45	-1%	-4pp
Robert Gordon University	6,110	5%	6,300	5%	190	3%	+1pp
The University of Stirling	5,420	5%	5,480	4%	60	1%	-1pp
The University of St Andrews	3,980	3%	4,445	3%	465	12%	+4pp
University of the Highlands and Islands	3,215	3%	3,810	3%	595	19%	+2pp
Abertay University	2,340	2%	3,120	2%	780	33%	+12pp
Queen Margaret University, Edinburgh	3,240	3%	3,095	2%	-145	-4%	-2pp
SRUC	1,320	1%	1,370	1%	50	4%	+6pp
Glasgow School of Art	550	<1%	595	<1%	45	8%	No change
Total	**118,545**	**100%**	**127,950**	**100%**	**9,380**	**8%**	**No change**

Source: HESA, 2021

Profile of learners

In 2019/20, 54% of students enrolled in STEM-related subjects at Scottish HEIs were female. This is significantly lower than the 59% across all subjects; however it is high relative to trends in other provision considered earlier in this chapter (for example Apprenticeships; though it should be noted that considers enrolment data only, and does not take into account applications to study). The gender split grew slightly from 53:47 to 54:46 between 2016/17 and 2019/20.

There were, however, significant differences in the gender gap between different subjects, which impacts on the overall gender balance of enrolments, as shown at Table A4.23. For example, in 2019/20, 84% of enrolments in Veterinary Science and 83% of enrolments in Subjects Allied to Medicine were female. This compared with just 22% in each of Engineering and Technology and Computing Science. This subject split appears to reflect traditional gender norms with women more represented in subjects associated with caring and less so in areas seen to be more technical. The limited number of females studying engineering and computing subjects is particularly significant as they are projected to experience significant growth. For the most part, the gender split within subjects remained broadly stable from 2016/17 and 2019/20. The only significant changes were:

- In Biological Sciences/Biological and Sports Sciences where the share of male enrolments increased from 35% to 42%, becoming more gender balanced; however, the change in subject definition across the period may have been a factor in this change; and
- In Veterinary Sciences where the share of female enrolments grew from 80% to 84%, becoming less gender balanced.

Table A4.23: University enrolment in STEM-related subjects by gender (2016/17 and 2019/20)[52]

Subject	2016/17		2019/20	
	Female % enrolments	Male % enrolments	Female % enrolments	Male % enrolments
Medicine and Dentistry	60%	40%	62%	37%
Subjects Allied to Medicine	81%	19%	83%	17%
Biological Sciences/Biological and Sports Sciences	65%	35%	57%	42%
Psychology	-	-	79%	20%
Veterinary Science	80%	20%	84%	16%
Agriculture (Food) and Related Subjects	63%	37%	60%	39%
Physical Sciences	44%	56%	43%	57%
General and Others in Sciences	-	-	56%	43%
Mathematical Sciences	42%	42%	43%	57%
Engineering and Technology	19%	81%	22%	78%
Computing Science	20%	80%	22%	77%
Geographical and Environmental Studies (Natural Sciences)	-	-	59%	41%
Architecture, Building and Planning	43%	57%	40%	60%
Total	**53%**	**47%**	**54%**	**46%**

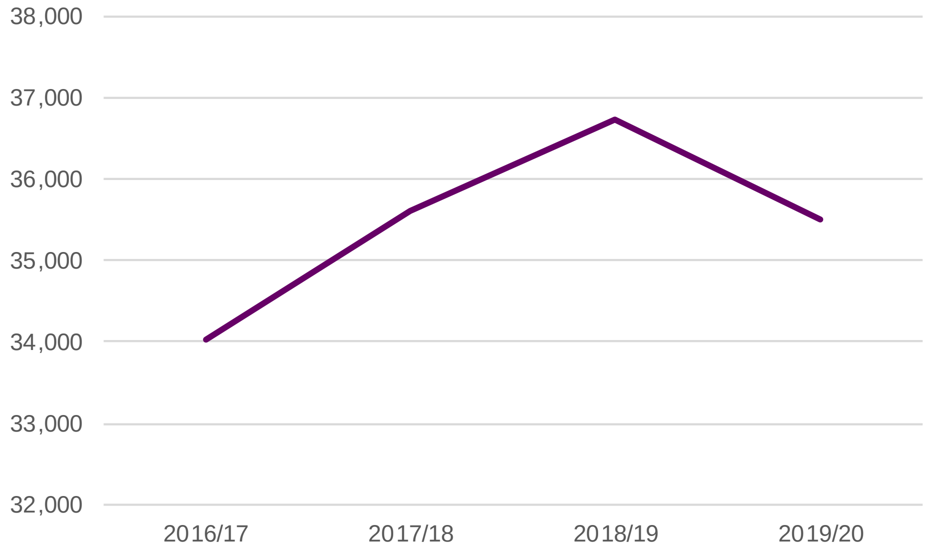
Source: HESA, 2021

Graduates profile

In total, 35,495 students qualified from Scottish universities in STEM-related subjects in 2019/20 – 47% of the total – following growth in recent years (+1,465, or 4% since 2016/17). The STEM share of qualifiers has grown from the 2016/17 level (46%), despite the actual number of qualifiers falling slightly between 2018/19 and 2019/20, as shown at Figures A4.11 and A4.12.

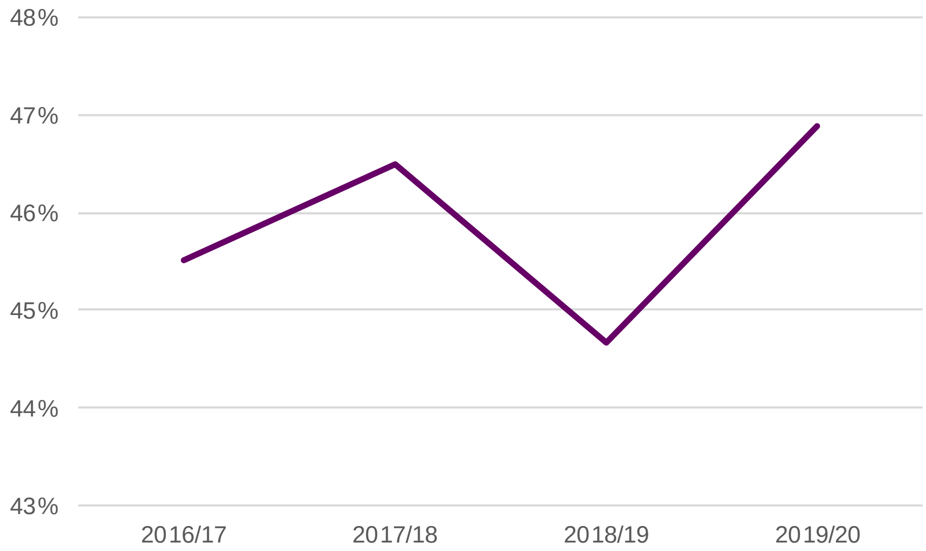
[52] Percentages may not sum to 100 due to rounding in the raw data

Figure A4.11: STEM qualifications at Scottish universities (2016/17-2019/20)



Source: HESA, 2021

Figure A4.12: STEM qualifications as a share of total qualifications (2016/17-2019/20)



Source: HESA, 2021

In terms of subject coverage of qualifiers, as shown in Table A4.24:

Subjects Allied to Medicine had the highest number of qualifiers from Scottish universities in 2019/20 at 8,255, or 23% of total STEM qualifiers reflecting strong enrolments in this subject area. This was followed by Engineering and Technology with 6,175 qualifiers, or 17%.

- The biggest absolute growth in qualifiers between 2016/17 and 2019/20 was in Computing Science at +825 (+24%), whilst the biggest proportional growth was in Mathematical Sciences at +35%, although from a much lower base.
- There was a decrease in the number of Biological Sciences/Biological and Sports Sciences qualifiers over the period, of 2,855 or -44%, however this is due to the change in subject definition and therefore the numbers are not comparable.

Table A4.24: STEM qualifiers at Scottish universities by subject (2016/17 and 2019/20)

Subject	2016/17		2019/20		Change	
	Count	Share %	Count	Share %	Count	%
Subjects Allied to Medicine	7,890	23%	8,255	23%	365	5%
Engineering and Technology	6,065	18%	6,175	17%	110	2%
Computing Science	3,495	10%	4,320	12%	825	24%
Biological Sciences/Biological and Sports Sciences	6,435	19%	3,580	10%	-2,855	-44%
Psychology	-	-	2,645	7%	-	-
Physical Sciences	3,245	10%	2,380	7%	-865	-27%
Medicine and Dentistry	2,195	6%	2,205	6%	10	0%
Architecture, Building and Planning	2,180	6%	2,000	6%	-180	-8%
Mathematical Sciences	1,205	4%	1,625	5%	420	35%
Agriculture (Food) and Related Subjects	990	3%	940	3%	-50	-5%
Geographical and Environmental Studies (Natural Sciences)	-	-	825	2%	-	-
Veterinary Sciences	330	1%	405	1%	75	23%
General and Others in Sciences	-	-	140	0%	-	-
Total	**34,030**	**100%**	**35,495**	**100%**	**1,465**	**4%**

Source: HESA, 2021

In 2019/20, 53% of STEM qualifiers from Scottish universities were female and 47% were male. Table A4.25 gives a breakdown of qualifiers by gender and subject. The percentage of STEM female qualifiers is significantly lower than that across all subjects where it is 59%. The gender split has been become slightly less balanced since 2016/17, having been 51% female to 49% male then, before rising to 53% female and 47% male in 2019/20. As with enrolments, there are significant differences in the gender balance across subjects with points of note including:

- Veterinary Science and Subjects Allied to Medicine had the highest percentage of female qualifiers in 2019/20, at 83% and 82% respectively. Psychology also had a high share of female qualifiers at 79%.
- Engineering and Technology and Computer Science had the lowest percentage of female qualifiers, at 22% and 25% respectively.
- The biggest increases in the female share of qualifiers were in Veterinary Sciences and Computing Science, which grew by seven and five percentage points respectively over the period, making the former less gender balanced and latter more gender balanced.

Table A4.25: STEM qualifiers at Scottish universities by gender (2016/17 and 2019/20)[53]

Subject	2016/17		2019/20	
	Female % qualifiers	Male % qualifiers	Female % qualifiers	Male % qualifiers
Medicine and Dentistry	59%	41%	61%	39%
Subjects Allied to Medicine	81%	19%	82%	17%
Biological Sciences/Biological and Sports Sciences	64%	36%	56%	44%
Psychology	-	-	79%	20%
Veterinary Sciences	76%	24%	83%	17%
Agriculture (Food) and Related Subjects	65%	35%	60%	40%
Physical Sciences	44%	56%	41%	59%
General and Others in Sciences	-	-	50%	54%
Mathematical Sciences	46%	54%	47%	53%
Engineering and Technology	19%	80%	22%	78%
Computing Science	20%	81%	25%	75%
Geographical and Environmental Studies (Natural Sciences)	-	-	59%	41%
Architecture, Building and Planning	42%	58%	42%	58%
Total	**51%**	**49%**	**53%**	**47%**

Source: HESA, 2021

[53] Percentages may not sum to 100 due to rounding in the raw data

Appendix 5: School entries and passes by gender

Table A5.1: STEM entries and qualifications for Scottish school pupils by gender (2017-2020)

	2017		2018		2019		2020		% or p.p. change 2017-20	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
SCQF 3-5										
Entries	86,823	106,451	81,705	100,228	82,626	101,520	85,109	104,611	**-2.0%**	**-1.7%**
Passes	68,263	84,461	63,590	76,732	63,165	77,722	73,341	89,972	**7.4%**	**6.5%**
Pass rate	78.62%	79.34%	77.83%	76.56%	76.45%	76.56%	86.17%	86.01%	**9.6 p.p.**	**8.4 p.p.**
SCQF 6										
Entries	30,367	36,871	30,434	34,735	30,078	33,517	30,379	33,599	**0.0%**	**-8.9%**
Passes	22,709	26,360	23,110	24,673	22,271	23,337	26,571	28,651	**17.0%**	**8.7%**
Pass rate	74.78%	71.49%	75.93%	71.03%	74.04%	69.63%	87.47%	85.27%	**17.0 p.p.**	**19.3 p.p.**
SCQF 7										
Entries	5,131	6,935	5,367	6,964	5,392	6,489	5,425	6,505	**5.7%**	**-6.2%**
Passes	4,055	5,104	4,302	5,124	4,207	4,817	5,001	5,842	**23.3%**	**14.5%**
Pass rate	79.03%	73.60%	80.16%	73.58%	78.02%	74.23%	92.18%	89.81%	**16.6 p.p.**	**22.0 p.p.**

Source: SQA, 2021

Appendix 6: STEM education definitions

School subjects (covering SCQF Levels 3-5, 6, 7)

Biology
Chemistry
Human Biology
Physics
Other Science
Computing Science
Mathematics
Technology

Source: SQA

Skills for Work courses (covering SCQF Levels 3-6)

Automotive Skills	Energy
Building Services Engineering	Engineering Skills
Construction Crafts	Food and Drink Manufacturing Industry
Creative Digital Media	Laboratory Science
Creative Industries	Practical Experiences: Construction and Engineering

Source: SQA

National Progression Awards (covering SCQF Levels 3-6)

Administration: Information Technology and Audio	Internet Technology
Art and Design: Digital Media	Laboratory Science
Building Services Engineering	Mobile Technology
Business with Information Technology	PC Passport
Computer Games Development	PC Passport: Advanced
Computer Networks and Systems	PC Passport: Beginner
Computer Refurbishment	PC Passport: Intermediate
Computers and Digital Photography	Practical Science
Cosmetology	Professional Computer Fundamentals
Creative and Digital Media: Technologies, Processes and Practices	Science and Health
Creative Industries	Science and Technology
Cyber Security	Scientific Technologies
Data Science	Social Software
Digital Literacy	Software Development
Digital Media	Sound Production: Live
Digital Media Animation	Sound Production: Recording
Digital Media Basics	Television Production
Digital Media Editing	Web Design
Digital Media Production	Web Design Fundamentals
Digital Passport	

Source: SQA

Awards (covering SCQF Levels 3-6)

Cyber Security Fundamentals
Internet Safety

Source: SQA

National Certificates (covering SCQF Levels 3-6)

Aeronautical Engineering	Electronic Engineering
Applied Sciences	Engineering Practice
Civil Engineering	Engineering Systems
Computer Aided Design and Technology	Fabrication and Welding Engineering
Computer Arts and Animation	Land-based Engineering
Computer Games Development	Land-based Engineering: An Introduction
Computer Games: Creative Development	Manufacturing Engineering
Computer Games: Software Development	Measurement and Control Engineering
Computer with Digital Media	Mechanical Engineering
Computing: Technical Support	Mechanical Maintenance Engineering
Creative Industries	Mobile Technology
Digital Media Computing	Social Sciences
Electrical Engineering	

Source: SQA

Foundation Apprenticeships frameworks

Civil Engineering
Creative and Digital Media
Engineering
Food and Drink Technologies
IT: Hardware Systems Support
IT: Software Development
Scientific Technologies

Source: SDS

Modern Apprenticeship frameworks

Agriculture	Horticulture
Aquaculture	Information Security
Automotive	Industrial Applications
Bus and Coach Engineering and Maintenance	IT and Telecommunications
Construction: Building	IT and Telecommunications: Technical Apprenticeship
Construction: Civil Engineering	Land-based Engineering
Construction: Professional Apprenticeship	Life Sciences and Related Science Industries
Construction: Specialist	Network Construction Operations (Gas) (no longer exists)
Construction: Technical	Pharmacy Services (no longer exists)
Construction: Technical Apprenticeship	Plumbing
Creative and Digital Media	Power Distribution
Dental Nursing	Process Manufacturing
Electrical Installation	Rail Engineering
Electronic Security Systems	Trees and Timber
Engineering	Upstream Oil and Gas Production
Engineering Construction	Water Industry
Equine	Water Treatment Management (no longer exists)
Gas Heating & Energy Efficiency	Wind Turbine Installation and Commissioning (no longer exists)
Gas Industry	Wind Turbine Operations and Maintenance
Heating, Ventilation, Air Conditioning and Refrigeration	

Source: SDS

Graduate Apprenticeship frameworks

Civil Engineering
Creative and Digital Media
Engineering
Food and Drink Technologies
IT: Hardware Systems Support
IT: Software Development
Scientific Technologies

Source: SDS

College superclasses

C: Information Technology and Information
Information and Communication Technology (general)
Computer Science
Using Software
Information Systems / Management
Software for Specific Applications / Industries
Information Work / Information Use
Information Systems / Management
Libraries / Librarianship
R: Science and Mathematics
Science
Mathematics
Physics
Chemistry
Astronomy / Space Science
Earth Sciences
Land and Sea Surveying / Cartography
Life Sciences
X: Engineering
Engineering / Technology
Metals working / Finishing
Welding / Joinery
Tools / Machining
Mechanical Engineering
Electrical Engineering
Power / Energy Engineering
Electronic Engineering
Telecommunications
Electrical / Electronic Servicing
Aerospace / Defence Engineering
Ship and Boat Building / Marine / Offshore Engineering
Road Vehicle Engineering
Vehicle Maintenance / Repair
Rail Vehicle Engineering

Source: SFC

University subjects

Subjects Allied to Medicine
Biological Sciences / Biological and Sports Sciences
Engineering and Technology
Physical Sciences
Computing Science
Medicine and Dentistry
Architecture, Building and Planning
Mathematical Sciences
Agriculture (Food) and Related Subjects
Veterinary Science
Psychology
Geographical and Environmental Studies (Natural Sciences)
General and Others in Sciences

Source: HESA

Appendix 7: Monitoring and Evaluation Framework

Indicator(s)	Measure type	STEM CLPL Programme objective	Data collection method	When/frequency	How
No of STEM a) CLPL sessions delivered to practitioners	Output	Increasing the confidence, skills and capacities of practitioners in relation to STEM	Count of sessions	Project end	Monitoring information
No of STEM b) CLPL hours delivered to practitioners	Output	Increasing the confidence, skills and capacities of practitioners in relation to STEM	Count of hours	Project end	Monitoring information
No of engagement with STEM partners (e.g. business/ college/ universities/ science centres/ festivals)	Output	Increasing the confidence, skills and capacities of practitioners in relation to STEM	Count of engagements	Project end	Monitoring information
Increased confidence in understanding what STEM is	Outcome	Increasing the confidence, skills and capacities of practitioners in relation to STEM	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Increased confidence in delivering excellent STEM learning	Outcome	Increasing the confidence, skills and capacities of practitioners in relation to STEM	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Increased confidence in inspiring young people to develop STEM skills and to promote awareness of STEM career pathways	Outcome	Increasing the confidence, skills and capacities of practitioners in relation to STEM	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Increased quality of engagement with STEM partners (e.g. business/ college/ universities/ science centres/ festivals)	Outcome	Increasing the confidence, skills and capacities of practitioners in relation to STEM	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Number of STEM Nation Awards	Output	To drive and share excellent practice in STEM in ELCs and schools	Count	Annual	STEM Nation data
Number of practitioners in STEM Nation Awarded settings	Output	To drive and share excellent practice in STEM in ELCs and schools	Count	Annual	Count of practitioners benefitting per setting

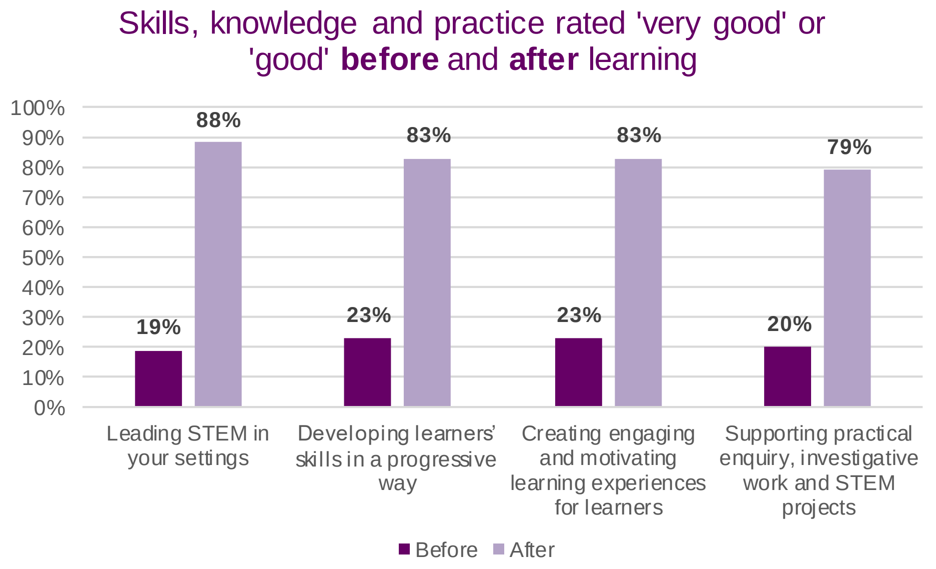
Indicator(s)	Measure type	STEM CLPL Programme objective	Data collection method	When/frequency	How
No of STEM sessions delivered to learners (because of the STEM grants)	Output	To improve outcomes for learners in relation to STEM	Count of sessions	Project end	Monitoring information
No of learners participating in the STEM sessions	Output	To improve outcomes for learners in relation to STEM	Count of learners	Project end	Monitoring information
Increase in knowledge and awareness of the relevance of STEM to the lives and futures of the learner	Outcome	To improve outcomes for learners in relation to STEM	Learner self-assessment	Project end	Survey of leaners
Increase in engagement and enthusiasm for STEM amongst learners	Outcome	To improve outcomes for learners in relation to STEM	Learner self-assessment	Project end	Survey of leaners
Increase in uptake (or likelihood of take-up?) of STEM pathways and work-based learning opportunities	Outcome	To improve outcomes for learners in relation to STEM	Learner self-assessment	Project end	Survey of leaners
Increased confidence in strategies to close equity gaps in participation and attainment in STEM (practitioners)	Outcome	To reduce equity gaps in participation and achievement in STEM learning/ training	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
No of STEM sessions delivered to learners (as a result of the STEM grants) specifically designed to address inequality across: - Geography (rurality) - Deprivation - Ethnicity - Disability - Care leavers	Output	To reduce equity gaps in participation and achievement in STEM learning/ training	Count of sessions	Project end	Monitoring information
No of sessions for practitioners specifically designed to address inequality across: - Geography (rurality) - Deprivation - Ethnicity - Disability - Care leavers	Output	To reduce equity gaps in participation and achievement in STEM learning/ training	Count of sessions	Project end	Monitoring information

Indicator(s)	Measure type	STEM CLPL Programme objective	Data collection method	When/frequency	How
No of STEM sessions delivered to learners (as a result of the STEM grants) specifically designed to address gender imbalance/bias	Output	To promote gender balance in STEM pathways and aspirations of young people	Count of sessions	Pre- and post-project, or post-project including retrospective assessment	N/A
Increase in awareness (amongst practitioners) of inequality across: - Geography (rurality) - Deprivation - Ethnicity - Disability - Care leavers	Outcome	To reduce equity gaps in participation and achievement in STEM learning/ training	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Improved attitudes towards issues related to inequality across: - Geography (rurality) - Deprivation - Ethnicity - Disability - Care leavers	Outcome	To reduce equity gaps in participation and achievement in STEM learning/ training	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Increased confidence in tackling issues concerned with inequality across: - Geography (rurality) - Deprivation - Ethnicity - Disability - Care leavers	Outcome	To reduce equity gaps in participation and achievement in STEM learning/ training	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
No of STEM sessions delivered to practitioners (as a result of the STEM grants) specifically designed to address gender imbalance/bias	Output	To promote gender balance in STEM pathways and aspirations of young people	Count of sessions	Pre- and post-project, or post-project including retrospective assessment	N/A
Number of practitioner IGBE leaders receiving training	Output	To promote gender balance in STEM pathways and aspirations of young people	Count of practitioners	Pre- and post-project, or post-project including retrospective assessment	N/A

Indicator(s)	Measure type	STEM CLPL Programme objective	Data collection method	When/frequency	How
Increase in awareness (amongst practitioners) of gender inequality	Outcome	To promote gender balance in STEM pathways and aspirations of young people	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Improved attitudes to gender stereotypes and unconscious bias	Outcome	To promote gender balance in STEM pathways and aspirations of young people	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Increased confidence in tackling gender stereotypes and unconscious bias	Outcome	To promote gender balance in STEM pathways and aspirations of young people	Practitioner self-assessment	Pre- and post-project, or post-project including retrospective assessment	Survey of practitioners
Practitioner IGBE network established	Outcome	To promote gender balance in STEM pathways and aspirations of young people	Establishment of network	N/A	N/A
No of Education Scotland STEM team development sessions	Output	Education Scotland STEM team to link to and support other national priorities; and to support work in regions	Count of sessions	Annual	Monitoring information
Improved working with stakeholders, partners and partner teams	Outcome	Education Scotland STEM team to link to and support other national priorities; and to support work in regions	Partner assessment	Annual	Survey/ consultation
Added value working between the regional STEM team and the Regional Directorate of Education Scotland and the regional Improvement collaboratives (RICs)	Outcome	Education Scotland STEM team to link to and support other national priorities; and to support work in regions	RIC and Education Scotland Regional team assessment	Annual	Survey/ consultation

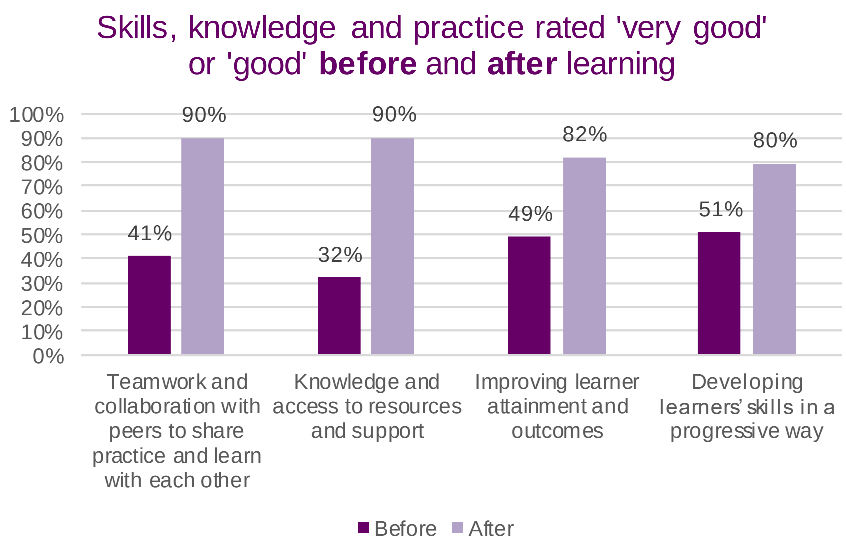
Appendix 8: STEM practitioner survey summary

Early Learning and Childcare			
Total responses	**39**	**Main project(s) undertaken by ELC practitioners**	Scottish Childminding Association ➢ **44%**
STEM sessions delivered to tackle gender imbalance	1 to 10 sessions (**43%**) 11 to 30 sessions (**26%**)	**Main activities undertaken by ELC practitioners**	1. Reading (**62%**) 2. Practical activities (**49%**)
Main method(s) of delivery for learning received by ELC practitioners	1. Online learning (**54%**) 2. Face-to-face course (**33%**)	**Ease of access to STEM learning before the STEM Grants programme**	Very difficult or fairly difficult ➢ **34%**
Main barrier prior to currently learning, highlighted as a significant or moderate issue	Lack of funding to pay for training ➢ **45%**	**Wider impact of professional learning on other colleagues**	It will benefit their setting or school ➢ 54%
Awareness of equity and equality issue in STEM before and after learning	Before: **83%** After: **100%**	**Confidence in STEM before and after the STEM Grants programme**	Before: **19%** After: **80%**



Primary			
Total responses	**98**	**Main project(s) undertaken by primary practitioners**	1. e-Sgoil (**26%**) 2. South Lanarkshire Council (**12%**) 3. Highland Council (**8%**)
STEM sessions delivered to tackle gender imbalance	1 to 10 sessions (**60%**) 11 to 30 sessions (**15%**)	**Main activities undertaken by primary practitioners**	1. Practical activities (**69%**) 2. Group work (**37%**) 3. Reading (**38%**)
Main method(s) of delivery for learning received by primary practitioners	1. Online workshop (**36%**) 2. Online webinar (**30%**)	**Ease of access to STEM learning before the STEM Grants programme**	Very difficult or fairly difficult ➢ **21%**
Main barrier prior to currently learning, highlighted as a significant or moderate issue	Difficulty finding staff cover ➢ **45%**	**Wider impact of professional learning on other colleagues**	It will benefit their setting or school ➢ **56%**
Awareness of equity and equality issue in STEM before and after learning	Before: **76%** After: **92%**	**Confidence in STEM before and after the STEM Grants programme**	Before: **16%** After: **66%**

Secondary			
Total responses	**70**	**Main project(s) undertaken by secondary practitioners**	1. Highland Council (**24%**) 2. St Andrew's High School (**22%**)
STEM sessions delivered to tackle gender imbalance	1 to 10 sessions (**54%**) 11 to 30 sessions (**8%**)	**Main activities undertaken by secondary practitioners**	1. Reading (**63%**) 2. Practical activities (**66%**) 3. Networking (**56%**)
Main method(s) of delivery for learning received by secondary practitioners	1. Online workshop (**33%**) 2. Online resource (**29%**)	**Ease of access to STEM learning before the STEM Grants programme**	Very difficult or fairly difficult ➢ **36%**
Main barrier prior to currently learning, highlighted as a significant or moderate issue	Difficulty attending training or events due to other commitments ➢ **44%**	**Wider impact of professional learning on other colleagues**	It will benefit their setting or school and cluster colleagues **69%**
Awareness of equity and equality issue in STEM before and after learning	Before: **67%** After: **94%**	**Confidence in STEM before and after the STEM Grants programme**	Before: **28%** After: **68%**



Appendix 9: STEM end beneficiary survey summary

School pupils and college students			
Total responses	**187** ➢ **91%** primary school ➢ **9%** secondary school	**Main way(s) pupils or students have been involvement in STEM**	1. School: Teaching (**68%**) 2. Online learning (**53%**) 3. School: Practical activities (**37%**)
Reasons for studying or choosing to study STEM	1. Enjoy subjects (**41%**) 2. Important for job/future career (**30%**) 3. Good at it (**19%**)	**What pupils or students enjoy most about STEM learning**	1. Learning new things (**42%**) 2. Building knowledge and skills for job/future career (**37%**) 3. Solving problems in groups (**36%**)
Things pupils or students find most difficult or challenging in STEM learning	1. Learning new skills they were previously unaware of (**23%**) 2. Not as good at STEM subjects (**22%**) 3. Group working (**21%**)	**Moderate/strong understanding of STEM jobs/careers after learning**	Science (**57%**) Technology (**31%**) Engineering (**52%**) Mathematics (**25%**) Digital (**47%**)
Likelihood of studying or choosing a job/career in a STEM area in future following STEM learning	Yes – more likely ➢ **46%** No – less likely ➢ **13%**	**Change in awareness, engagement and enthusiasm for STEM after learning**	A lot or some *awareness* to life **(50%)** A lot or a little more *enthusiastic and engaged* **(52%)**

Parents			
Total responses	**8**	**Engagement in STEM to date**	***6 engage in STEM often*** **7 undertake STEM learning activities at home**

Parents			
Parents understanding of STEM themes, rated 'fully understood' or 'a lot of understanding' before STEM learning	Science (**25%**) Technology (**25%**) Engineering (**25**%) Mathematics (**38%**) Digital (**25%**)	**Parents' main reasons for child's learning in STEM**	1. Important for studies in the future (**6**) 2. Enjoy or find it interesting (**6**) 3. Increase their knowledge of STEM in everyday life (**6**)
What parents children enjoy most about STEM learning	1. Learning new things (**7**) 2. Undertaking practical activities (**7**) 3. Wider appreciation of STEM in work and life (**4**)	**Parents' understanding of STEM jobs/careers, rating 'fully understood' or 'a lot of understanding' since STEM learning**	Science (**86%**) Technology (**86%**) Engineering (**86%**) Mathematics (**83%**) Digital (**83%**)
Since undertaking STEM learning, how has children's enthusiasm and engagement changed	**6** are a lot more enthusiastic	**Since undertaking STEM learning, how informed do parents feel around about education, jobs and careers in STEM**	More informed ➢ **100%**