Professional Learning in STEM

Findings from the Annual STEM Practitioner Survey 2020/21

Early learning and childcare, primary, secondary and ASN

April 2022

For Scotland's learners, with Scotland's educators

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Introduction

This report presents the key findings from Education Scotland's Annual STEM Practitioner Survey for early learning and childcare (ELC), primary, secondary and additional support needs (ASN) covering academic year 2020/21.

Education Scotland has continued to gather and analyse this data since 2016/17 to inform and support the ongoing implementation of the STEM Education and Training Strategy (2017)[1].

The findings from the surveys[2] provide valuable insights into the professional learning needs of practitioners; the challenges they face in accessing professional learning and their professional learning priorities. The survey findings have been used by Education Scotland to help shape the national professional learning offer, including the projects supported through the Enhancing Professional Learning in STEM Grants Programme. A wide range of partner organisations have also used the survey findings to help them align their professional learning programmes and strategies to the needs of practitioners.

Education Scotland will continue to measure progress against the following STEM Strategy key performance indicator[3]:

II. Increased practitioner confidence in STEM learning in the early years, primary years and in CLD settings and increased practitioner engagement in STEM professional learning opportunities. (Excellence)

- Increase the cumulative hours of STEM professional learning accessed by early years, schools, college and CLD practitioners annually.

Progress against this key performance indicator, and others, are reported on annually with detailed findings available through the First[4], Second[5] and Third STEM Strategy Annual Reports[6].

Due to the COVID-19 pandemic, the Annual STEM Practitioner Survey was not issued in 2019/20. In addition, the 2020/21 survey coincided with the COVID Omicron wave, resulting in a significant reduction in the response rate in comparison to previous years. Care should, therefore, be taken when comparing results year on year.

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[1] STEM Education and Training Strategy for Scotland: https://www.gov.scot/publications/science-technology-engineering-mathematics-education-training-strategy-scotland/
[2] A summary of STEM resources: https://education.gov.scot/improvement/learning-resources/a-summary-of-stem-resources/
[3] STEM strategy: key performance indicators: https://www.gov.scot/publications/stem-strategy-key-performance-indicators/
[4] STEM Strategy for Education and Training in Scotland - First Annual Report: https://www.gov.scot/publications/stem-strategy-education-training-scotland-first-annual-report/
[5] STEM Strategy for Education and Training in Scotland - Second Annual Report: https://www.gov.scot/publications/stem-strategy-education-training-scotland-second-annual-report/
[6] STEM Strategy for Education and Training in Scotland - Third Annual Report: https://www.gov.scot/publications/stem-strategy-education-training-scotland-third-annual-report/

Key findings

Number of responses – The number of survey responses decreased by 73.9% from 1187 responses in the 2018/19 survey to 310 responses in the 2020/21 survey. The proportion of responses from each sector are listed below. When compared to the 2018/19 survey, the proportion of responses from the ELC sector increased from 17.4% to 32.9%. It is important to note that the information contained within this report is based on a much smaller sample size than previous surveys and care should be taken when drawing comparisons or identifying trends.

- Secondary   37.1% (115 responses)

- Early learning and childcare   32.9% (102 responses)

- Primary   25.8% (80 responses)

- Additional support needs   4.2% (13 responses)

More than two-thirds of the responses in the 2020/21 survey came from class teachers or ELC practitioners with a smaller proportion coming from classroom assistants, probationer teachers and practitioners in middle or senior leadership roles.

STEM in your setting – Practitioners were asked a range of questions about STEM improvement planning, leadership and partnership working in their setting. 36.9% of respondents confirmed that STEM featured on the 2020/21 improvement plan for their setting and 23.0% stated that STEM featured on their cluster improvement plan. 42.0% of respondents confirmed that a STEM coordinator had been identified within their setting. The proportion of settings working with a STEM partner decreased from 42.1% in the 2018/19 survey to 23.1% in the 2020/21 survey. It is likely that COVID-19 advice on social distancing and restrictions on visitors in schools and ELC settings will have had a significant impact on this measure.

Level of engagement with professional learning in STEM – The total number of hours of professional learning accessed by the 310 survey respondents between 1 August 2020 and 31 July 2021 was 5,405 hours. During this period the average hours of STEM professional learning per practitioner was 17.4 hours. This shows a slight increase in the average figure of 16.1 hours per practitioner per annum reported in the 2018/19 survey. In the 2020/21 survey, 18.4% of respondents stated that they had undertaken zero hours of STEM professional learning – this is consistent with the response to the 2018/19 survey. The number of STEM professional learning hours per practitioner per annum is broken down by sector below:

- Secondary   29.8 hours

- Additional support needs   13.8 hours

- Primary   11.5 hours

- Early learning and childcare   8.7 hours

Across all sectors, approximately two-thirds of respondents stated that they engaged with either the same or more hours of STEM professional learning in 2020/21 than they did in 2019/20.

Engagement in professional learning as part of STEM grants – 18.1% of respondents stated that their setting had received funding from Education Scotland's Enhancing Professional Learning in STEM Grants Programme.

Types of professional learning accessed – The most common types of STEM professional learning accessed by practitioners were:

1st.	Online learning	62.6% (248 responses)
2nd.	Professional reading and engaging with research	60.0% (236 responses)
3rd.	Collegiate working within my setting	55.2% (213 responses)

Practitioners were also asked to describe how valuable they found each professional learning format. The top three responses identified by practitioners as 'valuable' or 'very valuable' were:

1st.	Visits to other schools/settings/organisations with interesting STEM practice	88.1% (59 out of 67 responses)
2nd.	Attending an externally-provided course outside of my setting	87.8% (72 out of 82 responses)
3rd.	External company/organisation coming into my setting	82.0% (50 out of 61 responses)

The format practitioners reported as least valuable was learning through social media. Only half of the respondents who engaged with this type of professional learning reported that it was 'valuable' or 'very valuable'.

Organisations providing STEM professional learning – When asked which organisation provided the STEM professional learning they had engaged with, the top three responses were:

1st.	Local authority	40.0% (124 responses)
2nd.	Education Scotland	35.5% (110 responses)
3rd.	SSERC	27.1% (84 responses)

Accessing professional learning in STEM – In the 2020/21 survey, 41.7% of respondents reported that they found it 'easy' or 'very easy' to access STEM professional learning. Despite the COVID-19 pandemic, this is the highest figure reported for this measure over the course of the last three surveys, resulting in an 11.6% rise from the 2018/19 figure of 30.1%. This rise may be related to the increased number of online learning opportunities.

The most common barriers to accessing professional learning in STEM were:

1st.	Difficulty in attending professional learning due to other commitments	41.3% (128 responses)
2nd.	Difficulty in finding staff cover	35.8% (111 responses)
3rd.	Lack of funding to pay for professional learning	29.4% (91 responses)

STEM professional learning priorities for 2021/22 – The top three responses across ELC, primary, secondary and ASN sectors for STEM professional learning priorities for in the year ahead were:

1st.	Pedagogies and teaching approaches to deliver STEM learning effectively	50.3% (156 responses)
2nd.	Skills progression in STEM subjects	31.9% (99 responses)
3rd.	Developing the curriculum for STEM	28.7% (89 responses)

When broken down to sector level the top priority for practitioners in each sector was:

- **ASN**: Awareness about the resources and support available for STEM (5 responses)

- **ELC**: Understanding of the concepts and knowledge that underpin mathematics (31)

- **Primary**: Using STEM as a context to raise attainment in literacy and numeracy (32)

- **Secondary**: Skills progression in STEM subjects (49 responses)

Practitioner confidence – In the 2020/21 survey, 63.0% of practitioners stated that they were 'confident' or 'very confident' delivering STEM learning. Confidence levels were highest in secondary (76.1%) and primary (66.7%) and lowest in ELC (47.7%) and ASN (46.2%) sectors.

Practitioners were also asked about their confidence in relation to discrete areas of STEM. Of those who answered each question, the proportion of practitioners who responded 'agree' or strongly agree' to the statement "I feel confident in delivering [discrete area of STEM]" were:

Mathematics and numeracy	81.0% (235 out of 290 responses)
Sciences	69.8% (192 out of 275 responses)
Gender balance, equity and equalities	66.9% (190 out of 284 responses)
Digital learning	61.0% (180 out of 295 responses)
Technologies	59.5% (172 out of 289 responses)
Engineering	35.7% (95 out of 266 responses)

When broken down to sector level the key points relating to practitioner confidence were:

- Confidence levels in mathematics and numeracy were high in the ELC, primary and secondary sectors.
- Confidence levels in engineering were consistently low across all sectors.
- ASN practitioners reported the highest level of confidence in addressing gender balance, equity and equalities.
- When compared with the 2018/19 survey results, there has been a clear increase in practitioner confidence relating to digital learning.

Annual STEM Practitioner Survey 2020/21

About the survey

Background

The aim of the Annual STEM Practitioner Survey is to track enhancements in STEM professional learning undertaken by practitioners in early learning and childcare, primary, secondary and additional support needs sectors.

The survey covers aspects such as:

- Number of hours of STEM professional learning accessed
- Practitioners' confidence in delivery of STEM learning
- STEM professional learning priorities of practitioners
- Barriers to accessing STEM professional learning.

The 2020/21 survey gathered the views of a wide range of practitioners involved in delivering aspects of STEM learning including classroom assistants, senior leaders and teachers of curriculum areas not traditionally associated with STEM.

Three further surveys were issued in 2020/21 to gather data from other sectors including:

- Community and learning development (CLD) practitioners
- School-based technical support staff
- Organisations that provide STEM professional learning.

The data presented in the 2020/21 survey findings was collected during an unprecedented period of disruption to the Scottish education system. Survey questions were adapted from previous years to take cognisance of the impact of the COVID-19 pandemic on the professional learning of practitioners. The response rate to the 2020/21 survey was significantly lower than previous years. This was largely the result of the rapid spread of the COVID Omicron variant, shortly after the survey had been issued. Education Scotland reduced its promotion of the surveys accordingly to avoid putting undue pressure on practitioners. Therefore, care should be taken when comparing data from the 2020/21 survey with previous years as these results provide a limited snapshot of STEM professional learning within the wider context of education recovery.

Structure and purpose

The survey was available made available to all practitioners via an online survey. It was promoted widely via Education Scotland and Scottish Government communication channels.

The survey findings have played, and will continue to play, a crucial role in shaping the implementation of the professional learning actions in the STEM Education and Training Strategy (http://bit.ly/STEMstrategy).

The findings from previous surveys have directly influenced the framing of the Enhancing Professional Learning in STEM Grants Programme which has seen over £4 million awarded to support professional learning programmes since its inception in 2018. The ambition of the grants programme is to ensure that practitioners in relevant sectors, and in various geographical locations, have access to high-quality professional learning which meets their needs. The survey highlights priority areas for action and gaps that need to be addressed. The evidence provided by the surveys are also directly informing the work of and the professional learning offer from Education Scotland's regional teams. These teams play a key role in supporting and coordinating professional learning in STEM.

In addition, the survey data allows Education Scotland to track progress against the following key performance indicator in the STEM Education and Training Strategy:

II. Increased practitioner confidence in STEM learning in the early years, primary years and in CLD settings and increased practitioner engagement in STEM professional learning opportunities. (Excellence)

- Increase the cumulative hours of STEM professional learning accessed by early years, schools, college and CLD practitioners annually.

Detailed survey findings: About you

Number of survey responses

2016/17 Annual STEM Practitioner Survey	788 responses
2017/18 Annual STEM Practitioner Survey (ELC, primary, secondary and ASN practitioners)	876 responses
2018/19 Annual STEM Practitioner Survey (ELC, primary, secondary and ASN practitioners)	1187 responses
2019/20 Annual STEM Practitioner Survey (ELC, primary, secondary and ASN practitioners)	Survey not issued
2020/21 Annual STEM Practitioner Survey (ELC, primary, secondary and ASN practitioners)	312 responses

Table 1. Number of responses to the STEM practitioner surveys

Note. Of the 312 responses to the 2020/21 survey, only 310 respondents gave permission for their data to be used in this report. Therefore the totals in the following tables and figures will sum to 310.
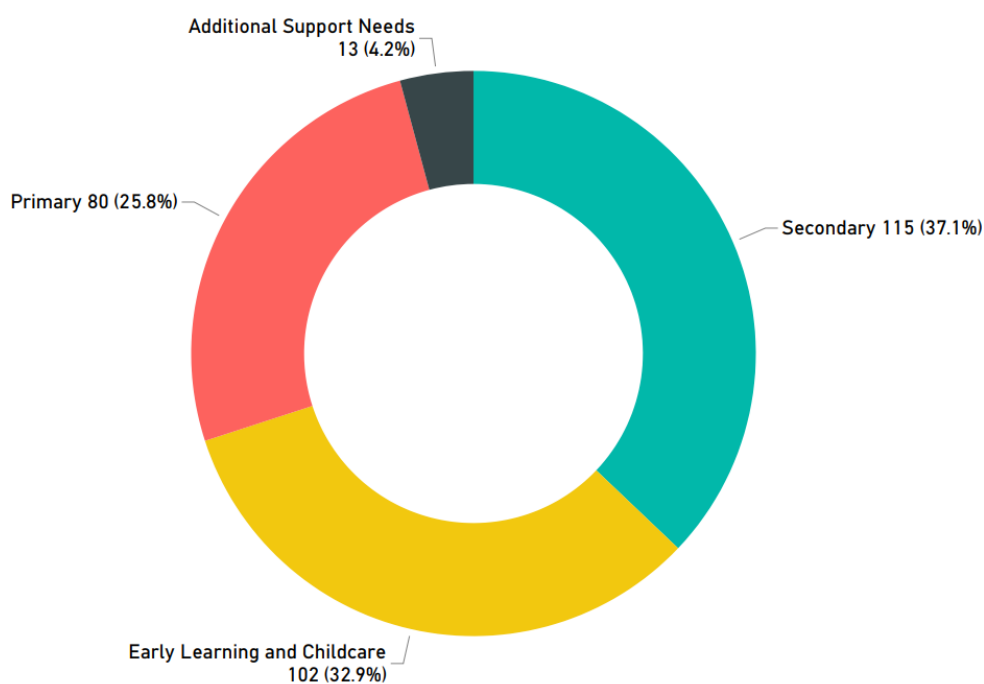
Figure 1. Number of responses by sector to the 2020/21 survey

Sector	2016/17	2017/18	2018/19	2019/20	2020/21
ASN	1.1% (9)	1.7% (15)	5.1% (61)	–	4.2% (13)
ELC	3.5% (28)	16.6% (145)	17.4% (206)	–	32.9% (102)
Primary	34.8% (274)	43.6% (382)	40.9% (485)	–	25.8% (80)
Secondary	58.5% (461)	38.1% (334)	36.6% (435)	–	37.1% (115)
Total number of responses	**788**	**876**	**1187**	**–**	**310**

Table 2. Number of completed survey responses by sector

The overall number of responses decreased by 73.9% from 1187 responses in the 2018/19 survey to 310 responses in the 2020/21 survey. The proportion of responses from the ASN and secondary sectors remained broadly similar to the distribution of responses in the 2018/19 survey. However, the proportion of responses from the primary sector decreased by 15.1% in comparison with the previous survey. The proportion of responses from the ELC sector increased by 15.5% from 17.4% of the total responses in 2018/19 to almost one third of the total responses in the 2020/21 survey.

Important: The significant reduction in the overall response rate and the shift in responses from the ELC and primary sectors between the 2018/19 and 2020/21 practitioner surveys should be carefully considered when comparing 2020/21 data with figures from previous years.

Response by role
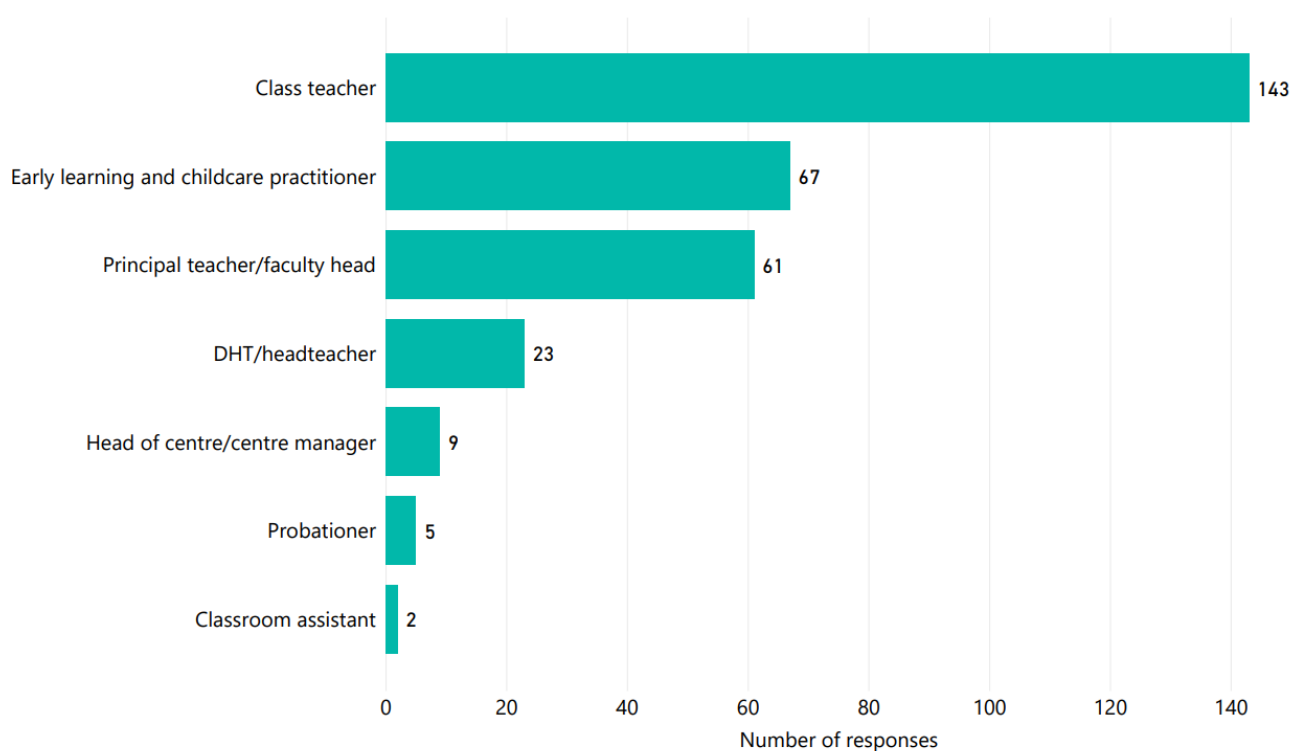
Figure 2. Breakdown of survey responses by role

Note. The principal teacher/faculty head category gives an overview of respondents in middle leadership roles across schools and ELC settings. This includes ELC practitioners who described their role as "Team Leader" or "Equity and Excellence Lead".

Respondents' work pattern
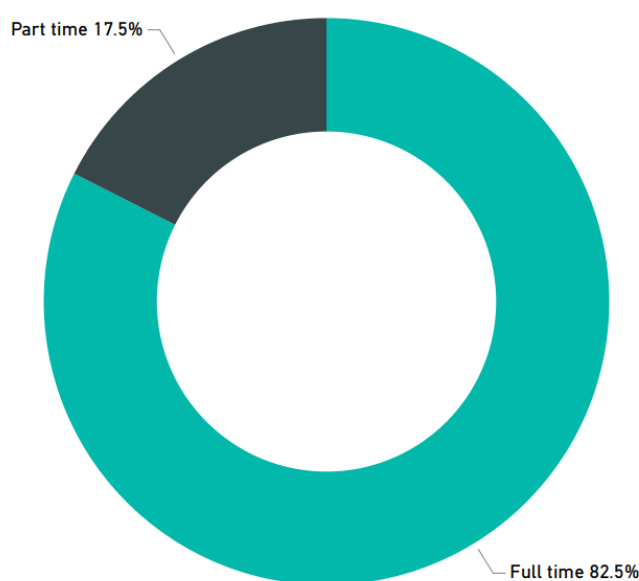
Figure 3. Respondents' work pattern

Note. Only 285 respondents provided a reply to this question.

Response by curriculum area
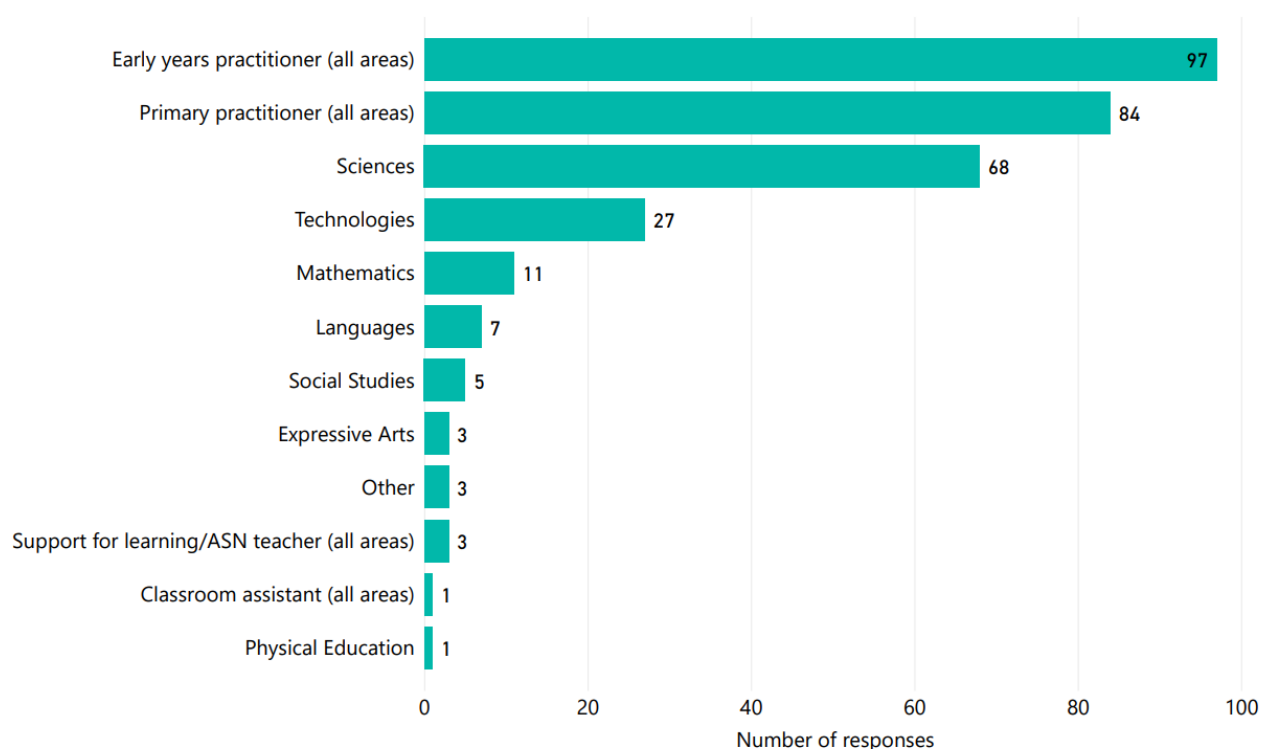
Figure 4. Breakdown of survey responses by respondents' main curriculum area

Figure 3 shows that more than four-fifths of the respondents reported that they worked on a full-time basis.

As shown in Figure 2 and Figure 4, the vast majority of survey responses came from classroom teachers and ELC practitioners. Of the secondary teachers who responded, most responses came from teachers in the sciences or technologies specialisms. Only three respondents described themselves as a support for learning/ASN teacher.

Detailed survey findings: STEM in your setting

STEM featured in setting improvement plan
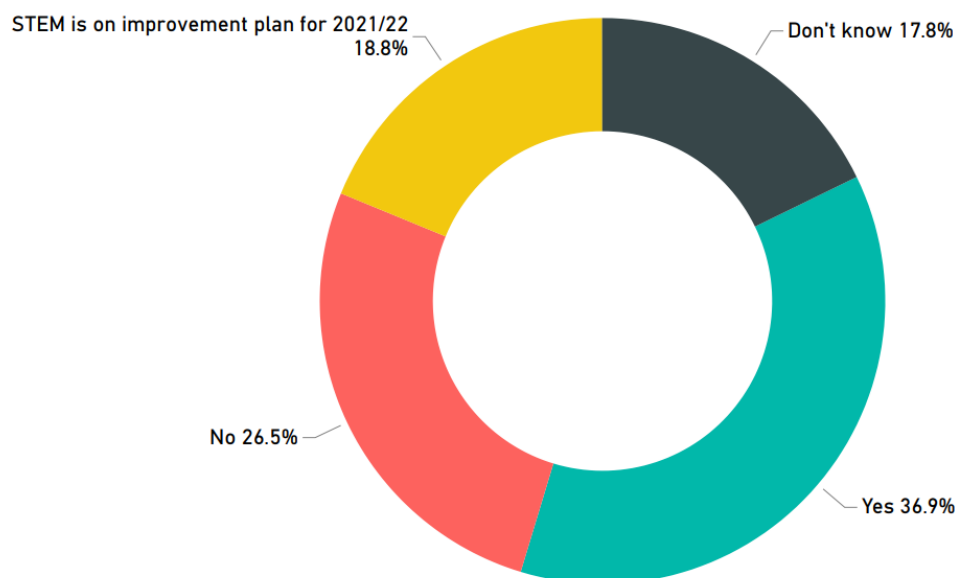
Figure 5. Overview of when STEM featured on respondents' setting improvement plan

Note. 309 respondents provided a reply to this question.

Figure 5 shows, of those who provided a response to this question, 36.9% confirmed that STEM featured on their improvement plan in academic year 2020/21. This is a decrease of 18.4% when compared with the responses in the 2018/19 survey. This may be attributed to the focus on education recovery following the COVID-19 pandemic whereby increased emphasis was placed on literacy, numeracy and health and wellbeing.

However, there was an increase in the proportion of respondents stating that STEM would feature on their improvement plan in the following 2021/22 academic year. This measure has gradually increased over the last three surveys; 8.8% in the 2017/18 survey, 11.3% in the 2018/19 survey and 18.8% in the 2020/21 survey.

STEM featured in cluster improvement plan

STEM is on improvement plan for 2021/22
7.2%

No 21.0%

Don't know 48.9%

Yes 23.0%

Figure 6. Does STEM feature on respondents' cluster improvement plan?

Note. 305 respondents provided a reply to this question.

Figure 6 shows, of those who provided a response to this question, 23.0% of respondents confirmed that STEM featured on their cluster improvement plan in academic year 2020/21. This is a decrease of 8.8% from the 2018/19 survey.
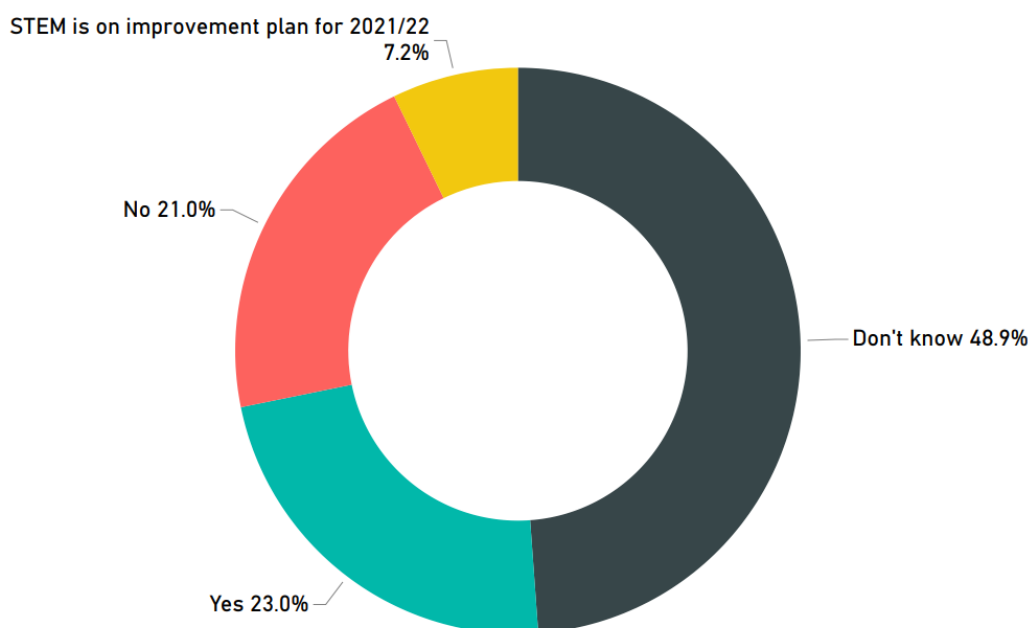
A further 7.1% of respondents stated that STEM would feature on their cluster improvement plan in the following 2021/22 academic year. This is a significant decrease from the 42.0% of respondents in the 2018/19 survey who anticipated that STEM would feature on their improvement plan in the following academic year.

Again, the reduction in this measure may be linked to an increased focus on literacy, numeracy and health and wellbeing as part of education recovery. However, it is important to note that almost half (48.9%) of respondents were unfamiliar with their cluster improvement plan and were unable to say whether STEM featured on this plan. Of those who identified themselves as a senior leader (i.e. headteacher, depute headteacher, head of centre of centre manager), only three respondents (less than 1% of the total number of respondents) replied "Don't know" when asked if STEM featured on their cluster improvement plan. It is worth considering whether all staff are included in discussions regarding their cluster improvement plan when reviewing the responses to this question.

Engagement with the STEM self-evaluation framework

Figure 7. School and setting engagement with the STEM self-evaluation framework

Note. 307 respondents provided a reply to this question.

Of those who provided a response to this question, 18.2% of respondents confirmed that their setting had engaged with Education Scotland's STEM self-evaluation framework in academic year 2020/21. A further 9.8% of respondents stated that their setting planned to engage with the framework in session 2021/22. This is significantly lower than 40.9% of respondents in the 2018/19 survey who anticipated that they would engage with the framework in 2019/20. It is likely that changed priorities due to COVID-19 will have impacted the number of practitioners engaging with the framework. However, as education recovery continues, the framework will provide support for practitioners looking to deliver breadth in the curriculum.

STEM coordinator in setting
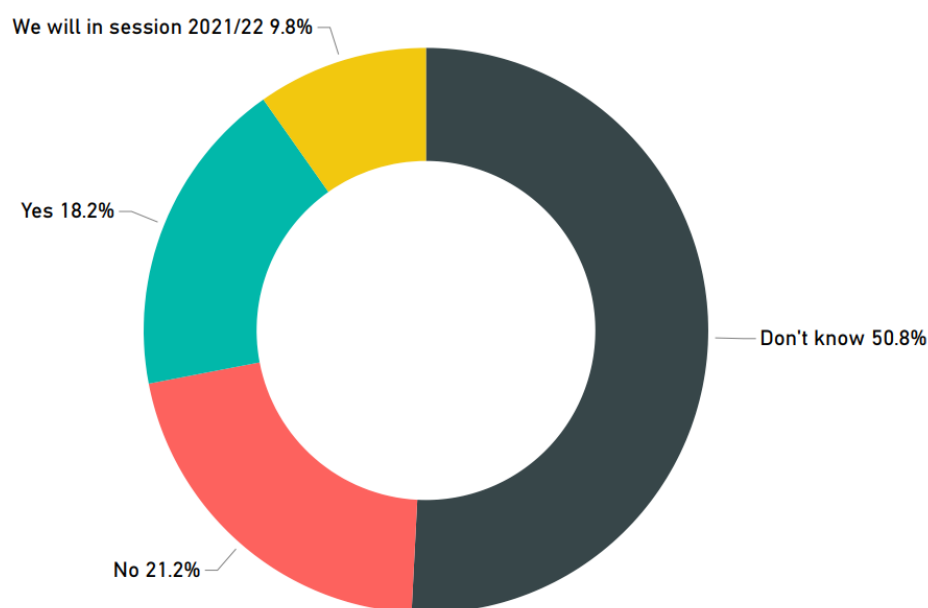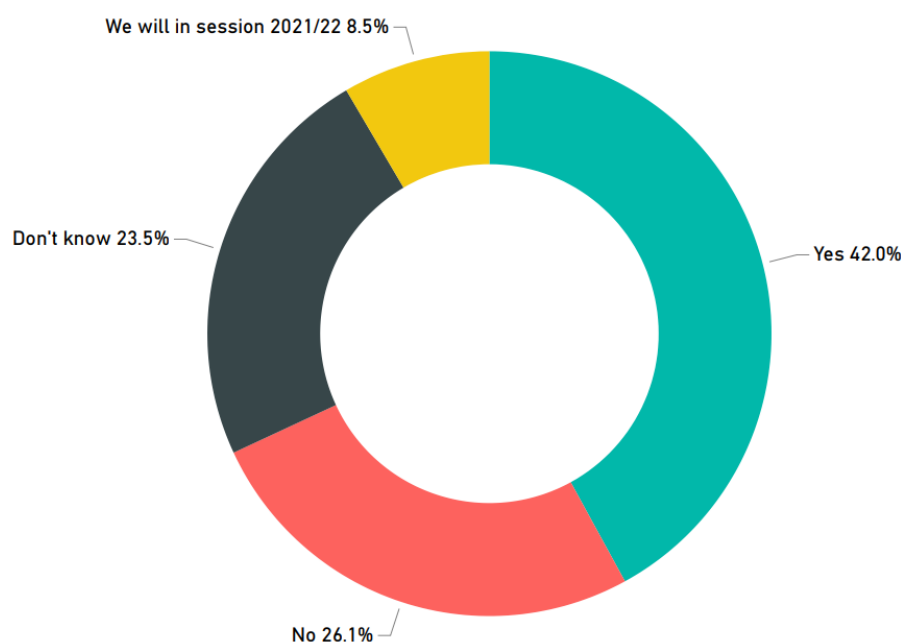

Figure 8. Do settings have an identified STEM coordinator?

Note. 307 respondents provided a reply to this question.

Of those who provided a response to this question, 42.0% of respondents confirmed that their setting had a STEM coordinator in 2020/21. This remains broadly similar to the figure reported in the 2018/19 survey (45.4%). A further 8.5% of respondents stated that their setting intended to have a STEM coordinator in place for the 2021/22 academic year.

STEM partners
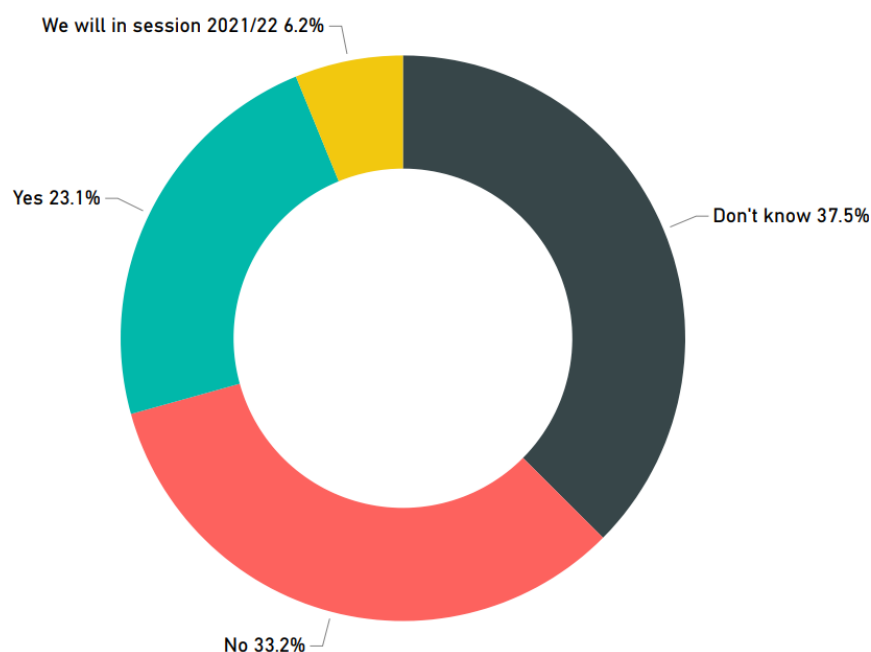
Figure 9. Overview of STEM partners in schools and ELC settings

Note. 307 respondents provided a reply to this question.

Of those who responded to this question, less than one quarter (23.1%) of respondents stated that their setting had a STEM partner from the private, public or third sector in 2020/21. A further 6.2% of settings are planning to establish a STEM partnership in 2021/22. The previous 2018/19 survey showed that 42.1% of settings had worked with one or more STEM partners. During the COVID-19 pandemic, a number of settings and STEM partners found innovative ways to work together virtually. However, the ongoing restrictions regarding visitors in schools and ELC settings will have undoubtedly have had an impact on the levels of STEM partnership working reported in the 2020/21 survey.
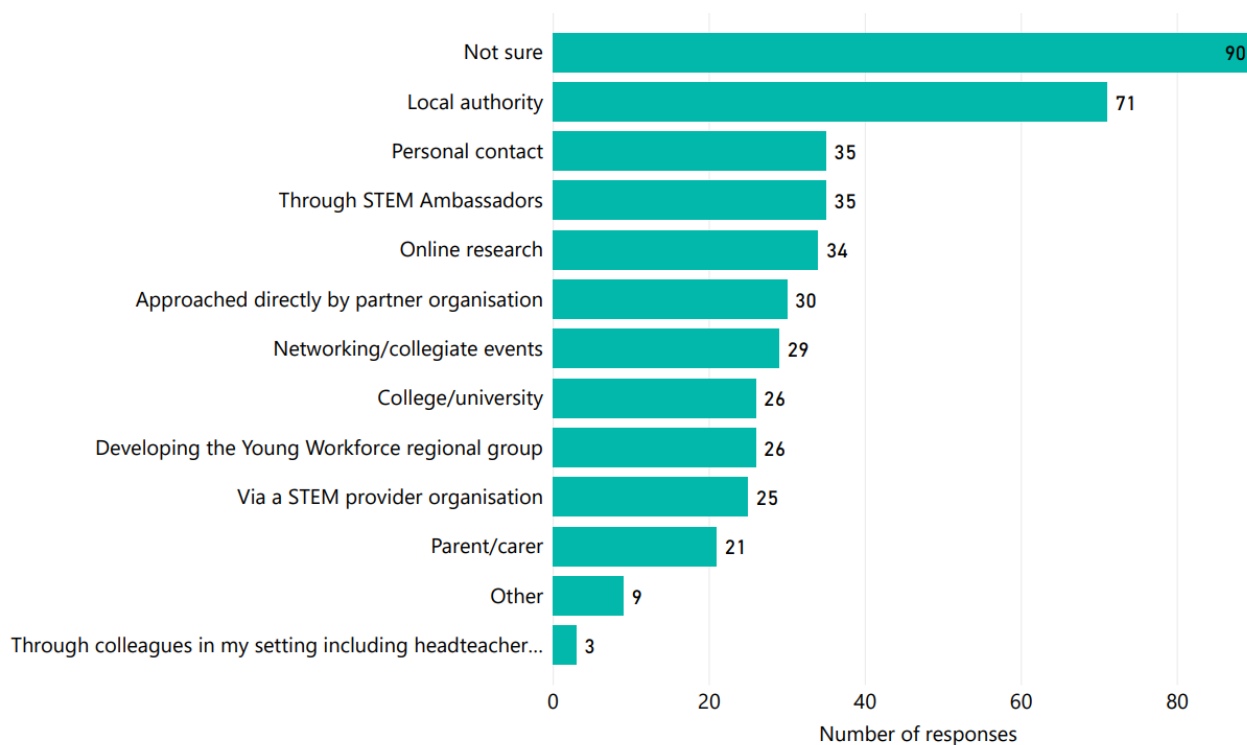
Figure 10. Approaches to connecting with STEM partner organisations

Note. The number of practitioner responses in this figure exceeds the total number of responses as multiple selections were possible for this question in the online survey.

The top three ways (excluding the response *'not sure'*) in which practitioners found out about partner organisations were through:

1. Local authority contacts
2. Personal contacts
3. STEM Ambassadors.

In the 2020/21 survey, the prominence of local authorities in helping settings identify STEM partners is a significant change from previous surveys. In the 2018/19 survey, local authorities were fourth on the list (when the 'Not sure' responses were excluded). This could signify an increase focus and capacity for STEM at local authority level. Regional working, support from Education Scotland's Regional Teams and an increase in the number of authorities participating in the RAiSE Programme may also be factors.

Detailed survey findings: Your professional learning

Total number of hours of professional learning in STEM

The **total number of cumulative hours** of practitioner professional learning in STEM accessed by the 310 survey respondents between 1 August 2020 and 31 July 2021 was **5,405 hours**. This equates to a mean average of **17.4 hours per practitioner per annum**. This shows a slight increase in the average figure of 16.1 hours reported in the 2018/19 survey.

In line with the 2018/19 survey, 18.4% of respondents (57 responses) stated that they did not participate in any STEM professional learning in the given time period. More than one quarter of the total hours of STEM professional learning can be attributed to the five respondents reporting the highest number of individual hours. The median value was 5.5 hours of STEM professional learning per practitioner per annum.
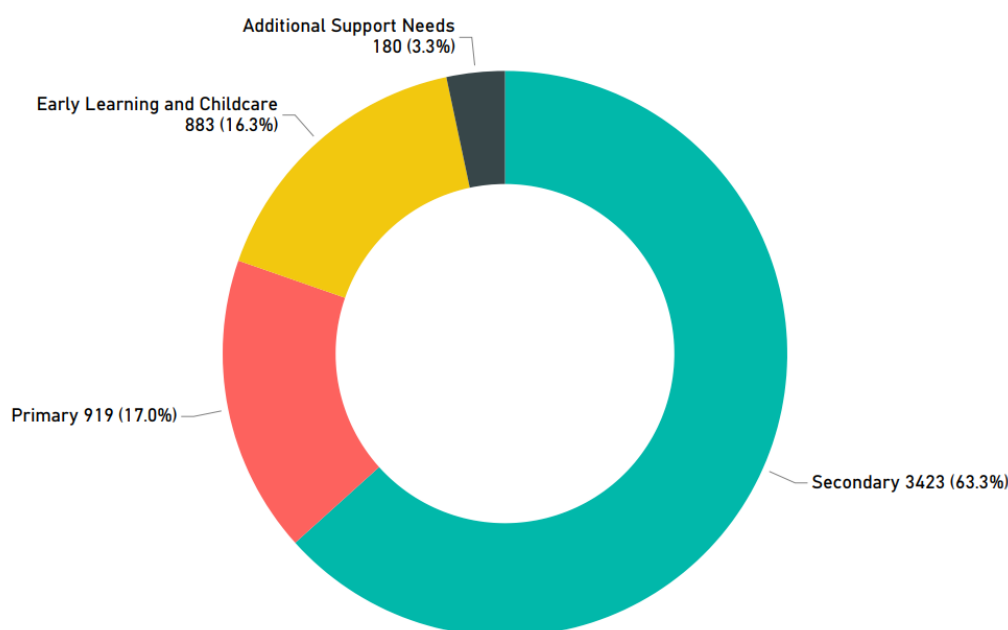
Figure 11. Total number of hours of STEM professional learning accessed by sector

Sector	2017/18		2018/19		2019/20	2020/21	
	Total hours of STEM PL	Hours of STEM PL per practitioner	Total hours of STEM PL	Hours of STEM PL per practitioner		Total hours of STEM PL	Hours of STEM PL per practitioner
ASN	135	9.0	583	9.6	–	180	13.8
ELC	2,799	19.3	1,368	6.6	–	883	8.7
Primary	5,186	13.6	5,865	12.1	–	919	11.5
Secondary	10,556	31.6	11,250	25.9	–	3423	29.8
Total	**18,675**	**–**	**19,066**	**–**	**–**	**5,405**	**–**

Table 3. Number of STEM professional learning hours per sector

Note: Data not available for 2019/20 as survey was not issued.

Secondary practitioners reported the highest number of STEM professional learning hours per practitioner. ASN practitioners reported the largest increase of STEM professional learning hours per practitioner from 9.6 hours in the 2018/19 survey to 13.8 hours of STEM professional learning per practitioner in the 2020/21 survey.
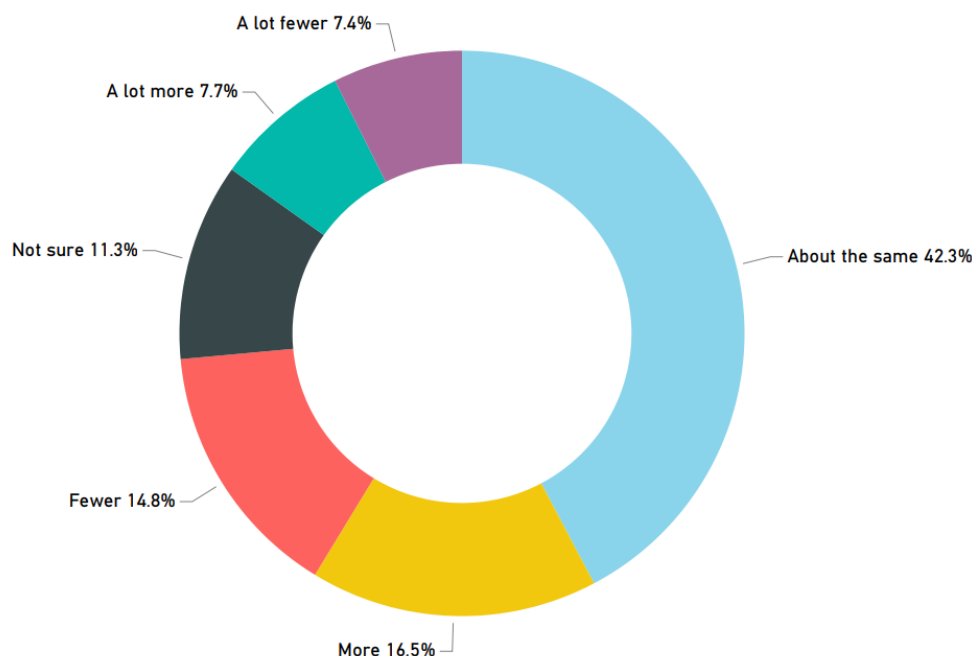
Figure 12. Number of STEM professional learning hours compared to the previous year

Hours of STEM professional compared to the previous academic year	2017/18	2018/19	2019/20	2020/21
'More' or 'A lot more'	30.4%	28.4%	–	24.2%
'About the same'	47.7%	51.5%	–	42.3%
'Fewer' or 'A lot fewer'	21.9%	14.3%	–	22.3%

Table 4. Comparison of number of STEM professional learning hours with previous years

Note: 2019/20 data is not available as survey was not issued.

Roughly one quarter of respondents said the number of hours of STEM professional learning they accessed in 2020/21 was 'more' or 'a lot more' than the previous year. Furthermore, 42.3% of respondents said the number of hours of STEM professional learning they accessed in 2020/21 was 'about the same' as the previous year. In contrast to the significant reduction in overall response rate to the Professional Learning in STEM Annual Practitioner Survey, the figures relating to engagement with STEM professional learning from those who did complete the survey remained broadly similar to previous years.

Engagement in professional learning as part of STEM grants
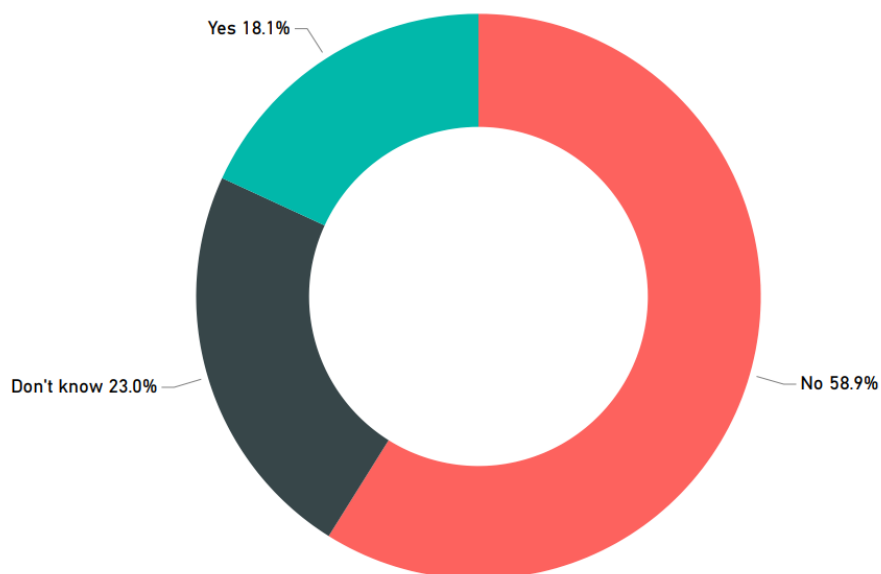
Figure 13. Engagement with professional learning as part of the Enhancing Professional Learning in STEM Grants Programme

Note. 309 respondents provided a reply to this question.

For the first time, in the 2020/21 survey practitioners were asked whether their setting received funding from Education Scotland's Enhancing Professional Learning in STEM Grants Programme. Although 71 respondents did not know whether their professional learning has been supported with grant funding, 56 respondents (18.1%) reported that they had benefitted from the grants programme. Further information on the reach and scale of professional learning provided by settings in receipt of grant funding can be found in the analysis of the 2020/21 Annual STEM Data Gathering Exercise.

Types of professional learning accessed and perceived value

Practitioners were surveyed about which types of STEM professional learning they accessed during the 2020/21 academic year and were also asked to rate how valuable they found each format. The most common responses remain unchanged from the 2018/19 survey namely online learning, collegiate working within a setting and professional reading and engaging with research. Table 5 shows that the proportion of practitioners participating in online learning has continued to increased year on year. The reduction in face-to-face professional learning opportunities as a result of COVID-19 is evidenced by a decrease in the number of practitioners accessing external courses, external companies delivering professional learning in settings and open day visits and collegiate working between settings.

The final column in Table 5 shows the perceived impact of different professional learning formats. Of the respondents who participated in each type of professional learning, only those who rated the experience as 'valuable' or 'very valuable' were included in this analysis.

Types of professional learning	2016/17 Response %	2017/18 Response % (count)	2018/19 Response % (count)	2019/20 Response % (count)	2020/21 Response % (count)	2020/21 Impact
Attending an external course	49.4%	53.5% (469)	45.3% (538)	–	23.2% (82)	**87.8% (72)**
External company coming into my setting	17.1%	37.9% (332)	36.6% (435)	–	16.1% (61)	**82.0% (50)**
Collegiate working within my setting	43.1%	74.5% (653)	64.0% (760)	–	55.2% (213)	**80.3% (171)**
Collegiate working across my cluster	28.4%	53.9% (472)	41.4% (491)	–	31.6% (128)	**76.6% (98)**
Attending visits to other settings	*	33% (289)	27.9% (332)	–	19.0% (67)	**88.1% (59)**
Attending local, regional and national events to share practice	*	45.8% (402)	39.3% (467)	–	36.5% (145)	**77.9% (113)**
Online learning	25.8%†	37.9%† (332)	56.5% (671)	–	62.6% (248)	**78.2% (194)**
Through social media	17.3%	45.8% (401)	48.0% (570)	–	28.4% (166)	**53.0% (88)**
Professional reading and engaging with research	40.1%	78.5% (688)	68.8% (817)	–	60.0% (236)	**78.8% (186)**
Other	12.8%	15.9% (139)	9.6% (114)	–	<1% (3)	**NA**

Table 5. Types of professional learning accessed by practitioners and the impact on learning

Note: ■ Indicates top 3 responses per survey year

      * Question not included in survey

      † In the 2016/17 and 2017/18 surveys, online learning was one of a number of digital approaches to professional learning including webinars and online networks. From 2018/19 onwards, these subcategories were collectively listed under online learning.

      – Data not available as survey was not issued in 2019/20
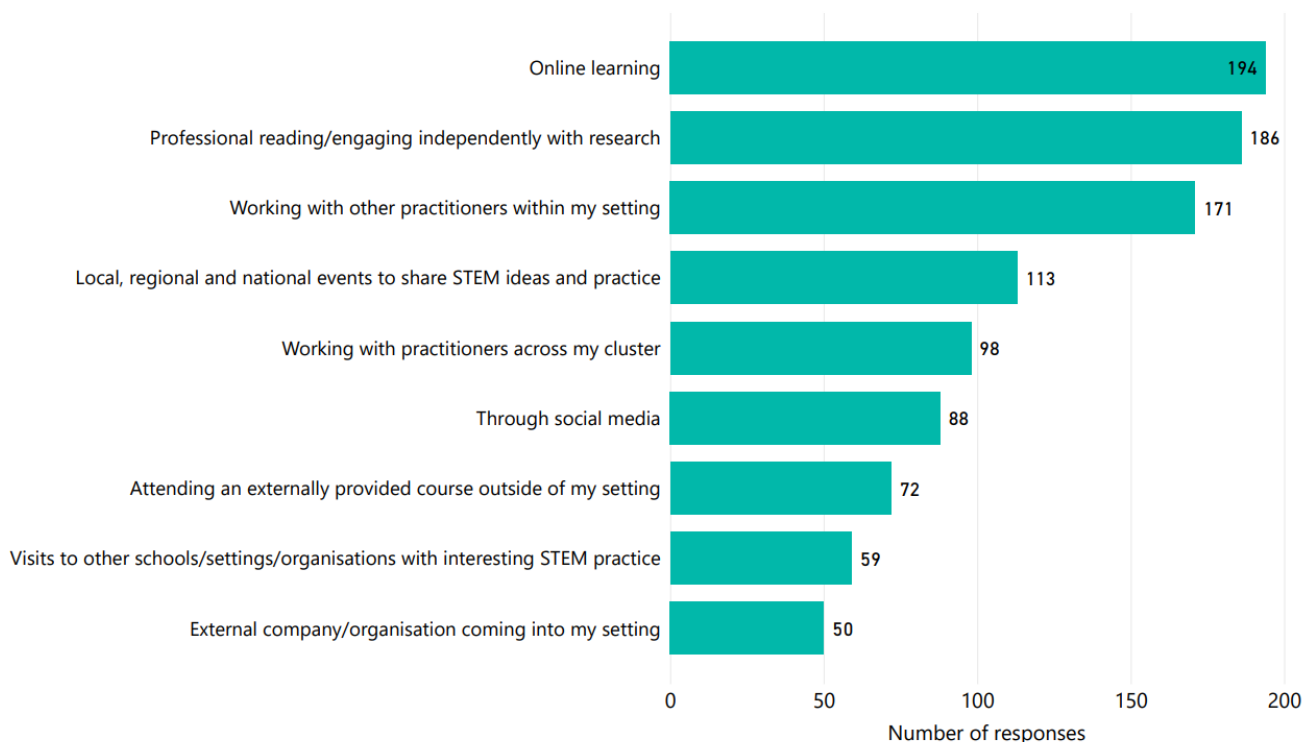
Figure 14. Types of STEM professional learning accessed by practitioners and rated as 'valuable' or 'very valuable'

Note. The number of practitioner responses in this figure exceeds the total number of responses as multiple selections were possible for this question in the online survey.

Of those who participated in each type of professional learning, the 2020/21 survey responses indicate that the most valuable formats with the highest perceived impact were:

1st.	Visits to other schools/settings/organisations with interesting STEM practice	88.1% (59 out of 67 responses)
2nd.	Attending an externally provided course outside of my setting	87.8% (72 out of 82 responses)
3rd.	External company/organisation coming into my setting	82.0% (50 out of 61 responses)

The format practitioners reported as least valuable was accessing STEM professional learning through social media. Only half of the respondents who engaged with this type of professional learning reported that it was 'valuable' or 'very valuable'.

Organisations that provided STEM professional learning

Respondents were asked to identify the main organisations providing them with STEM professional learning. Table 6 outlines the top three responses from recent surveys.

	2016/17	2017/18	2018/19	2019/20	2020/21
1	SSERC	Local authority	Local authority	–	Local authority
2	Local authority	SSERC	SSERC	–	Education Scotland
3	STEM Ambassadors	STEM Ambassadors	Education Scotland	–	SSERC

Table 6. Top three organisations providing STEM professional learning (2016/17 to 2020/21)

Note. 2019/20 data is not available as survey was not issued.
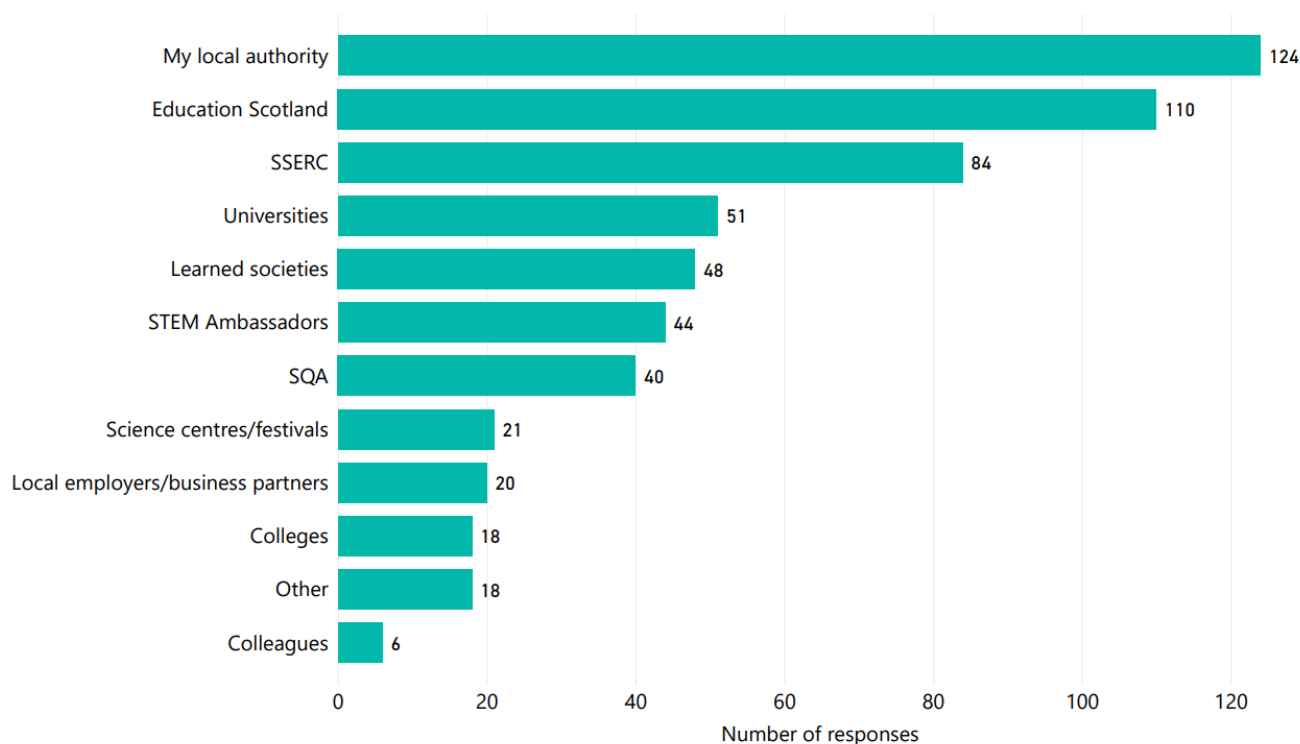
Figure 15. Organisations providing STEM professional learning

Note. The number of practitioner responses in this figure exceeds the total number of responses as multiple selections were possible for this question in the online survey.

Figure 15. Organisations providing STEM professional learning shows the remaining responses to this question. The proportion of practitioners accessing STEM professional learning through their local authority increased slightly from 38.2% in the 2018/19 survey to 40.0% in 2020/21. An additional 'colleagues' option was added to group together 'other' responses with a similar

theme. These comments referred to informal peer-to-peer professional learning as opposed to formal professional learning organised and delivered by local authorities or other organisations.

A number of other professional learning providers were included in respondents free text comments including:

- Regional Improvement Collaborative
- eSgoil
- West OS
- SDS
- DYW
- Young STEM Leader Award
- SmartSTEM
- First Discoverers
- Food and Drink Federation
- Food Standards Scotland
- RHET
- RNCI
- Good Food Champs
- National Space Academy
- Space Agency
- Blairvadach Outdoor Centre
- Virtual Nature School
- Therapeutic Forest
- Highland One World Centre
- Cross Border Organisation
- International Baccalaureate Organisation
- Cambridge International Education
- Council of International Schools
- Microsoft Education
- Apple
- Open University
- Future Learn
- Association of Language Learning
- Scottish Association of Language Teaching

Ease of accessing professional learning in STEM

In the 2020/21 survey, 41.7% of respondents reported that they found it 'easy' or 'very easy' to access STEM professional learning. Despite the COVID-19 pandemic, this is the highest figure reported for this measure over the course of the last three surveys, resulting in an 11.6% rise from the 2018/19 figure of 30.1%. This may be attributed to the increased availability of online STEM professional learning. However the data may be skewed by the low response rate to the 2020/21 survey.
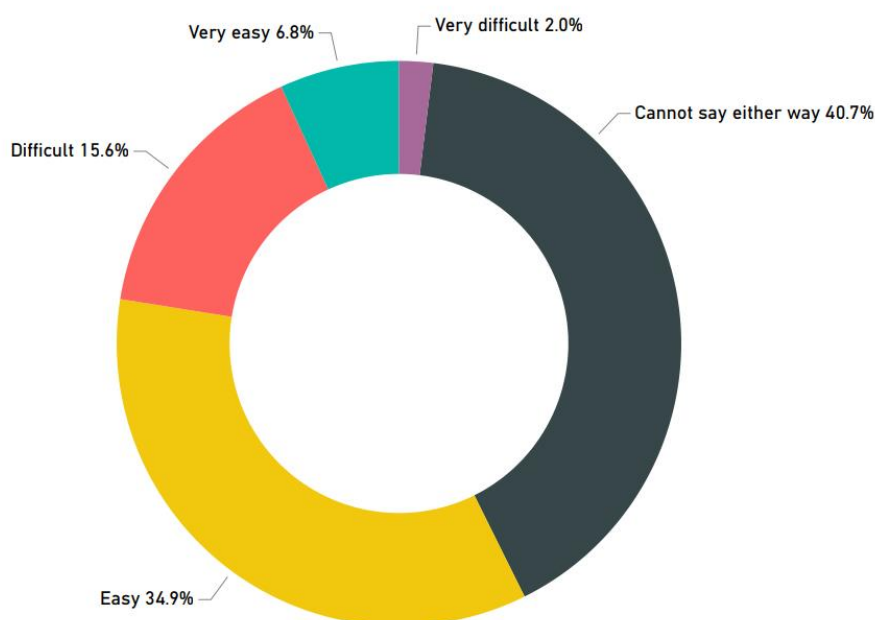
Figure 16. Ease of accessing professional learning in STEM

Note. 307 respondents provided a reply to this question.

Main barriers to accessing professional learning in STEM

The 2020/21 survey highlighted a number of barriers to accessing professional learning in STEM. The responses to this question are shown in Figure 17.
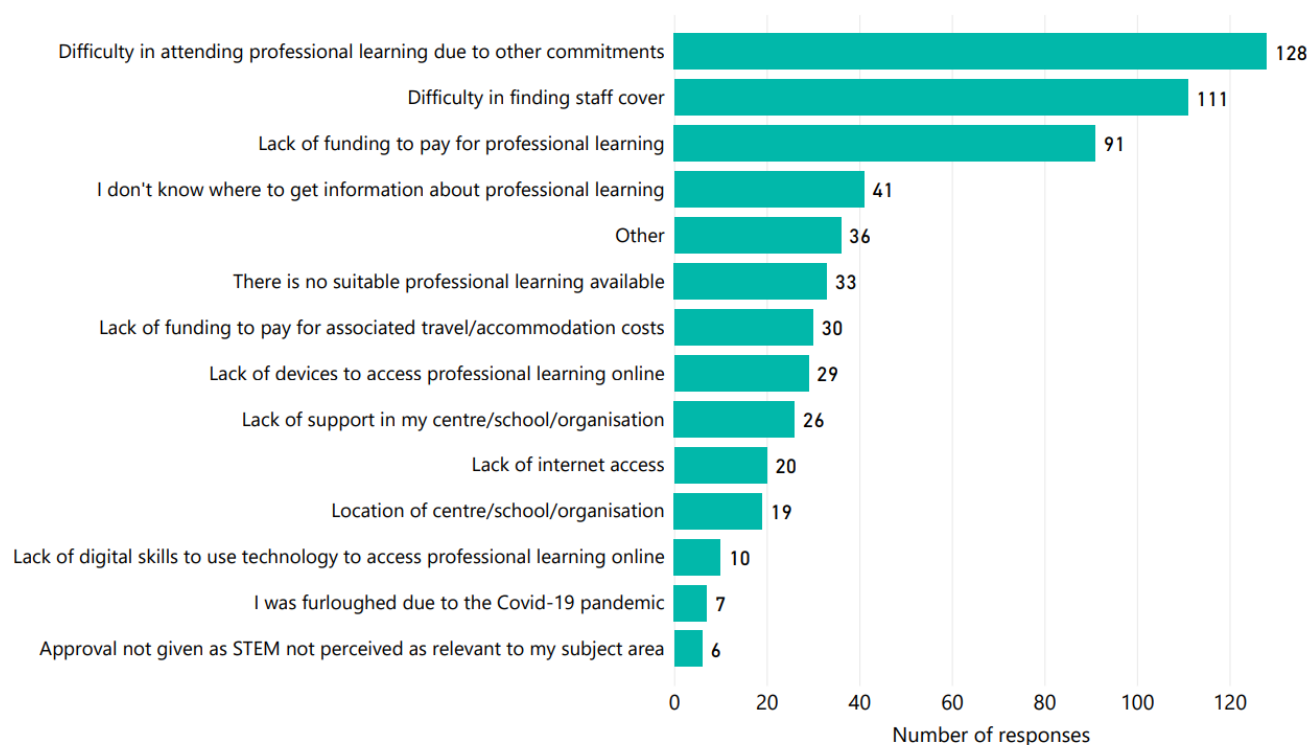
Figure 17. Main barriers to accessing professional learning in STEM

Note. The number of practitioner responses in this figure exceeds the total number of responses as multiple selections were possible for this question in the online survey.

Table 7 lists the top three barriers to accessing professional learning in STEM over the last four surveys.

	2016/17	2017/18	2018/19	2019/20	2020/21
1	Too many demands on staff time	Difficulty finding staff cover	Difficulty finding staff cover	–	Difficulty in attending PL due to other commitments
2	Lack of funding to pay for professional learning	Difficulty in attending PL due to other commitments	Difficulty in attending PL due to other commitments	–	Difficulty in finding staff cover
3	Difficulty finding staff cover	Lack of funding to pay for professional learning	Lack of funding to pay for professional learning	–	Lack of funding to pay for professional learning

Table 7. Main barriers to accessing professional learning in STEM

Note: 2019/20 data is not available as survey was not issued.

Due to the global pandemic, a new response relating to the impact of the COVID-19 furlough scheme was included in the 2020/21 survey. Whilst this option was only selected by seven respondents a further 16 respondents included additional comments about the impact of COVID-19 on their ability to access STEM professional learning. The comments below give a flavour of these responses:

"No face to face contact or outside agencies/visitors allowed in to school or to visit other establishments."

"Covid stopped everything"

"A lot of time was taken up getting to grips with technology for changes in schooling due to the pandemic - eg. home learning, Googlemeets, Teams etc etc so less time on STEM learning that would impact on children's STEM learning."

Conversely, a number of practitioners reported that they did not experience any barriers to accessing STEM professional learning. As the comments below show, this could be attributed to the increased availability of online STEM professional learning as a result of the COVID-19 pandemic.

"Due to many courses being online and outside school hours, this year - the usual difficulties of cover and funding have been less of an issue."

"It was quite easy as there is such a lot of good content online."

STEM professional learning priorities for the academic year 2021/22

In the 2020/21, STEM professional learning survey practitioners were asked what their professional learning priorities were for the year ahead. The top three responses in the 2020/21 survey mirrored the 2018/19 survey showing a clear focus on STEM pedagogy, skills progression in STEM and STEM curriculum development.

The top response from practitioners across all sectors was in relation to STEM pedagogy and effective learning and teaching approaches to delivering STEM. However, the remaining responses differed by sector as show in Table 8.

The responses show that practitioners in the ASN and ELC sectors require further information on the resources and support available for STEM. Using STEM as a context to raise attainment in literacy and numeracy is a key priority for practitioners in the ASN and primary sectors. Similarly, ELC practitioners focused in on the need to develop further understanding of the concepts and knowledge that underpin mathematics as a priority for their sector. Given the priority placed on STEM skills progression and curriculum development in the primary and secondary sectors this may be useful to consider across the Broad General Education rather than discrete support for separate sectors. Finally, secondary practitioners highlighted a desire to increase their awareness of STEM careers and the relevance of STEM to the world of work.
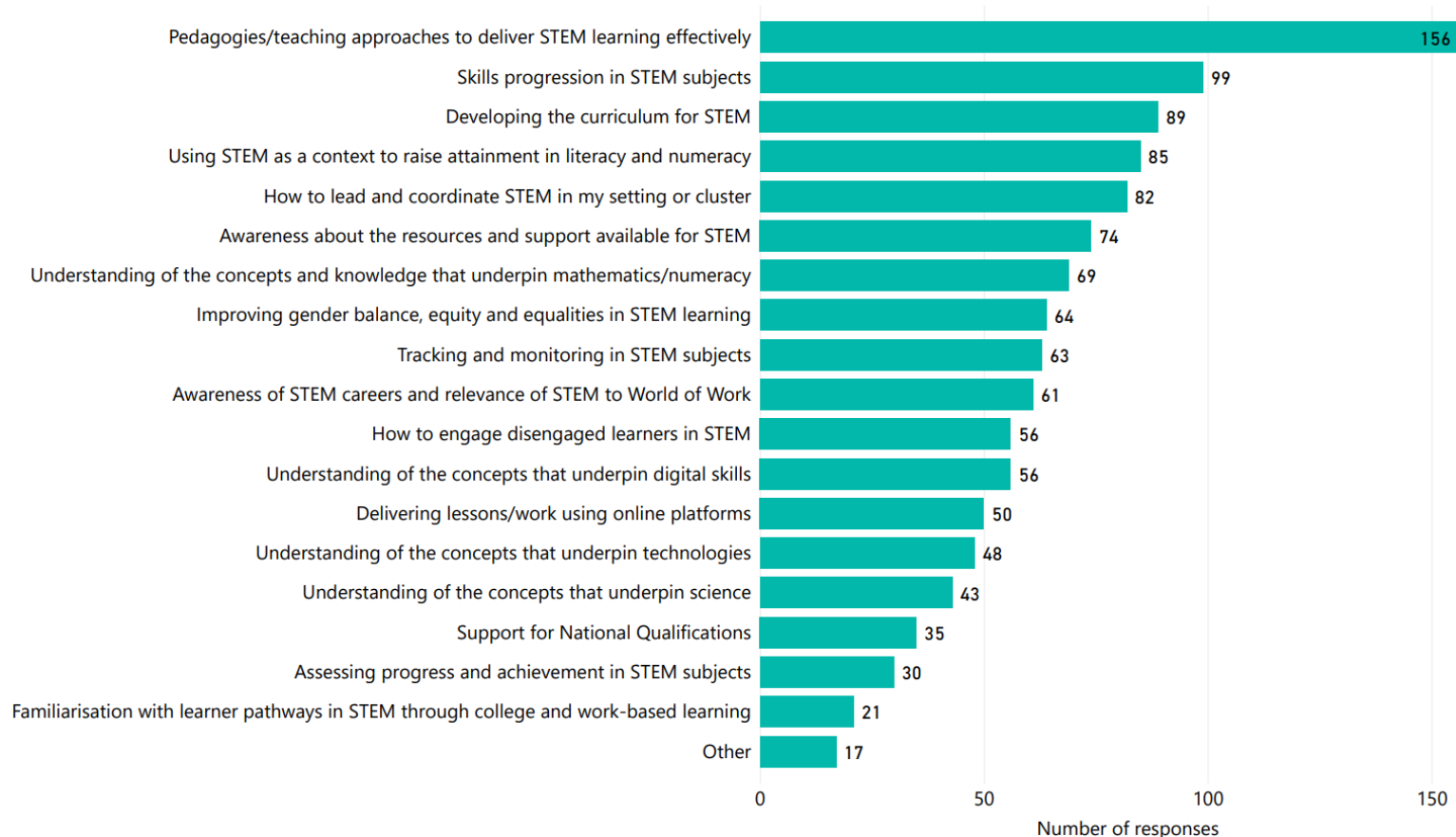
Figure 18. STEM professional learning priorities for academic year 2021/22

Note. The number of practitioner responses in this figure exceeds the total number of responses as multiple selections were possible for this question in the online survey.

	ASN (no. of responses)	ELC (no. of responses)	Primary (no. of responses)	Secondary (no. of responses)
1	Awareness about the resources and support available for STEM (5)	Understanding of the concepts and knowledge that underpin mathematics (31)	Using STEM as a context to raise attainment in literacy and numeracy (32)	Skills progression in STEM subjects (49)
2	How to engage disengaged learners in STEM (5)	Awareness about the resources and support available for STEM (29)	Skills progression in STEM subjects (27)	Developing the curriculum for STEM (40)
3	Using STEM as a context to raise attainment in literacy and numeracy (5)	How to lead and coordinate STEM in my setting or cluster (23)	Developing the curriculum for STEM (24)	Awareness of STEM careers and relevance of STEM to the world of work (35)

Table 8. STEM professional learning priorities for academic year 2020/21

Detailed survey findings: STEM in your practice

Practitioner confidence

Practitioners were asked about their confidence in delivering STEM learning during academic year 2020/21. Figure 19 shows the responses across all sectors. Approximately two-thirds of respondents stated that they were 'confident' or 'very confident' delivering STEM.
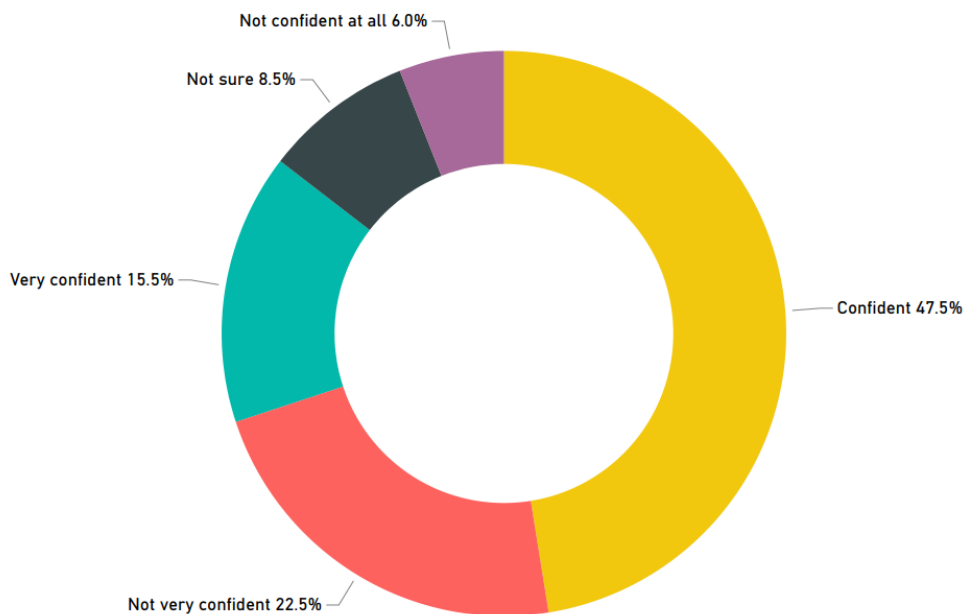
Figure 19. Overall practitioner confidence delivering STEM

Note. Education Scotland promoted the STEM professional learning survey through a variety of channels to ensure a representative response from practitioners. However, as with all surveys, it is likely that respondents have high levels of engagement or interest in the subject matter. Subsequently, the levels of confidence expressed are prone to reflect this and may be higher than that of the general practitioner population. Some respondents selected multiple responses to this question resulting in 316 discrete responses from 310 practitioners.

Legend: ● Very confident ● Confident ● Not sure ● Not very confident ● Not confident at all

	Very confident	Confident	Not sure	Not very confident	Not confident at all
Secondary	24.8%	51.3%	11.1%	7.7%	5.1%
Primary	14.8%	51.9%		25.9%	4.9%
ELC	6.7%	41.0%	11.4%	33.3%	7.6%
ASN	7.7%	38.5%		46.2%	7.7%

STEM confidence levels by sector
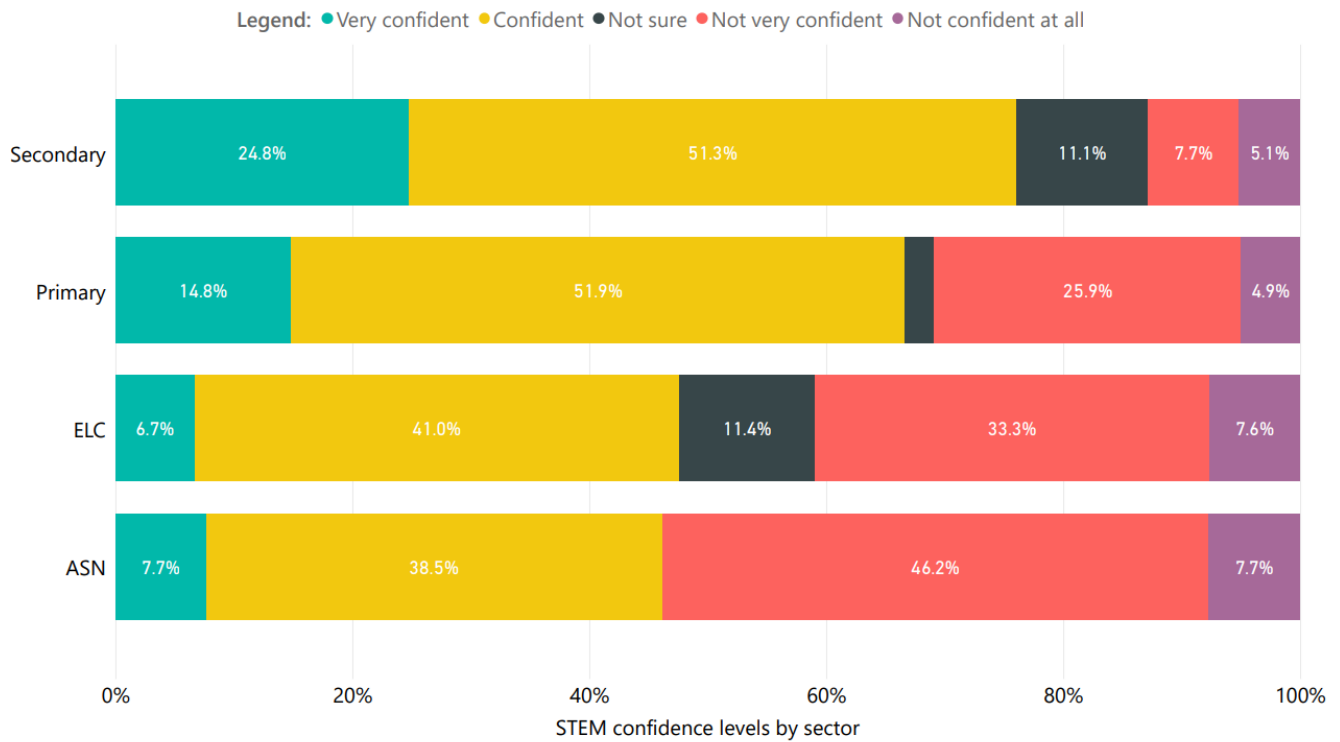
Figure 20. Practitioner confidence delivering STEM broken down by sector

Figure 20 shows that confidence delivering STEM was highest amongst secondary teachers with 76.1% of respondents stating they were 'confident' or 'very confident'. Confidence delivering STEM was lowest in the ASN sector with more than half of respondents stating they were 'not very confident' or 'not confident at all'.

In the 2020/21 survey, practitioners were also asked about their confidence in delivering learning in discrete aspects of STEM. Practitioners reported the highest level of confidence in the delivery of mathematics and numeracy with more than three-quarters of respondents 'agreeing' or 'strongly agreeing' with the statement "I felt confident in delivering mathematics and numeracy based learning in my practice." The aspect of STEM with the lowest overall confidence rating from practitioners was engineering with only 35.7% of respondents 'agreeing' or 'strongly agreeing' with the statement "I felt confident in delivering engineering based learning in my practice." The confidence levels for the remaining aspects are shown in Figure 21.

Confidence in delivering sciences — 69.8%

Confidence in delivering technologies — 59.5%

Confidence in delivering digital learning — 61.0%

Confidence in delivering engineering — 35.7%

Confidence in delivering mathematics and numeracy — 81.0%

Confidence in delivering gender balance, equity and equalities — 66.9%
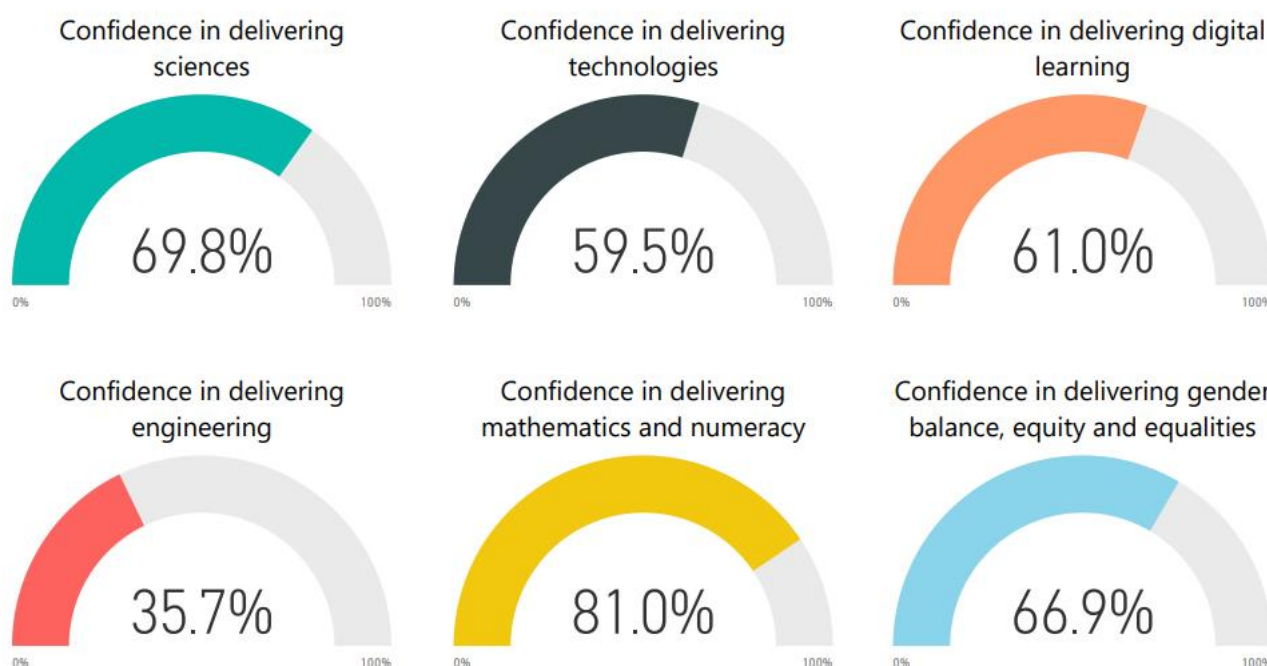
Figure 21. Overall practitioner confidence in delivering discrete aspects of STEM

In comparison, the confidence levels for the discrete aspects of STEM in 2018/19 were: Sciences (60.2%), Technologies (54.6%), Digital (53.7%), Engineering (31.0%), Numeracy and Mathematics (77.8%), Gender balance and equalities (60.2%).

The practitioner responses are further broken down by sector in Figure 22. This shows the number of respondents who 'agreed' or 'strongly agreed' with the statement "I felt confident in delivering [discrete aspect of STEM] based learning in my practice."
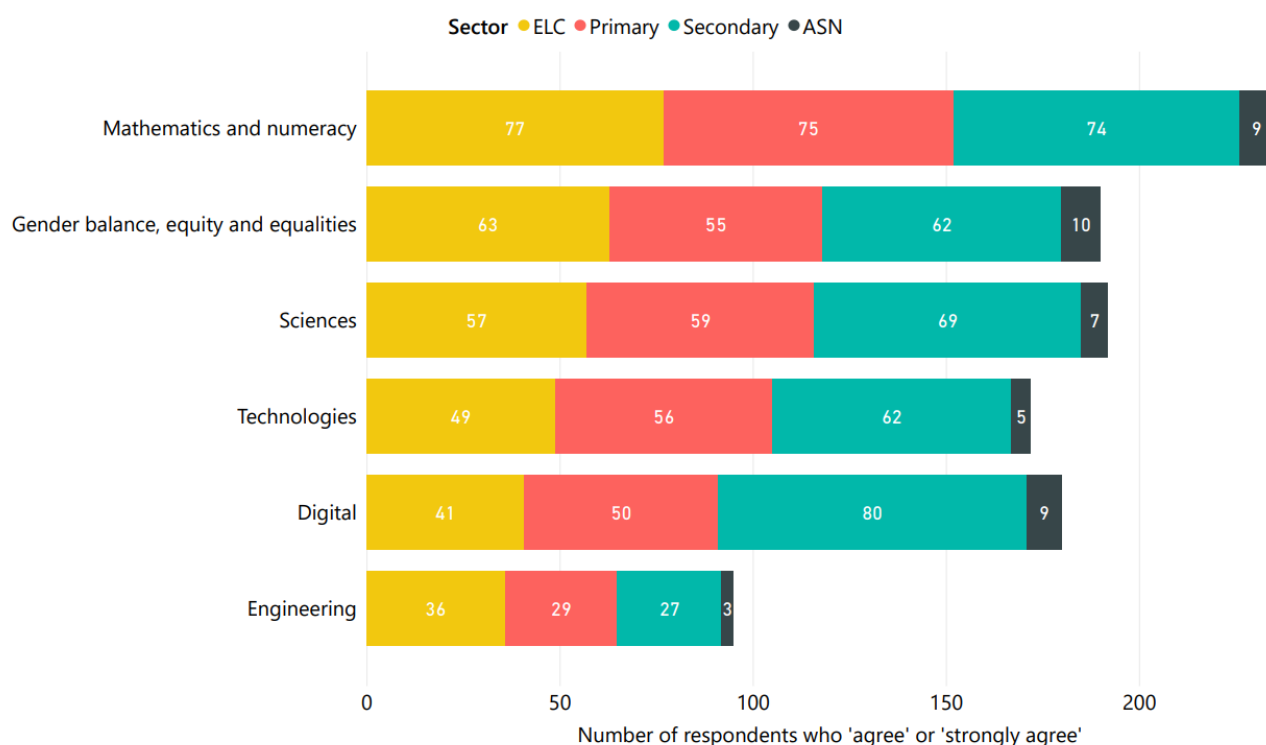
Figure 22. Practitioner confidence in delivering each aspect of STEM by sector

Practitioner confidence statements	Percentage who responded 'agree' or 'strongly agree' (Number/Total responses)			
	ELC	Primary	Secondary	ASN
I felt confident in delivering science based learning in my practice.	60.0% (57 / 95)	75.6% (59 / 78)	76.7% (69 / 90)	58.3% (7 / 12)
I felt confident in delivering technologies based learning in my practice.	51.0% (49 / 96)	72.7% (56 / 77)	60.2% (62 / 103)	38.5% (5 / 13)
I felt confident in delivering digital based learning in my practice.	42.7% (41 / 96)	66.7% (50 / 75)	72.1% (80 / 111)	69.2% (9 / 13)
I felt confident in delivering engineering based learning in my practice.	37.9% (36 / 95)	38.7% (29 / 75)	32.5% (27 / 83)	23.1% (3 / 13)
I felt confident in delivering mathematics and numeracy based learning in my practice.	81.1% (77 / 95)	94.9% (75 / 79)	71.8% (74 / 103)	69.2% (9 / 13)
I felt confident in addressing gender balance, equity and equalities in my practice.	67.7% (63 / 93)	74.3% (55 / 74)	59.6% (62 / 104)	76.9% (10 / 13)
Overall number of survey responses	102	80	115	13

Table 9. Practitioner confidence levels in each aspect of STEM by sector

Note. The respondents from the secondary sector were from a range of different subject specialisms. This should be considered when reviewing the responses in Table 9. For example, a secondary mathematics teacher may express a high level of confidence delivering mathematics and numeracy but a lower level of confidence delivering other curriculum areas. Some practitioners chose not to respond to every statement therefore the totals for each aspect are inconsistent. Care should be taken when drawing comparisons between the responses from the ASN sector and other sectors due to the relatively lower number of responses from that sector.

Key points when considering the responses by sector:

- Confidence levels in mathematics and numeracy were high in the ELC, primary and secondary sectors.
- Confidence levels in engineering were consistently low across all sectors.
- ASN practitioners reported the highest level of confidence in addressing gender balance, equity and equalities.

Education Scotland response

Academic year 2020/21 marked the fourth year of implementation of the STEM Education and Training Strategy. During this period Education Scotland continued to put in place the key national infrastructure and resources required to address the priorities and needs identified by practitioners in relation to STEM. In addition, Education Scotland's Regional Teams put very significant support in place to support practitioners during the COVID-19 pandemic. This included an extensive programme of online professional learning to build the digital skills of practitioners and the collation of many thousands of classroom resources to support remote learning. These resources are now available through the National e-Learning Offer.

Enhancing Professional Learning in STEM Grants Programme

Education Scotland awarded a total of £430,000 of STEM professional learning grants in financial year 2021/22, supporting 84 projects in Round 3. This funding was aligned to the priorities and findings from the previous STEM annual practitioner surveys. Since the grants programme started in 2018, over £4 million has been awarded to 248 projects. An estimated 58,161 practitioners have benefitted from the three funding rounds which have run to date. More information about the grants being supported is available from the STEM summary page on the National Improvement Hub.

Education Scotland Regional Teams

Throughout this period, Education Scotland's Improving Gender Balance and Equalities (IGBE), Numeracy & Mathematics, Digital/Technologies and Community Learning and Development teams contributed to the provision of STEM professional learning on a local, regional and national basis.

Education Scotland's Regional STEM Officers have engaged widely with Regional Improvement Collaboratives and local authorities to identify and support the STEM professional learning needs of practitioners. Between 1 August 2019 and 23 March 2022 the Education Scotland STEM team undertook 2115 direct engagements reaching 922 distinct establishments and 10,632 attendees. In total this amounted to over 2900 hours spent on engagements. This activity represented a wide range of engagements including delivering professional learning, providing professional advice and supporting policy and strategy developments.

When the COVID pandemic struck in March 2020, Education Scotland adapted quickly to meet the local, regional and national needs of stakeholders at that time, with all support moving to an online delivery format. This increased the reach and scale of delivery with positive feedback from practitioners in more remote and rural areas. Included in the engagements noted above, 4,847 practitioners and stakeholders attended the 77 online webinar sessions led by the STEM team from the start of COVID lockdown (March 2020). Professional learning was provided on a range of themes to support the immediate priorities of practitioners during lockdown. This included directing them to valuable resources to support remote learning and also subject support for the SQA Alternative Certification Model.

Education Scotland's STEM Team has also now developed an interactive STEM resources directory spreadsheet to help settings access the right STEM support. See Education Scotland's STEM Nation Online Resource to access this directory: https://blogs.glowscotland.org.uk/glowblogs/stemnation/stem-resources/

Similarly, Education Scotland's Improving Gender Balance and Equalities Team has supported 866 sessions since January 2019 which have reached 9422 practitioners in 1156 distinct establishments. In addition to supporting the Education Scotland STEM professional learning programmes and providing bespoke support and advice to STEM grantees, the Improving Gender Balance & Equalities (IGBE) team launched a new IGBE self-evaluation framework.

Furthermore, the IGBE team has worked collaboratively with SSERC to develop and deliver a suite of resources for both STEM Ambassadors and the Young STEM Leaders Programme. A suite of six complimentary sessions for STEM Ambassadors, has been co-developed with SSERC colleagues and delivered by the IGBE team. A train the trainer programme is now underway to enable SSERC colleagues to continue the delivery of these sessions. A set of modules with a focus on gender stereotypes and unconscious bias has been co-created for the Young STEM Leaders Award.

RAiSE Programme

The Raising Aspirations in Science Education (RAiSE) programme aims to build the capacity of practitioners, particularly in primary school settings, to deliver inspiring and engaging learning in science and STEM. The programme is led by Education Scotland and funded by The Wood Foundation, Scottish Government and participating local authorities. The programme was established in 2016 and is now being extended nationally, following its successful pilot. The local authorities that are participating, or have participated, in the programme to date include:

- Angus Council
- City of Edinburgh Council
- Clackmannanshire Council
- Comhairle Nan Eilean Siar
- Dumfries and Galloway Council
- Falkirk Council
- Fife Council
- Glasgow City Council
- Moray Council
- North Ayrshire Council
- North Lanarkshire Council
- Orkney Islands Council
- Renfrewshire Council
- South Ayrshire Council
- South Lanarkshire Council
- The Highland Council
- West Dunbartonshire Council
- West Lothian Council

Local authorities participating in the RAiSE Programme, are provided with co-funding to support the recruitment of a Primary Science Development Officer (PSDO). These officers coordinate and lead professional learning in science and STEM across authority establishments. Since it was established in 2016, the RAiSE Programme has reached 19,372 practitioners through 1675 professional learning sessions. This has resulted in over 57,500 cumulative hours of professional learning being provided.

RAiSE Officers also collaborated to produce a comprehensive [Science Planning Resource](#) and [context planners](#) which are freely available to all nationally.

More information about the RAiSE programme can be found on the [National Improvement Hub](#).

National e-Learning Offer

Education Scotland's STEM Officers provided critical support for the development of all three aspects of the [National e-Learning Offer (NeLO)](#) including collaborating with West Online

School to support the development of recorded lessons and direct delivery of e-Sgoil live lessons. STEM Officers also led developments on the supported resources within NeLO, drawing inspiration from its sciences network to grow it into an extensive bank of online resources to support the STEM curriculum.

In response to requests from practitioners, Education Scotland's STEM team worked with a wide range of partners to film videos of practical science experiments. Since the start of COVID lockdown, over 240 videos have now been produced. See our STEM Nation Online Resource to access all these videos: https://blogs.glowscotland.org.uk/glowblogs/stemnation/stem-resources/

STEM Networks

Education Scotland has continued to lead and support a number of local, regional and national STEM networks. These provide practitioners and local authority STEM leads with opportunities to share practice, collaborate and learn together.

National practitioner networks were launched to support STEM exploration and learning in early learning and childcare settings, develop STEM pedagogy in primary schools and support ASN settings. Furthermore, Education Scotland's Secondary Sciences Network of 600 science teachers has collectively shaped a programme of professional learning relating to STEM curriculum development and broadening pathways.

Education Scotland has also re-established the local authority STEM Leads Network and STEM Partners Network to ensure those with a responsibility for strategic leadership in STEM within local authorities and Regional Improvement Collaboratives have the opportunity to connect, share practice, collaborate and inform national developments.

STEM Nation Award

From 2022, ELC, ASN, school and community learning and development (CLD) settings are invited to apply for the STEM Nation Award in recognition of innovative and inclusive STEM practice. The award programme provides a framework to help evaluate existing practice, identify areas of strength and development needs and create an action plan for continued improvement in STEM. The award contains five elements which can be worked towards over a period of three years: Leadership in STEM; STEM family learning; Employability and STEM partnership working; STEM curriculum and learner pathways; and Equity and equality in STEM. Education Scotland's Regional STEM Education Officers will provide ongoing support to those settings interested in working towards and applying for the STEM Nation Award. Visit our STEM Nation Online Resource to find out more about the new award programme: https://blogs.glowscotland.org.uk/glowblogs/stemnation/stem-nation-award/

Engaging with partners

In recognition of the significant disruption to education and the pressures on educators to adapt to remote teaching during the national lockdown, the 2019/20 Professional Learning in STEM surveys were not issued. However, a number of STEM professional learning providers were still able to share very useful data as part of the 2019/20 Annual STEM Provider Data Gathering exercise.

The provider data report featured 105 responses from 82 unique providers. This included returns from settings and organisations in receipt of Enhancing Professional Learning in STEM grant funding from Education Scotland. The provider data covered the period from 1 August

2019 to 31 July 2020 and provided a useful snapshot of the provision of STEM professional learning throughout the academic year leading up to and including the pandemic.

The survey findings have been used by Education Scotland to help shape the national professional learning offer, including the projects supported through the third round of the Enhancing Professional Learning in STEM Grants Programme. A wide range of partner organisations have also used the survey findings to help them align their professional learning programmes and strategies to the needs of practitioners.

Appendix: Survey questions

2020/21 survey questions for ELC, primary, secondary and ASN practitioners
Which sector do you work in?
What is your role?
Please tell us more about your work pattern. (Which of the following best describes your work pattern)
Which local authority do you work in?
Please tell us the full postcode of your school/setting.
Which subject do you teach? If you teach more than one curricular area then please select main curricular area.
Did STEM feature in your school or setting improvement plan in academic year 2020-21?
Did STEM feature in your associated school group/cluster improvement plan in academic year 2020-21?
Did your school or setting engage with Education Scotland's STEM Self-evaluation and Improvement Framework in academic year 2020-21?
Did your setting have a STEM co-ordinator/s in academic year 2020-21?
Did your setting or organisation have a STEM partner, or partners, from the private, public, or third sector in academic year 2020-21?
How did you find out about these STEM partner organisations?
Approximately how many hours of professional learning in STEM did you complete between 01 August 2020 and 31 July 2021?
Was this more or fewer hours than the same period last academic year: i.e. from 01 August 2019 to 31 July 2020?
Has your setting/organisation received any Education Scotland STEM grant funding between 2018 and 2020?
Please tell us more about the types of professional learning in STEM that you accessed between 01 August 2020 to 31 July 2021.
Which, if any, of the following organisations provided you with professional learning support between 01 August 2020 to 31 July 2021?
How easy was it for you to access professional learning in STEM in academic year 2020-21?
What, in your opinion, were the barriers (if any) to you accessing professional learning in STEM in academic year 2020-21?
What are your STEM professional learning priorities for this academic year (01 August 2021 - 31 July 2022)?
Overall, how confident did you feel in delivering STEM in academic year 2020 - 2021?
To what extent do you agree with the following statements with regard to your STEM practice between 01 August 2020 to 31 July 2021?

Education Scotland

Denholm House

Almondvale Business Park

Almondvale Way

Livingston EH54 6GA

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