Evaluation of the STEM Grants Programme Rounds One to Three

YEAR 3 REPORT (Part 2)
for
Education Scotland

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ekosgen

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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. To date the following reports have been issued:

- Year 1: Evaluating the Impact of Professional Learning in STEM: Building a STEM Nation (May 2020)[1];
- Year 2: Evaluation of the STEM Grants Programme Round Two and Wider Education Scotland STEM Support (September 2021)[2]; and
- Year 3: (Part 1): The Structural Barriers to STEM Engagement Final Report (November 2022).[3]

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 was 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.

Year 3 evaluation objectives

1.3 This Year 3 study examines the benefits and impacts of the SGP on practitioners and learners across all settings, in relation to STEM and its contribution to the STEM Education and Training Strategy's aims and objectives across Rounds One, Two and Three of the programme.

1.4 A monitoring and self-evaluation toolkit was also implemented as part of Round Three with SGP Lead grantees, which had been developed by the consultants in Year Two. It intended to support project self-evaluation capability across the Round Three grantee organisations. The toolkit provided background guidance on the need for good monitoring and evaluation, and provided SGP Lead grantees with a suite of guidance on approaches to capturing the required information for monitoring and evaluating SGP project delivery. It also provided a framework in Microsoft Excel in which to record captured data.

1.5 The focus of this report is the evaluation of the SGP's impact over Rounds One, Two and Three.

Study methodology

1.6 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; and

[1] https://education.gov.scot/media/n5oh42iv/evaluation-of-stem-grants-programme-round-1-24-11-21.pdf

[2] https://education.gov.scot/media/2wddhwgy/ekosgen-stem-evaluation-year-2-report-2021.pdf

[3] https://education.gov.scot/media/0skjinph/ekosgen-structural-barriers-to-stem-engagement-year-3-report-nov-2022.pdf

- The design, delivery and analysis of learner and parent surveys conducted in 2022 and an analysis of Education Scotland's 2020/ 2021 annual practitioner survey.

How the report is structured

1.7 The report is structured in the following way:

- **Chapter 1** provides an introduction to the research and the key objectives of this Year 3 study.
- **Chapter 2** updates the current context for the SGP and Education Scotland's support for the STEM Strategy implementation. It also provides a summary of STEM education and attainment for 2018-2021.
- **Chapter 3** provides an overview of the SGP, presenting trends and analysis across Rounds One, Two and Three in areas such as project profiling and funding. It also provides an analysis of programme performance against activity and outcome targets for the three rounds.
- **Chapter 4** discusses the progress towards the objectives for learners, practitioners and parents, with regard to the STEM Education and Training Strategy's four themes of Excellence, Equity, Inspiration and Connection.
- **Chapter 5** presents conclusions and impact, and lessons learned and considerations for the future to support STEM learning.

1.8 Appendices include:

- **Appendix 1**: Analysis of education and attainment in STEM for 2018-2021.
- **Appendix 2**: STEM subject school entries and passes by gender for 2018-2021.
- **Appendix 3**: STEM education definition.
- **Appendix 4**: Monitoring and evaluation framework and project self-evaluation toolkit.
- **Appendix 5**: End beneficiary survey analysis summary.

2 The current context for the STEM Grants Programme

Introduction

2.1 This chapter provides an overview of the current context for STEM education and the delivery of the SGP over its three rounds to date. It also presents an update of Education Scotland's support for the delivery of the STEM Education and Training Strategy, and a summary of STEM education and attainment data for 2018-2021.

Current context

2.2 The context for the delivery of STEM education (see Appendix 3 for definition) and professional learning in Scotland is complex, and much has changed in both a global and educational context since 2017 when the STEM Education and Training Strategy was launched by the Scottish Government. The importance of and need for STEM skills has only increased as the rate of technological change continues apace. The education context has also changed with a number of significant changes in the policy and strategy environment in the last two years.

2.3 The Scottish Government has announced a number of far-reaching reforms to the education system and in particular into the re-structuring of Education Scotland and the SQA. This reform was announced as part of the Scottish Government's response to the Ken Muir Report, *Putting Learners at the Centre: Towards a Future Vision for Scottish Education*.[4] The Report sets out the case for a renewed vision of education in Scotland, one that places the learner at the centre of all decisions.[5]

2.4 This reform program is ongoing and will affect the way schools are supported to deliver Curriculum for Excellence (CfE). It will impact on the context in which STEM learning is delivered in schools, both as part of the Broad General Education (BGE) and in the Senior Phase. This reform has followed the OECD Review of the CfE.[6] The Review found that the CfE continues to be a "bold and widely supported initiative", with the flexibility needed to improve student learning further. However, it acknowledged the need to improve implementation of CfE through the BGE phase, particularly with regard to the balance between breadth and depth of learning, with delivery supported by a clearer framework and supporting documentation. From the point of view of schools and teachers, the Review also argued for building curricular capacity at various levels through enhanced collaboration between practitioners and educational settings as well as ensuring dedicated, ring-fenced time to lead, plan and support CfE at the school level. It also emphasised the need to ensure that the approach to STEM skills stretches from early years, through school and into higher and further education and on to the world of work.

2.5 The Scottish Government mid-point review of the STEM Education and Training Strategy was not conducted as a consequence of the COVID-19 pandemic. Instead, the fourth annual report for the Strategy, published in May 2022, represents a refresh for the Strategy's extension to 2025. It does this acknowledging that the context for STEM education, and indeed education, is incredibly dynamic. It also recognises that the original aims of the Strategy continue to be both relevant and present a valuable focus for work programmes going forward.

2.6 It is within this context that the SGP has been delivered and continued to be delivered into its fourth round.

[4] https://www.gov.scot/publications/putting-learners-centre-towards-future-vision-scottish-education/

[5] https://www.unicef-irc.org/portfolios/general_comments/GC1_en.doc.html

[6] https://www.oecd.org/education/scotland-s-curriculum-for-excellence-bf624417-en.htm

STEM Strategy delivery update

2.7 A key delivery strand of the STEM Education and Training Strategy has been the SGP. In its three rounds of delivery, it has increased its geographic coverage and expanded its project portfolio and has positively evolved in response to emerging government priorities, and practitioner and grant recipient feedback.

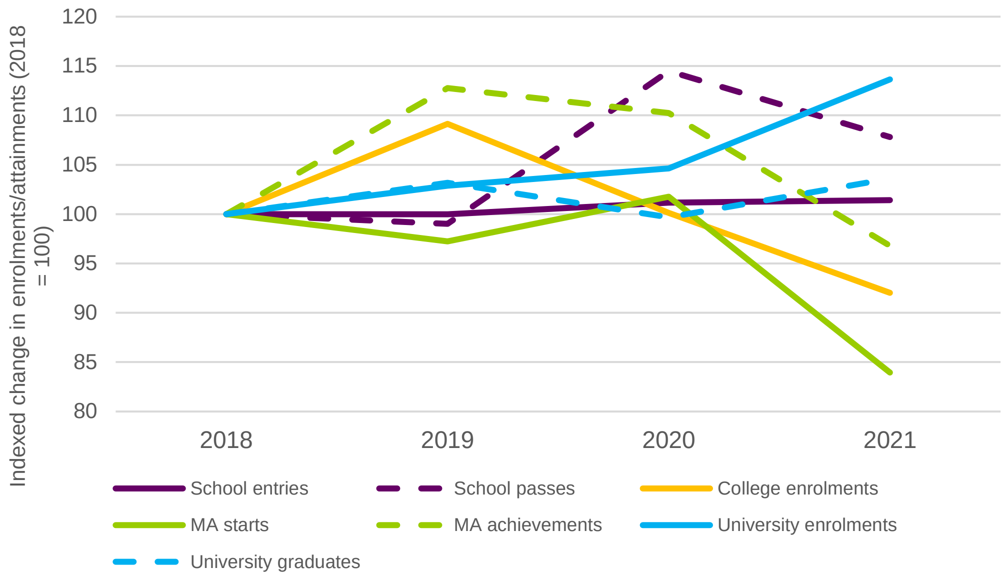
2.8 The majority of recommendations to improve the reach, scale and impact of the investment in the SGP, which were contained in the ekosgen Year Two evaluation report, were accepted and implemented by Education Scotland when planning for subsequent rounds of the programme. Of particular importance have been: revisions to the approach to ensuring target groups are appropriately represented in project delivery; improving the variety of project subjects and topics; building on previously delivered projects in the first year of the STEM Grants Programme (2018/2019), to maximise the potential for cumulative outcomes; implementing a more robust monitoring and evaluation approach at the project and programme level; and maximising the opportunity for collaborative partnership working to deliver STEM professional learning, through the Programme and more widely.

Summary of STEM education and attainment (2017-2021)

2.9 This section presents a summary analysis of education enrolment and attainment in STEM across the period 2018 to 2021. Analysis is presented across a range of indicators (as far as possible as data will allow), including subject, gender and institution. More detailed analysis can be found in **Appendices 1-3**.

2.10 Figure 2.1 shows the overall indexed trend in STEM education and attainment in Scotland between 2018 and 2021 (or equivalent latest year of data). There has been a slight rise in the number of school entries since 2018, coupled with a significant rise in the number of school passes – particularly at Higher and Advanced Higher levels, as shown by the particularly high indexed rise in Figure 2.1 for school passes. This rise in passes is largely due to changes in the assessment process in 2020, and to some extent 2021, as a result of the COVID-19 pandemic. There were declines in the numbers of college enrolments and Modern Apprenticeship starts/achievements between 2018 and 2021, again due to the impact of COVID-19 on take up, as well as constraints on practical delivery of STEM subjects in 2020 and 2021. However, there has been a rise in both the number of university enrolments and graduates over the period, suggesting an increasingly strong STEM offer at Higher Education level.

Figure 2.1: Overall indexed trend in STEM education and attainment (2018 to 2021)



Source: SQA, SFC, SDS and HESA[7], 2022. Please note trends are indexed from 100 in 2018

2.11 Table 2.1 presents a simplified summary view of overall STEM take-up, including by gender, across a range of education provision from school to university, and apprenticeships to Skills for Work. The table shows the proportion of female and male learners that take up STEM subjects. For example, 26% of overall college enrolments are in STEM subjects, but only 16% of overall female college enrolments are in STEM subjects compared to 36% of overall male college enrolments. Further details on the breakdown of STEM subjects by gender across school, college, apprenticeships, and university provision is given in **Appendices 1 and 2**.

Table 2.1: STEM share of overall provision, and share by gender (2021)[8]

Education	Total (%)	Female (%)	Male (%)
School – National level	**44**	40	48
School – Higher level	**34**	29	40
School – Advanced Higher level	**49**	40	61
National Progression Awards	**25**	16	32
Awards	**>1**	>1	>1
National Certificates[9]	**36**	15	58
Skills for Work	**22**	13	35
College provision	**26**	16	36
Foundation Apprenticeships[10]	**39**	17	71
Modern Apprenticeships	**45**	8	57
University provision	**49**	45	55

Source: SQA[11], SFC[12], SDS[13] and HESA[14], 2022

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

[8] Note that rows do not sum to 100%, since data shows STEM take-up as a proportion of overall provision – overall, and for males and females.

[9] Attainment is shown for National Certificates

[10] Data provided is for the 2020/22 cohort

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

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

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

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

2.12 There is a higher rate of male entries than female entries in STEM-related subjects at all school levels (National, Higher and Advanced Higher). Almost three-fifths (57%) of male Modern Apprenticeships (MAs) are in STEM-related frameworks, however STEM only accounts for a small proportion of female MA take-up (8%). This is due to the high volume of starts on typically male-dominated frameworks such as construction and engineering, an ongoing trend in MA provision. Around half of all university enrolments are STEM-related, although again there is a lower rate for females than for males.

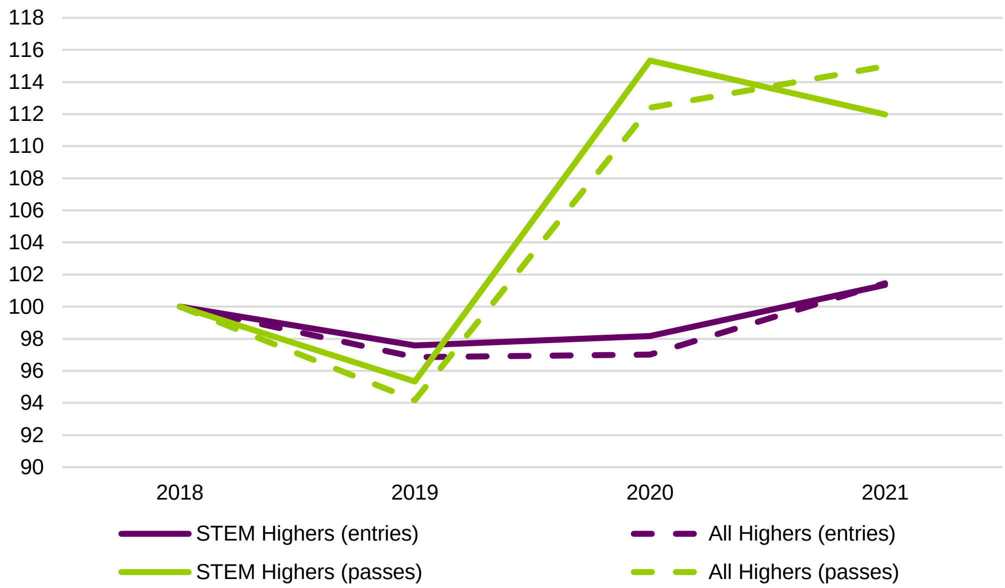
2.13 Within most education types and levels, there is an imbalance towards male representation. STEM provision is slightly more gender balanced at Higher level in school than at National and Advanced Higher level, albeit there is still an imbalance towards males across all three levels (between 53% and 56%). The vast majority of STEM MA starts were male in 2020/21 (92%). However, females made up a higher proportion of university enrolments (54%).

Schools

2.14 Between 2018 and 2021 there has been a rise in both STEM entries (up 1%) and STEM passes (up 6%) at SCQF level 3-5 (National level). This follows a fall in entries in 2020 and indicates a greater volume, and potentially variety, of STEM learning opportunities in the senior phase of school. The greater rate of increase in passes compared to entries is largely due to the changes in assessment criteria and process as a result of the COVID-19 pandemic.

2.15 At Higher level, there has again been a 1% increase in STEM entries over this period, with the number of STEM passes rising by 12%, again due to the assessment changes in 2020 and 2021 arising from the impact of the COVID-19 pandemic. This is at the same level as the overall increase in entries (up 1%) and slightly less pronounced that the rise in passes (up 15%) for all Highers in Scotland, as shown at Figure 2.2.

Figure 2.2: Index of total STEM entries and passes for Highers, 2018-2021



Source: SQA, 2022

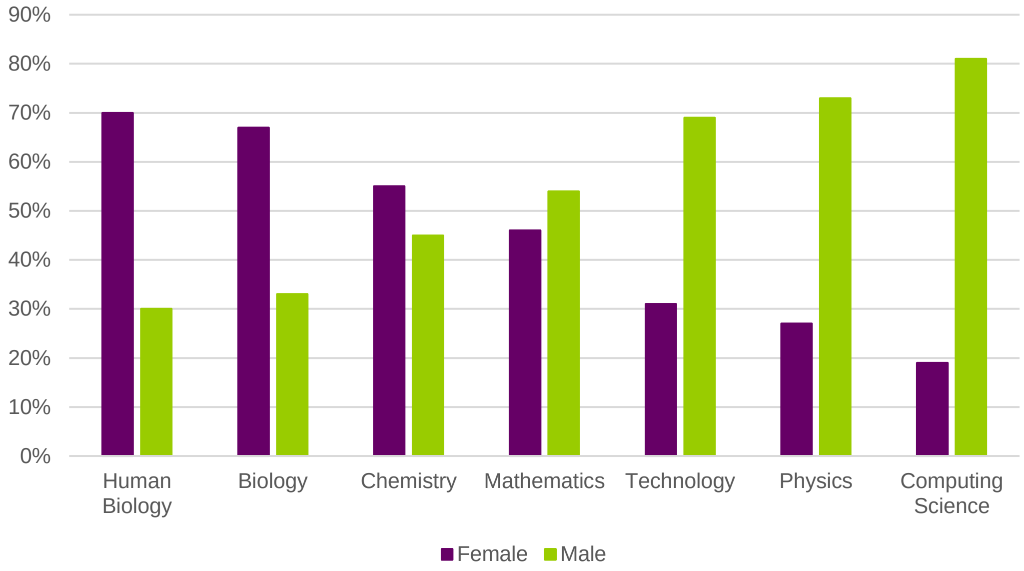
2.16 There has been relatively little change in the number of STEM Advanced Higher entries from 2018 to 2021 (down 1%). The pass rate has risen 18% over the period, again impacted by the pandemic assessment changes, and masking a 4% fall in passes between 2018 and 2019.

2.17 Overall, STEM passes have risen an average of 8% across all three levels during the period 2018 to 2021, compared to a 1% rise in entries. Between 2018 and 2019, STEM passes fell 1%, highlighting the impact of COVID-19 on 2021 figures.

2.18 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 Higher level (3.2 percentage points high) and Advanced Higher level (2.2 percentage points higher).

2.19 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 (59%), 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, 2021

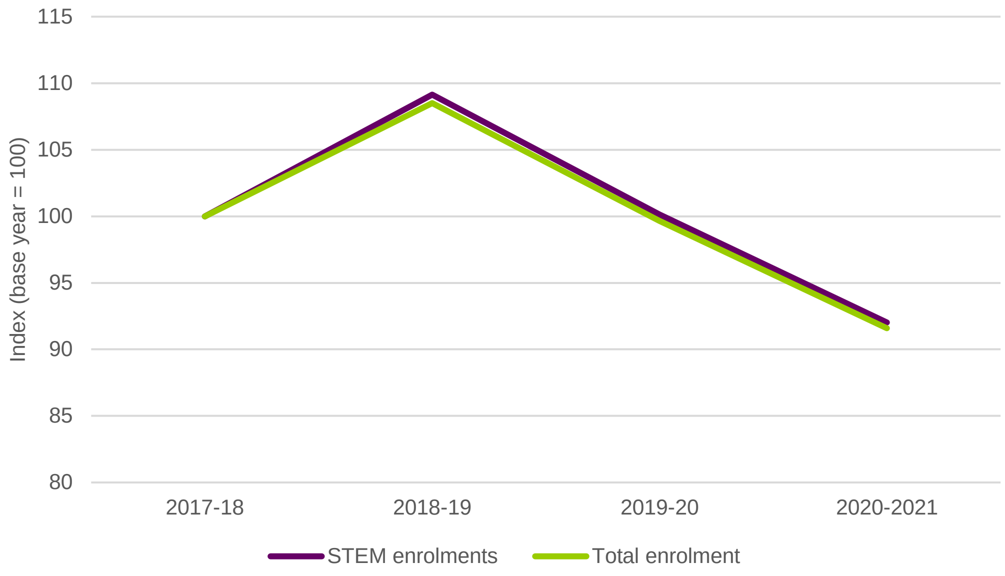


Source: SQA, 2022

College and Further Education

2.20 STEM-related subjects accounted for 26% of enrolments (over 71,600) in Scottish colleges in 2020/21. STEM enrolments grew between 2017/18 and 2018/19 before falling 16% in 2020/21 – 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 (2017/18-2020/21)



Source: SFC, 2022

2.21 The STEM share of overall college enrolments has remained the same at 26% over the period. STEM college enrolments are concentrated in the Fife and Glasgow college regions, accounting for 48% of all STEM enrolments in Scotland. The share of STEM enrolments in Fife and Glasgow has risen since 2019/20 when it was 38%. STEM accounts for 65% and 21% of all enrolments in those regions respectively. STEM enrolments are also high in Forth Valley and Aberdeen City and Shire (both around 5,300 enrolments). However, STEM enrolments in these two college regions fell 43% and 40% respectively between 2019/20 and 2020/21.

2.22 Engineering accounted for the highest share of STEM college enrolments in 2020/21 at 60% and has been the highest over the period (2017-2021). However, there has been a decline in Information Technology and Information enrolments since 2017/18 (down 27%) as well as Sciences and Mathematics (down 17%), while enrolments in Engineering rose 7%.

2.23 Over half (55%) of STEM college enrolments were by people aged 19 or younger in 2020/21, making the STEM student profile significantly younger, on average, than across all college enrolments (41%).

2.24 At college level, males are more likely to study STEM courses. Males accounted for around two-thirds of STEM enrolments (67%) in 2020/21, but only 48% of all college provision. This STEM gender gap has remained largely the same since 2017/18, with the number of females and males enrolled in STEM subjects falling (down 14% and 6% respectively). Engineering subjects are still heavily dominated by males (77%), with males also more likely to study Information Technology and Information subjects (56%). More females enrolled in Sciences and Mathematics subjects in 2020/21 (55%).

Apprenticeships

2.25 There were around 1,200 starts on STEM related Foundation Apprenticeship frameworks for the 2020-22 cohort, a decrease of around 250 starts on the previous cohort. The Foundation Apprenticeship STEM-related frameworks with the highest number of starts for the 2020-22 cohort were Engineering (around 330) and Creative and Digital Media (around 310). There were more males starts on all STEM-related frameworks with the exception of Food and Drink Technologies and Scientific Technologies, where females accounted for 58% and 53% of starts in the 2020-22 cohort. Males dominated the Civil Engineering (93% of starts), IT: Software Development (91%) and Engineering (89%) 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 and 2020-22 cohorts were not available at the time of reporting.

2.26 In 2020/21 almost 8,500 people registered for STEM Modern Apprenticeships (MA) in Scotland. Since 2017/18, STEM MA starts declined but at a slower rate all MA starts (down 18% versus 31%). The STEM achievement rate stands at 79%, higher than the rate for all MAs (76%). Construction: Building recorded the highest number of starts for STEM MAs in 2020/21, at around 1,400, followed by Construction: Technical, Construction: Civil Engineering, Engineering, Creative (each ranging from around 630 to 960 starts).

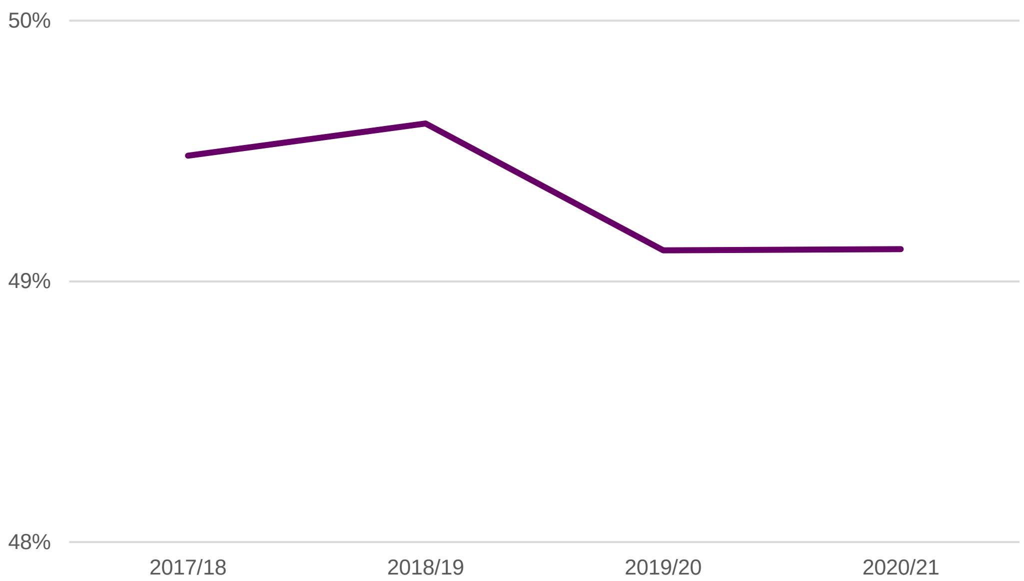
2.27 Males accounted for 92% of starts in STEM MAs, reflecting male dominance across most frameworks and the workforce (between 97% and 100% on the various construction frameworks). From the data available (i.e. not suppressed), only Digital Applications had more female starts, however it is likely MAs such as Dental Nursing and Equine also had a higher number of female starts in 2019/20.

2.28 Graduate Apprenticeships (GAs) began in 2015/16, and in 2020/21 there were 1,160 starts. Within these, around 690 GA starts were in STEM-related subjects (59%).

University and Higher Education

2.29 In 2020/21 there were 138,960 enrolments in STEM-related subjects at Scottish universities. This accounted for 49% of total enrolments and the number has increased by 16,700 (14%) since 2017/18, 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 (2017/18-2020/21)



Source: SFC, 2022

2.30 For the academic year 2019/20, there were changes in the definition for university subjects. For instance, Biological Sciences became Biological and Sports Sciences, and Agriculture and Related Subjects is now Agriculture, Food and Related Studies. Three new overarching subject areas were also 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 (and 2020/21). The overall enrolment and qualifications figures are unaffected. See **Appendix 3** for the full definition of STEM subjects at university.

2.31 Taking this into consideration, subjects allied to Medicine had the highest number of STEM enrolments at around 34,300 and a 25% share of total STEM enrolments.

2.32 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 2020/21 at 18,200 and 17,500, respectively. The STEM share of total enrolments was highest at Scotland's Rural College at 88%, reflecting its specialist nature. The biggest absolute increases in STEM enrolments from 2017/18 to 2020/21 were recorded at the University of Glasgow (up 3,600), the Open University (up 2,700) and the University of Edinburgh (up 2,500). At 11 of Scotland's 18 Higher Education Institutions, STEM growth outstripped overall growth in enrolments.

2.33 Across all STEM-related subjects, 54% of enrolments were female. This is 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% and 23% in each of Engineering and Technology and Computing Science.

2.34 Overall, in 2020/21, just under 36,900 students qualified from Scottish Higher Education Institutions (HEIs) in STEM related subjects. This accounted for 45% of total qualifiers and the number has increased by almost 1,300 (4%) since 2017/18.

2.35 Over this period, the largest increase in absolute qualifiers has been in those studying Computing Science, an increase of just 500, while the largest proportional increase has been in Mathematical Sciences qualifiers, an increase of 34%. Apart from Biological Sciences/Biological and Sport Sciences, and Physical Sciences, where definitions have changed, there has been a slight decline in Medicine and Dentistry qualifiers (down 1%).

3 The STEM Grants Programme performance

Introduction

3.1 This chapter examines the SGP in detail, with a summary of the programme and profiling of the projects in Rounds One, Two and Three. It presents an analysis of 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 has built the capacity and confidence of practitioners in its aim to support the implementation of the STEM Education and Training Strategy for Scotland.[15] 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 of the grants has been on the Sciences, Numeracy and Mathematics, Digital Learning, Engineering, and Technologies. Round Two of the programme included two funding streams, the Regional and National Partner Fund and the Leadership and Collegiate Professional Learning Fund. The projects funded were selected in response to the results of the 2018/19 Annual STEM Practitioner Survey[16] and the STEM Provider Survey 2017/18.[17]

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 Three funded projects were 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 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 was put in place from January 2019, introduced midway through Phase One of the Round One projects. The team's work was aligned to the

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

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

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

work of the six Regional Improvement Collaboratives (RICs) and helped to support the coordination of STEM Career-long Professional Learning (CLPL) at a national level. Following a successful three-year pilot, the learning from the Improving Gender Balance Programme[18] was extended regionally to include an Improving Gender Balance & Equalities (IGBE) team of six officers whose role (between 2019 and 2023) was to lead and support this work in school, early learning and childcare settings.

Formative evaluation of the STEM Grants Programme

SGP – Round One

3.8 ekosgen evaluated **Round One** of the SGP which reported in April 2020. The evaluation found that the programme had improved access to STEM professional learning by removing barriers to CLPL. A total of 24 projects were funded with all lead organisations being Regional and National Partners, with funding awarded across two financial years (or phases) amounting to £758,662. 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.

SGP – Round Two

3.9 ekosgen subsequently evaluated **Round Two** of the SGP, reporting in September 2021. Round Two included a £2.1 million grant fund across two funding streams: Regional and National Partners, and Leadership and Collegiate Professional Learning. A total of 140 successful organisations at local, regional and national level were awarded funding. ekosgen's evaluation found that the SGP continued to have a positive impact on the capacity and capability of STEM practitioners, while learners were becoming increasingly aware of and skilled in STEM. The evaluation highlighted the importance of Education Scotland's Regional Teams in fulfilling a very valuable role at the interface of national, regional and local STEM education and training structures. Evidence pointed towards the impact of COVID-19 on the delivery of Round Two projects, resulting in the re-scoping of many projects which were subsequently delivered digitally, with this increased availability of, and capacity for digital delivery broadening the accessibility of professional learning. The ekosgen Year 2 evaluation report[19] did highlight some challenges such as the need for greater clarity on functions and responsibilities across the mix of national, regional and local STEM structures and a need to further develop headteacher and other leaders' understanding of STEM in order to champion it across all education settings.

3.10 As with the Round One evaluation, ekosgen set out several recommendations for further rounds of the SGP, including: target groups, STEM subject/project diversity, the project appraisal process, sustainability and use of resources, funding approaches, monitoring and evaluation, and strategic considerations around the STEM Strategy, alignment and partnership working.

SGP – Round Three

3.11 **Round Three** of the SGP included a £798,000 grant fund across 84 projects, with projects being informed of funding awarded in June 2021. This report evaluates the impact of Round Three, while also presenting an overview of the impact of all three SGP Rounds to date. Like Round Two, all Round Three

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

[19] https://education.gov.scot/media/2wddhwgy/ekosgen-stem-evaluation-year-2-report-2021.pdf

projects fell under one of two funding streams: Regional and National Partners, or Leadership and Collegiate Professional Learning.

3.12 As was the case in Round Two, it is important to again highlight that the delivery of the Round Three programme had been impacted, albeit to a lesser extent, by the COVID-19 pandemic and the accompanying restrictions around schools and other delivery organisations. This had some impact on the scale of project activity delivered.

3.13 In Round Three, a cap was introduced for each of the funding phases to ensure maximum impact from a reduced grant fund. For the Leadership and Collegiate Professional Learning funding stream, a maximum of £3,000 was allowed for each phase. For the Regional and National Partners Fund, a maximum of £10,000 was allowed for each phase.

Profile of Rounds One to Three projects

3.14 This section presents an overview of the 248 projects that have been delivered in all three Rounds as part of the SGP. The funding has been provided in three rounds:

- Round One: October 2018 – March 2020;
- Round Two : August 2019 – March 2021; and
- Round Three: June 2021 – March 2023.

3.15 As part of the SGP, funding was split across two different funding streams from financial year 2019/20 (the beginning of Round Two). 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.

3.16 Table 3.1 shows the split of these funding streams across the successful projects. The Leadership and Collegiate funding stream supported 57% of projects, and 43% of projects fell within the Regional and National funding steam. One project in Round Two elected not to take up the funding and proceed with their project delivery, and so a total of 139 projects were progressed.[20]

Table 3.1: Funding stream by projects

Funding stream	Round One		Round Two		Round Three		Total submitted projects	Total % of submitted projects	Total successful projects	Total % successful projects
	Submitted	Funded	Submitted	Funded	Submitted	Funded				
Leadership and Collegiate	0	0	190	97	100	44	290	53%	141	57%
Regional and National	40	24	126	43	93	40	259	47%	107	43%
Total	**40**	**24**	**316**	**140**	**193**	**84**	**549**	**100%**	**248**	**100%**

Source: Education Scotland (2022)

3.17 The projects approved through the SGP in all Rounds had reasonably good spread across most of the RIC areas, as Table 3.2 shows. In Round Two, a large number of projects (32%) were delivered within the West Partnership, with nearly 70% of these being within schools. Over one-sixth (17%) of Round 1 projects were delivered in the Northern Alliance and just over one-eighth (13%) in the Forth Valley and West Lothian Collaborative in Round Three. The Tayside Collaborative consistently accounted for the lowest number of projects across all Rounds. It needs to be recognised that Tayside is one of the smallest regional improvement collaboratives and, as a result, there was a lower number of bids submitted for Tayside Collaborative Region. There was a considerably higher proportion of

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

projects presented as a National Offer for Rounds One[21] and Three than Round Two (+28 percentage points and +12 percentage points, respectively).

Table 3.2: Rounds One, Two, and Three submitted and funded projects by RIC area[22]

Funding stream	Round One (No, of projects (% of total projects)		Round Two (No, of projects (% of total projects)		Round Three (No, of projects (% of total projects)		% success rate of project being funded by RIC area
	Submitted	Funded	Submitted	Funded	Submitted	Funded	
West Partnership	11 (28%)	5 (21%)	114	44 (32%)	62	28 (33%)	41%
Northern Alliance	5 (13%)	4 (17%)	42	30 (21%)	14	7 (8%)	67%
South East Collaborative	2 (5%)	1 (4%)	41	25 (18%)	23	7 (8%)	50%
South West Collaborative	4 (10%)	3 (13%)	36	17 (12%)	17	9 (11%)	51%
Forth Valley and West Lothian Collaborative	3 (8%)	2 (8%)	25	11 (8%)	18	11 (13%)	52%
National Offer	13 (33%)	8 (33%)	42	7 (5%)	40	14 (17%)	31%
Tayside Collaborative	1 (3%)14	1 (4%)	16	6 (4%)	10	7 (8%)	52%
Independent	0	0 (0%)	0	0 (0%)	9	1 (1%)	11%
Total	**40**	**24**	**316**	**140**	**193**	**84**	**-**

Source: Education Scotland (2022)

3.18 In Rounds Two and Three, each project sought to deliver CLPL against one primary STEM theme; however, some projects cut across multiple themes. Across all Rounds, most projects had a strong focus on either STEM (37% overall) or Numeracy and Mathematics (33% overall). The stronger focus on Numeracy and Mathematics within Rounds Two and Three of the SGP was made possible through additional funding from the Learning Directorate in the Scottish Government. Around a quarter of all projects had either a Technologies and Digital theme (16%) or a Science theme (9%), whilst only 4% covered Engineering. Across all rounds, only three projects had Improving Gender Balance and Equalities as its primary theme (IGBE). It is, however, important to again acknowledge that multiple themes were woven through or crossed-over in project delivery.

Table 3.3: Rounds One, Two and Three funded projects by theme

Main theme	Round One		Round Two		Round Three	
	No. projects	% of total projects	No. projects	% of total projects	No. projects	% of total projects
Numeracy and Mathematics	1	4%	56	40%	25	30%
STEM	14	58%	41	29%	36	43%
Science	3	13%	16	12%	4	5%
Technologies (incl. Digital)	6	25%	22	16%	12	14%
Engineering	0	0%	4	3%	5	6%
IGBE	0	0%	1	1%	2	2%
Total	**24**	**100%**	**140**	**100%**	**84**	**100%**

Source: Education Scotland (2021)

3.13 Across all Rounds of the SGP, the majority of projects (57%) have been delivered in schools. This is followed by early learning and childcare, covering 15% of projects across all rounds. Projects that were cross-sectoral also accounted for the delivery of 11% of projects across the three Rounds, but accounted for 20% of all projects in Round Two. Just 6% of projects were within the ASN sector across all Rounds, but this increased in Round Three, equating to 11% of projects in Round Three alone. Projects with a specific focus on colleges and technicians equated to 1% of total projects across all Rounds. However, across Rounds One to Three of the SGP, 438 school-based technical support staff are recorded as having being included and benefitted from STEM Grants projects.

[21] Please note, Round One was open only to National partners rather than schools

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

Table 3.4: Rounds One, Two and Three funded projects by sector

Sector	Round One		Round Two		Round Three	
	No. projects	% of total projects	No. projects	% of total projects	No. projects	% of total projects
School	-	-	92	66%	50	57%
Primary	*18*	*75%*	-	-	-	-
Secondary	*12*	*50%*	-	-	-	-
Cross sector	-	-	28	20%	0	11%
ELC	10	42%	14	10%	14	15%
CLD	9	38%	3	2%	10	9%
ASN	3	13%	2	1%	9	6%
Technicians	-	-	1	1%	1	1%
College	3	13%	-	-	-	1%
Total	**24**	**100%[23]**	**140**	**100%**	**84**	**100%**

Source: Education Scotland (2022)

3.19 The majority (55%) of projects across all rounds were led by organisations in clusters and school settings and were the primary source of delivery for all RIC areas. However, on a national level, partner organisations were the main delivery source, accounting for 11% of all projects. Over one quarter (27%) of projects were led by local authorities, 5% by further and higher education bodies, and just 2% by multi-authority/RIC areas.

Table 3.5: Rounds One, Two and Three funded projects by organisation type

Organisation type	Round One	Round Two	Round Three	Total	%
Cluster/school/setting	0	98	39	137	55%
Local authority	10	26	30	66	27%
Partner organisation[24]	7	11	10	28	11%
Multi Authority/RIC	0	3	1	4	2%
Further and Higher Education[25]	7	2	4	13	5%
Total	**24**	**140**	**84**	**248**	**100%**

Source: Education Scotland (2022)

Project funding analysis

3.20 The SGP was organised into three distinct rounds, with a total of £4.02 million of funding awarded across the three rounds to enhance professional learning and delivery in STEM. Overall, there were 248 projects awarded funding. Round Two had the largest underspend of the three rounds, with over £223K being given back following awarding of funds. In all rounds, 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 Round Two funding, the COVID-19 pandemic was a significant factor. This was due to the disruption to many professional learning activities scheduled for March 2020, as the pandemic struck.

[23] Note: The sum percentage of Round 1 projects is significantly above 100% (229%) as projects in Round 1 were not categorised the same as in Years 2 and 3, where each project was assigned a "main sector." Projects in Round 1 touched upon several sectors and were not asked to assign a "main" one.

[24] In Round 1 this was referred to as "Partner Organisations"

[25] In Round 1, this was referred to as "Universities"

Table 3.6: Rounds One, Two and Three Funding requested and funding awarded

Funding stream	Round One		Round Two		Round Three		Total (Rounds One - Three)	
	Requested	Awarded	Requested	Awarded	Requested	Awarded	Requested	Awarded
Leadership and Collegiate	£0	£0	£3,098,516	£1,106,620	£418,022	£196,406	£3,516,538	£1,303,026
Regional and National	£2,470,744	£758,662	£8,327,572	£1,353,700	£1,409,849	£601,280	£12,208,165	£2,713,642
Total	**£2,470,744**	**£758,662**	**£11,426,088**	**£2,460,320**	**£1,827,871**	**£797,686**	**£15,724,703**	**£4,016,668**

Source: Education Scotland (2022)

Table 3.7: Rounds One, Two and Three Funding awarded and underspend

Round One		Round Two		Round Three	
Awarded	Actual underspend	Awarded	Actual Underspend	Awarded	Actual underspend
£758,662	**£48,736**	**£ 2,460,320**	**£222,779**	**£797,686**	**£102,345**

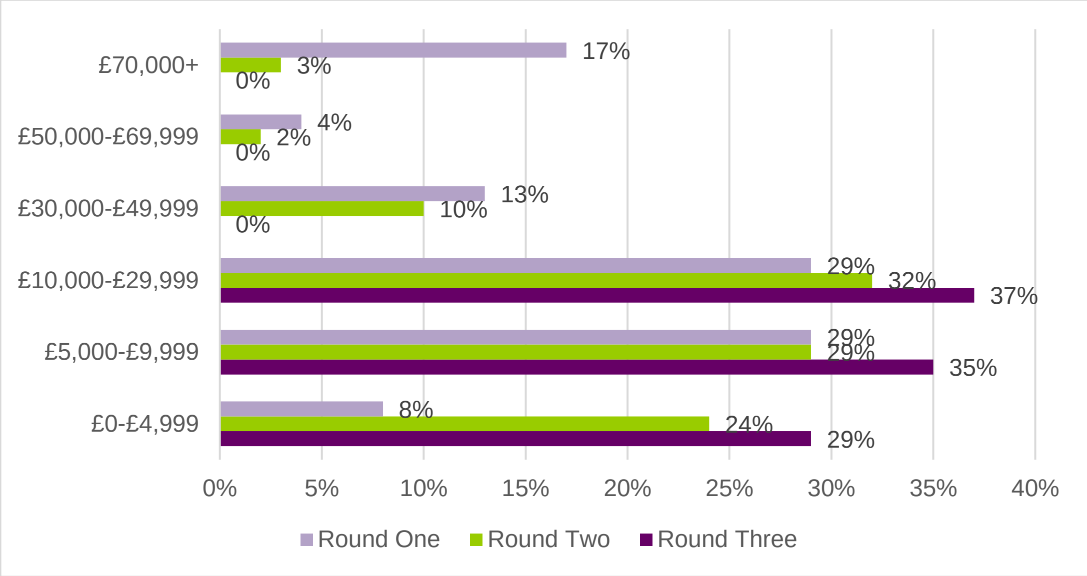
Source: Education Scotland (2023)

3.21 Table 3.6 sets out requested and allocated funding across all three rounds. Over the three funding rounds, a total of £15.72 million was requested from a total of 549 projects submitted. Funding of £4.02 million was awarded to 248 projects. Round Two had the largest amount of funding awarded (£2.46 million), followed by Round Three (£797,686) and finally Round One (£758,662).

3.22 Table 3.7 sets out allocated funding awarded and the actual underspend across all three rounds. Round Two had the largest amount of underspend (£223,779), followed by Round Three (£102,345) and then Round One (£48,736). Round Two featured considerably more projects (140) than Round One (24) and Round Three (84), and as such had the largest actual expenditure, despite significant challenges presented by the COVID-19 pandemic.

3.23 Figure 3.1 shows the spread of total expenditure for all rounds across all projects. The average project expenditure was at just over £14,000, and the majority of projects (85%) spent up to £29,999. In Round One, the joint highest proportion of projects (29% each) spent between £5,000 and £9,999 and between £10,000 and £29,999. The highest proportion of projects (32%) spent between £10,000 and £29,999 in Round Two. In Round Three, the highest proportion of projects (37%) spent between £10,000 and £29,999. In Round Three a cap was introduced for each of the funding phases. For the Leadership and Collegiate funding stream, a maximum of £3,000 was allowed for each phase and for Regional and National Partners a maximum of £10,000 for each phase. Therefore, in Round Three the Regional and National Partners funding stream had a maximum of £20,000 of total funding across both phases (or financial years), while the Leadership and Collegiate funding stream had a £6000 maximum of total funding across both phases.

Figure 3.1: Rounds One, Two and Three projects by total expenditure size band



Source: Education Scotland (2022)

3.24 Table 3.8 shows the breakdown of expenditure for the top ten highest funded projects in each Round, which accounted for 42% of expenditure overall on the programme. The project with the greatest actual and anticipated expenditure across all Rounds on the programme was delivered by the Royal Society of Chemistry, at £117,795 in Round One. This was followed by e-Sgoil, Comhairle nan Eilean Siar, at £102,427 in total, to support their online STEM experience for primary school learners.

3.25 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 3.8, meaning they received a greater amount of funding and expenditure overall as an organisation. Winning Scotland Foundation had two projects which were both in the top ten projects with the highest expenditure in Round Two, addressing maths and science themes (4% of overall Round Two expenditure).

3.26 For comparison, those with lowest project expenditure were around the region of £700-900 and occurred in Round Two. 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.

Table 3.8: Rounds One, Two, and Three total expenditure across top ten projects with highest level of award

Ranking	Round One Project (Value)	Round Two Project (Value)	Round Three Project (Value)
1.	The Royal Society of Chemistry (£117,795)	e-Sgoil, Comhairle nan Eilean Siar (£102,427)	Aberdeenshire Council (£20,000)
2.	Aberdeen University (£97,892)	Renfrewshire Council (£96,062)	Angus Council (£20,000)
3.	New College Lanarkshire (£80,903)	South Lanarkshire Council (£93,363)	East Ayrshire Council (£20,000)
4.	Dundee University (£80,167)	The Highland Council (£92,298)	e-Sgoil nan Eilean Siar (£20,000)
5.	Institute of Physics £46,662)	Argyll and Bute Council (£65,125)	Midlothian Council (£20,000)
6.	Glasgow City Council (£41,125)	The City of Edinburgh Council (£62,194)	Moray Council (£20,000)
7.	Forth Valley College (£38,868)	Winning Scotland Foundation (£50,593)	South Ayrshire Council (£20,000)
8.	Aberdeenshire Council (£23,870)	Bo'ness Academy (£48,450)	South Lanarkshire Council (£20,000)
9.	Youth Scotland (£23,167)	Winning Scotland Foundation (£46,138)	South West Collaborative (£20,000)
10.	Scottish Childminding Association (£23,053)	Glasgow's Improvement Challenge (£44,648)	The City of Edinburgh Council (£20,000)
Total (top ten)	**£596,555**	**£701,298**	**£200,000**
Remaining projects	*£162,108*	*£1,759,022*	*£597,686*
Total (overall)	*£758,663*	***£2,460,320***	*£797,686*

Source: Education Scotland (2022)

3.27 Table 3.9 shows the breakdown of expenditure across each RIC area for all rounds of the programme. The West Partnership was awarded the highest amount of funding (27%) which reflects the region having the greatest number of grant-funded projects in each round. The Northern Alliance was also awarded a significant amount of funding, totalling just under £973,000 and 24% of overall project expenditure for the three rounds.

3.28 Tayside Collaborative featured the lowest amount of funding awarded, totalling just under £237K, which is 6% of total funding awarded across all three rounds. Both Forth Valley and West Lothian Collaborative and South West Collaborative, each shared approximately 8% of the total expenditure across all three rounds.

Table 3.9: Rounds One, Two and Three total funding awarded across each RIC area

RIC area	Round One	Round 2	Round 3	Total	% Total
West Partnership	£152,510	£709,142	£207,518	£1,069,170	27%
Northern Alliance	£197,879	£687,541	£87,530	£972,950	24%
South East Collaborative	£33,304	£419,455	£82,492	£535,251	13%
Forth Valley and West Lothian Collaborative	£44,293	£207,406	£88,814	£340,513	8%
South West Collaborative	£26,873	£198,443	£83,507	£308,823	7%
National Offer	£223,637	£149,707	£173,403	£546,747	14%
Tayside Collaborative	£80,167	£88,626	£68,422	£237,215	6%
Independent	-	-	£6,000	£6,000	1%
Total	**£758,663**	**£2,460,320**	**£797,686**	**£4,016,669**	**100%**

Source: Education Scotland (2022)

3.29 Rounds One, Two and Three funding awarded, as well as overall total funding awarded across all rounds, is shown across the different target sectors identified earlier in the chapter. In Round Three, there was an increase in spend in both the CLD and ASN sectors from both Rounds One and Two, suggesting the greater emphasis on these sectors by Education Scotland's targeting was successful. Schools were awarded 53% of funding overall, with a total of over £2.1 million funding awarded across all rounds. Projects crossing over multiple sectors were awarded funding of over a quarter of overall funding in Round Two (22%), totalling 17% over both rounds. ELC were awarded funding of 13% across both Rounds Two and Three.

Table 3.10: Rounds One, Two and Three funding awarded across each target sector

Target sectors	Round 1[26]	Round 2	Round 3	Total funding	% Total funding
School	£94,243	£1,560,972	£477,924	£2,133,139	53%
All (cross sector)	£579,249	£540,219		£1,119,468	28%
ELC	£23,053	£269,206	£158,099	£450,358	11%
CLD	£52,757	£59,938	£91,165	£203,860	5%
ASN	-	£26,185	£67,498	£93,683	2%
Technicians	£9,361	£3,800	£3,000	£16,161	<1%
Total	**£758,663**	**£2,460,320**	**£797,686**	**£4,016,669**	**100%**

Source: Education Scotland (2022)

3.30 As shown in Table 3.11, STEM projects accounted for 41% of the funding awarded followed by Numeracy and Mathematics projects with 34% of overall funding awarded. Numeracy and mathematics projects accounted for the largest amount of funding for Round Two, accounting for nearly half (45%) of overall funding awarded in that Round. Projects with their main theme as Technologies (including Digital) accounted for 10% of overall funding awarded. Only three projects categorised IGBE as their primary aim, explaining the 1% of overall funding awarded. However, improving gender balance and equalities did feature heavily in Round Three of the SGP with 42 out of the 84 (50%) projects funded listing it as one of their secondary project themes. This was likely due to the concerted effort by Education Scotland to raise the profile and prioritise IGBE within the STEM Grants Programme.

[26] Due to Round One projects not being asked to state their main targeted sector, sectoral breakdown has been retroactively assigned by Education Scotland

Table 3.11 Rounds One, Two and Three funding awarded across main themes

Main theme	Round One	Round Two	Round Three	Total funding	% Total funding
STEM	£509,996	£816,348	£307,670	£1,524,345	41%
Numeracy/Mathematics	£4,159	£1,110,768	£263,150	£1,378,077	34%
Science	£186,507	£211,877	£39,183	£552,306	11%
Technologies (inc. Digital)	£58,000	£249,067	£111,817	£373,844	10%
Engineering	£0	£55,827	£54,560	£110,387	3%
IGBE	£0	£16,433	£21,306	£37,739	1%
Total	**£758,663**[27]	**£2,460,320**	**£797,686**	**£4,016,668**	**100%**

Source: Education Scotland (2022)

Project activity

Round One

3.31 In Round One, a total of 24 projects were funded from 40 projects submitted. All 24 projects were delivered by regional and national partners in the Regional and National Partner funding stream as the Leadership and Collegiate Professional Learning funding stream was only introduced in Round Two.

3.32 Of the 24 projects, there were just under 8,400 attendees in 710 STEM professional learning sessions, totalling over 34,000 hours of professional learning provided. Table 3.12 shows the total number of attendees, sessions, and professional learning provided.

Table 3.12: Round One actual project delivery against funding streams

Funding stream	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
Leadership and Collegiate	0	0%	0	0%	0	0%
Regional and National	8,392	100%	710	100%	34,098	100%
Total	**8,392**	**100%**	**710**	**100%**	**34,098**	**100%**

Source: Education Scotland (2022)

3.33 There were some key projects in Round One that delivered high levels of activity. The largest project in terms of overall activity was delivered by the Highland Council, involving the virtual delivery of STEM CLPL sessions using G Suite with a body of trained STEM mentors. It was awarded a total of over £58,500 over both phases from the Regional and National funding stream, providing sessions for 350 practitioners.

3.34 Youth Scotland followed with the second highest activity levels. The project sought to upskill primary teachers, CLD practitioners, parents and volunteers in the use of Youth Scotland's Hi-5 STEM activity toolkit. It received over £23,000 in funding and provided 10 sessions with 200 practitioners.

3.35 Table 3.13 shows the recorded number of attendees, sessions, and hours in Round One by RIC area. Almost half of the Round One attendees were from the West Partnership, and as a collective this had the largest number of sessions (24%) and hours (59%). The Forth Valley and West Lothian Collaborative also had a high number of hours delivered in projects for Round One, at just under 5,500 hours (19%) along with around a fifth of total attendees and sessions.

[27] Note: Column total is £758,662 as a result of rounding to nearest pound.

Table 3.13: Round One attendees, sessions and hours by RIC area[28]

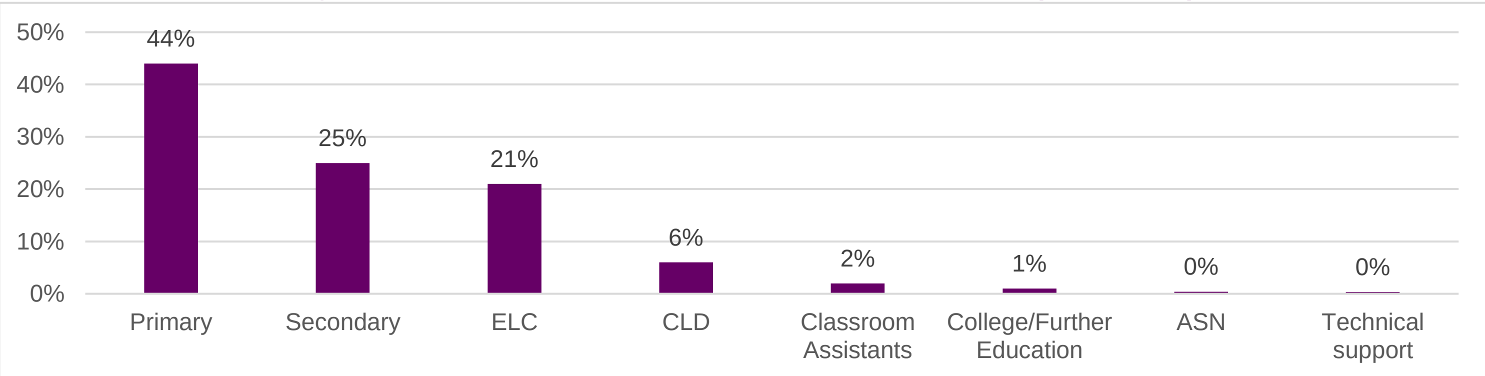
RIC area	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
West Partnership	3,322	48%	63	24%	17,380	59%
Forth Valley and West Lothian Collaborative	1,305	19%	49	19%	5,451	19%
South East Collaborative	877	13%	37	14%	1,864	6%
Northern Alliance	539	8%	41	16%	1,527	5%
Tayside Collaborative	464	7%	43	17%	2,206	8%
South West Collaborative	260	4%	18	7%	609	2%
Independent Sector	*129*	*2%*	*9*	*3%*	*320*	*1%*
Total	**6,896**	**100%**	**260**	**100%**	**29,357**	**100%**

Source: Education Scotland (2022)

3.36 As displayed in Figure 3.2, a significant proportion of attendees were from the Primary school sector (44%). Secondary school (25%) and early learning and childcare (21%) 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.

3.37 Schools also had the highest number of hours delivered at 77% (26,100 hours). This was followed by early learning and childcare at 17% (5,725 hours). Collectively, community learning and development, technical support, college and further education, additional support needs and school-based technicians delivered around 7% (2,273) of hours.

Figure 3.2: Number of attendees across education sectors (Round One)

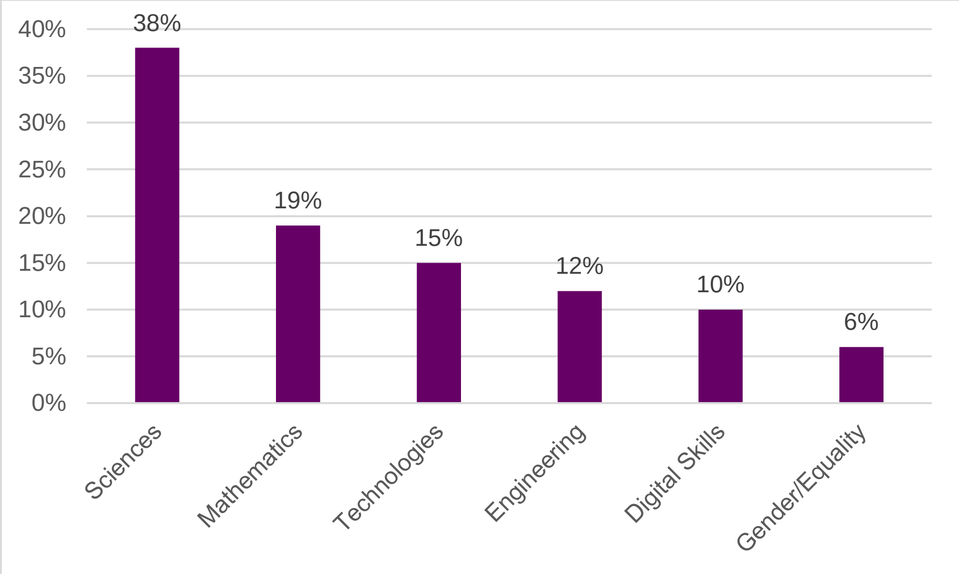


Source: Education Scotland (2022)

3.38 38%, or 270 sessions delivered, as shown in Figure 3.3 were within a project with a sciences theme. Just under a fifth of sessions were delivered by projects leading on Numeracy and Maths (19%; 135 sessions), with Technology-led projects accounting for 15% (106 sessions). Engineering, Digital Skills and Gender Equality-led projects delivered fewer sessions accounting for 12% (85), 10% (71) and 6% (43) of sessions, respectively.

[28] Calculations are based on reported totals for each local authority area within each RIC Area and as such, do not sum to the totals expressed in Table 3.11.

Figure 3.3: Project themes and number of sessions (N=710) (Round One)



Source: Education Scotland (2022)

3.39 Based on available data on where the sessions were delivered across local authorities, Glasgow accounts for the highest proportion at 16% of total recorded sessions. This was followed by Angus which accounted for 13% of these sessions. Stirling (9%), Edinburgh City (8%), Aberdeen City (6%), Falkirk (5%) and Aberdeenshire (4%) followed thereafter. This reflects a distribution of session delivery that is predominantly delivered in and around the more densely populated cities of Scotland.

Table 3.14: Geographical spread of Round One STEM learning sessions[29]

Local authority	No.	%	Local authority	No.	%
Glasgow	42	16%	Argyll and Bute	4	2%
Angus	35	13%	Scottish Borders	3	1%
Stirling	29	9%	Dumfries & Galloway	3	1%
Edinburgh City	22	8%	West Lothian	2	1%
Aberdeen City	18	6%	Perth and Kinross	2	1%
Falkirk	14	5%	Moray	2	1%
Aberdeenshire	11	4%	Midlothian	2	1%
Fife	10	4%	Renfrewshire	1	<1%
East Ayrshire	9	4%	East Renfrewshire	1	<1%
South Lanarkshire	8	3%	East Dunbartonshire	1	<1%
South Ayrshire	6	3%	Shetland	0	<1%
Highland	6	3%	Orkney	0	<1%
Dundee	6	3%	North Ayrshire	0	<1%
West Dunbartonshire	5	2%	Inverclyde	0	<1%
North Lanarkshire	5	2%	Eilean Siar	0	<1%
Clackmannanshire	4	2%	East Lothian	0	<1%
			Other (Online)	*9*	*3%*
			Total	**260**	**100%**

Source: Education Scotland Data (2022)

Round Two

3.40 Of all projects that have reported their activity, the Leadership and Collegiate funding stream represents 69% of these (97 projects) and the Regional and National funding stream represents 31%

[29] Does not include data from Aberdeenshire Council, College Development Network, Midlothian Council and Scottish Technician's Advisory Council. Information was not available

(43 projects). This suggests that a greater number of projects were delivered by clusters, schools or settings and higher level of engagement in schools than in Round One.

3.41 Of the 140 projects monitored in Round Two, there were 28,409 attendees in 1,013 STEM professional learning sessions, totalling over 83,000 hours. Table 3.15 shows the total number of attendees, sessions, and professional learning hours against the two funds. The Regional and National fund had a greater number of hours (73%) and attendees (73%), albeit with a slightly lower number of sessions than the Leadership and Collegiate funding stream. The greater level of reach that the projects on this stream 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 3.15: Round Two actual project delivery against funding streams

Funding stream	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
Leadership and Collegiate	7,580	27%	536	53%	22,325	27%
Regional and National	20,829	73%	477	47%	60,785	73%
Total	**28,409**	**100%**	**1,013**	**100%**	**83,110**	**100%**

Source: Education Scotland (2022)

3.42 There were some key projects in Round Two 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 and over 14,826 professional learning hours.

3.43 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. The funding awarded was £24,000, which provided for 15 sessions with 1,559 attendees over 12,291 professional learning hours.

3.44 The Mackie Academy project delivered the greatest number of sessions at 59, accounting for 6% of total sessions delivered. The project was part of the Leadership and Collegiate funding stream and was awarded £43,000 overall for practitioners to develop professional learning to teachers to assist in the early years mentoring and transitionary periods of pupils in STEM in Stonehaven.

3.45 Table 3.16 shows the number of attendees, sessions, and hours by RIC area. Almost half of the Round 2 attendees were from the West Partnership, and as a collective this had the largest number of sessions (39%) and hours (48%). This is to be expected as a significant proportion of the national education workforce is located in the West Partnership. The South East Collaborative also had a high number of hours delivered in projects for Round 2, at just over 19,000 hours (23%) along with around a fifth (21%) of total attendees and sessions. These align with the previous discussed projects with high activity.

Table 3.16: Round Two attendees, sessions and hours by RIC area

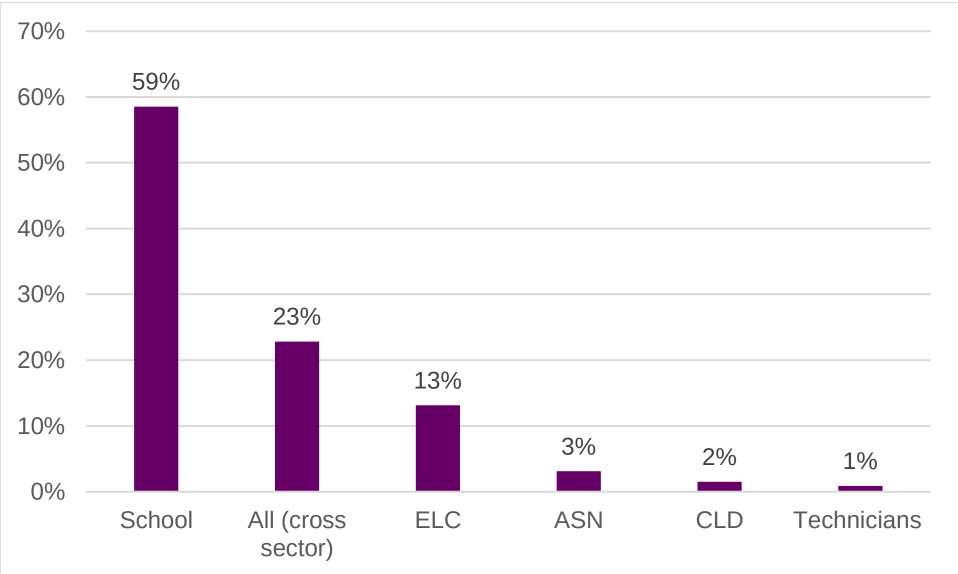
RIC area	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
West Partnership	8,844	31%	394	39%	40,201	48%
South East Collaborative	5,840	21%	186	18%	19,383	23%
Northern Alliance	2,450	9%	168	17%	6,525	8%
National Offer	7,209	25%	91	9%	3,244	4%
Forth Valley and West Lothian Collaborative	980	3%	86	8%	5,623	7%
Tayside Collaborative	474	2%	25	2%	486	1%
South West Collaborative	2,612	9%	63	6%	7,649	9%
Total	**28,409**	**100%**	**1,013**	**100%**	**83,110**	**100%**

Source: Education Scotland (2022)

3.46 As displayed in Figure 3.4, a significant proportion of attendees were from the school sector (59%), a decrease from the previous year as projects began to diversify more. Cross-sectoral projects (23%) and early learning and childcare (13%) were the next most common sectors based on number of attendees. There were fewer attendees across additional support needs, community learning and development and technical support, together accounting for the remaining 6% of attendees.

3.47 Schools also had the highest number of sessions delivered at 66% (670 sessions) and hours at 60% (49,729 hours). This was followed by cross sector delivery at 22% (225 sessions) and 28% (23,063 hours). Community learning and development delivered 7% of sessions (69) and 10% of hours (8,195) in Round 2. Collectively, ELC, ASN and school-based technicians delivered around 5% (49) of sessions and 3% (2,122) of hours.

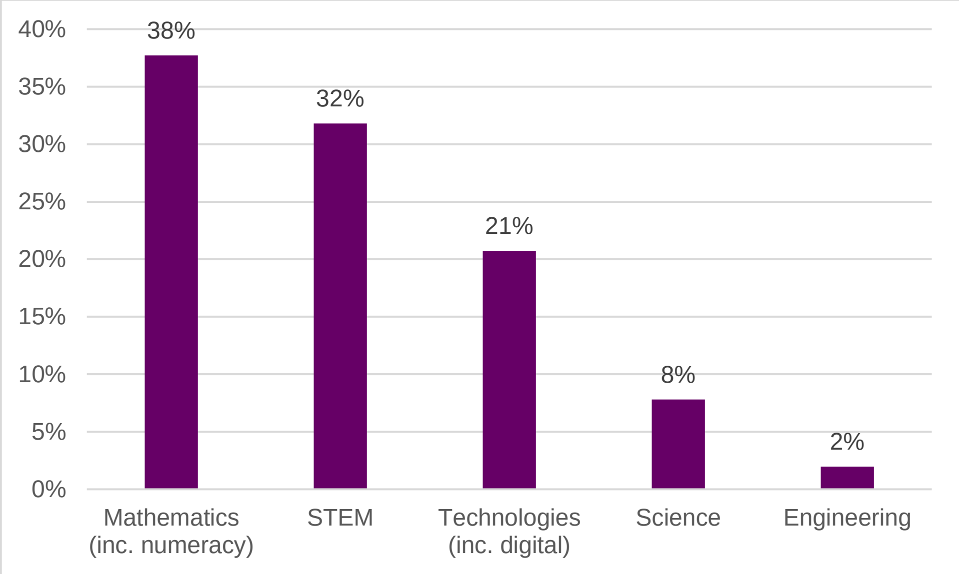
Figure 3.4: Number of attendees across education sectors (Round Two)



Source: Education Scotland (2022)

3.48 38%, or 382 sessions delivered, as shown in Figure 3.5 were within a project with Numeracy and Maths as the main theme. Just under a third of sessions were delivered by projects leading on STEM (32%; 322 sessions), with Digital/Technology projects accounting for around a fifth (21%; 210 sessions). Science and Engineering led projects delivered fewer sessions accounting for 10% (99) of sessions. This data is based on the main themes identified for the projects. In practice, many projects touched on multiple themes. For example the main theme for the project (identified by the project applicants) may have been STEM, but sciences and improving gender balance could be important secondary themes for the activities supported.

Figure 3.5: Main project themes and number of sessions (Round Two)



Source: Education Scotland (2022)

3.49 Available data on where the sessions were delivered across local authorities indicates that Glasgow accounts for the highest proportion at 16% with 4,268 attendees. This was followed by the national delivery which accounted for 12% and 1,934 attendees, likely to be associated with online sessions. Aberdeenshire (8%), Inverclyde (7%), Scottish Borders (7%) and South Lanarkshire (6%) 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 3.17: Geographical spread of Round Two STEM learning sessions

Local authority	No.	%
Glasgow City	162	16%
Aberdeenshire	80	8%
Inverclyde	66	7%
Scottish Borders	66	7%
South Lanarkshire	64	6%
Argyll and Bute	51	5%
Edinburgh City	51	5%
Clackmannanshire	47	5%
Midlothian	37	4%
East Renfrewshire	32	3%
South Ayrshire	31	3%
North Lanarkshire	26	3%
West Lothian	25	2%
Renfrewshire	23	2%
Dumfries and Galloway	22	2%
Fife	19	2%
East Lothian	13	1%
Falkirk	13	1%
Highland	13	1%
East Dunbartonshire	12	1%
Angus	11	1%
Moray	11	1%
East Ayrshire	10	1%
Na h-Eileanan Siar	6	1%
West Dunbartonshire	3	<1%
National Offer / NA	*119*	*12%*
Total	**588**	**100%**

Source: Education Scotland Data (2022)

Round Three

3.50 From the Round Three projects, the Leadership and Collegiate funding stream represented 52% of these (44 projects) and the Regional and National funding stream represented 48% (40 projects). This provides the smallest variation of funding streams of the three Rounds, as Round One funded Regional and National projects only (100%), while 69% of projects funded in Round Two were within the Leadership and Collegiate funding stream.

3.51 There were 10,206 attendees in 751 STEM professional learning sessions, totalling 25,696 hours. Table 3.18 shows the total number of attendees, sessions, and hours against the two funds. The Leadership and Collegiate fund had a greater number of hours (73%), sessions (71%) and attendees (60%).

Table 3.18: Round Three project delivery against funding streams

Funding stream	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
Leadership and Collegiate	6,076	60%	530	71%	18,718	73%
Regional and National	4,130	40%	221	39%	6,979	27%
Total	**10,206**	**100%**	**751**	**100%**	**25,697**	**100%**

Source: Education Scotland (2022)

3.52 Projects in Round Three delivered various levels of activity. The largest project in terms of overall activity was delivered by South Ayrshire Council in the South West Collaborative, involving improvements to pedagogical approaches with respect to mathematics in STEM. It was awarded a total of £20,000 over both phases from the Regional and National funding stream, providing 43 sessions with 1,036 attendees and over 2,769 professional learning hours.

3.53 Awarded funding through the Leadership and Collegiate funding stream, Inverclyde Education Services followed with the second highest activity levels in Round 3 Phase 1 with respect to attendees and sessions. The project sought to upskill staff throughout Inverclyde's early years settings in providing mathematics through play. It received £6,000 funding and provided 27 sessions to a total of 292 attendees, resulting in over 234 hours of professional learning.

3.54 Fraserburgh Academy delivered the second highest number of professional learning hours at 918, accounting for almost 10% of total hours accumulated in Round 3 Phase 1. The project was part of the Leadership and Collegiate funding stream and was awarded £5,720 overall for assisting in the delivery of the Academy's STEM Strategy.

3.55 Table 3.19 shows the number of attendees, sessions, and hours by RIC area. Approximately one third (32%) of the attendees were from the West Partnership, and as a collective this had the largest number of sessions (38%) and hours (26%). The Tayside Collaborative also had a high number of hours delivered across Round Three projects, at just over 6,760 hours (26%) along with 16% of total attendees and 11% of sessions.

Table 3.19: Round Three attendees, sessions and hours by RIC area

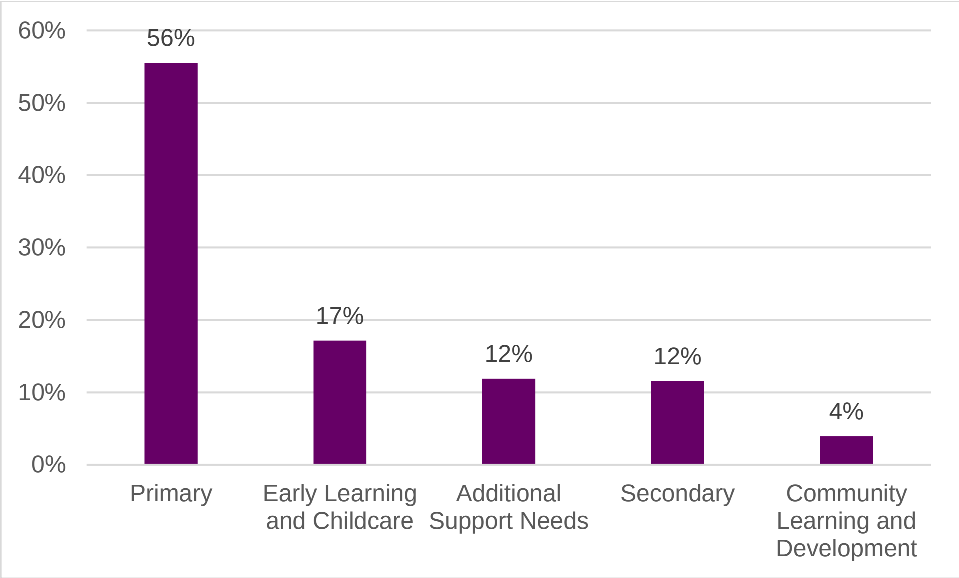
RIC area	Actual No. Attendees	%	Actual No. Sessions	%	Actual No. Hours	%
West Partnership	3,309	32%	284	38%	6,692	26%
South East Collaborative	652	6%	74	10%	2,376	9%
Northern Alliance	1,295	13%	72	10%	3,368	13%
National Offer	427	4%	21	3%	809	3%
Forth Valley and West Lothian Collaborative	472	5%	62	9%	680	5%
Tayside Collaborative	1,614	16%	145	19%	6,766	26%
South West Collaborative	2,437	24%	93	11%	5,006	18%
Total	**10,206**	**100%**	**751**	**100%**	**25.697**	**100%**

Source: Education Scotland (2022)

3.56 As displayed in Figure 3.6, a significant proportion of attendees were from the primary school sector (56%). Early learning and childcare (17%), and both additional support needs and secondary schools (12% each) were the next most common sectors based on number of attendees. There were fewer attendees across community learning and development, accounting for 4% of attendees recorded.

3.57 Primary schools also had the highest number of sessions delivered at 52% (393 sessions) and hours at 52% (13,294 hours). This was followed by early learning and childcare at 21% of sessions (160 sessions) and 14% of hours (3,511 hours). Secondary schools accounted for 16% of sessions (119 sessions) and 9% of hours (2,286 hours). Additional support needs sessions accounted for 5% of the total sessions (40 sessions) and 16% of hours (4,074 hours) and community learning and development accounted for 5% of sessions (39 sessions) and 10% (2,531) of hours.

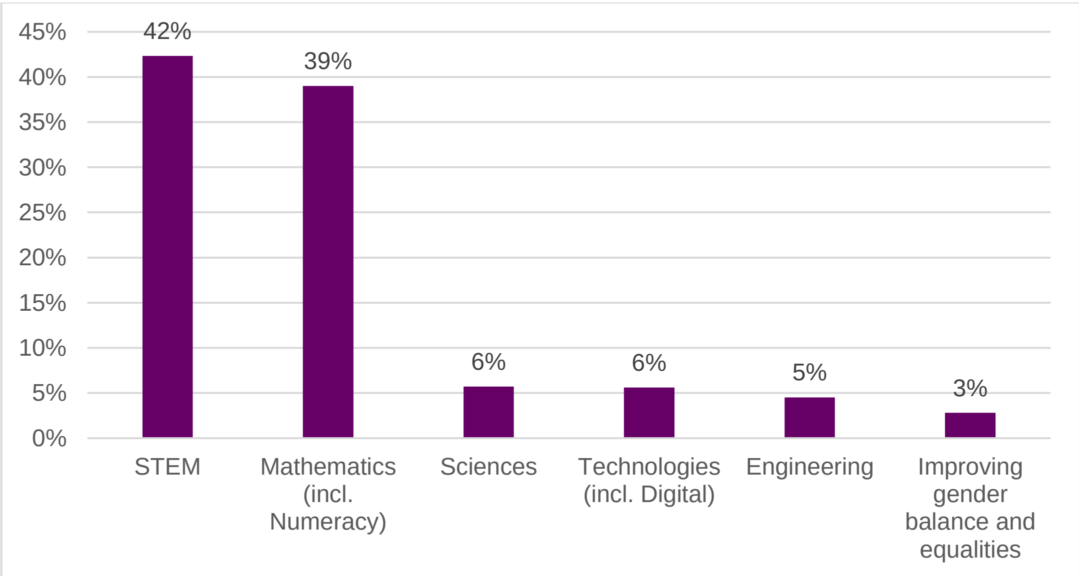
Figure 3.6: Proportion of attendees across education sectors (Round Three)



Source: Education Scotland (2022)

3.58 42%, or 318 sessions delivered, as shown in Figure 3.7, focused on projects with an overall STEM theme. This was closely followed by projects leading on Mathematics (including numeracy) (39%; 293 sessions), with both Science, and Technology and Digital projects each accounting for 6% of sessions (43 and 42 sessions, respectively). Engineering and Improving gender balance and equality-led projects each delivered fewer sessions, delivering 5% (34 sessions), 6% (20 sessions) and 1% (4 sessions) respectively.

Figure 3.7: Proportion of sessions across project themes (Round Three)



Source: Education Scotland (2022)

3.59 Available data on where the sessions were delivered across local authorities indicates that Dundee City Council accounts for the largest number of sessions delivered with 16% followed by North Lanarkshire Council with 14%. South Ayrshire Council had the largest number of attendees at the sessions with 2,049 attendees which accounts for 20%. This is followed by North Lanarkshire Council with 972 attendees which accounts for 10% of attendees.

Table 3.20: Geographical spread of Round Three STEM Projects

Local Authority	No. Sessions	% Sessions
Dundee City Council	121	16%
North Lanarkshire Council	102	14%
South Ayrshire Council	81	11%
Inverclyde Council	65	9%
Glasgow City Council	48	6%
Falkirk Council	44	6%
Midlothian Council	39	5%
Renfrewshire Council	34	5%
Aberdeenshire Council	33	4%
Moray Council	23	3%
Scottish Borders Council	23	3%
National	21	3%
Perth and Kinross Council	21	3%
East Dunbartonshire Council	20	3%
East Ayrshire Council	12	2%
Stirling Council	12	2%
The City of Edinburgh Council	12	2%
Comhairle nan Eilean Siar	11	1%
East Renfrewshire Council	6	1%
Aberdeen City Council	5	1%
West Dunbartonshire Council	5	1%
West Lothian Council	5	1%
South Lanarkshire Council	4	1%
Angus Council	3	0%
Clackmannanshire Council	1	0%
Dumfries and Galloway Council	0	0%
Independent	0	0%
North Ayrshire Council	0	0%

Source: Education Scotland Data (2022)

Deliverables

3.60 As part of Round 3 Phase 1 applications, projects were asked to provide access to resources that have been created as a result of the STEM Grant awards. These resources vary between teacher materials to help inform professional development, to videos and webinars explaining the training that has happened, to toolkits that lesson development.

3.61 Of the 84 projects awarded funding in Round 3 Phase 1, 46 (55%) of these were able to signpost Education Scotland to the resources they have created as a result of this project. The vast majority of these resources were training materials (either recorded videos or PowerPoint presentations) that were made available to enhance collaborative learning across the SGP.

3.62 Other resources that were made available to Education Scotland as a result of this scheme in Round Three Phase 1 include:

- Session and lesson plans, course handbooks and assessment materials to assist other teachers in development of classes;

- Documentation detailing the development and release of a school's STEM Strategy as best practice in strategy development;
- Surveys that were used to inform the evidence base with which grantees used to justify the investment and monitor progress from baselines; and
- Parental guidance documents to inform parents of the educational benefits of certain STEM subjects, such as woodworking.

Summary

3.63 The SGP saw a range of projects developed around professional learning in STEM and delivery across all local authorities in Scotland between 2018/19 and 2022/23. Whilst all 24 projects in Round One were funded through the Regional and National Partner funding stream, the majority (57%) of all 248 projects across Rounds One – Three were funded through the Leadership and Collegiate Professional Learning funding stream. Indeed, there has been a trend towards delivery through the Leadership and Collegiate strand. This appears to be a result of the targeting of the programme funding, with greater responsiveness to local needs and demand for collegiate and collaborative working. However, the reduced funding available through Round 3 may also have influenced this trend, with large-scale unable to be delivered at the national level with smaller budgets.

3.64 Projects have been delivered across all RIC areas, with almost half (47%) of attendees to sessions found within the West Partnership. Almost two thirds of projects (64%) have been delivered through schools (including clusters and ELC settings). This is indicative of the focus on more local impact, responsiveness to practitioner need, and equity of access to STEM professional learning.

3.65 Whilst there has been some focus on individual discipline areas, around 38% of projects focus on STEM as a whole in their professional learning. Though Science and Technologies (including Digital) have seen some focus during the programme's delivery, Engineering projects have arguably been under-represented, despite concerted efforts by Education Scotland to encourage and prioritise Engineering-related bids. The number of Numeracy and Mathematics projects, the second most represented project type, was driven by the additional funding for Numeracy and Mathematics provided by Scottish Government in Rounds Two and Three. It may also have been driven, at least in part, by the COVID-19 pandemic and recovery curriculum measures implemented by schools and local education authorities, which focussed heavily on Numeracy, Literacy and Health and Wellbeing.

3.66 For all projects across the SGP Rounds One to Three, on average each project reached 190 practitioners, over 10 sessions and provided 576 cumulative hours of professional learning.

3.67 Despite COVID-19 severely affecting delivery in Round Two, STEM professional learning continued to reach practitioners across the whole of Scotland. The reach has been greater in Round Two Phase 2 and Round Three Phase 1 than in Round Two Phase 1, reflecting a greater proportion of online learning on offer, engaging practitioners regardless of location. This may also be indicative of increasing effectiveness of projects that build on the delivery and legacy of projects funded through previous rounds.

3.68 The development and sharing of deliverables in Round Three will continue to reinforce learning and provide a wide range of accessible resources that will assist in professional development across STEM practitioners in Scotland.

4 Progress towards objectives: learners, practitioners and parents

Introduction

4.1 This chapter reviews the impact of the SGP in terms of its effects on learners, practitioners and parents. It explores progress towards the following objectives:

- Access to STEM professional learning, motivations for participation and prior skills, capabilities and confidence (practitioners);
- Distance travelled towards the "excellence" objective, notably the role of the SGP in "improving STEM learning and teaching, and delivering enhanced professional learning". This brings into discussion the quality of STEM learning (for learners) as well as the quality of professional learning (for practitioners). The section explores practitioner skills, knowledge and practice 'before' and 'after' SGP participation;
- Distance travelled towards the important "equity' objective, notably the role of the SGP in "improving participation in STEM further and higher education courses and apprenticeships". This explores the role of the SGP programme in improving participation for learners, including the role it plays for parents in learner decision-making. The impact of SGP on practitioners is also covered here;
- Progress made towards the 'inspiration' objective, including the role of the SGP in "creating positive STEM role models, mentors and coaches" and "promoting the opportunities and benefits of STEM learning and careers". The impact of SGP on practitioners is covered in this section and the resultant influence on learners and parents;
- Progress towards the 'connection' objective, including the role of the SGP in "improving the support available to schools" and "delivering up to date advice and information on STEM careers". Again, the impact of SGP on practitioners is covered in this section and the resultant influence on learners and parents.

4.2 The chapter draws on the following data available for the study. As set out in the introduction, a consequence of the COVID-19 pandemic was a reduction in the primary research available (notably an ekosgen practitioner survey for 2021/2022). Nonetheless, the following research was conducted, compiled and analysed to support this study:

- The learners' survey conducted by ekosgen in 2022;
- The parents' survey conducted by ekosgen in 2022;
- Education Scotland's survey of practitioners, 2020/2021; and
- Impacts identified in SGP Round Two Interim reports.

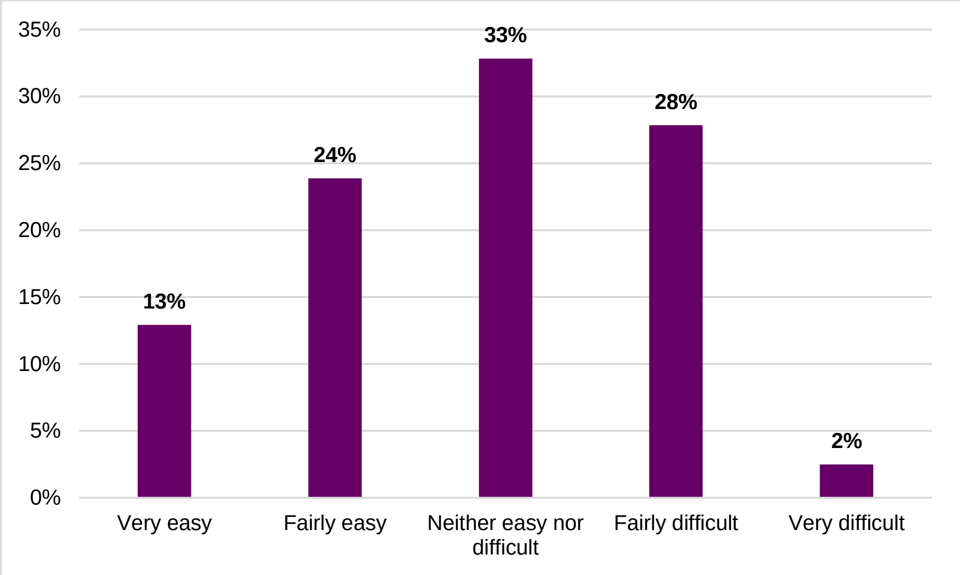
4.3 Whilst there was no practitioner survey in 2021/22, the chapter nonetheless makes some references to the practitioner survey conducted by ekosgen in 2020/21.

Improving access to STEM professional learning

Prior professional learning

4.4 The 2020/21 ekosgen practitioner survey indicated that 37% found it 'very easy' or 'fairly easy' to access STEM professional learning, prior to their involvement in the SGP. This is broadly consistent with the Education Scotland survey of practitioners 2020/2021, where 42% (Primary, Secondary, ELC and ASN practitioners) reported that they found it easy to access STEM professional learning. As the Education Scotland report stated, this was a considerable increase from the 30% reporting it easy to access professional learning in 2018/2019, perhaps related to the increase in online learning that was made available as a result of the COVID pandemic.

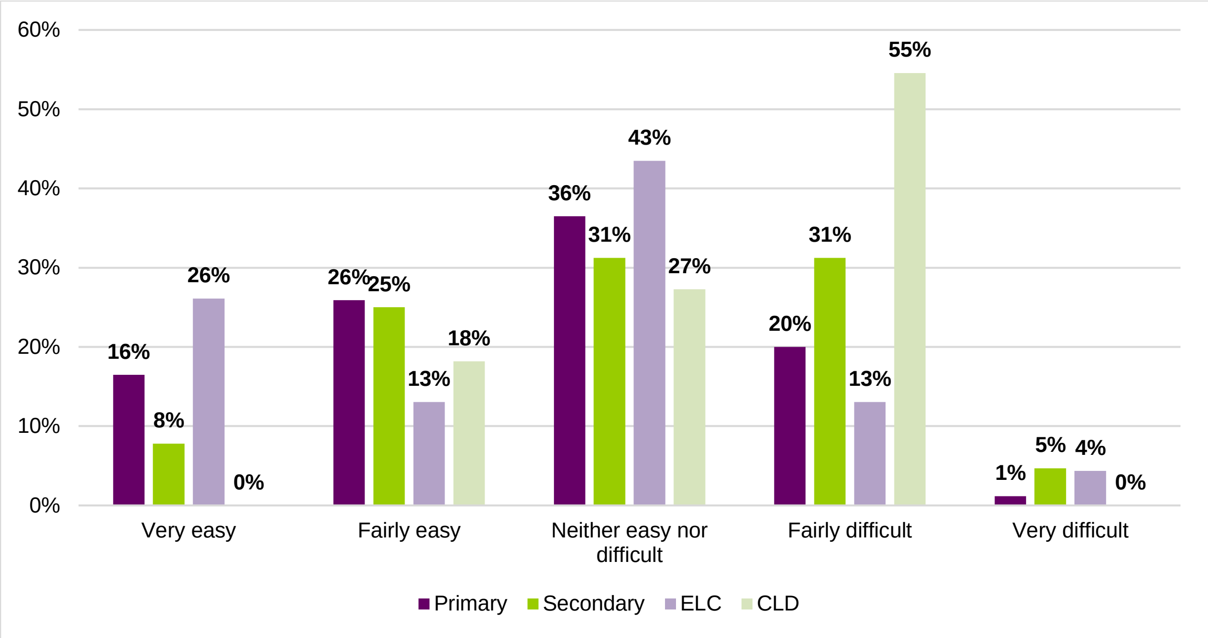
Figure 4.1: Ease of access to STEM professional learning prior to Education Scotland-supported training



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

4.5 The 2020/21 ekosgen practitioner survey indicated that it was the CLD sector who found it the most difficult to access STEM professional learning, with 55% reporting this to be "fairly difficult", and just 18% reporting this to be easy. Education Scotland survey findings found the situation, however, to be improving. Although the Education Scotland survey was based on a lower number of responses, the data suggested that 37% found it easy to access STEM professional learning (2020/21), up from 27% in 2018/2019. It is highly probable the SGP was the reason for the increase in CLD access.

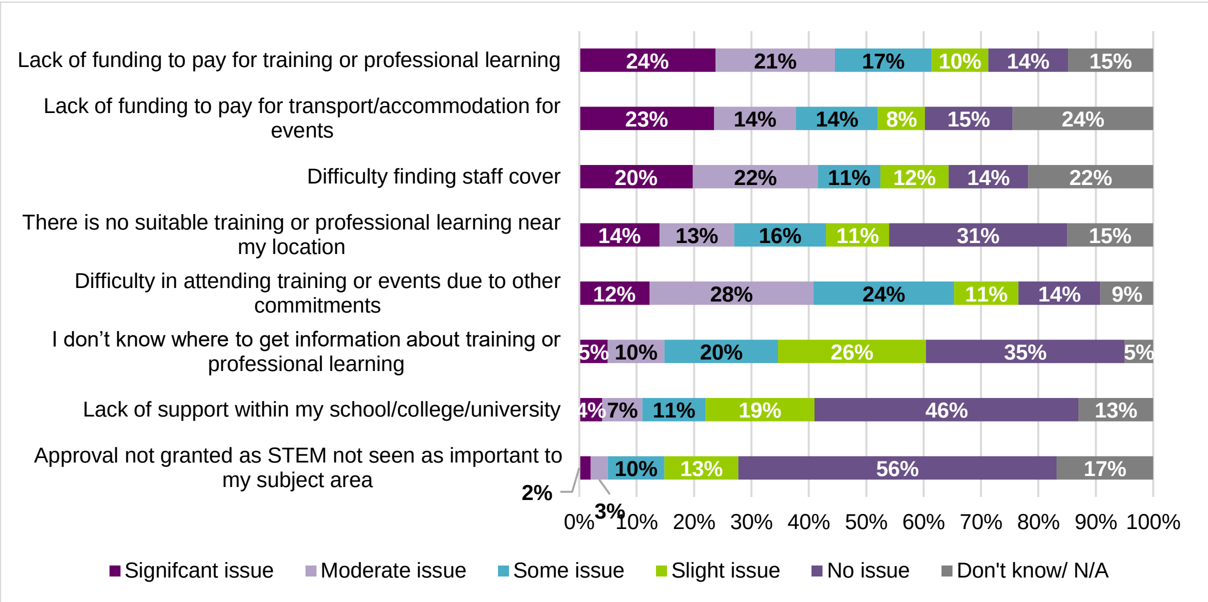
Figure 4.2: Ease of access to STEM professional learning prior to Education Scotland-supported training, by sector



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

4.6 There are a range of barriers to practitioners accessing STEM professional development. The 2021/22 ekosgen practitioner survey indicated lack of funding to pay for training or professional learning and lack of funding to pay for transport accommodation/events as the greatest 'significant' issues. There has also been a challenge in finding staff cover, particularly in rural and more remote areas.

Figure 4.3: Barriers to accessing prior STEM professional development



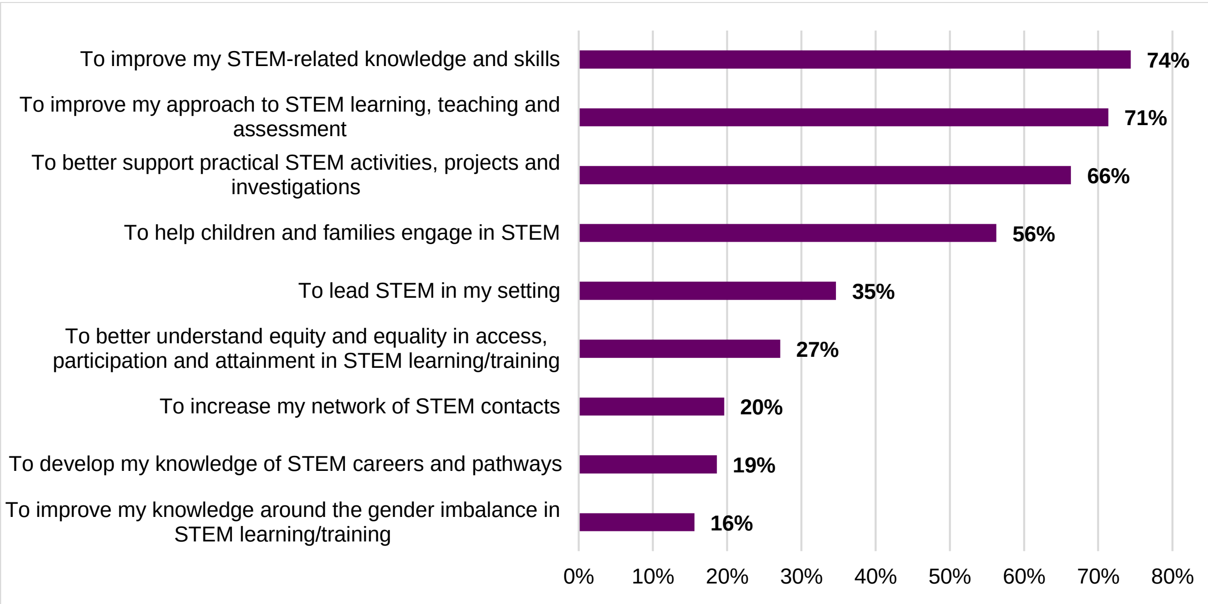
Source: ekosgen Survey Data (2021), N=202

Motivation

4.7 Almost three in four practitioners reported their motivation for engaging in Education Scotland - supported STEM professional learning was to improve their STEM-related knowledge and skills (74%, ekosgen practitioner survey 2020/21). More than seven out of 10 (71%) also said their motivation was to improve their approach to STEM learning, teaching and assessment. Two-thirds also wanted to be to better support practical STEM activities, projects and investigations (66%).

4.8 A lower proportion said their motivation was related to equity and equality. In all, 27% said their motivation was to better understand equity and equality in access, participation and attainment in STEM learning/training and 16% said their motivation was to improve their knowledge around gender imbalance in STEM learning/training. Despite this, very many of the SGP projects involved some form of support for better equity and equality understanding, and many practitioners have improved their equity and equality understanding as a result of their support (see 4.25).

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



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

Prior skills and capabilities

4.9 The ekosgen practitioner survey 2020/2021 illustrated that the prior skills, knowledge and practice of practitioners in relation to STEM was variable and quite low for practitioners in certain settings, notably ELC and to a lesser extent CLD and primary. Prior abilities were lowest (below 3 out of 5) for:

- Supporting practical enquiry, investigative work and STEM projects – particularly low (2.5) amongst CLD practitioners;
- Improving progression in learning across transitions and sectors – especially amongst ELC practitioners (2.5);
- Adaptability and innovation in approaches to teaching STEM – amongst both CLD (2.6) and ELC practitioners (2.5);
- Bring knowledge of STEM careers and pathways into learning – lowest in the ELC setting (2.2) and CLD (2.5):
- Leading STEM in your settings – lowest amongst those in CLD (1.7) and in secondary schools (2.4);
- Engaging parents, families and communities – rated 2.5 or less by secondary and primary school practitioners, and in the ELC setting.

4.10 Self-rated prior skills, knowledge and practice was lowest on the whole amongst ELC practitioners, where scores were under 3 out of 5 for all categories bar developing learners' skills in a progressive way.

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

4.11 Not surprisingly, prior confidence in delivering STEM learning was therefore lowest amongst ELC practitioners, followed by those in primary and CLD settings. Only practitioners in secondary schools felt confident (4.0 or above out of 5) in relation to inspiring young people to develop STEM skills and confidence in promoting awareness of STEM learning. Confidence in strategies to close equity gaps in *participation* in STEM and strategies to close equity gaps in *attainment* in STEM was lowest, at an overall average of 2.4 out of 5, albeit practitioners in secondary schools were more confident with regard to these (3.4 and 3.3 out of 5 respectively).

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

Key points

- There is no new practitioner survey for 2021/2022, however the indications prior to this were that practitioners were finding it easier to access STEM professional learning. This occurred despite (and potentially as a result of) the pandemic and the availability of online learning and resources. The SGP will undoubtedly have played a role in helping practitioner access to STEM professional learning;

- The CLD sector continues to find it more difficult to access STEM professional learning, although there are indications that CLD practitioner access has also improved. Barriers are typically in relation to availability of funding and staff cover;
- The strongest motivations for practitioner participation are in relation to knowledge acquisition, developing new approaches and being better able to support STEM learning in practical ways. Fewer report equity and equality motivations for participating in STEM professional learning;
- The ELC and CLD sectors were the least confident in delivering STEM learning prior to their STEM CLPL training, and prior confidence levels amongst primary school practitioners were also relatively low. For all practitioners, confidence levels increased post SGP project participation, as described in subsequent sections.

Excellence

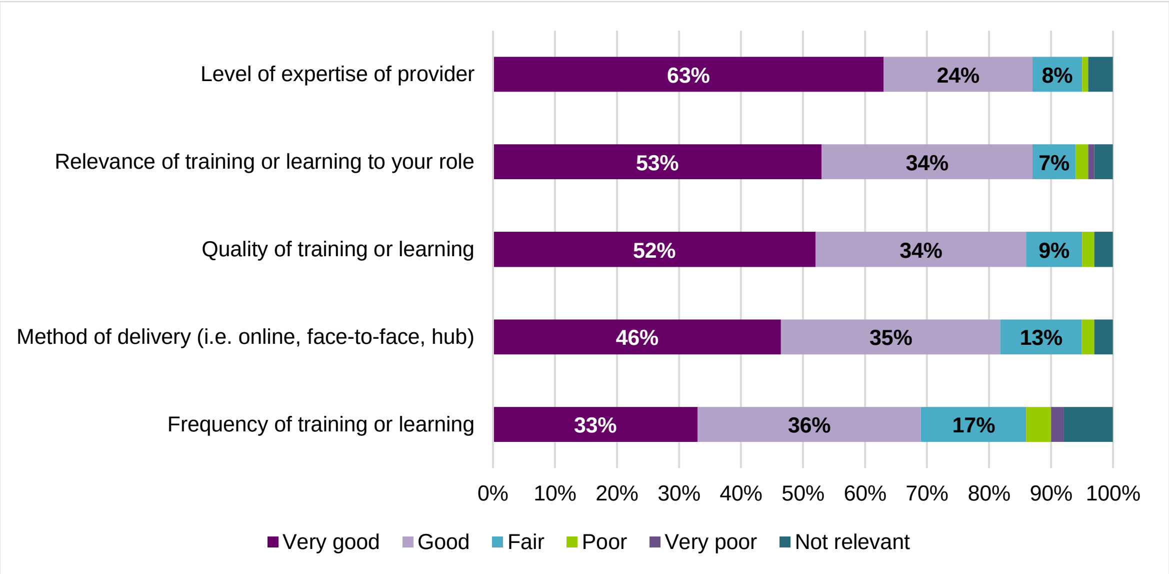
We will promote **Excellence** by:

- **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**

Quality of STEM Grant Programme learning (practitioners)

4.12 The SGP has consistently delivered high quality learning (86% saying this was good or very good in the 2020/21 ekosgen practitioner survey) and with 87% saying the level of expertise of the provider was good or very good. A similar proportion saying this was relevant to their role. The following chart shows this.

Figure 4.5: Rating of STEM CLPL



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

Quality of STEM learning (for Learners and Parents)

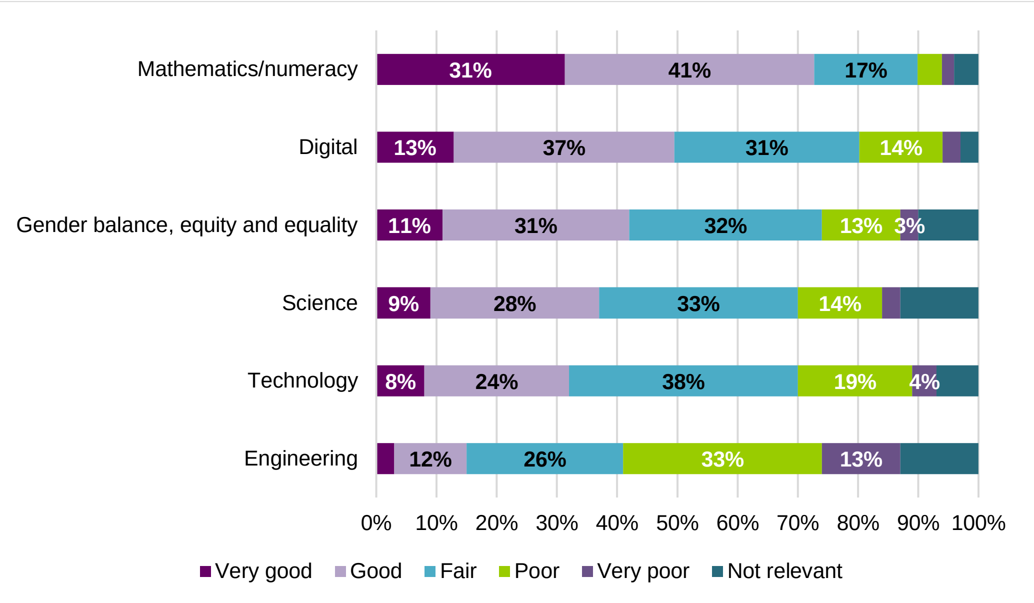
4.13 There is evidence of a positive impact from STEM teaching for **learners**, with a quarter of learners who will continue with STEM (25%) saying this is due to their "teachers being helpful and encouraging" (2021 learner survey). A little over one third of learners (36%) say they will continue STEM because "the lessons are fun and interesting" and 31% say "I like the experiments, practicals and hands-on challenges". Whilst these responses cannot be directly attributed to the SGP, the evidence is that good quality STEM teaching is positively influencing learners.

4.14 Amongst **parents**, just under one in five say they wish for their child/children to continue with STEM because of their "teachers being helpful and encouraging" (19%). More parents (than learners) say the "experiments, practicals and hands-on challenges" are a reason for continuing in STEM (54%). Again, whilst not directly attributable to the SGP, there is evidence that parents find STEM practical engagement as important.

Impact of STEM Grant Programme on STEM skills (Practitioners)

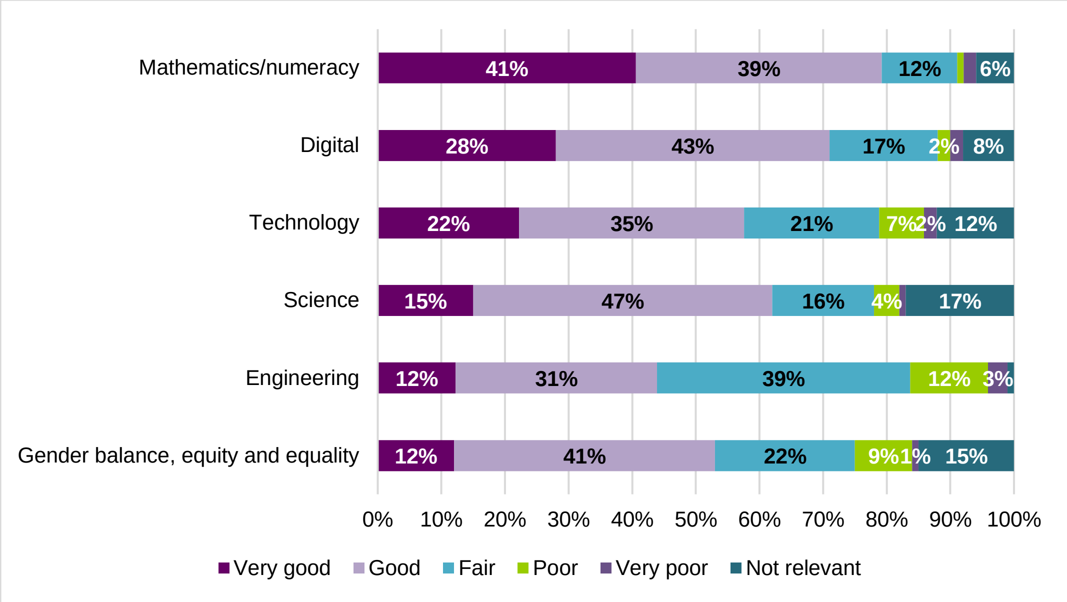
4.15 It is clear that the SGP had continued to have a positive impact on the STEM skills of practitioners. This is across all elements of STEM but is notably the case in relation to digital (13% rating their skills very good prior to the SGP support, rising to 28% after the SGP support), and in relation to science (up from 9% to 15%), engineering (up from 3% to 12%) and technology (from 8% to 22%). Even in mathematics, where 31% already rated their skills as very good, the SGP support helped to increase this proportion to 41%. Only for gender balance, equity and equality the SGP made only marginal difference (those rating their skills as very good rising only from 11% to 12%). The following charts show this, using the ekosgen practitioner survey data 2020/2021.

Figure 4.6: STEM skills rating prior to engagement



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

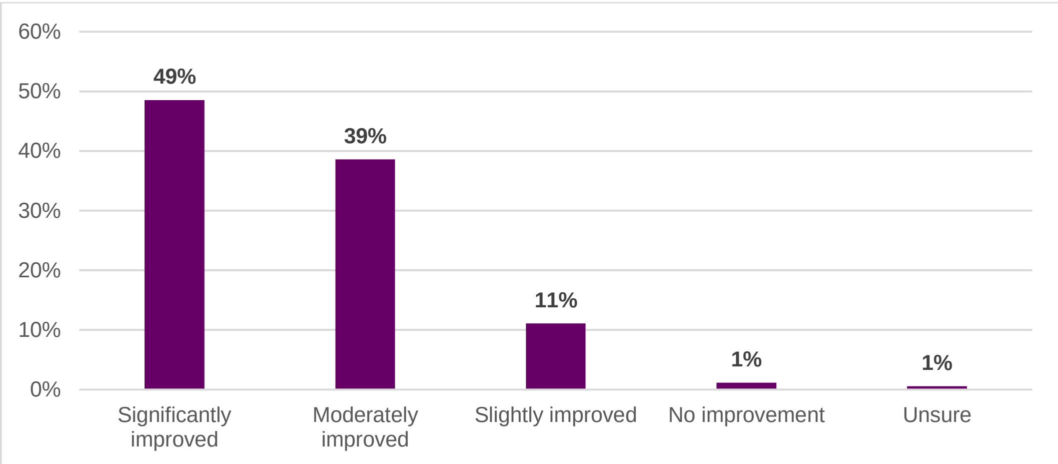
Figure 4.7: STEM skills rating after engagement



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

4.16 Figure 4.8 indicates the extent to which practitioners believe that the professional learning received via the SGP was beneficial to their STEM learning and teaching capabilities. In all, 98% felt the SGP had improved their capabilities, with 49% saying it had significantly improved.

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



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

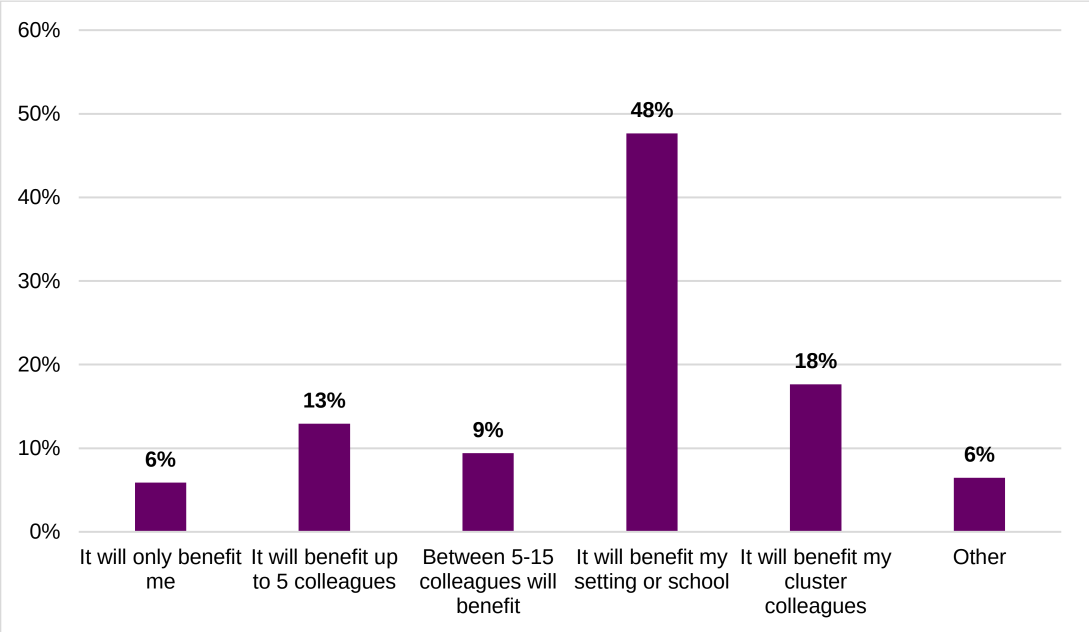
4.17 Feedback from interim reports from SGP projects indicates that the CLPL support was extremely valuable, and several of the projects supplied their own surveys of practitioners to evidence this. One example is the *"Upskilling Staff throughout Inverclyde Early Years Settings in Providing Mathematics through Play Inside and Out"* project. This was a modest £3,000 grant to deliver a mix of in-person and on-line training to 90 practitioners across 12 Early Years establishments. Their own survey of practitioners found that:

- 100% had increased their 'general mathematics' knowledge (46% very much so, 36% a lot).
- For 'teaching numbers from 1-10', 18% expressed a little increased knowledge, 46% a lot, and 36% very much increased knowledge.
- In 'subitising' 9% said their knowledge had increased a lot and 91% said their knowledge had increased very much so in this area. This was the area staff said they needed most support

in, *"so we have really supported in this area. Staff have liked that they can refer back to the videos when needed"* (project lead).

4.18 As Figure 4.9 shows, almost half of all the practitioners surveyed in 2020/2021 practitioner survey said the knowledge gained through supported professional learning benefited their whole school or setting (48%) and a further 18% said it would benefit their whole cluster. Just 6% said the benefits would be limited to themselves.

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



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

4.19 The SGP continued to help deliver a wide range of skills, knowledge and practice improvements amongst practitioners – and across all settings. Table 4.3 shows the actual scores (out of 5) for a wide range of factors, and Table 4.4 the improvement in scores compared to before the STEM CLPL training. The highest scores are evident for:

- 'Knowledge and access to resources and support' - 4.0 out of 5 and above for those in secondary and CLD settings;
- 'Teamwork and collaboration with peers to share practice and learn with each other' – 4.4 out of 5 for those in secondary schools;
- 'Developing learners' skills in a progressive way' - 4.0 out of 5 or above for all settings;
- 'Creating engaging and motivating learning experiences for learners' – 4.0 out of 5 or above for all settings bar secondary school;
- 'Improving learner attainment and outcomes' – 4.0 or above for secondary and CLD settings;
- 'Learning, teaching and assessment' – above 4.0 for CLD settings; and
- Adaptability and innovation in approaches to teaching STEM – above 4.0 for ELC practitioners.

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

4.20 The greatest improvements in scores, post STEM CLPL training were in:

- ELC settings – above 1.0 improvement in almost all categories, highest for 'adaptability and innovation in approaches to teaching STEM' at an increase of 1.5. The SGP support also helped make a big difference in 'engaging parents, families and communities' (+1.4), 'leading STEM in your settings' (+1.3), 'improving learner attainment and outcomes' (+1.3) and 'bringing knowledge of STEM careers and pathways into learning (+1.3);
- Improvement in 'knowledge and access to resources and support' for CLD practitioners (+;1.3) and in 'adaptability and innovation in approaches to teaching STEM' (+1.2);
- 'Teamwork and collaboration with peers to share practice and learn with each other' improvements for secondary practitioners (+1.1);
- 'Supporting practical enquiry, investigative work and STEM projects' – at an average of (+1.0) improvement across all settings.

4.21 Only for 'Improving progression in learning across transitions and sectors' did the SGP support lead to a lower score than prior to the project (-0.2).

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

Key points

- New 2021 learner survey data indicates the positive role of good quality teaching and lessons as a reason for learners to continue with STEM subjects. Whilst this cannot be directly attributed to the SGP, there is a clear correlation between appetite for STEM amongst learners and good quality STEM teaching;

- The practitioner survey 2020/2021 indicates the very positive effect of the SGP on raising the skills, knowledge and practice of STEM practitioners. The SGP support was effective for all settings – and especially for those in CLD settings and in ELC.

- The SGP helped increase access to resources and support and adaptability and innovation in approaches. It also supports teamwork and the sharing of good practice, especially in secondary schools.

- The SGP was effective in 'Supporting practical enquiry, investigative work and STEM projects' This hands-on, practical element to STEM is a key reason parents encourage their child/children to continue with STEM in schools;

- The practitioner views of the benefits of SGP project support translate into positive experiences for learners, with many learners citing that teachers are encouraging and helpful and that lessons are fun and interesting.

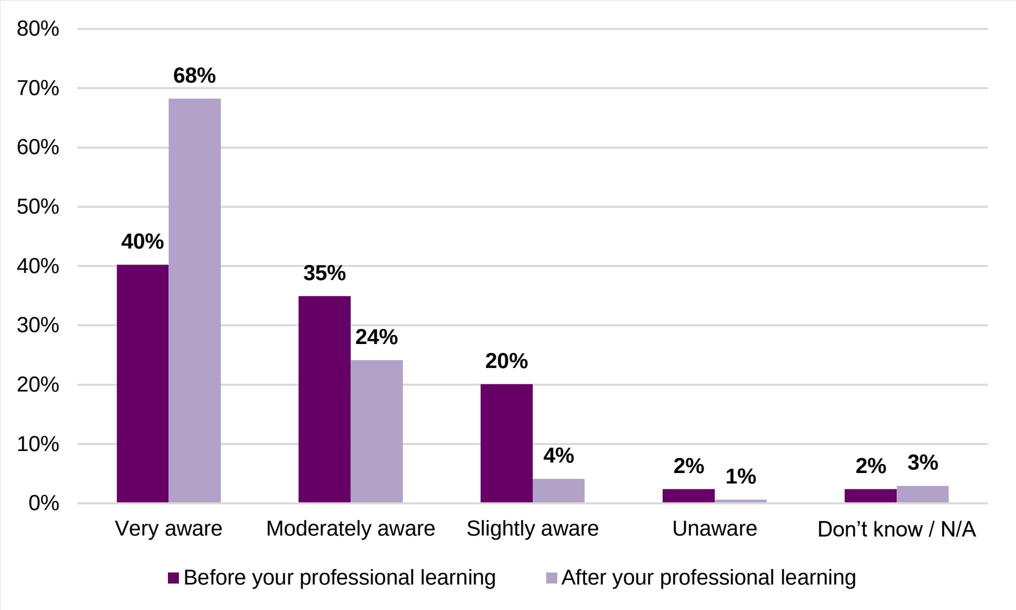
Equity

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**

4.22 The 2021 survey of practitioners indicated that the SGP made a substantial difference to the practitioner understanding of the need to ensure equity and equality in their approach with learners. Although 40% said they were "very aware" of the need to ensure equity and equality in their approach prior to the SGP support, this increased to 68% following support. Figure 4.10 shows this.

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



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

4.23 The 2021 ekosgen practitioner survey also indicated that there were a large number of sessions delivered specifically to address gender imbalances. Based on 161 responses, 75% of primary school sessions included those specifically designed to address gender imbalance, 62% in secondary school settings, 70% in ELC and 36% in CLD (based on a small sample).

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%
Sub total	*51*	*75%*	*31*	*62%*	*16*	*70%*	*4*	*36%*
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

4.24 The interim project reports from 2021/2022 projects also indicate a considerable emphasis on equity and equality issues. These include:

Equity

- Falkirk's Inclusion and Wellbeing Service and their 'Enhancing Professional Learning in STEM – Lego League' project – the project works with pupils who are often care experienced, come from a lower social economic background, and have social and emotional needs as a result of trauma, attachment and abuse. This was a £1,560 SGP Leadership and Collegiate project benefiting 11 practitioners which benefited learners considerably, although feedback indicated that a slower pace of delivery would have benefitted some of the participants;

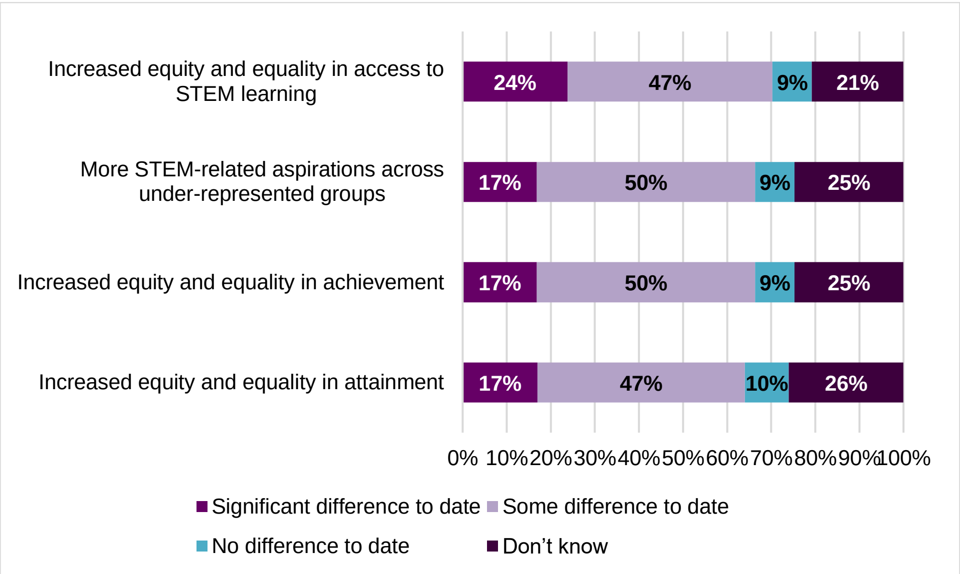
- City of Edinburgh Council's 'Developing Teachers' Skills and Knowledge of Fractions to Improve Learners' Progress in Numeracy' project – the £10,000 Regional and National SGP project was to train teachers in numeracy skills and also to help address the poverty-related attainment gap, where four out of the five schools receiving this support were in areas of higher deprivation. The learning for the 128 practitioners had a significant positive impact for two thirds of them as education professionals, and one third significantly so.

Equality

- St Catherine's Primary School, Renfrewshire and their 'Learning Together to Improve Mathematics in Every Classroom' project. A £2,340 SGP Leadership and Collegiate project for three facilitated CLPL sessions, facilitated staff collaboration and implementation of Skills Development Scotland lessons aimed at raising awareness of gender bias and need for equality within the world of work. The project amongst other things evaluated the impact of gender bias with regard to careers within their P5 to P7 learners.

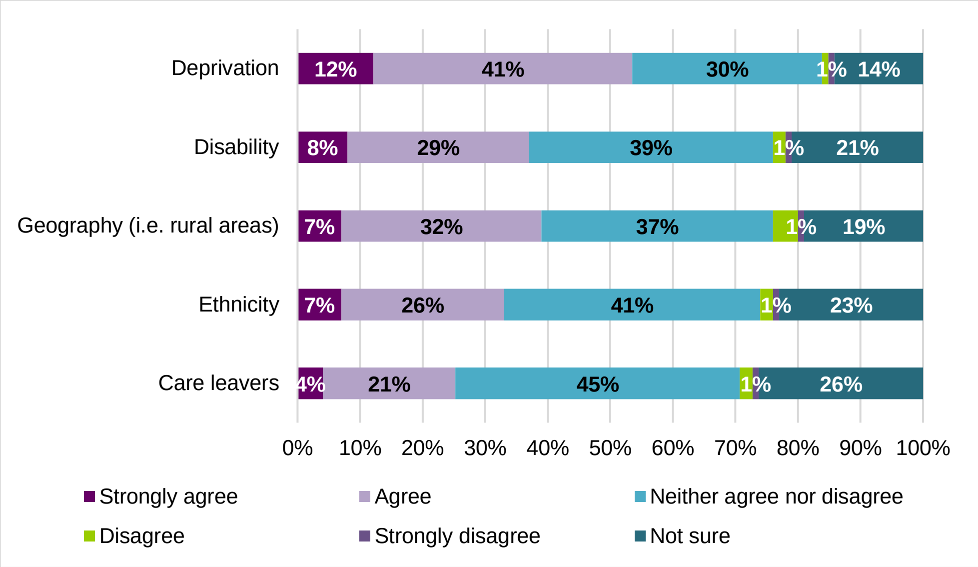
4.25 The 2021 ekosgen practitioner survey demonstrated the increase in confidence in tackling equality issues (Figure 4.12) but also the tangible positive impact on learner attainment and achievement (Figure 4.11). More than two thirds had seen increased equity and equality in achievement (67%, 17% significantly so) and almost two thirds (64%) increased equity and equality in attainment (17% significantly so). Some seven in 10 (71%) had seen increased equity and equality in access to STEM learning. STEM-related aspirations had also increased across under-represented groups (67%). Confidence tackling equality issues increased in relation to deprivation, disability, geography, ethnicity and care leavers.

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



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

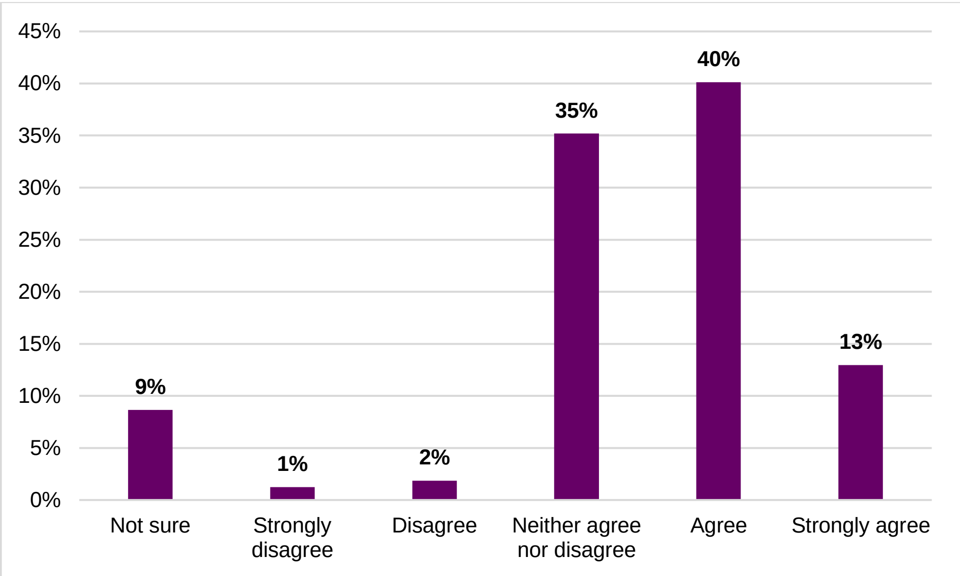
Figure 4.12: Increased confidence tackling equality issues in STEM



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

4.26 More than half of the practitioners in the 2021 survey felt they had increased confidence in tackling gender stereotypes and unconscious bias. Four in 10 (40%) agreed they had increased confidence, and 13% strongly agreed.

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



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

4.27 Further evidence from the interim and final reports of projects in 2021/2022, indicates that the SGP projects have really extended the reach of projects to address equity and equality. These include:

- National, Scotland-wide projects – these include the project 'Becoming a Numeracy Champion: Children, families & feeling good about maths programmes'. This project provided training to equip participants with knowledge on how to support children to develop positive attitudes towards maths as well as the understanding to help parents with their own barriers around engaging with maths. In all, the end of project survey found that 88% of participants who responded to the final survey said that they had discussed gender stereotypes in relation to maths during the training programme, 96% discussed maths anxiety, and 100% discussed the impact of poor numeracy on life chances. The £9,200 SGP Regional and National project involved largely CLD practitioners (50 and out 55), across 18 different establishments.

- Regional projects – including those specifically related to certain geographies/economic sectors, for example, the 'Cow to Cone' Project led by Scotland's Rural College in Dumfries. This £9,375 National and Regional SGP project provided STEM training to 39 practitioners and created a 23-page resource workbook, associated dataset and R code using real-life information from SRUC dairy farm data. The workbook and data resource was created and delivered by women working in agriculture and STEM and two of the three vignettes developed as part of the project featured women without a previous farming background to present 'rewarding and varied careers in agriculture'.

Learner perspectives:

4.28 Of the learners who responded to say that they have dropped or plan to drop STEM subjects, zero of them stated that the STEM subjects were 'only for girls' or 'only for boys'. However, there may be more subtle influences at play in relation to gender. For example:

- Of those not continuing with STEM, almost two thirds say they 'do not enjoy STEM subjects' – 64% in P6/P7, falling to 56% by S4-S6. Boys are much more likely to say this – 83% compared to 54% for girls;
- 'STEM subjects are not really suited to someone like me' – 24% at P6/P7, 13% at S1-S3 and 25% in S4-S6. This is much higher for girls (29%) compared to boys (8%);
- 'The exams are difficult' – 7% of girls say this, compared to 33% of boys;
- 'I find the Maths hard' – here 36% of girls say this, compared to 17% of boys;
- 'I'm not good at them' – 28% in P6/P7, rising to 38% by S4-S6. Girls and boys are almost equally likely to say this;
- 'The teachers do not encourage me' – 25% of boys say this, whereas none of the girls reported this to be the reason for not continuing with STEM.

4.29 The analysis shows that girls are more likely to say STEM subjects are not suited to them, and to say they find the Maths hard. Boys, however, are more likely to say that the exams are harder and that they do not enjoy STEM subjects. However, neither boys nor girls are more likely than the other to say they are not good at them.

Key points

- SGP projects played a wide-reaching and valuable role in boosting practitioner confidence in ensuring equity and equality in their approach with learners. In excess of two thirds of all SGP projects included sessions specifically designed to address gender imbalance.
- The extensive project activity is translating into positive impacts on learners. More than two thirds of practitioners report increases in equity and equality in achievement and almost as many report this for attainment.
- Despite the very considerable progress in addressing equity and equality issues via SGP, more can be and still needs to be done. Whilst just over half of practitioners have increased confidence of tackling gender stereotypes and unconscious bias, the corollary is that almost half *do not* have increased confidence.
- Learners themselves do not directly say STEM subjects are only for boys or only for girls. However, a greater proportion of boys are likely to say they 'do not enjoy STEM subjects' and that the exams are hard, and girls more 'they are not really suited to someone like me' and that they find the maths hard.

Inspiration

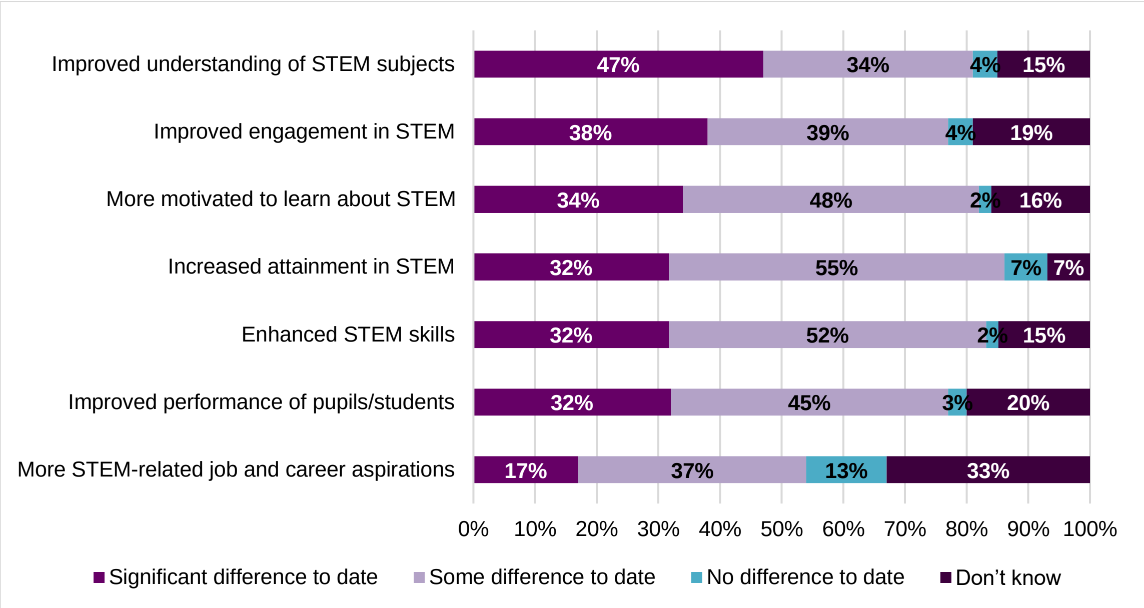
We will promote **Inspiration** by:

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

4.30 Practitioners report considerable improvements amongst STEM learners as a result of the SGP project support. From the 2021 survey, more than eight in 10 practitioners reported that learners had an improved understanding of STEM subjects (81%, 47% significantly so). Further, 77% report improved engagement with STEM amongst learners and 82% increased motivation to learn about STEM. This is very encouraging and reflects that practitioners believe that learners are being inspired to engage with STEM.

4.31 Moreover, some 87% of practitioners believe that learners increased their attainment in STEM as a result of the SGP, almost a third significantly so. Practitioners also report that learners have enhanced STEM skills (84%) and improved performance (78%). More than half also think learners have more STEM-related job and career aspirations (54%) although a third were not able to say.

Figure 4.14: Improvements amongst STEM learners as observed by practitioners



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

Learner perspectives

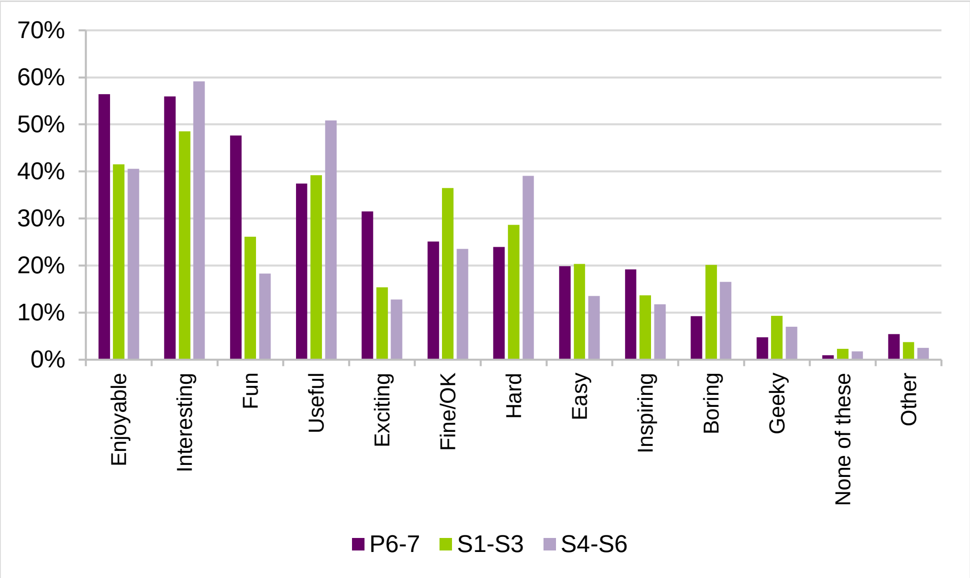
4.32 From a learner perspective, 'inspiring' is not typically the word they use to describe what they think of STEM subjects when compared to alternatives. Overall, learners saying STEM is inspiring ranges from 19% for learners in P6-P7, to 14% for learners in S1-S3, down to 12% for those in S4-S6. However, more than half P6-P7 learners describe STEM subjects as 'enjoyable' and 'interesting' (56%). There is a general pattern where learners consider STEM subjects to become less fun and enjoyable over time, but more interesting and useful. Learners also consider that STEM subjects become harder as they get older.

4.33 The following chart shows this, which indicates:

- Learners thinking STEM subjects are 'fun' falls from 48% for learners in P6/P7 to 18% by S4-S6;
- Those thinking STEM subjects are 'useful' rises from 37% for learners in P6/P7 to 51% by S4-S6;
- Those thinking STEM subjects are 'exciting' falls from 32% in P6/P7 to 13% by S4-S6; and
- Learners thinking STEM subjects are 'hard' rises from 24% in P6/P7 to 39% in S4-S6.

4.34 Most of these changes are most pronounced in the move from primary school to secondary school.

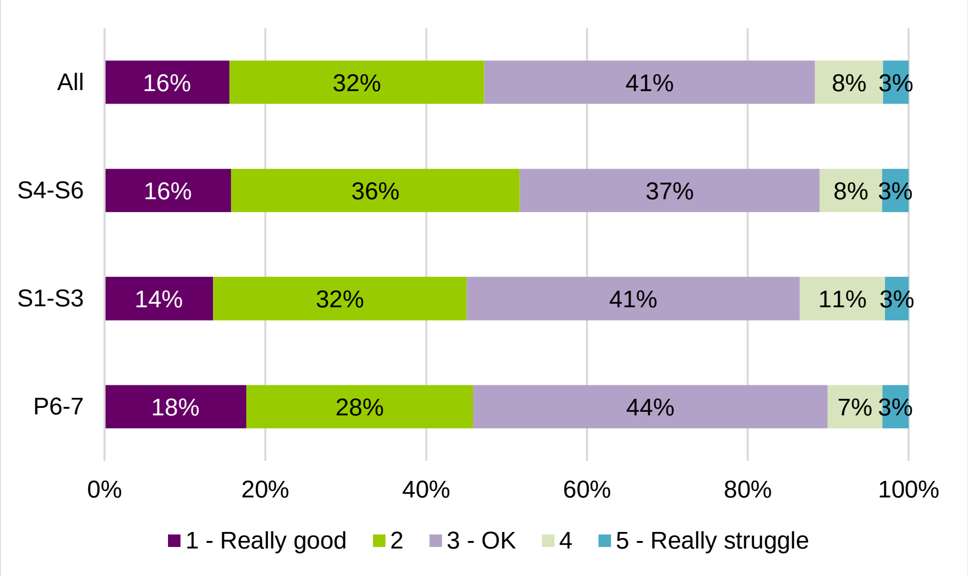
Figure 4.15: How would you describe STEM subjects? (Learners)



Source: ekosgen Survey Data (2021), N=1,243

4.35 It is also evident that learners' confidence in their STEM abilities diminish between primary and secondary school, with a lower proportion of learners considering themselves to be 'very good' in S1-S3 when compared to P6/P7 and also a higher proportion saying they 'struggle'. In S4-S6, the proportion saying that they are 'really good' rises again, and a lower proportion say they 'struggle', as subject choices means more of those interested (and good) at STEM are taking these subjects.

Figure 4.16: When it comes to STEM, I feel I am…. (Learners)



Source: ekosgen Survey Data (2021), N=1,170

Motivation for learners continuing in STEM

4.36 Only 10% of learners say they do not want to continue with STEM subjects at P6/P7, which rises just slightly to 14% in S1-S3 and S4-S6. The proportion saying they are continuing with STEM subjects 'because they have to' rises from 3% for learners in P6/P7 to 8% for those in S4-S6. Reasons for continuing with STEM as pupils get older is very much associated with their perceived usefulness in the workplace. The following points illustrate this:

- Those stating 'They are important for what I want to study in future' is the most often cited reason for those in S4-S6 (43% of those who plan to continue STEM say this), whereas the proportion is 27% in P6-P7;
- Some 41% say they are continuing with STEM subjects as 'They are important for the job I want to do' – whereas this is 21% in P6/P7.

4.37 By contrast, the reasons for continuing in STEM at P6/P7 is 'they help me develop useful skills for life' (38%) which is lower at secondary school level (24% by S4-S6) and that 'STEM lessons are fun and interesting (34%), again higher than for secondary school (23% by S4-S6).

4.38 'My teachers are encouraging and helpful' is highest for primary school pupils (22%), falling to 15% for learners in S1-S3 and 18% for those in S4-S6.

4.39 For those who have dropped, or plan to drop STEM subjects, the main reason is that learners 'do not enjoy them' (64% in P6/P7, down to 56% in S4-S6), although the numbers dropping or planning to drop STEM subjects is small. Other reasons are typically that they are not relevant to the jobs that the pupil wants to do in the future, or not relevant to their future area of study.

4.40 Parents and teachers are the ones most likely to encourage learners to take STEM, with parents more likely to do so as the pupil progresses through school. The role of Young STEM leaders and STEM ambassadors is starting to emerge, particularly for P6/P7 pupils, where 7% of learners say their Young STEM leaders had encouraged them to take STEM, and 3% mentioned STEM ambassadors. In all, 7% of learners also said Youth workers encouraged them to take STEM subjects. For all three of these categories (bar STEM ambassadors), the proportion falls for those in secondary school.

4.41 When asked what would encourage more pupils to take up STEM, the most frequently cited response was 'more subject choice, such as skills for work, apprenticeships' (cited by all age groups – 43% to 47%). More than four in 10 of those in S4-S6 (41%) said 'there should be more work experience' and more than one third in S4-S6 said ' We should get more chance to work with companies and visit STEM workplaces'. Particularly for those in the senior phase, the responses were focused on more work experience and opportunities to work with companies.

4.42 A far lower proportion of learners said that their teachers should encourage them more to take STEM (16%-20%) or that their parents should encourage them more (12%-16%). More than a third (36%) of those in S4-S6 said there should be more hands-on learning and less from the textbook. A third of those in P6/P7 said there should be more outdoor learning (33%), although this is lower for those in secondary school (27%-28%). More than a third of P6/P7 think there should be more STEM challenges and competitions (35%), which drops to just 21%-22% in secondary school.

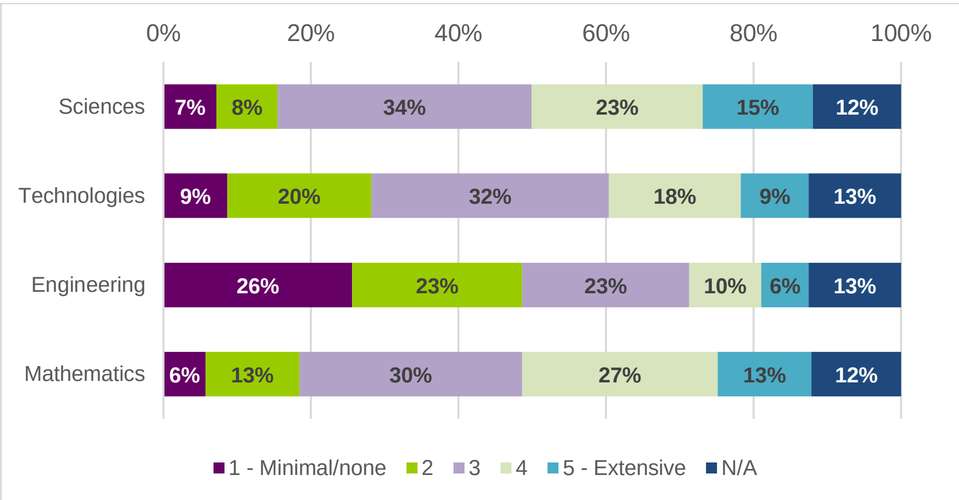
Parent/carer survey

4.43 Parents and carers are clearly a significant influence on the learners. The 2022 parent survey indicated that some two thirds of parents were either directly working in STEM jobs themselves (21%), had partners working in STEM (25%) or who had wider family and friends working in STEM (59%). That said, one third of parents did not work in STEM or know anyone who did.

4.44 Parent/carer knowledge of the learner involvement in STEM varies, with 18% not knowing how much STEM was undertaken by the leaner. Parents' perception of STEM is different to that of their children, with 77% considering STEM subjects to be 'interesting' followed by 56% who say they are 'useful'. Parents also consider STEM subjects to be 'enjoyable' (54%), 'inspiring' (43%), 'exciting' (31%) and 'fun' (30%). More than a quarter (27%) also feel STEM subjects are 'hard'.

4.45 The following chart shows the variable understanding of parents with respect to STEM subjects. More than 20% have no or minimal understanding of engineering. Overall, no more than 40% rate their understanding as 4 or more out of 5 (for mathematics), followed by 38% in sciences. This falls to 27% for technologies and 16% for engineering.

Figure 4.17: Parent understanding of STEM subjects



Source: ekosgen Survey Data (2021), N=478

4.46 Almost six out of 10 parents say they 'really want them to study/continue with STEM subjects' (59%) and almost all the remainder (35%) 'would like them to'. Only 1% say they 'don't want them to study/continue to take STEM subjects but I feel that they have to' and 5% did not know. Not one respondent said they did not want the learner to study/continue with STEM or to drop STEM.

4.47 Parents were asked 'If you want your child/children to study or continue with STEM subjects at school, explain why'. Multiple answers were allowed:

Table 4.6: Factors influencing parental desire for children to continue with STEM subjects

They help to develop useful skills for life	74%
They like specific subjects or topics (i.e. Science, Maths, Computing)	65%
The experiments, practicals and hands-on challenges are enjoyable	54%
They are important for what they want to study in future	48%
They like learning about things that are real life – not just in textbooks	47%
They are good at them	44%
They are important for the job they want to do	38%
The lessons are fun and interesting	22%
They are important for what I want/would like them to study in future	19%
Their teachers are encouraging and helpful	19%
They are important for the job I want them to do	7%

Source: ekosgen Survey Data (2021), N=439

4.48 Parents consider STEM to be harder than the learners themselves. In all, 39% of parents say STEM subject exams, tests and assessments are hard (4 or 5 out of 5 where 5 is hard), compared to 32% amongst learners.

4.49 Almost half of parents say they encourage their children to take STEM subjects 'a lot' (46%) and 42% say they do 'a little'. Just 12% say they do not. Advice given by parents to children in terms of studying STEM subjects typically focuses on the importance of STEM to most if not all career paths, or on the skills and understanding of the world that STEM subjects can provide. However, many parents encourage based on what their children enjoy or are good at – though it is worth noting that such advice can often be gendered as a result of lack of confidence in STEM subjects on the part of parents, amongst other factors.

4.50 Amongst parents, when asked what would encourage more pupils to take up STEM, the most frequently cited response was 'they should get more chance to work with companies and visit STEM workplaces'. In all, 59% said this (compared to 34% amongst learners). 'A better range of subject choices, such as skills for work, apprenticeships' was mentioned by 54% (again, higher than for learners at 43% to 47%). 47% of parents said that 'there should be more work experience' (higher than the 41% amongst S4-S6 learners). Other means of encouragement cited were 'more information on STEM' (51% of parents) and 'more hands-on learning and less from textbooks' (49%). More than a third of parents wanted more assessment through the year, rather than end of year exams (36%). Fewer parents thought outdoor learning would encourage more STEM take-up (26%).

4.51 The 2022 Learners Survey indicated that almost two thirds of learners (65%) know someone who has a STEM-related job, with this being immediate family (36%), wider family members (24%) or friends (5%). In all, 28% of learners say their parents encouraged them to take STEM subjects. Brothers and sisters and friends working in STEM appear to be a greater influence than parents for those saying they 'really want to' take STEM subjects. Of those learners really wanting to take STEM, 63% had brothers and sisters working in STEM and 63% had friends who did so, a higher proportion than the 52% saying their parents worked in STEM.

4.52 Family influence on learner likelihood of wanting to take STEM subjects is illustrated in the points below. There is a very strong correlation between those whose family encouraged them to take STEM subjects and those really wanting to do so:

- Of those actively encouraged to take STEM by family members, more than two thirds ‘really wanted’ to take STEM subjects and 21% might do so. None wished to drop STEM subjects and only 2% did not want to continue in STEM; and
- Of those actively discouraged from taking STEM by family members, 57% wanted to drop STEM subjects.

Key points

- Practitioners reported considerable improvements amongst STEM learners as a result of SGP support. This extends to improved learner understanding, improved learner engagement and increased motivation to learn about STEM. Practitioners believe this leads to both increased attainment and achievement;
- Learners themselves do not consider themselves to be ‘inspired’ to do STEM, rather younger learners consider STEM to be ‘enjoyable’, or ‘interesting’. Enjoyment and interest in STEM diminishes as the learner gets older, and STEM becomes ‘harder’ and ‘useful’. As learners get older, motivations to study STEM are more associated with future study and jobs;
- Learner confidence in their abilities falls as they get older. The proportion of learners saying their teachers are encouraging and helpful also diminishes in secondary school, compared to P6/P7;
- Family influence in encouraging learners to take STEM subjects is high. Those learners really wanting to continue in STEM are far more likely to have family members who work in STEM, and families who encourage the learner to take STEM subjects;
- ‘More subject choice, such as skills for work, apprenticeships’ would encourage more pupils to take up STEM, say learners, and older learners (S4-S6) in particular would value more work experience and opportunities to visit more STEM workplaces. Learners also want more hands-on and less textbook learning, and younger pupils in particular wish to see more outdoor learning; and
- Parents too would like to see learners have more opportunities to work with companies and visit workplaces. Parent understanding of STEM is highly variable and more information for parents on STEM would be beneficial in helping parents encourage their child/children to take STEM subjects.

Connection

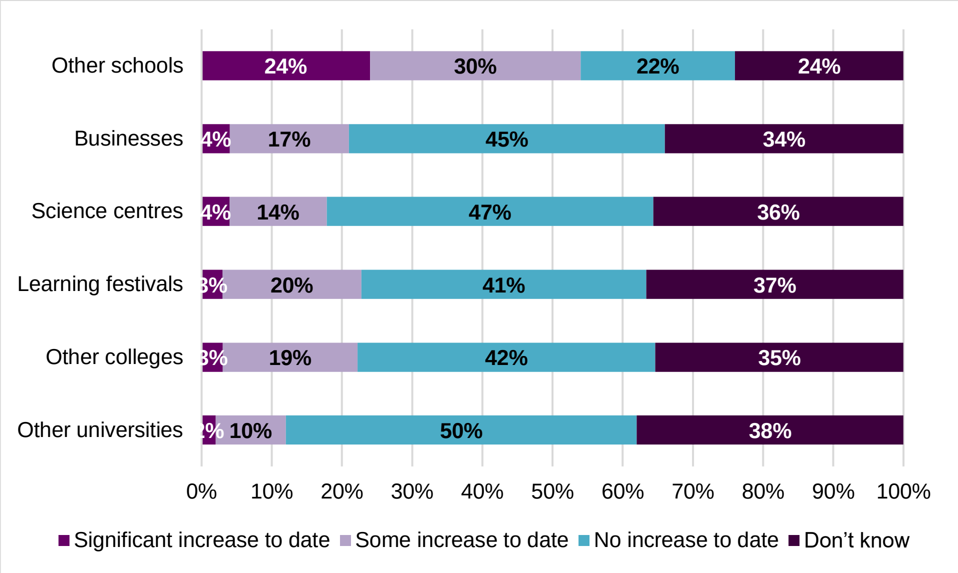
We will promote **Connection** by:

- **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**

4.53 The SGP increased the quality of engagement with STEM-related partners. SGP projects frequently worked with several partners involved, particularly larger regional and national projects. Practitioners report that there has been increased quality of engagement with other schools in particular, with almost one in four (24%) saying the quality of engagement has improved significantly, with a further 30% reporting some increase. Many projects have involved bringing practitioners together, either different schools within a cluster, or bringing together practitioners across a local authority or region, either virtually or in-person.

4.54 To a lesser extent, SGP projects have increased the quality of engagement with businesses, with one in five practitioners reporting this (21%), with a small proportion (4%) saying there has been a significant improvement. Despite the pandemic, there are instances of projects successfully engaging businesses, sometimes where the business has been present in classrooms virtually. Practitioners also report increased quality of engagement with Science Centres (18%) and Learning Festivals (23%). Nonetheless, the COVID-19 pandemic undoubtedly reduced the number of interactions with businesses, Science Centres and Learning Festivals.

Figure 4.18: Increase in the quality of engagement with STEM-related partners



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

4.55 A relatively low proportion of practitioners report increased quality of engagement with colleges (22%) and universities (12%), although this is across all settings. More than a third of secondary school practitioners report an increase in the quality of engagement with colleges (36%) and more than a fifth (22%) report an increase in quality of engagement with universities (22%). This is encouraging, although there is scope to further increase engagement in other settings' interactions, and also further in secondary schools. For CLD practitioners, there is very little interaction with other settings, schools, business, colleges and universities, an area which can be explored further in the future.

Table 4.7: 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

Learner perspectives on influences on STEM learning and career choices

4.56 Guidance and PSE staff, and Careers Advisors, become more important in the learner decision to take STEM subjects as they progress through school, although parents and teachers are still far more important influences. The following points illustrate this:

- At S4-S6, 23% say Guidance or PSE staff encouraged them to take their STEM subjects, and 15% said Careers Advisors did so. By contrast, 62% said their parents/carers encouraged the learner to take STEM subjects, and 53% said their teachers did so. In all, 27% said 'nobody' had encouraged them to take STEM subjects;

- At P6-P7, the teacher is the biggest influence, with 72% saying their teacher had encouraged them to take STEM subjects, compared to 47% saying their parents encouraged them. Other staff (19%) were also important;
- At S1-S3, parents/carers (51%) were the most important influence, followed by teachers (49%). More than a third of this cohort (35%) said nobody had encouraged them to take STEM subjects.

Views of STEM jobs

4.57 Learners that say they know 'a lot' about STEM jobs increases the older the learner, but only marginally. By S4-S6, 16% say they know a lot about STEM jobs, up from 12% in P6/P7, however across the age groups those saying they know 'some' things about STEM jobs is 44%-46% and those saying 'a little' is 30%-31%. There would, therefore, seem to be scope to increase knowledge of STEM jobs across the age groups, including in the senior phase. Amongst parents, 21% say they know 'lot' and only 6% say they know nothing (similar to the 5% amongst learners).

4.58 The perception is, however that STEM jobs are well paid. In all, 29% of learners think STEM jobs are well paid (where well-paid = 1 out 5) and just 1% think STEM jobs are low paid (where low paid = 5 out of 5). In addition, parents also consider STEM jobs to be well paid (24% saying 1 out of 5, 47% saying 2 out of 5). Almost a third of learners think STEM jobs are plentiful (at 1 out of 5), and three out of 10 parents (30%) also think this. There is also a general perception that STEM jobs are relatively exciting (49% of learners saying 1 or 2 out of 5, compared to 7% saying 4 out of 5, where 1 = exciting and 5 = boring). Even more parents think STEM jobs are exciting, with 69% rating the jobs 1 or 2 out of 5 where 1 = exciting). There is also a general perception amongst learners that STEM jobs can be done by all (43% saying 1 or 2 out of 5, compared to 15% saying 4 or 5 out of 5, where 1 = they can be done by everyone).

STEM career intentions

4.59 Overall, amongst those in the learner survey, two thirds of those at S4-S6 planned to go to university. The proportion planning to go to college amongst those at S4-S6 was 10%, an apprenticeship 5% and a job straight away 2%. Amongst those at P6/P7, 34% planned to go to university and 23% to college. This clearly is just a reflection of our survey sample. Overall, more females planned to go to university (53%) than males (40%). More than a third of those at S4-S6 'definitely' planned to study STEM or do a STEM job, compared to just 10% amongst those at P6/P7. Overall, 20% of parents said their child/children definitely planned to study STEM or do a STEM job.

4.60 When asked what would encourage them to look for a STEM job in future, the following were given as the top responses by learners and parents:

Table 4.8: Factors influencing pursuit of STEM jobs in future

What would encourage you to look for a STEM job in future?	Learners	Parents
If I enjoyed STEM subjects at school / if they enjoyed subjects at school	55%	78%
Knowing I am good at STEM subjects / knowing they are…	48%	69%
Knowing that STEM jobs are well paid	41%	46%
Knowing that lots of STEM jobs are available	34%	52%
Knowing more about STEM learning pathways, courses and qualifications that would suit me / suit them	33%	67%
Encouragement from family	25%	32%
Videos on YouTube, Instagram, Snapchat, TikTok	22%	27%
Knowing that STEM jobs provide opportunities to travel	22%	39%
If my teacher encouraged me / if their teacher encouraged them	20%	36%
Encouragement from friends	19%	21%
Talk/visit from a STEM company	17%	46%
Personal research into STEM careers	17%	20%
Guidance from a careers adviser at school	12%	34%
Attending a careers fair	11%	21%

Source: ekosgen Survey Data (2021), N=1,075

4.61 A third of parents say guidance from a careers advisor at school would help encourage their child/children to look for a STEM job in the future, although this is much lower amongst learners. One fifth of parents say that their child/ children attending a careers fair would encourage them to look for a STEM job (21%) and 11% of learners. There would appear to be scope to increase the value of career advisor advice and the value of careers fairs in encouraging learners to take up STEM.

4.62 Further, just 5% of parents say that careers advisors *have* encouraged their child to take STEM subjects, and 10% say that the Guidance/ PSE have done so. By contrast, two thirds of parents say the teachers have encouraged their child/ children to take up STEM (66%) and half say other family members have done so (50%). One in five parents (20%) says no one has encouraged their child to do STEM.

Key points

- Practitioners strongly report that the SGP increased the quality of engagement with STEM-related partners, especially with other schools. There have been many projects bringing practitioners together across school clusters and from across local authorities and regions;
- SGP projects also increased the quality of engagement with businesses, colleges, universities, science centres and festivals. Secondary schools have increased their quality of engagement with colleges and universities in particular. Early learning and childcare settings have worked well with other schools. There has been an increased quality of engagement despite the pandemic.
- Those in CLD settings are least likely to report increased quality engagement, and this is an area that can be developed in the future. Engagement with STEM-related partners could increase from all settings as schools undertake more in-person activities with partners;
- Guidance, PSE staff and careers advisors appear to play a relatively limited role in encouraging learners to take STEM subjects, particularly in comparison to parents and teachers. Even at S4-S6, less than a quarter say guidance and PSE staff encouraged them to take STEM and less than one in seven cited their careers advisor. Further, a low proportion say that more guidance from careers staff or careers fair would encourage them to take STEM;
- Learners and parents consider STEM jobs to be well-paid and plentiful. They also think they are relatively exciting and that, on the whole, anyone can do these jobs. There would therefore appear to be an 'open door' in terms of encouraging more learners to take up STEM subjects and careers.

5 Conclusions and key considerations

Introduction

5.1 This chapter sets out our conclusions and assessment of the SGP's impact, as well as observations on lessons learned from the Programme's delivery. It also sets out our considerations for future delivery, and next steps.

Conclusions

5.2 The SGP was responsive to need and demand from STEM practitioners across Scotland. Starting with delivery by national partners at the outset, Programme delivery has shifted during its lifetime to more local delivery meeting local need. Whilst the typical project size may have shrunk, projects are now doing things that have more reach, and can be scaled up if they are impactful enough.

5.3 Through Rounds One to Three, the SGP has supported 248 projects. Whilst at the outset these were mainly delivered by regional- and national-level organisations, the majority of projects have been delivered at the local or school cluster level through Leadership and Collegiate activity. Each project has reached an average of 190 practitioners and provided 576 cumulative hours of professional learning.

5.4 Most projects have had a broad focus on STEM, though Numeracy and Mathematics, Science and Technologies have been areas of focus for some delivery. However, Engineering projects have been under-represented in projects supported by the programme, despite this being identified as a priority and the encouragement from Education Scotland for bids in this area.

5.5 The COVID-19 pandemic has impacted the scale and nature of delivery. A much-reduced budget for the grants from Scottish Government in Round 3 has also meant that smaller projects, focused on localised delivery, were supported. Nevertheless, the reach of the SGP increased as its delivery progressed. This is reflective of the greater proportion of online learning (in part a result of the pandemic response), but also the sustainability of projects, and effectiveness of building on the delivery and legacy of earlier projects supported through previous rounds.

Impact and lessons learned

5.6 Evidence has shown from this (and previous) evaluation activity that the SGP positively contributed to the STEM Training and Education Strategy across all four themes, namely, Excellence, Equity, Inspiration and Connection.

5.7 STEM practitioners are finding access to STEM professional learning easier. There is increased availability of online learning and resources, and the SGP has undoubtedly played an important role in contributing to this body of nationally available resources and support. In turn, it is fostering improvement, adaptability, and innovation in STEM teaching approaches.

5.8 Knowledge acquisition, developing new approaches and being better able to support STEM learning in practical ways are the strongest motivators. Across all beneficiary practitioners, increased confidence levels were reported post-participation. Additionally, there was increased knowledge exchange, collaboration and teamwork amongst beneficiary practitioners and subsequently with colleagues – particularly within secondary schools.

5.9 The SGP had a very positive effect on raising the skills, knowledge and practice of STEM practitioners. It is effective in all settings – especially for those in Community Learning and Development and Early Learning and Childcare. In turn this translates into positive experiences for learners, and thus greater levels of engagement and participation in STEM lessons.

5.10 However, practitioners from certain sectors – for example Community Learning and Development, continue to find it difficult to access STEM professional learning. This is important since practitioners from Community Learning and Development, along with Early Learning and Childcare, were the least confident prior to engagement with STEM professional learning.

5.11 Beneficiary practitioners report increased attainment and achievement amongst their learners. However, learners report diminishing enjoyment and interest as they progress through their learning journey, and STEM learning becomes 'harder' and 'more useful'. Greater choice of subjects and learning pathways (e.g., work-based learning) may help to counter this and is the focus of the current education review and potential curriculum reform.

5.12 The SGP played a valuable role in boosting practitioner confidence in ensuring equity and equality in their approach with learners, and in tackling gender stereotypes and unconscious bias. This translates into reported increases in equity and equality in achievement and attainment.

5.13 The Programme projects have increased the quality of engagement with STEM-related partners, with industry, as well as with colleges and universities. Better connections have also been made with science centres and festivals. This increase in engagement quality is in spite of the effects of the pandemic and associated public health measures.

Considerations for the future

5.14 The impact and benefits delivered by the programme as discussed in this report, are evidence that the SGP as a delivery model was effective in its scale and reach over the last three years of funding. The programme adopted a formative evaluation approach since its inception and has recognised the need to continually develop the delivery model in response to the needs of all settings and practitioners in terms of STEM learning. It is, however, recognised that more progress is needed beyond Round Four of the SGP.

5.15 A future programme should aim to maintain and build upon the current levels of engagement with STEM learning and practitioner CLPL through focussing on local delivery, building on the legacy of previous projects, and growing and sharing the knowledge bank of online STEM resources developed to date. There is now a critical mass of STEM activity in place across Scotland and all settings; this needs to continue and be ready to respond and adapt to the changes which curriculum reform in the coming period may bring.

5.16 The delivery model of any future support for STEM learning must have the ability to flex and adapt to a continually changing education and technology landscape. This involves considering the key aspects of partnership and sector and industry collaboration, geographic coverage, project focus and sustainability, and the needs of different settings.

5.17 In the current climate of economic recession and the accompanying pressures on the public purse, the case for further programme investment may require the consideration of a range of funding approaches. A future programme may necessarily have to focus on smaller scale project investments, and thus local delivery. However, it may be possible to find ways of scaling up overall STEM activity by achieving economies of scale through linking up/connecting smaller projects by using, for example, the same project template, toolkit and resources.

5.18 With respect to further investment in STEM learning and CLPL, considering commercial sponsorship or funding from the private sector is an option which is not uncommon in the context of STEM, and the current policy focus on Scotland's technology sectors. There are a number of levers which may attract the participation of larger companies, not least the skills shortages faced by some sectors and some of the recommendations from the Scottish Technology Ecosystem Review[30] for the Scottish Government.

5.19 A demand-led approach (where Education Scotland sets a challenge and proposed solutions are required to fit with the STEM Training and Education Strategy, RIC priorities and curriculum) where STEM learning and CLPL projects are co-developed with industry needs in mind and which also align with a funder's corporate/community/social priorities.

5.20 Working alongside local authority and other partners, e.g. colleges, Education Scotland acting in an advisory role to develop a STEM learning programme/projects, could support funding bids into a variety of Scottish and UK investment funds. Through existing partners and networks there could also be opportunities to input to, broaden the scope of and/or co-design elements of STEM-focussed projects within existing Growth Deals. The Moray Growth Deal, Argyll and Bute Rural Growth Deal and the Islands Deal, could all benefit from the experience and knowledge gained through the delivery of the SGP.

5.21 The Scottish Funding Council currently fund some eight Innovation Centres serving Scotland's key industry sectors. Some are already delivering training to provide skills for STEM industries, for example, the IBioIC (Industrial Biotechnology Innovation Centre) which delivers HND courses for the life sciences sector and promotes STEM learning by providing work experience for teachers via its membership companies. The Data Lab, the Innovation Centre for Data and AI, which as part of Edinburgh City Deal, is delivering 'Data Skills for Work', a programme which supports workers in adapting to the demands of increasingly digitalised, automated, and data-driven workplaces; it supports training and education providers who want to reach learners from diverse backgrounds. Education Scotland may find willing funding partners in these organisations and their company membership bases.

Next steps

5.22 Round Four of the SGP concluded in March 2024, and the STEM Education and Training Strategy continues to deliver against its objectives and action plan. In total, the STEM Grants Programme achieved the following outcomes:

- Overall funding awarded: R1-R3 total (£4,016,668) + R4 total (£559,583) = £4,576,251
- Projects awarded funding: R1-R3 total (248) + R4 total (59) = 307
- Sessions delivered: R1-R3 total (2,474) + R4 total (628) = 3,102
- Number of practitioner engagements: R1-R3 total (47,007) + R4 total (22,342) = 69,349
- Hours of professional learning delivered: R1-R3 total (169,905) + R4 total (26,185) = 196,090 hours

In relation to number of sessions delivered, practitioner engagements and hours of professional learning, Education Scotland is aware of a level of under-reporting in these areas from some grantees. Therefore, these figures should be seen as conservative figures. The actual figures are likely to be higher.

5.23 Education and curriculum reform is underway, the outcomes of which are likely to have significant implications for STEM learning and pathways. In the meantime, the SGP legacy must be kept alive to ensure that its contribution to meeting the objectives of the STEM Education and Training Strategy is maximised.

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

Appendices

Appendix 1: 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 evaluations of professional learning in STEM, developed in 2020 and 2021. 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 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.[31]

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.

[31] 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.[32] 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 A1.1 sets out STEM entries and qualifications for Scottish school pupils from 2018 to 2021.[33] In 2021, there were 151,000 passes at SCQF Levels 3 to 5 (National level), 54,000 at SCQF Level 6 (Higher) and 11,000 at SCQF Level 7 (Advanced Higher). Between 2018 and 2021, 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 SCQF Level 7 between 2018 and 2021. 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.[34]

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

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

[34] 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[35] (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 this 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, 2020 and 2021.[36] Comparing a single year (2021) with a previous single year (e.g. 2018) 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 of passes in STEM-related subjects at Advanced Higher level remained fairly steady between 2018 and 2019, before increasing in 2020 and 2021. At Higher level, the number of passes had fallen overall between 2018 and 2019, and at a greater rate than the decrease in the size of the STEM Higher cohort, before rising in 2020. In 2021, the number of passes at Higher level decreased, yet remaining higher than the number of passes in 2019.

The pass rate at Higher level fell between 2018 to 2019 before increasing in 2020. It decreased again in 2021, as entries increased while passes decreased. For Higher, the subjects that have seen the largest positive increase in entries were Music Technology, Human Biology, Environmental Science, and Engineering Science, where entries increased by 36%, 27%, 22%, and 17% respectively. Health and Food Technology, Mathematics, Physics, and Biology also increased. For Advanced Higher, the largest increases in entries took place in Engineering Science (53%), Biology (28%), and Design and Manufacture (16%), with Statistics, Mathematics of Mechanics, Mathematics, Physics, and Chemistry also increasing.

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

[36] Scottish Government (2018) Pupils in Scotland, 2018; also Scottish Government (2020) Summary statistics for schools in Scotland 2020 edition; also Scottish Government (2021) Summary statistics for schools in Scotland 2021 edition.

Table A1.1: STEM entries and qualifications for Scottish school pupils, 2018-2021

	2018	2019	2020	2021	% or p.p.[37] change 2018-21
SCQF 3-5					
Entries	184,456	186,425	189,069	186,390	1.0%
Passes	143,394	144,036	163,713	151,383	5.6%
Pass rate	77.7%	77.3%	86.6%	81.2%	7.9 p.p.
SCQF 6[38]					
Entries	65,172	63,598	63,978	66,055	1.4%
Passes	47,899	45,667	55,246	53,642	12.0%
Pass rate	73.5%	71.8%	86.4%	81.2%	7.7 p.p.
SCQF 7					
Entries	12,328	11,883	11,930	13,212	-1.1%
Passes	9,438	9,051	10,847	11,370	18.1%
Pass rate	76.6%	76.2%	90.9%	86.1%	9.5 p.p.

Source: SQA, 2022

Table A1.2 shows the change in entries and attainment across non-traditional STEM subjects at SCQF Levels 3 to 6. Over the period, 12% fewer pupils undertook STEM-related Skills for Work courses, with 47% more pupils completing NPAs in STEM subjects. STEM-related National Certificate attainment fell by 29% across the period, and overall entries/attainment in non-traditional STEM qualifications grew by about 4% between 2018 and 2021. 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 3**.

Table A1.2: Non-traditional STEM entries and attainment for Scottish school pupils, SCQF 3-6, 2018-2021[39]

Qualification Type	2018	2019	2020	2021	% change 2018-21
Skills for Work[40]	3,372	3,896	4,491	2,969	-12.0%
NPAs[41]	4,122	4,880	6,135	6,077	47.4%
Awards	4	47	30	20	400.0%
National Certificates	3,924	3,313	2,916	2,807	-28.5%
Total	**11,422**	**12,136**	**13,572**	**11,873**	**3.9%**

Source: SQA, 2022

STEM's relative performance

In line with the overall SCQF Level 6 entry and pass trends in Scotland over the period from 2018, STEM Higher entries and passes have followed a similar trend, as shown at Figure A2.1. STEM entries at Higher level increased by 1% between 2018 and 2021, over a period when the number of all Higher

[37] Percentage point

[38] Human Biology only available at SCQF level 6

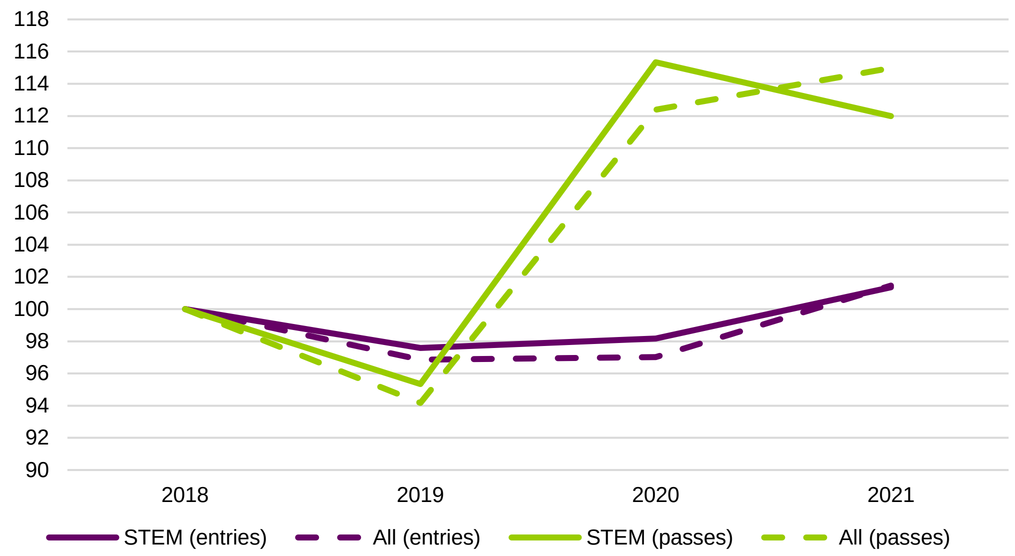
[39] Figures are higher here than in the previous report due to the inclusion of SCQF 6 data in this table, as well as a range of new STEM-related provision listed in the Appendix 6 subject definitions tables

[40] Skills for Work entries are shown

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

entries has increased by the same amount (1%). For STEM and all subjects, passes fell between 2018 and 2019 (5% and 6% respectively), but rose 12% and 15% across the full period.

Figure A1.1: Index of total and STEM entries and passes for Highers, 2018-2021

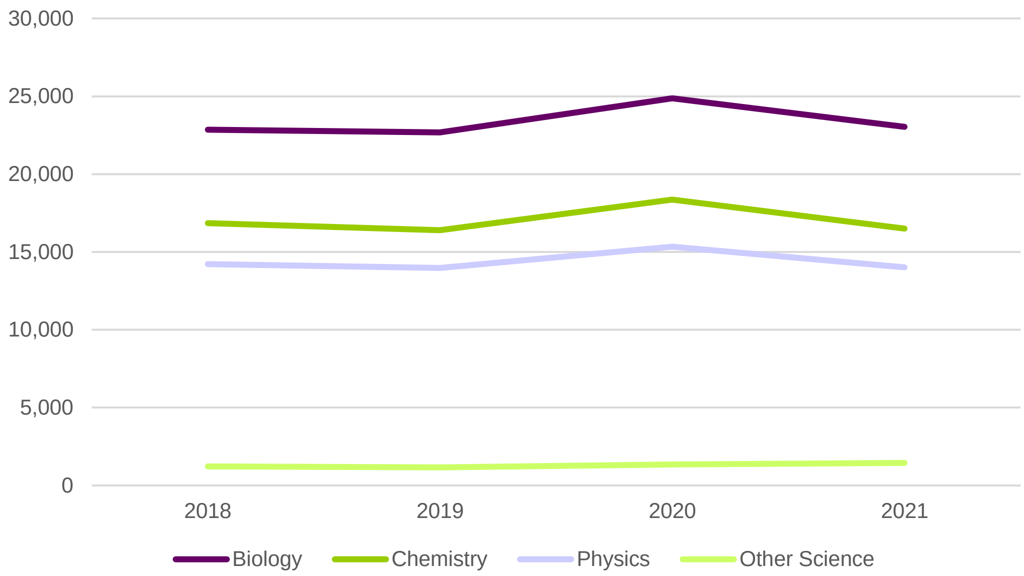


Source: SQA, 2022

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

Passes in Biology at SCQF 5 went up by 1% from 2017 to 2021, while passes in Chemistry and Physics went down over this period (by 2% and 1% respectively), as shown in Figure A1.2. The temporary increase in 2020 is largely due to changes to assessment processes that happened in the first year of the COVID-19 pandemic.

Figure A1.2: STEM passes for Science subjects at National level, 2018-2021[42]



Source: SQA, 2022

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

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). A slight rise to 26,400 technology-related subject passes occurred in 2021.

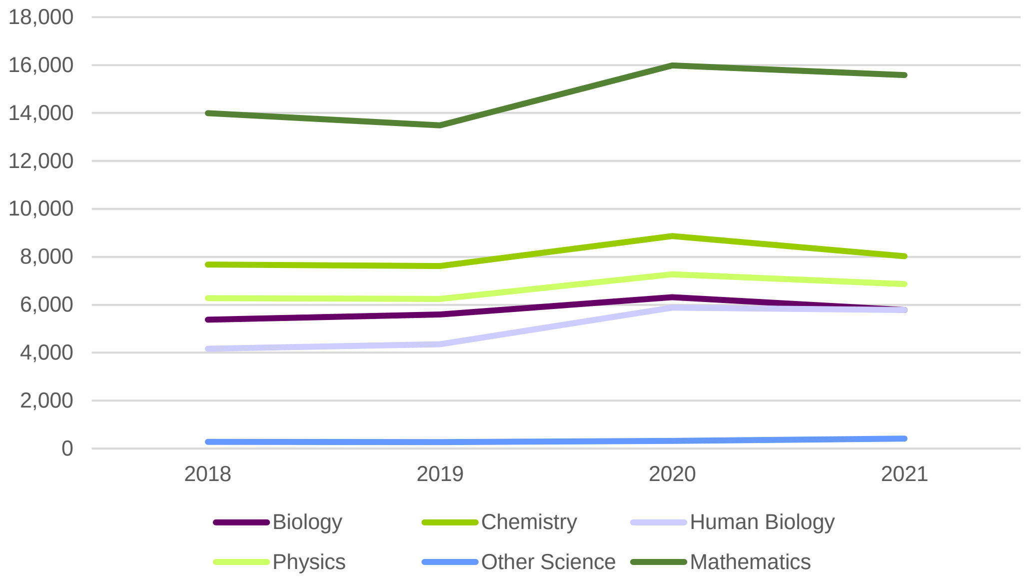
There has been a notable increase in Computing Science[43] passes at National level from 2018 to 2021, over 250 in absolute terms and 3% proportionally. This is despite the number of entries falling by nearly 500 in absolute terms, 5% proportionally.

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 2018 and 2019, there was not been a great deal of change, with small fluctuations for all subjects (Figure A1.3). Between 2019 and 2020, i.e. the pandemic year, there was been an increase in passes for all listed subjects: Human Biology (+35%), Other Science (+20%), Mathematics (+19%), Chemistry (+16%), Physics (+16%), and Biology (+13%). Passes in all subjects except for Other Science have decreased from 2020 to 2021. Over the whole period, then, passes in Other Sciences had the highest growth (+60%), followed by Human Biology (+37%), and Mathematics (+11%). Passes in Biology, Chemistry, and Physics also increased from 2018 to 2021 (+5%, +4%, and +1% respectively).

Figure A1.3: STEM passes for Science and Mathematics subjects at Higher level, 2018-2021

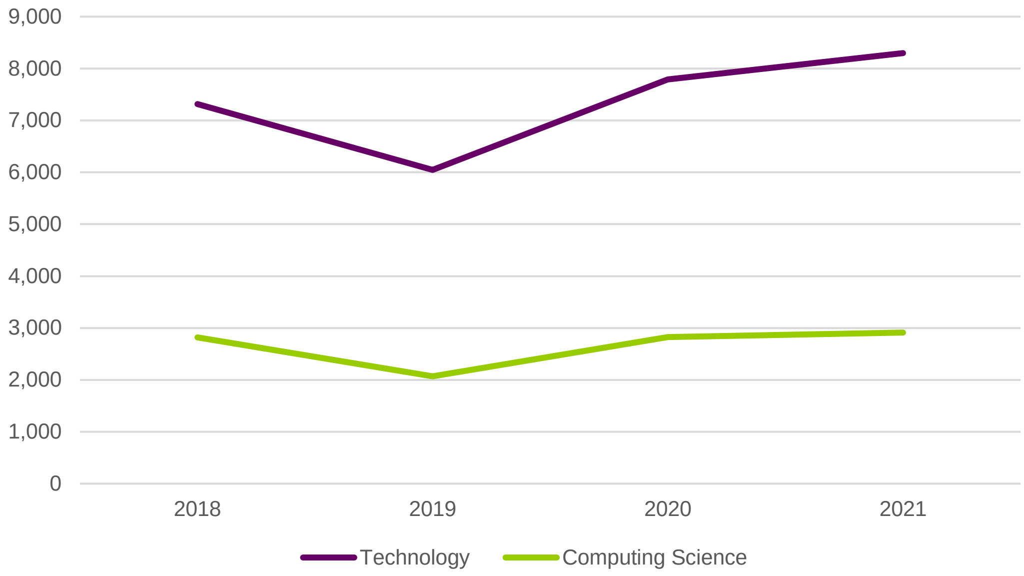


Source: SQA, 2022

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 A1.4 shows that passes for both Technology and Computing Science have increased over this period (13% and 3% respectively), after a particularly stark decline for Technology between 2018 and 2019 (from 7,300 to 6,000).

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

Figure A1.4: STEM passes for Technology subjects at Higher level, 2018-2021

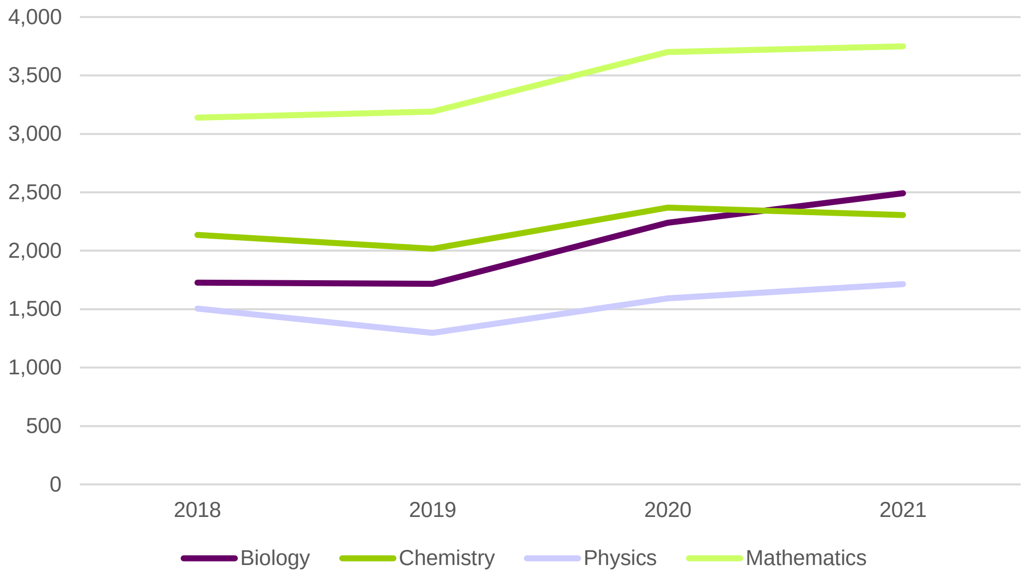


Source: SQA, 2022

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

As shown in Figure A1.5, there has been an increase in passes for all subjects over the period 2018 to 2021. The largest increase was in Advanced Higher passes for Biology (44%).

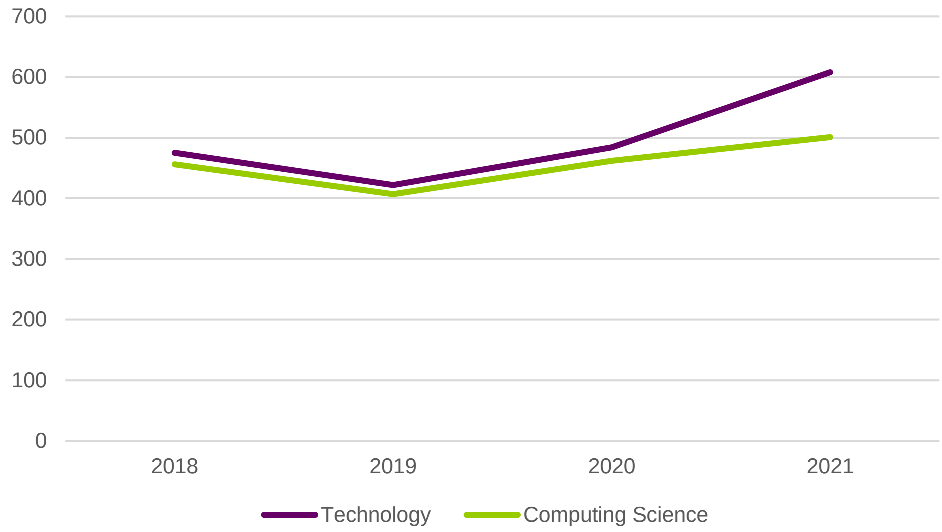
Figure A1.5: STEM passes for Science and Mathematics subjects at Advanced Higher level, 2018-2021



Source: SQA, 2022

As shown in Figure A1.6, 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 A1.6: STEM passes for Technology subjects at Advanced Higher level, 2018-2021



Source: SQA, 2022

Profile of learners

Table A1.3 shows that female pupils continue to be under-represented in STEM-related subjects at school. In 2020, 44.2% of STEM entrants were female at National level, 46.9% were female at Higher level, and 46.0% 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 47.9%, 57.3% and 64.3%, respectively.

Where female pupils engage in STEM-related subjects, data suggests that they can secure a higher success rate than male pupils. Female pupils make up a higher percentage of STEM passes than STEM entrants for Higher and Advanced Higher levels. This reflects their higher pass rate across these levels, with the difference in pass rate being highest at Advanced Higher level in 2021. It may also reflect the likelihood that only female pupils who are confident and committed to STEM subjects will choose to undertake them. In 2021, the female pass rate in STEM-related subjects at Advanced Higher level was 0.9 percentage points higher than that for males, it was 0.7 percentage points higher at Higher level and 0.3 percentage points lower at National level. The breakdown of STEM entries, passes and pass rate by gender and over time is given at **Appendix 2**.

Table A1.3: STEM school entries and passes, by gender, 2021

Level	STEM entries		STEM passes	
	Female share	Male share	Female share	Male share
SCQF 3-5	44.2%	55.8%	43.9%	56.1%
SCQF 6	46.9%	53.1%	47.5%	52.5%
SCQF 7	46.0%	54.0%	46.9%	53.1%

Source: SQA, 2022

The differences in gender representation between subjects are also notable. For example, female pupils made up 64% of Biology passes at National level in 2021. This compares with females accounting for just 20% 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 and 2020.

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 3.**[44]

Overall college provision in STEM

STEM enrolments at Scottish colleges have grew from 2017/18 to 2018/29, however there has been a decline in enrolments from 2018/19 to 2020/21. Table A1.8 below shows the total number of enrolments on STEM-related qualifications as a proportion of total provision in Scottish colleges in from 2017/18 to 2020/21.

Table A1.8: College enrolments in STEM-related subjects (2017/18-2020/21)

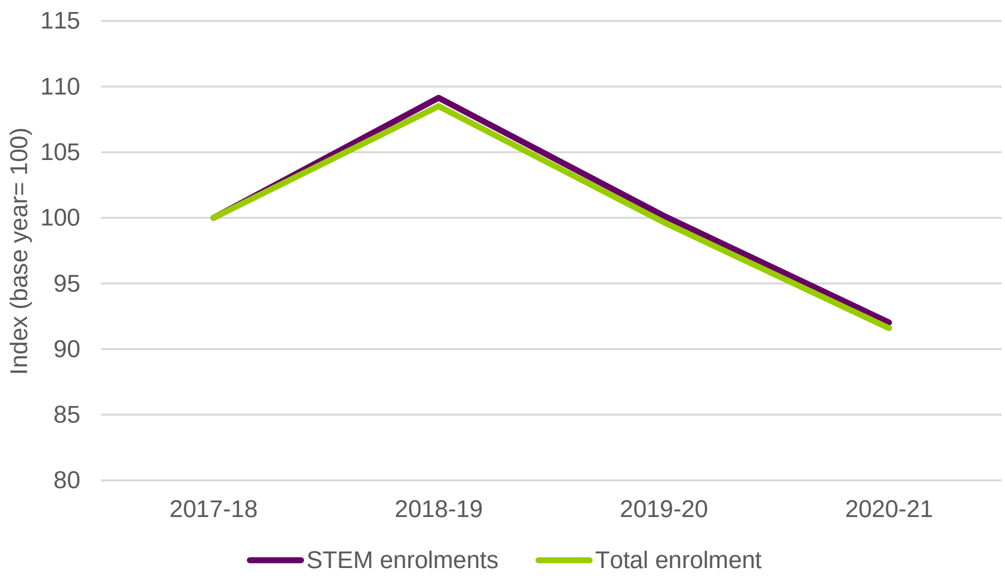
	2017/18	2018/19	2019/20	2020/21
STEM enrolments	77,824	84,938	77,931	71,616
STEM share of all enrolments	26%	26%	26%	26%

Source: SFC, 2022

STEM-related subjects contribute a significant proportion of college enrolments in Scotland, accounting for 26% of the total every year from 2017/18 to 2020/21, with over 71,000 enrolments in 2020/21. As shown at Table A1.7, this rose from 2017/18 to 2018/19, to almost 85,000 enrolments, before falling 8% each year in the following two years (at the same rate as all subject enrolments).

As shown in Figure A1.7, the growth in STEM college enrolments is practically the same of that of overall college enrolments over the period between 2017/18 and 2020/21 (8% decrease for both).

Figure A1.7: College enrolments in STEM-related subjects (2017/18-2020/21)



Source: SFC, 2022

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

Provision by region

Across Scotland, as of 2021, 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 A1.8). In 2020/21, provision was greatest in the Fife region (Fife local authority) with close to 23,000 enrolments, 65% of the total in Fife, followed by the Glasgow region (East Dunbartonshire, East Renfrewshire and Glasgow City local authorities) with almost 12,000 enrolments, 20% of the total in Glasgow. This was followed by provision in the Forth Valley (over 5,000 enrolments), Aberdeen and Aberdeenshire (over 5,000 enrolments), and West (close to 5,000 enrolments). The gap in the share of STEM enrolments between Fife and Glasgow widened in 2020/21 to 16 percentage points (from 3 in 2019/20). The share of enrolments in each of Forth Valley, Dundee and Angus, and Edinburgh and the Lothians has decreased in the last year, by five, five, and four 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 35% since 2017/18, while the number of STEM enrolments in Dumfries and Galloway has fallen by 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 59,000, over double the number of any other region. However, the prevalence of STEM enrolments in Fife, Forth Valley, and Aberdeen and Aberdeenshire reflects the higher share of STEM enrolments at these institutions. The top four college regions[45] for number of overall enrolments are: Glasgow (59,000), Fife (35,000), Edinburgh and the Lothians (29,000), and the West (24,500).

As shown in Table A1.9, 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 65%, Forth Valley and Aberdeen and Aberdeenshire also have high proportions of its enrolments being in STEM subjects, at 29% and 28% respectively. One-fifth of all enrolments in Ayrshire, Glasgow, West, and Dundee and Angus are in STEM-related subjects. Although it has a fairly high number of STEM enrolments, Edinburgh and the Lothians has a relatively low STEM share of all enrolments, at 18%.

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

Table A1.9: College enrolments in STEM-related subjects by college region (2017/18-2020/21)

College region	2017/18	2018/19	2019/20	2020/21	STEM % of all enrolments (2020/21)
Fife	20,232	21,096	16,071	22,744	65%
Glasgow	17,922	16,852	13,711	11,779	20%
Forth Valley	5,071	6,276	9,364	5,310	29%
Aberdeen and Aberdeenshire	5,219	9,814	8,811	5,289	28%
Edinburgh and Lothians	6,423	8,064	6,432	5,217	18%
West	5,649	4,875	4,394	4,802	20%
Lanarkshire	3,530	3,803	3,741	3,806	19%
Dundee and Angus	2,694	2,734	6,714	3,638	20%
Highlands and Islands	4,813	4,802	3,902	3,381	17%
Ayrshire	3,423	3,909	2,520	2,937	20%
West Lothian	1,050	1,052	893	1,390	16%
Dumfries and Galloway	1,214	1,076	958	832	19%
Borders	506	498	349	393	10%
Landbased (SRUC)	78	87	71	98	4%
Total	**77,824**	**84,938**	**77,931**	**71,616**	**26%**

Source: SFC, 2022

Please note, this data includes HE provision in colleges

Full-time/part-time split

In 2020/21, approximately 21% of enrolments in STEM-related subjects were full-time (including short full-time), whilst for the remainder of enrolments 64% were studying STEM-related subjects part-time (part-time day release/day course or other part-time modes) and 15% were studying STEM-related subjects with distance or flexible learning. The share of students studying STEM-related subjects full time in 2020/21 is lower than the full-time rate for all enrolments at college in the same year, which was 29%.

Since 2017/18, there has been a fall in the proportion of enrolments in STEM-related subjects which are full-time, falling one percentage point from 22% to 21%. This is in contrast to the overall trend at college level, where full-time study increased by one percentage point from 28% to 29%.

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 3** for details). Table A1.10 presents the subject groupings with the number of STEM enrolments within each for 2020/21.

Table A1.10: College enrolments by STEM subjects, 2020/21

Subject	No.	% of total	Change from 2016/17
Engineering	43,064	60%	+7%
Computing and ICT	18,735	26%	-27%
Sciences and Mathematics	9,817	14%	-17%
Total	**71,616**	**100%**	**-8%**

Source: SFC, 2022

Engineering has the highest STEM enrolments of the subject groupings, accounting for over half (60%) of enrolments (over 43,000) in 2020/21.

Comparing the 2020/21 enrolments to 2017/18, 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 2017/18 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 2017/18), to then increase again in 2020/21 to about 43,000 (up 10% from the previous year). Science and Mathematics enrolments over the period varied, increasing by 20% from 2017/18 (12,000 to over 14,000) to then decrease by 31% from 2017/18 to 2020/21 (over 14,000 to about 10,000). The number of enrolments in Computing and ICT oscillated during this time, from a peak of about 26,500 in 2019/20 to a trough of below 19,000 in 2020/21.

FE/HE split

Table A1.11 shows that most college enrolments are at further education level, accounting for 86% of student enrolments in STEM-related subjects compared to 14% for higher education. This is broadly consistent with all college enrolments in Scotland (82% v 18%).

Table A1.11: College enrolments on STEM qualifications by FE/HE split (2020/21)

Level	Enrolments	
	No.	% of total
Further education	61,270	86%
Higher education	9,809	14%
Total	**71,616**	**100%**

Source: SFC, 2022

Between 2017/18 and 2020/21, the trend of further education dominating STEM college provision remained between 85% to 87%. This is set in the context of the proportion of further education provision across all college enrolments oscillating between 82% to 85% over the period.

Profile of learners

The age profile of the STEM student cohort has been younger than the age profile for all students over the period considered. 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 A1.12: College enrolments on STEM qualifications by age (2020/21)

Age group	% of STEM total	% of total enrolments
Under 16	31%	12%
16-19	24%	28%
20-24	16%	16%
25 and over	28%	43%
Total	**100%**	**100%**

Source: SFC, 2022

Males are much more likely to study STEM-related subjects at college. Table A1.13 shows that males accounted for around two-thirds (67%) of college enrolments on STEM qualifications in 2020/21, despite only accounting for 48% of all college enrolments in that year. The STEM gender gap has increased over the last four years, with female enrolments in STEM-related subjects falling from 34% in 2017/18 to 32% in 2020/21 (an overall fall of over 3,000 enrolments).

Table A1.13: College enrolments on STEM qualifications by gender (2020/21)

Subject	Gender		
	Female	Male	Other
Engineering	22%	77%	>1%
Computing and ICT[46]	43%	56%	2%
Sciences and Mathematics	55%	44%	1%
Total	**32%**	**67%**	**>1%**

Source: SFC, 2022

As expected, the gender variation differs significantly by subject grouping. For example, in 2020/21, 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 (77%) 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.[47] Data is reported on here starting from 2016/18 and includes subsequent cohorts for 2017/19, 2018/20, 2019/21, and 2020/22 where data allows. Data for the 2021/23 cohort was not available at the time of report.

Table A1.14 shows STEM FA starts across the four most recent cohorts. There has been an increase of starts to over 1,173 in the 2020-22 cohort, however there were 18% more enrolments in the 2019-21

[46] Does not sum to 100% due to rounding

[47] Frameworks falling under the STEM definition are outlined in **Appendix 3**

cohort (1,432 enrolments). Mirroring the trend in STEM college enrolments, there is a clear gender imbalance, with males accounting for most of the STEM FA starts. However, this gap is closing.

Table A1.14: STEM Foundation Apprenticeship starts (2017/19-2020/22)[48]

Academic Year	Starts[49]			Currently in Training	Completers
	Total	Female	Male		
2017/19	552	14%	86%	-	371
2018/20	722	21%	79%	536	66
2019/21	1,432	23%	77%	1,859	404
2020/22	1,173	24%	76%	1,315	-

Source: SDS, 2022

Starts by framework

As Table A1.15 shows, across all cohorts, the Engineering framework accounted for the largest proportion of STEM starts (between 28% and 44%). Creative and Digital Media accounted for just over one-quarter of 2020/22 STEM starts (26%). Civil Engineering accounted for 18% and IT: Software Development accounted for 12% of STEM starts in the 2020/22 cohort.

Table A1.15: STEM Foundation Apprenticeship starts by framework (2017/19-2020/22)

Framework	2017/19		2018/20		2019/21		2020/22	
	No.	%	No.	%	No.	%	No.	%
Civil Engineering	87	16%	95	13%	184	13%	215	18%
Creative and Digital Media	43	8%	135	19%	353	25%	305	26%
Engineering	232	42%	304	42%	469	33%	327	28%
Food and Drink Technologies	0	0%	10	1%	60	4%	43	4%
IT: Hardware Systems Support	40	7%	35	5%	69	5%	40	3%
IT: Software Development	130	24%	104	14%	189	13%	146	12%
Scientific Technologies	20	4%	39	5%	108	8%	97	8%
Total	**552**	**100%**	**722**	**100%**	**1,432**	**100%**	**1,173**	**100%**

Source: SDS, 2022 Percentage is as a percentage of starts on STEM frameworks, rather than overall

As Table A1.16 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.

[48] 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

[49] 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 A1.16: STEM Foundation Apprenticeship starts by framework (2017/19-2020/22)

Framework	2017/19		2018/20		2019/21		2020/22	
	%M	%F	%M	%F	%M	%F	%M	%F
Civil Engineering	89	11	84	16	90	10	93	7
Creative and Digital Media	44	56	64	36	54	46	52	48
Engineering	94	6	87	13	93	7	89	11
Food and Drink Technologies	-	-	20	80	53	47	42	58
IT: Hardware Systems Support	*	*	*	*	*	*	100	0
IT: Software Development	90	10	87	13	92	8	91	9
Scientific Technologies	50	50	46	54	47	53	47	53

*Source: SDS, 2022 * denotes disclosure data*

Provision by geography

Table A1.17 shows provision by local authority, grouped under the Scottish Government's RESAS definition. Data for the 2019/21 and 2020/22 cohorts 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 A1.17: 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 absolute number of starts on SDS-funded Modern Apprenticeships in STEM-related subjects in Scotland decreased from 2017/18 to 2020/21, falling 18% to 8,467. The number of achievements has increased over time despite a slightly fall between 2018/19 and 2019/20, with the achievement rate[50] averaging at 78%, with minor fluctuations (see Table A1.18).

During 2020/21, there were 8,467 starts on SDS-funded Modern Apprenticeships in STEM-related subjects in Scotland.[51] In the same year, there were 7,065 achievements against 8,890 leavers, equating to an achievement rate of 79%, slightly higher than the overall MA achievement rate of 78%.

Table A1.18: Starts, achievements, leavers and success rate for MAs in STEM-related subjects 2017/18 to 2020/21[52]

Year	Starts	Achievements	Leavers	Achievement rate
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%
2020/21	8,467	7,065	8,890	79%
Total	**39,337**	**31,204**	**39,886**	**78%**

Source: SDS, 2022

Based on available data, the vast majority of STEM starts in 2020/21 were males at 92%.[53] 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 54 different frameworks in Scotland, including 15 formerly offered frameworks that are included for calculations of leavers and achievements (see **Appendix 3** for the definition applied). As presented in Table A1.19 below, Construction: Building was the most popular MA in 2020/21, with over 1,300 starts. This is followed by Construction: Technical (960 starts), Construction: Civil Engineering (746 starts), Engineering (744 starts), and Construction: Technical Apprenticeship (625 starts).

The top 10 frameworks by starts have not shifted greatly from 2018/19 to 2020/21 (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 A1.19 due to relatively low numbers), in which females make up the majority of starts including Pharmacy Services.

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

[51] 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

[52] 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

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

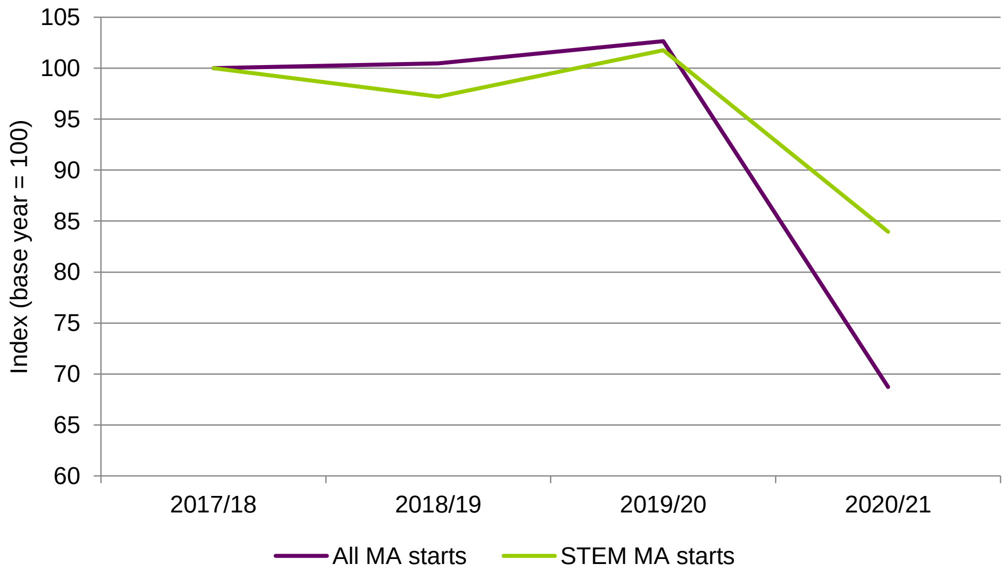
Table A1.19: Top 10 MA frameworks in STEM-related subjects (2017/19-2020/21)

Framework	2018/19			2019/20			2020/21		
	No.	%F	%M	No.	%F	%M	No.	%F	%M
Construction: Building	1,620	2%	98%	1,612	3%	97%	1,386	1%	99%
Construction: Civil Engineering	1,242	-	-	1,193	-	-	746	-	-
Construction: Technical	1,115	4%	96%	1,166	5%	95%	960	3%	97%
Engineering	1,039	5%	95%	1,160	7%	93%	744	6%	94%
Automotive	1,151	2%	98%	1,123	5%	95%	503	3%	97%
IT and Telecommunications	923	16%	84%	740	16%	84%	450	16%	84%
Construction: Technical Apprenticeship	522	3%	97%	719	3%	97%	625	3%	97%
Electrical Installation	739	1%	99%	716	2%	98%	519	2%	98%
Dental Nursing	251	-	-	350	-	-	312	-	-
Construction: Professional Apprenticeship	^	-	-	266	3%	97%	266	3%	97%
All other STEM frameworks				1,728			1,956		
Total	**10,038**	**5%**	**95%**	**10,507**	**6%**	**94%**	**8,467**	**8%**	**92%**[54]

Source: SDS, 2022. ^ These figures are included in 'All other STEM frameworks' in these years as they were not in the top 10

STEM MA provision grew between 2017/18 and 2019/20, as more STEM-related frameworks came on stream, but fell again in 2020/21. Starts fell by 16% over this period, from 10,325 in 2017/18 to 8,688 in 2018/19. The number of active frameworks has varied between 34 and 39. It should be noted that, as shown at Figure A1.8, there was a larger fall in overall apprenticeship provision over the period, which fell by 31% over the period.

Figure A1.8: Change in all and STEM MA starts, indexed (2017/18-2020/21)



Source: SDS, 2022. Please note trends are indexed from 100 in 2016/17

[54] Please note: this is an estimated figure due to data suppression amongst some STEM frameworks across gender starts

Apprenticeships by geography

MAs for learners in STEM-related subjects are provided across Scotland, although to varying extent, as shown at Table A1.20. 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 A1.20: Provision of MAs in STEM-related subjects by RESAS geography (2018/19 to 2020/21)

	2018/19		2019/20		2020/21	
RESAS geography	**No.**	**% of total**	**No.**	**% of total**	**No.**	**% of total**
Larger cities	1,768	19%	1,883	19%	1,307	18%
Urban with substantial rural areas	4,582	48%	4,840	49%	3,357	47%
Mainly rural	2,876	30%	2,797	28%	2,098	30%
Islands and remote	328	3%	396	4%	320	5%
Total	**9,554**	**100%**	**9,916**	**100%**	**7,082**	**100%**

Source: SDS, 2022. Please note, MA data by local authority does not equal total MA Framework data due to disclosure and therefore "% of total" refers to percentage of total that have been disclosed.

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.[55]

During 2020/21, a total of 1,158 learners started Graduate Apprenticeships (GAs).[56] This is down 0.1% from 1,160 starts in 2019/20, but is still 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 returned to 13 in 2020/21, after rising to 15 in 2019/20, up from 13 in 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)

[55] https://www.skillsdevelopmentscotland.co.uk/media/44711/modern-apprenticeship-statistics-quarter-4-2017-18.pdf
[56] https://www.skillsdevelopmentscotland.co.uk/media/45882/ga-report-2020-final-v2.pdf

- IT: Software Development (SCQF Level 10)

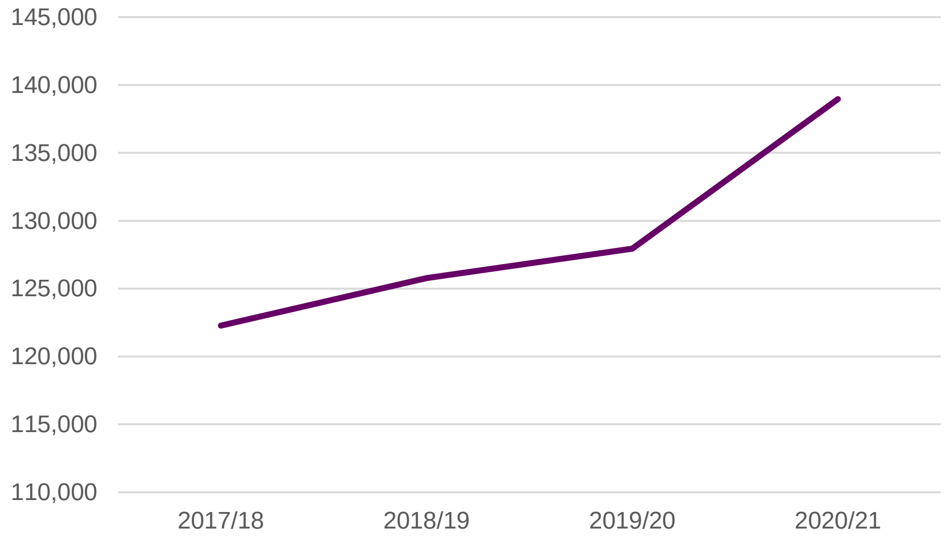
University and higher education[57]

Overall university provision in STEM

In the academic year 2019/20, there were 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 3.**

During the 2020/21 academic year there were a total of 138,960 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 2017/18 and 2020/21 total enrolments in STEM-related subjects at Scottish universities increased by 14% (+16,685 enrolments), as shown at Figure A1.9. The STEM share of total enrolments has remained between 49%-50% since 2017/18, as shown at Figure A1.10. 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 (14% since 2017/18).

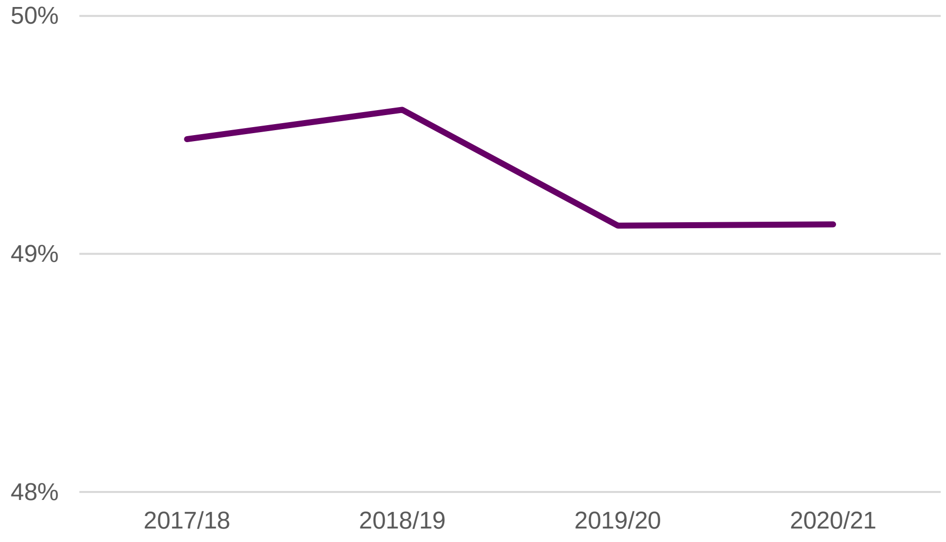
Figure A1.9: University enrolments in STEM-related subjects (2017/18-2020/21)



Source: HESA, 2022

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

Figure A1.10: University enrolments in STEM-related subjects as a share of total enrolments (2017/19-2020/21)



Source: HESA, 2022

Provision by subject

As shown in Table A1.21, Subjects Allied to Medicine accounted for the highest number (34,255) and share (25%) of STEM enrolments at Scottish universities in 2020/21. This is followed by Engineering and Technology which had 21,850 enrolments and a 16% share of total STEM enrolments. In comparison with 2017/18, 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 A1.21: University enrolments by STEM-related subject (2017/18 and 2020/21)

Subject	2017/18		2020/21		Change in enrolments	
	Count	Share %	Count	Share %	Count	%
Subjects Allied to Medicine	30,690	25%	34,255	25%	3,565	12%
Engineering and Technology	20,670	17%	21,850	16%	1,180	3%
Computing Science	12,640	10%	17,380	13%	4,740	34%
Biological Sciences/Biological and Sports Sciences	24,020	20%	13,165	9%	-10,855	-47%
Psychology	-	-	12,190	9%	-	-
Physical Sciences	11,890	10%	8,660	6%	-3,230	-28%
Medicine and Dentistry	7,655	6%	9,595	7%	1,940	7%
Architecture, Building and Planning	6,150	5%	6,935	5%	785	9%
Mathematical Sciences	4,665	4%	5,695	4%	1,030	24%
Geographical and Environmental Studies (Natural Sciences)	-	-	4,240	3%	-	-
Agriculture (Food) and Related Subjects	2,345	2%	2,755	2%	410	14%
Veterinary Science	1,550	1%	2,240	2%	690	36%
General and Others in Sciences	-	-	-	-	-	-
Total	**122,275**	**100%**	**138,960**	**100%**	**16,685**	**8%**

Source: HESA, 2022

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 2017/18 and 2020/21.
- The biggest absolute increase in enrolments was recorded against *Computer Science*, which saw a total increase of 4,740 and a growth in share from 10% to 13%.
- The largest proportional increase in enrolments between 2017/18 and 2020/21 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 2020/21, 79% of enrolments in STEM-related subjects at Scottish universities were for full-time programmes and 21% were part-time. The STEM full-time enrolment rate was slightly higher than that across all subjects which stood at 77%. From 2017/18 there has been a slight drop in the proportion of full-time enrolments in STEM-related subjects, when the full time employment rate was 20%. Reflecting the length of the course and its vocational nature, the full-time enrolment rate was highest in Veterinary Science at 90%, and Biological and Sport Sciences was second highest at 88%. Part-time enrolments were most common for Psychology where the share of part-time enrolments was 31%, followed by Subjects Allied to Medicine where the share of part-time enrolments was 29%.

Provision by level

In 2020/21, 73% of enrolments in STEM-related subjects at Scottish universities were for undergraduate programmes and 27% 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 29% of total enrolments. The share of postgraduate enrolments for STEM-related subjects increased from 2017/18 to 2020/21 (23% to 27%). Veterinary Science had the lowest rate of postgraduate enrolments in 2020/21 at just 17%. This likely reflects the length and vocational nature of the course. The share of postgraduate enrolments was highest for Geographical and Environmental Studies (natural sciences) at 50%.

Provision by institution

As shown in Table A1.22, in 2020/21 STEM enrolment was highest at the University of Edinburgh with 18,190 enrolments. This was followed by the University of Glasgow with 17,525. 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 88% of enrolments, reflecting the specialist nature of this institution. Abertay University (67%), Glasgow Caledonian University (63%), 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 2017/18 to 2020/21 the biggest absolute increase in STEM enrolments was seen at the University of Glasgow (3,610), the Open University (2,670) and University of Edinburgh (2,510). 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 with a 47% increase in STEM enrolments.

The smallest enrolments in STEM at Scottish universities in 2019/20 were at Glasgow School of Art (640) and Scotland's Rural College (1,575). 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 (27%), which is to be expected due to the specialism of this institution. The Open University, University of the Highland Islands and University of Aberdeen also reported low STEM shares, at 39%, 40% and 42% respectively. It should be noted that this still reflects a growth in STEM's share of overall enrolments at these institutions, aside from the University of Aberdeen.

Whilst overall there has been absolute and proportionate growth for STEM-related subjects from 2017/18 to 2020/21, this has not been reflected across all institutions. The University of Aberdeen saw a fall in STEM enrolments of 180 (down 3%) during this time.

Table A1.22: University enrolment in STEM-related subjects by institution (2017/18 and 2020/21)

Institution	2017/18		2020/21		Change in Enrolments		Change in STEM share of total enrolments
	STEM enrolment	STEM share	STEM enrolment	STEM share	Count	%	
The University of Edinburgh	15,680	13%	18,190	13%	2,510	16%	No change
The University of Glasgow	13,915	11%	17,525	13%	3,610	26%	+2pp
Glasgow Caledonian University	11,290	9%	12,070	9%	780	7%	No change
The University of Strathclyde	10,635	9%	11,995	9%	1,360	13%	No change
The University of Dundee	8,400	7%	9,020	6%	620	7%	-1pp
The University of the West of Scotland	8,385	7%	8,685	6%	300	4%	-1pp
The Open University	5,685	6%	8,355	6%	2,670	47%	No change
Edinburgh Napier University	7,520	6%	8,190	6%	670	9%	No change
Robert Gordon University	6,265	5%	7,065	5%	800	13%	No change
Heriot-Watt University	6,760	5%	6,935	5%	175	3%	No change
The University of Aberdeen	6,960	6%	6,780	5%	-180	-3%	-1pp
The University of Stirling	5,455	4%	6,215	4%	760	14%	No change
The University of St Andrews	4,190	3%	4,915	4%	725	17%	+1pp
University of the Highlands and Islands	3,500	3%	4,195	3%	695	20%	No change
Queen Margaret University, Edinburgh	3,250	3%	3,585	3%	335	10%	No change
Abertay University	2,435	2%	3,045	2%	610	25%	No change
SRUC	1,360	1%	1,575	1%	215	16%	No change
Glasgow School of Art	595	<1%	640	<1%	45	8%	No change
Total	**122,280**	**100%**	**138,960**	**100%**	**16,700**	**12%**	**No change**

Source: HESA, 2022

Profile of learners

In 2020/21, 54% of students enrolled in STEM-related subjects at Scottish HEIs were female. This is slightly lower than the 55% 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 2017/18 and 2020/21.

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 A1.23. For example, in 2020/21, 84% of enrolments in Veterinary Science and 83% of enrolments in Subjects Allied to Medicine were female. This compared with just 22% in Engineering and Technology and 23% in 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 2017/18 and 2020/21. The only significant changes were:

- In Biological Sciences/Biological and Sports Sciences where the share of male enrolments increased from 34% 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 81% to 84% and in Medicine and Dentistry where the share of female enrolments grew from 61% to 63%, becoming less gender balanced.

Table A1.23: University enrolment in STEM-related subjects by gender (2017/18 and 2020/21)[58]

Subject	2017/18		2020/21	
	Female % enrolments	Male % enrolments	Female % enrolments	Male % enrolments
Medicine and Dentistry	61%	39%	63%	37%
Subjects Allied to Medicine	82%	18%	83%	17%
Biological Sciences/Biological and Sports Sciences	66%	34%	57%	42%
Psychology	-	-	79%	20%
Veterinary Science	81%	19%	84%	16%
Agriculture (Food) and Related Subjects	61%	39%	61%	39%
Physical Sciences	45%	55%	45%	55%
General and Others in Sciences	-	-	-	-
Mathematical Sciences	42%	58%	42%	58%
Engineering and Technology	19%	81%	22%	78%
Computing Science	21%	79%	23%	76%
Geographical and Environmental Studies (Natural Sciences)	-	-	57%	43%
Architecture, Building and Planning	43%	57%	39%	60%
Total	**53%**	**47%**	**54%**	**46%**

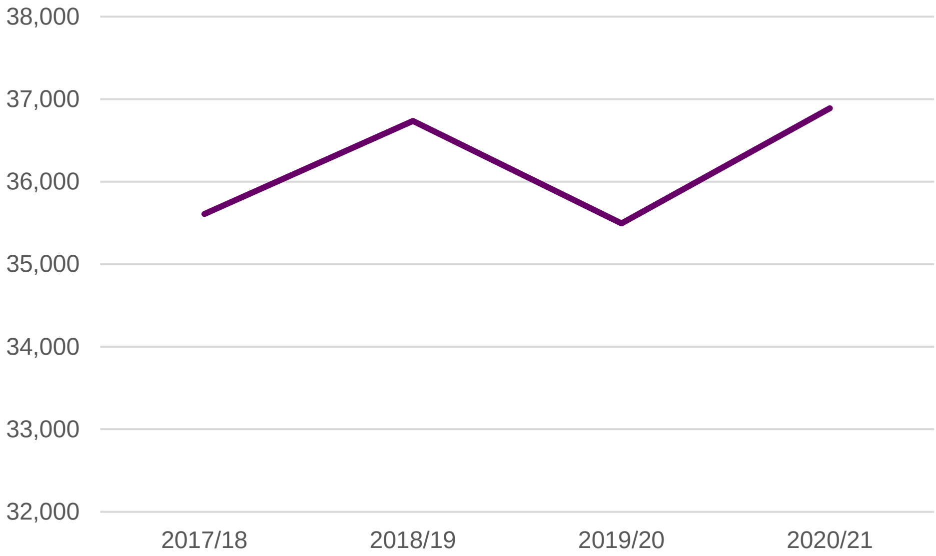
Source: HESA, 2022

Graduates profile

In total, 36,890 students qualified from Scottish universities in STEM-related subjects in 2020/21 – 45% of the total – following growth in recent years (+1,280, or 4% since 2017/18). The STEM share of qualifiers has fallen slightly from the 2017/18 level (46%), despite the absolute number of qualifiers rising to their highest point in 2020/21, as shown at Figures A4.11 and A4.12.

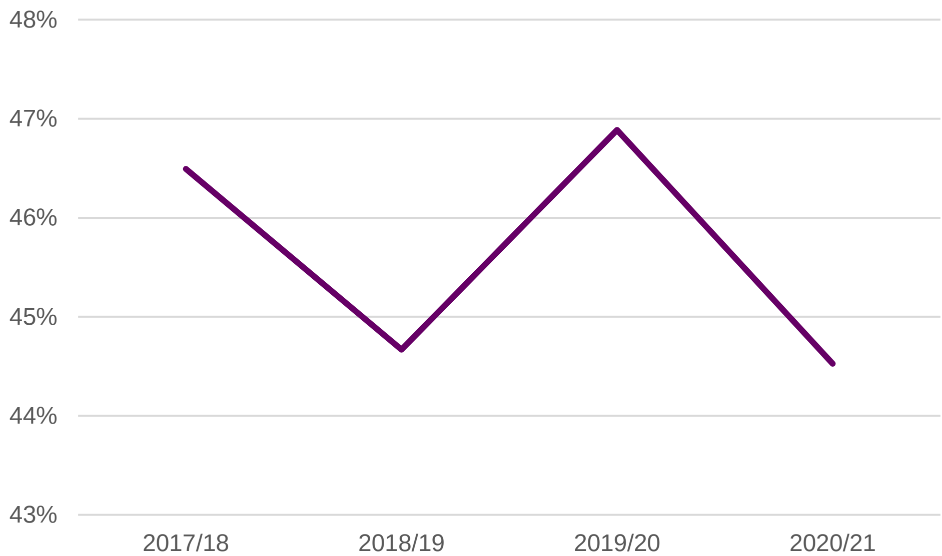
[58] Percentages may not sum to 100 due to rounding in the raw data

Figure A1.11: STEM qualifications at Scottish universities (2017/18-2020/21)



Source: HESA, 2022

Figure A1.12: STEM qualifications as a share of total qualifications (2017/18-2020/21)



Source: HESA, 2022

In terms of subject coverage of qualifiers, as shown in Table A1.24:

Subjects Allied to Medicine had the highest number of qualifiers from Scottish universities in 2020/21 at 8,530, or 23% of total STEM qualifiers reflecting strong enrolments in this subject area. This was followed by Engineering and Technology with 6,275 qualifiers, or 17%.

- The biggest absolute growth in qualifiers between 2017/18 and 2020/21 was in Computing Science at +480 (+12%), whilst the biggest proportional growth was in Veterinary Sciences at +44%, 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 3,540 or -50%, however this is due to the change in subject definition and therefore the numbers are not comparable.

Table A1.24: STEM qualifiers at Scottish universities by subject (2017/18 and 2020/21)

Subject	2017/18		2020/21		Change	
	Count	Share %	Count	Share %	Count	%
Subjects Allied to Medicine	8,365	23%	8,530	23%	165	2%
Engineering and Technology	6,020	17%	6,275	17%	255	4%
Computing Science	3,855	11%	4,335	12%	480	12%
Biological Sciences/Biological and Sports Sciences	7,025	20%	3,485	9%	-3,540	-50%
Psychology	-	-	3,365	9%	-	-
Architecture, Building and Planning	2,165	6%	2,325	6%	160	7%
Medicine and Dentistry	2,160	6%	2,135	6%	-25	-1%
Physical Sciences	3,425	10%	1,950	5%	-1,475	-43%
Mathematical Sciences	1,300	4%	1,740	5%	440	34%
Geographical and Environmental Studies (Natural Sciences)	-	-	1,205	3%	-	-
Agriculture (Food) and Related Subjects	1,000	3%	1,110	3%	110	11%
Veterinary Sciences	295	1%	425	1%	130	44%
General and Others in Sciences	-	-	-	-	-	-
Total	**35,610**	**100%**	**36,890**	**100%**	**1,280**	**4%**

Source: HESA, 2022

In 2020/21, 54% of STEM qualifiers from Scottish universities were female and 46% were male. Table A1.25 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 60%. The gender split has been become slightly less balanced since 2017/18, having been 52% female to 48% male then, before rising to 54% female and 46% male in 2020/21. 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 2020/21, at 84% and 82% respectively. Psychology also had a high share of female qualifiers at 81%.
- Engineering and Technology and Computer Science had the lowest percentage of female qualifiers, at 22% and 24% respectively.
- The biggest increases in the female share of qualifiers were in Veterinary Sciences and Computing Science, which each grew by two percentage points over the period 2017/18 to 2020/21, making the former less gender balanced and latter more gender balanced.

Table A1.25: STEM qualifiers at Scottish universities by gender (2017/18 and 2020/21)[59]

Subject	2017/18		2020/21	
	Female % qualifiers	Male % qualifiers	Female % qualifiers	Male % qualifiers
Medicine and Dentistry	61%	39%	61%	39%
Subjects Allied to Medicine	81%	19%	82%	18%
Biological Sciences/Biological and Sports Sciences	65%	35%	57%	42%
Psychology	-	-	81%	19%
Veterinary Sciences	81%	19%	84%	16%
Agriculture (Food) and Related Subjects	62%	39%	63%	37%
Physical Sciences	46%	54%	44%	56%
General and Others in Sciences	-	-	-	-
Mathematical Sciences	45%	55%	46%	54%
Engineering and Technology	20%	80%	22%	77%
Computing Science	22%	78%	24%	76%
Geographical and Environmental Studies (Natural Sciences)	-	-	56%	44%
Architecture, Building and Planning	45%	55%	41%	59%
Total	**52%**	**48%**	**54%**	**46%**

Source: HESA, 2022

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

Appendix 2: School entries and passes by gender

Table A2.1: STEM entries and qualifications for Scottish school pupils by gender (2018-2021)

	2018		2019		2020		2021		% or p.p. change 2018-21	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
SCQF 3-5										
Entries	81,705	100,228	82,626	101,520	85,109	104,611	82,194	103,869	**0.6%**	**3.6%**
Passes	63,590	76,732	63,165	77,722	73,341	89,972	65,721	83,842	**3.4%**	**9.3%**
Pass rate	77.83%	76.56%	76.45%	76.56%	86.17%	86.01%	79.96%	80.72%	**2.1 p.p.**	**4.2 p.p.**
SCQF 6										
Entries	30,434	34,735	30,078	33,517	30,379	33,599	30,978	35,068	**1.8%**	**1.0%**
Passes	23,110	24,673	22,271	23,337	26,571	28,651	25,405	27,990	**9.9%**	**13.4%**
Pass rate	75.93%	71.03%	74.04%	69.63%	87.47%	85.27%	82.01%	79.82%	**6.1 p.p.**	**8.8 p.p.**
SCQF 7										
Entries	5,367	6,964	5,392	6,489	5,425	6,505	6,076	7,136	**13.2%**	**2.5%**
Passes	4,302	5,124	4,207	4,817	5,001	5,842	5,335	6,035	**24.0%**	**17.8%**
Pass rate	80.16%	73.58%	78.02%	74.23%	92.18%	89.81%	87.80%	84.57%	**7.7 p.p.**	**11.0 p.p.**

Source: SQA, 2022

Appendix 3: STEM education definitions

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

Application of Mathematics	Mathematics
Biology	Mathematics of Mechanics
Chemistry	Music Technology
Computing Science	Physics
Design and Manufacture	Practical Craft Skills
Design and Technology	Practical Electronics
Engineering Science	Practical Metalworking
Environmental Science	Practical Woodworking
Fashion and Textile Technology	Statistics
Graphic Communication	Science
Health and Food Technology	Statistics
Human Biology	

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 L8 and L10
Construction and the Built Environment
Cyber Security L10 and L11
Data Science
Engineering: Design and Manufacture
Engineering: Instrumentation, Measurement and Control
IT: Management for Business
IT: Software Development

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 4: 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 5: STEM end beneficiary survey summary

School pupils			
Total responses	**1,309** ➢ **32%** primary school ➢ **68%** secondary school	**How often pupils have STEM lessons**	1. Very often (**47%**) 2. Fairly often (**40%**) 3. Not very often (**9%**)
Reasons for choosing to study STEM	1. Enjoy subjects (**52%**) 2. Important for future studies (**46%**) 3. Important for job/future career (**42%**)	**STEM subjects are:**	1. Interesting (**57%**) 2. Enjoyable (**48%**) 3. Useful (**44%**)
Reasons for not wanting to continue studying STEM subjects	1. Not enjoying it (**61%**) 2. Not important for future jobs/career (**33%**) 3. Not good at STEM subjects (**31%**)	**STEM jobs:**	➢ There's lots (**38%**) ➢ Are well paid (**35%**) ➢ Could be done by anyone (**31%**) ➢ Are exciting (**27%**)
Future STEM learning and careers	Might or really want to continue with STEM subjects ➢ **75%** Maybe or definitely study STEM after school or get a STEM job ➢ **62%**	**What would encourage more pupils into STEM subjects?**	➢ A better range of subjects **(45%)** ➢ Work with companies/ visit STEM workplaces more **(32%)** ➢ More work experience **(32%)**

Parents			
Total responses	**543**	**In STEM jobs**	1. Siblings or wider family members (**36%**) 2. No-one I know (**32%**) 3. Partner (**25%**)
Parents understanding of STEM themes, rated '5/5 – extensive' or '4/5'	Mathematics (**45%**) Science (**43%**) Technology (**31%**) Engineering (**19%**)	**Parents' main reasons for child's learning in STEM**	1. Develop useful skills for life (**74%**) 2. Like specific subjects/topics (**65%**) 3. Enjoy experiments, practicals and hands-on challenges (**54%**)
STEM subjects are:	1. Interesting (**77%**) 2. Useful (**56%**) 3. Enjoyable (**54%**)	**STEM jobs:**	➢ There's lots (**30%**) ➢ Are well paid (**24%**) ➢ Are exciting (**24%**) ➢ Need few qualifications (**2%**)
What would encourage more learners into STEM subjects?	1. Work with companies/ visit STEM workplaces more (**59%**) 2. A better range of subjects (**54%**) 3. More info about STEM jobs (**52%**)	**What would encourage the children to look for a STEM job?**	4. Enjoyed STEM subjects (**78%**) 5. Know they are good at STEM subjects (**69%**) 6. Knowing more about STEM learning pathways, courses and quals (**67%**)