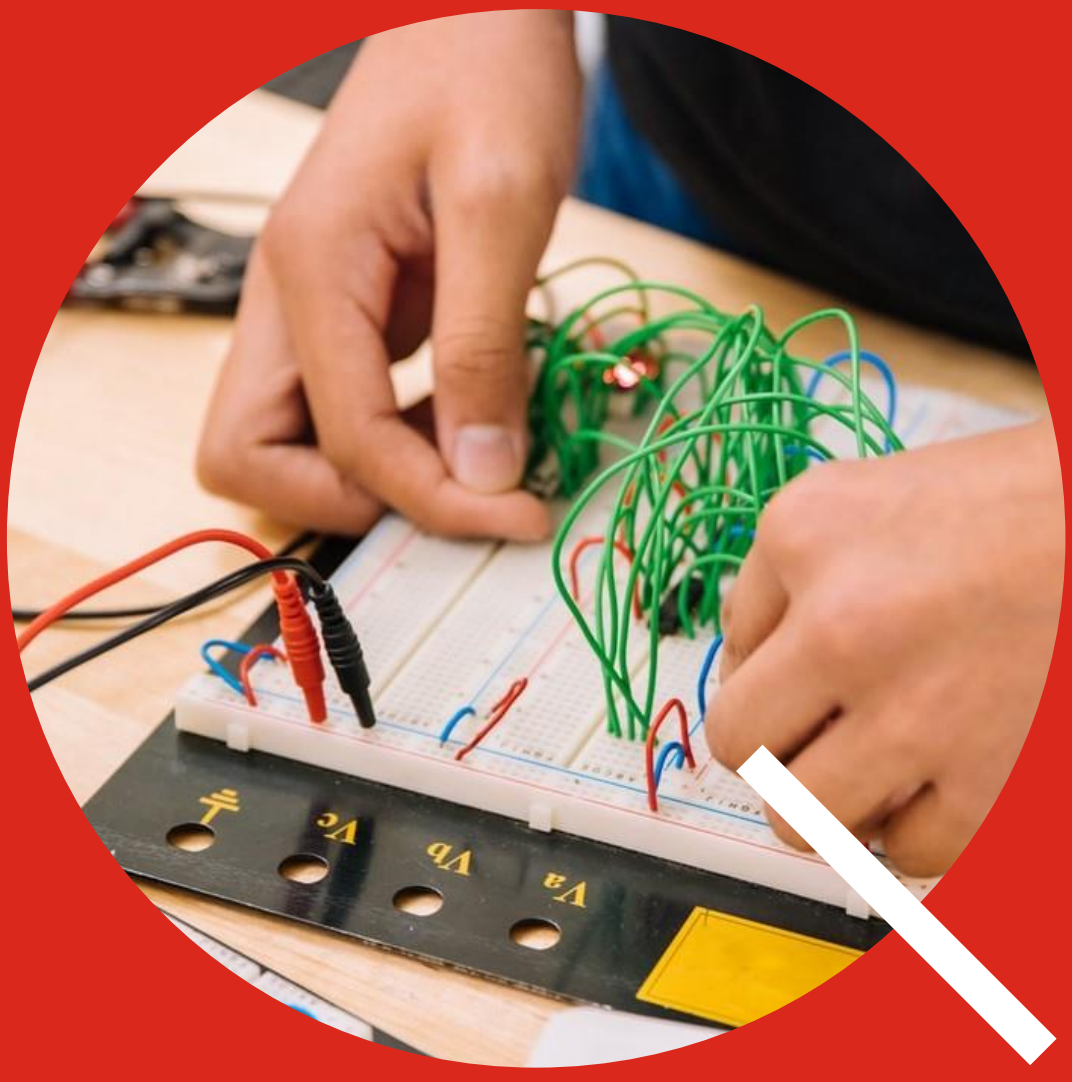
April 2022

STEM Ambassador Programme Review

A report for UKRI



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Contents

Report summary i
1. Introduction 1
2. Performance data 4
3. Programme infrastructure 13
4. Programme delivery and performance 22
5. Conclusions 31
6. Future programme options 37

Annex A: Data profile of the STEM Ambassador programme A-1
Annex B: STEM Ambassador KPIs B-1
Annex C: Locality based case studies C-1
Annex D: Case studies of international practice D-1

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Report summary

Introduction

1. UK Research and Innovation's (UKRI) STEM Ambassador programme aims to provide engaging informal learning opportunities to young people of all backgrounds to support their understanding of STEM and encourage them to consider whether STEM could be 'for them'. The programme is managed by STEM Learning. It links STEM employers and people working in STEM jobs who act as role models by sharing their knowledge and career stories with young people in schools, colleges and non-school organisations, including youth and community groups. Ambassadors are volunteers who come from a range of STEM and STEM-related businesses and backgrounds. They are connected to young people via activity organisers some of whom are education-based (including Careers Leaders, teachers, tutors and employer liaison staff), while others run voluntary and community youth groups.

2. In summer 2021 UKRI commissioned a review of the STEM Ambassador programme. The purpose of the review was to improve understanding around the overall effectiveness of the programme against its aims and objectives, how the programme has impacted policy, process and activity within the STEM engagement sector, and the effectiveness of the governance and management of the programme at local and national levels.

3. Data collection for the review comprised four key components:

   - Document and data review: annual reports to UKRI, samples of quarterly reports from all Hubs and other research documents were reviewed. An iterative process of interrogation of STEM Learning's dashboard data also informed the review
   - Interviews with key national stakeholders, the STEM Learning team, and Hub leads (five discussion groups were held with 18 participants from 16 of 17 Hubs)
   - Four locality-based case studies focussing on the organisation, delivery and impact of the STEM Ambassador programme in areas selected to explore a range of different contexts
   - Case studies of other volunteer programmes that deliver similar objectives to the STEM Ambassador programme in the UK and USA.

Performance

4. The STEM Ambassador programme delivers at scale across the UK, and has done so for a number of years. From 2016 to 2021, it is estimated that STEM Ambassadors delivered over 181k activities, engaging between 15.2m – 25.7m young people. Between 2016 and 2021, 143k STEM Ambassadors have been 'registered' to the programme, 38% of whom (54k) were 'active' at some point in this period (meaning they volunteered and delivered at least one activity). Since the Covid-19 pandemic activity has changed. The programme supported Ambassadors to transfer their formerly face-to-face activities to a digital environment, but

even with this change overall activity reduced as education providers re-focussed their priorities.

5. Data about STEM Ambassador activity is held in a data dashboard. It is managed by staff at STEM Learning and was introduced from 2018 to provide a digital platform to connect activity organisers and STEM Ambassadors. The dashboard is used by all Hubs and Ambassadors and has real time functionality to enable self-serve activity. It also provides reporting capabilities. The design of the data system however limits how the data can be used to manage performance. It is better at capturing self-reported STEM Ambassadors activity, compared with assessing to what extent organisations and young people engage with the programme, and whether needs are met. The system would benefit from an overhaul to ensure it caters to Hub needs and focuses on data that can inform decision making.

6. Dashboard data is designed to track Ambassador activity. This showed that, since 2017, the number of registered and active Ambassadors was declining but, more importantly, the number of hours being volunteered increased up to 2019/20, after which time the effects of the pandemic were observed in lower numbers of both.

7. Ambassadors are a diverse group with higher proportions of females than are in the STEM workforce and with most being under 40 years of age. The ethnic backgrounds of Ambassadors reflects the wider population and the STEM workforce, but not the ethnic profile of younger age cohorts. In general, the availability of Ambassadors is seen as sufficient to meet needs, but some issues were reported due to particular local circumstances.

8. The STEM Ambassador programme has national targets for reach into schools and colleges. While activity and reach were increasing pre-Covid-19, these targets have not been reached since 2018. The target for secondary schools is much higher, at 80% of all schools, but in the last three years performance has not exceeded 70%. The primary school target is lower, at 26%, reflecting that the programme was initially focussed in secondaries and that there are many more primaries. Performance here is much closer to target, just a couple of percentage points adrift. While the targets set are as a percentage of schools in a Hub area, the number of primary schools reached by the programme exceeds the number of secondary schools.

9. 15% of all schools in each Hub area are listed as Priority Schools. Lists are compiled using Department for Education assessments of need which are then reviewed and finalised through discussion between each Hub and STEM Learning. There is an expectation that Hubs will achieve at least one STEM Ambassador engagement in 95% of Priority Schools. In 2020/21, 1,066 STEM Ambassadors delivered activities in 1,319 Priority Schools representing 54% of Priority Schools of all types - although pre-Covid-19 this was at 76% in 2018/19.

Programme infrastructure

10. The STEM Ambassador programme is one of many that seeks to connect young people with engaging insights into science, mediated through a volunteer workforce. In this crowded

landscape the STEM Ambassador programme is reported to have high brand awareness. Stakeholders considered it to be well-known as a large national programme that was free to access and focussed on helping schools to engage their students with STEM study and STEM careers.

11. A national programme, with robust national infrastructure, helps to reduce duplication and inefficiency by connecting with other national programmes. It also creates efficiencies as tools and resources can be shared and STEM Ambassador training can be delivered at scale. IT systems that capture and handle data also bring added value.

12. The progamme is delivered by a network of 17 Hubs that vary in scale and experience. The Hubs are often managed and run by people who are very well connected with schools, colleges, employers and local skills infrastructures in their areas. This network of local, personal relationships means that they can align their programmes with local projects and priorities.

13. The Hubs did however report that the resources available to them through the STEM Ambassador programme were stretched. Over time expectations have changed with requirements introduced to implement new approaches, innovation and wider engagement, alongside delivery of the core programme. Financial resources have been fixed through this period.

14. In performance terms, the Review was not able to determine any relationship between the size of a Hub, number of schools and colleges covered, and its performance. This relationship is doubtless complicated by many other factors including data limitations, the time that the Hub and its staff have been in place, and local socio-economic contexts.

Performance management

15. The programme has a range of mechanisms to manage performance. These include monitoring activity through the digital platform, setting and reviewing action plans, and a regional reporting structure in England (with Regional Network Leads), with Hubs directly reporting to STEM Learning in Northern Ireland, Scotland and Wales.

16. There are two sets of KPIs linked to contracted delivery. These relate to number of volunteer hours and satisfaction with the programme expressed by activity organisers and STEM Ambassadors. The KPIs themselves do not cover the range of aims and objectives of the STEM Ambassador programme and the review heard a widely held view that they needed to be revised to better reflect the achievements of the programme.

17. The reporting systems used between Hubs and STEM Learning, and then between STEM Learning and UKRI require extensive written reports. However, despite the effort that clearly goes in to assembling these reports, the review was struck by: key lessons, risks and priorities becoming lost in the volume of paperwork; a lack of consistency in reporting with numerical achievement of KPIs or RAG assessments not then being explained or discussed in reports;

and similarly differences between the effectiveness and quality of provision between Hubs was not covered in standard reports to UKRI.

Programme activity and impact

18. The STEM Ambassador programme impacts upon young people's science knowledge and skills in a range of different ways. Four activity categories account for over 60% of all activities reported, these are 'Hands on practicals', 'STEM careers talks and / or advice ', 'Mentoring or support', and 'Support an exhibition or event'. Most of this activity is done in educational settings (86% of all Ambassador time), and mostly in secondary schools.

19. There is a different mix of activities in Priority Schools. Compared to the most common activities delivered in all settings, 'Hands on practicals' are no longer present in the top five most common activities in Priority Schools. Conversely, 'Mentoring' and 'Professional development of educators' are notably more common in Priority Schools.

20. The review found that the Priority Schools label was developed to highlight schools which were associated with disadvantage either due to lower participation in STEM subjects or lower attainment. The title 'Priority School' reflected the DfE criteria for schools that were an educational priority. The STEM Ambassador programme does not appear to be systematically prioritising these schools with enhanced, more intensive, or more tailored STEM activities (the key metric is simply for an Ambassador to engage with a Priority School at least once in a year). The programme should consider further prioritising and focusing on these schools with targeted strategies and interventions.

21. Hubs collect and capture satisfaction as reported by both Ambassadors and activity organisers. Activity organisers provide scores against a set of criteria that included enjoyment and satisfaction with the intervention, its contribution to learning objectives and achievement of links with the wider community. Education based activity organisers rated the quality of their experience with the STEM Ambassador programme highly. Across all measures, feedback was on average rated at least 4 out of 5.

22. That said, evaluation of the impact of the programme on young people is recognised as very challenging and has not been fully realised. Challenges are associated with resourcing data collection (e.g. staff time needed to take registers or distribute and collect feedback surveys), and with attribution (because young people's choices are affected by a very wide range of factors in which the STEM Ambassador programme plays a modest role). A STEM Learning evaluation tool to capture young people's immediate feedback is used and reported in Hub reports occasionally, but this is not typical. This area requires further consideration around what is important to measure and achievable at reasonable cost.

23. The Covid-19 pandemic has clearly impacted on the programme, with a reduction in the demand for STEM Ambassador time, as schools have closed and faced wider challenges; and a shift to online delivery. Digital delivery is likely to remain and will provide some advantages around accessibility. However, there was also an expectation of moving substantial amounts

of STEM Ambassador activity back to more traditional delivery methods largely based on demand from schools.

Future progamme options

24. There is no current written rationale informing the shape and strategic priorities for the progamme. Earlier rationale that focussed on the need to develop a pipeline of STEM skills to serve the economy and society may still be valid but do not necessarily align with the breadth of UKRIs vision for the programme. The rationale for the programme needs to be reviewed and re-stated to provide the context for its strategic direction.

25. The STEM Ambassador programme's broad universal aims are understood by its stakeholders to be a combination of careers information and science inspiration. UKRI have developed a set of 15 aims and objectives that shape their grant agreement with STEM Learning. One of these 15 is to use feedback to inform the evaluation and apply learning to improve future activities. The evaluation framework used by STEM Learning is based on a framework developed for BEIS that uses a somewhat different set of aims for the programme. STEM Ambassador programme aims should be consistently and clearly communicated by key stakeholders to ensure a consistent focus on achieving its purpose.

26. The review considered two options for how the programme might be reframed to emphasise either the aim to increase young peoples' engagement with STEM subjects, or the aim to raise awareness amongst young people of the wide range of careers opened up to them by studying STEM at school. The programme could choose to continue to deliver both aims, but with a segmented and differentiated offer. It suggested that each of these aims would be achieved by a different (complementary) set of actions. These could be reframed as a named project delivered by the STEM Ambassador programme. Different actions taken with different partners (alongside STEM Ambassadors) would lead to achievement of each aim. The review recommended that UKRI discuss the progamme rationale and aims with other stakeholders from both the STEM engagement community and the career guidance community.

Operational recommendations

27. The Review concluded with a set of recommendations to inform operational management of the programme:

- Review communications and feedback mechanisms to create communication loops between UKRI, STEM Learning and Hubs.
- Review whether demand for STEM Ambassador activity fits the supply of STEM Ambassadors by geography, Ambassador characteristics and scale.
- Encourage engagement with other national and local networks to connect skills and careers stakeholders at both national and local level.

- Maintain the number of Hubs to provide stability but commit to a review once programme rationale and aims have been resolved.
- Create named or 'branded' STEM Ambassador packages of activity that can be trialled, reviewed, marketed and scaled up to create a set of options that schools and colleges can engage with and subsequently tailor.
- Recognise the resource implications of additional activities, and if necessary, scale back some actions to introduce new activities.
- Expand the use of impactful sustained interventions.
- Focus on Priority Schools by investigating the experiences of Priority Schools, with a view to developing an offer tailored to their needs.
- Review KPIs to ensure they reflect the broad aims and objectives of the programme, while maintaining the broader set of performance measures that are reported for programme progress monitoring.
- Rationalise reporting arrangements so that each KPI is given a statistical measure, progress towards strategic priorities are RAG rated and any written narrative is aligned to these.
- Adapt data capture systems so that reports drawn from it provide insight into a wider range of key strategic priorities including number and type of schools that have multiple or regular engagements with the programme.
- Improve data quality through provision of advice for those inputting data followed by regular data cleaning.

1. Introduction

The STEM Ambassador Programme

1.1 The STEM Ambassador programme aims to provide engaging informal learning opportunities to young people of all backgrounds to support their understanding of STEM and encourage them to consider whether STEM could be 'for them'. The programme particularly aims to increase engagement of STEM in those from disadvantaged backgrounds. The programme links STEM employers and people working in STEM roles and STEM-related jobs and backgrounds who act as role models by sharing their knowledge and career stories with young people in schools, colleges and non-school organisations, including youth and community groups. The programme provides a network of support for the Ambassadors and employers, and a communication system with teachers, tutors and group leaders to ensure that interactions are safe, effective and productive.

1.2 The Programme operates across the UK and is funded by UK Research and Innovation (UKRI). It is well established with overall management delivered by STEM Learning Ltd who work with a network of 17 regional Hub organisations who provide local support to stakeholders and create new opportunities for interactions[1]. STEM Ambassadors are required to register on a digital platform via a portal where they can give information about themselves, the type of interaction they would be willing to do and their location. The same portal is used to make requests for support and search for appropriate Ambassadors by activity organisers, some of whom are education-based (including Careers Leaders, teachers, tutors and employer liaison staff), while others run voluntary and community youth groups.

1.3 Ambassadors are volunteers who come from a range of STEM and STEM-related businesses and backgrounds. They cover all ages, background and experience levels. They offer support to a range of activities including running STEM Clubs, giving career talks, contributing to CREST, various competitions, and delivering hands-on practical sessions in classrooms or at events.

Background to the Review

1.4 The STEM Ambassador programme has been running since 2002. Government funding for the programme moved from the Department for Business, Energy and Industrial Strategy (BEIS) and its predecessors to UKRI in 2019. Initially run by an organisation called STEMNET, the grant was then transferred to STEM Learning Ltd in 2016. Since moving to UKRI, the grant for STEM learning to deliver the programme has been extended annually.

[1] There were 17 Hubs at the time of the Review. However, it uses historical data when there were three Hubs covering Scotland rather than the single Hub that is now in place. A map of Hubs can be accessed here: https://www.stem.org.uk/stem-ambassadors/local-stem-ambassador-hubs

1.5 In summer 2021 UKRI commissioned a review of the STEM Ambassador programme. The purpose of the review was to improve understanding around the overall effectiveness of the programme against its aims and objectives, how the programme has impacted policy, process and activity within the STEM engagement sector, and the effectiveness of the governance and management of the programme at local and national levels. The findings of the review will inform UKRI's strategic planning for the programme in the context of their wider public engagement work.

Methodology

1.6 An initial scoping phase was undertaken to frame the review. The scoping phase was informed by interviews and small group discussions with teams at UKRI and STEM Learning, semi-structured interviews with key national stakeholders, and an initial scan of key data and documents. A long list of potential case studies was also created during this phase through a combination of nomination by interviewees and web searches.

1.7 The scoping phase concluded by establishing a set of investigation questions, and an approach to data collection which comprised four key components:

- Document and data review: working with STEM Learning, the evaluation team undertook an iterative process to interrogate dashboard data. This explored information captured on the system since 2018 and was supplemented by review of quarterly reports which provided a record of activity at regular time intervals. Working papers were prepared and shared with STEM Learning to ensure that data was being correctly interpreted and reported (Annex A provides a summary of this data analysis).

- Interviews with the STEM Learning team and Hub leads (five discussion groups were held with 18 participants from 16 Hubs). These explored different elements of the research questions from the perspectives of the contracting and delivery teams

- Four locality-based case studies focussing on the organisation, delivery and impact of the STEM Ambassador programme in those areas. In each locality at least one individual from each of five different groups was interviewed (Hub teams, schools, informal clients, employers, stakeholders). STEM Ambassadors were not included in the selection as work was being undertaken with Ambassadors by STEM Learning, although some of those we spoke with were, or had been, Ambassadors in previous roles. Annex C provides a summary of partnership activity in each locality, local priority and delivery issues and the effects of Covid-19.

- Case studies of other volunteer programmes that also sought to deliver similar objectives to the STEM Ambassador programme using volunteer contributions in the UK and the USA. These were based on a combination of interviews with the leader or manager from case study organisations alongside a review of websites and other written documentation. Annex D provides a written summary of each that have been fact-checked by the relevant interviewee.

1.8 Initial findings from the review were shared with senior managers at UKRI at an interim findings workshop. Discussions then informed the final review report and report summary.

Report structure

1.9 This report presents an overview of the thematic findings of the review process. Further information about the sources of evidence used are presented in the Annexes. The review concludes by presenting different strategic options for UKRI to consider. The structure of the report is as follows:

- Section Two presents a statistical overview of the performance of the STEM Ambassador programme to highlight what is known about its scope and scale and identify key data gaps
- Section Three describes the operational characteristics of the programme, the national infrastructure used by STEM Learning, the strengths and drawbacks of the Hub model and the effect that the Covid-19 pandemic and the associated disturbance to the educational system and community groups that affected the programme
- Section Four reviews the lessons about delivery and performance management from the perspective of different localities across the UK and other forms of volunteering programmes
- Section Five provides a series of conclusions drawn from evidence presented in the report
- Section Six then presents an overview of the strategic aims of the national programme and the options for future designs of the programme

Acknowledgements

1.10 The review has been an important reflection process for UKRI and its delivery partners. The research team have benefitted from the time and thoughtful insights offered by many people at a time when the effects of the Covid-19 were continuing to present practical and emotional challenges to many. We would particularly like to thank:

- The oversight team at UKRI for their guidance and reflections as the work developed
- Members of the national STEM Learning team and Hub regional teams who shared their data and reflective insights openly and in detail
- Stakeholders in wider STEM engagement networks including strategic stakeholders, managers of other volunteer programmes and local teachers, Ambassadors, managers and support teams who generously shared their experiences and expertise.

2. Performance data

2.1 The review sought to understand the scale and range of the STEM Ambassador programme, the extent to which it was delivering against its targets and how quality was monitored and reported. The data which is used to assess these aspects is derived from STEM Learning's data dashboard. This section reviews this data before presenting key findings from the data supplied by STEM Learning and then analysed by SQW.

The digital platform

2.2 Data about STEM Ambassador activity is held in a data dashboard which is managed by staff at STEM Learning. It was introduced from 2018 to provide a digital platform to connect activity organisers and STEM Ambassadors. The dashboard is used by all Hubs and Ambassadors and has real time functionality to enable some self-serve activity. It also provides reporting capabilities. Data to the platform is provided by STEM Ambassadors and activity organisers. The latter can be schoolteachers, college tutors, careers leads in educational establishments, and leaders of community groups such as scouts and guides. It includes both STEM Ambassador registration data and activity data. The data collection system has been adopted by all Hubs and is known and used by STEM Ambassadors.

2.3 Satisfaction data is also generated and held within this data set. Before any activity, both the STEM Ambassador and the activity organiser are asked to respond to a list of options to describe what they hope to achieve from the activity. When it is complete, both are asked to rate the extent to which the activity delivered against these expected achievements.

2.4 The data team at STEM Learning manage the digital platform. They work with an external provider who designed and periodically maintains and makes changes to the system. Each Hub and selected others have access to the data so that they can draw down reports of activity and consider progress against targets.

Data quality

2.5 The data is used both operationally in real time (matching STEM Ambassador with activity organiser requests) and for monitoring and reporting purposes at key dates. Consequently, dashboard data cannot be used to provide year by year accounts of progress as it is constantly being updated and refreshed. This can only come from annual reports that report summaries of data at key points.

2.6 The review found that stakeholders appreciated the need for a centralised data collection system and were able to work with it, but there were some aspects of the system that they found troublesome.

2.7 The platform relies on volunteers logging in, recording their activity accurately, completely and in good time. It was reported that there were often delays between activity and activity-

reporting. This is exacerbated as Ambassadors are required to do this for every session (for example if they were running a weekly STEM Club they should be recording this every week). There is no robust way of checking whether what has been delivered has been recorded. Therefore, reports of activity might under-represent reality and often suffer from a time lag. One manager estimated that the difference between activity reported at year-end compared with three months later could be around 10% of all activity. Similarly, there may be an element of bias as it uses self-reported assessments of impact and quality.

2.8 Reporting 'active' and 'registered' Ambassadors is not straightforward. Once an Ambassador registers they need to provide evidence of their Disclosure and Barring Service (DBS) check. DBS checks do not expire, but rather they are a record of a person's status at a specified date. For good practice, STEM Learning request these checks are renewed every three years. This DBS date provides a time-point when the Ambassadors become potentially active. If they record delivering an activity after this date then they can be considered to be an 'Active' Ambassador (as opposed to someone who registered but then did not engage in any volunteering activity). If at any point over the lifetime of the dashboard (c. five years) they have delivered an activity then they are reported as an 'active' Ambassador. Further analysis was undertaken for the review by the STEM Learning data team to provide an assessment of the number currently active (defined as active within two years of their DBS registration).

2.9 Data is designed around individual Ambassador inputs. This reflects the early aims of the programme which were about galvanising and harnessing the volunteer workforce to ensure national coverage of the programme at scale. It is less reliable when used to explore issues of demand (were all requests for activity provided for?), sustained interventions (do Ambassadors deliver a programme of interventions or 'one-off' talks or events), sustained relationships with activity organisers (which schools and colleges use the Ambassador programme regularly and intensively?).

2.10 Key data is missing. The numbers of young people reached through the programme is difficult to report with any accuracy, as are their characteristics. Data is reported by Ambassadors and activity organisers. If they are asked to give a careers talk to a small group of Year 12 students they are likely to be able to record the number accurately. However, this becomes more problematic if they are giving a talk to an Assembly, participating in a careers fair or skills event, or running a webinar with different class groups simultaneously. In addition, if they work with the same group more than once they would be counted repeatedly (giving a count of total interactions with young people than numbers of unique young people who had experienced at least one interaction). Finally, they cannot capture and report equality and diversity characteristics of the young people in a way that is both appropriate and robust. The review was therefore not able to access estimates of the numbers of young people reached.

2.11 The application of GDPR makes data sharing with key employers difficult. Employer engagement is important to the programme and some employers like to manage their engagement with the programme and need to know which employees have been volunteering at what level. Unless they have over 25 employees and a data sharing agreement in place this

information is not made available to them. Hub teams suggested that the need for a data sharing agreement creates a barrier to effective relationship building with some larger employers because of reluctance and perceived time barriers to engage with GDPR processes.

2.12 Not all Hubs rely solely on the digital platform for their own customer relationship management information. Several Hubs said that they found the dashboard to be too difficult and too risky for them to use as the sole record of their networks. Some also delivered other programmes and needed to maintain a system for other parts of their business. They therefore maintained separate Customer Relationship Management (CRM) systems of their own Ambassadors and contacts in schools and colleges (which often change frequently).

2.13 Trend data needs careful interpretation. As the programme has developed the way that data is captured has also changed. For example, the digital platform was introduced in 2018 which meant all Ambassadors needed to re-register and this may have contributed to an observable fall in the number of registrations at that time due to the removal of STEM Ambassadors who were no longer actively engaged with the progamme.

Disruption due to Covid-19

2.14 The effect of the Covid-19 pandemic was felt most intensely on delivery in the summer term of 2020 when the first national lockdowns were implemented and schools, colleges and youth and community groups were managing the challenges of moving to online teaching amongst examination uncertainty. The period between summer 2020 and autumn 2021 (when the review's fieldwork took place) was characterised by a series of localised lockdowns, national lockdowns (with different timing and rules in Northern Ireland, Scotland and Wales) and continued use of social distancing and safety protocols when educational establishments were open.

2.15 These had both immediate and extended impacts on the STEM Ambassador programme. A lot of enhancement and enrichment activity takes place in the summer term. Consequently, the national lockdown from March 2020 coincided with a period when work experiences, collapsed timetable days and other STEM Ambassador activity would usually be very intensive. This at a time when Ambassadors themselves would be dealing with stresses in their own employment. This had an inevitable negative effect on STEM Ambassador activity. In the longer-term schools continued to discourage visitors unless necessary and trips were either cancelled or modest in scale and scope. The national lockdowns had a dampening effect of STEM Ambassador activity which has yet to recover to pre-pandemic levels in spite of a range of mitigation measures pub in place (this is discussed in more detail in Section 4). The data findings below need to be reviewed in this context.

Data findings

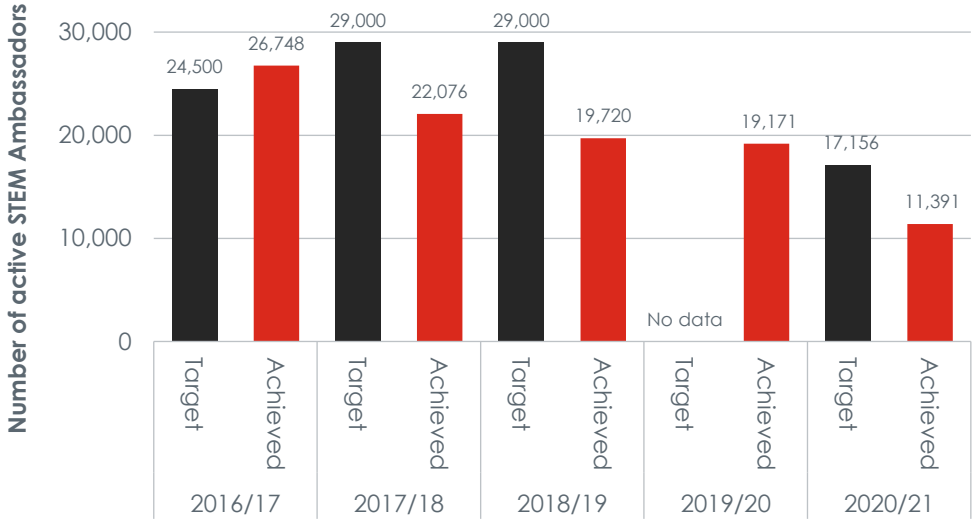
2.16 Analysis of the dashboard data for the review shows activity information by region and across the full five-year period from 2016 to 2021. This period includes two significant factors that

need to be considered in their interpretation, the first as mentioned above is Covid-19 and the second is the introduction of the digital platform which saw a period of data cleaning as Ambassadors were requried to re-register. This section provides a summary of more detailed analysis presented in Annex A.

STEM Ambassador numbers and characteristics

2.17 Figure 2-1 presents information about the targets set and achieved for the number of active STEM Ambassadors. This data is drawn from annual reports which used Hub reports prior to the digital dashboard being implemented and snapshot excerpts from digital platform data from 2018 onwards. Data collection methods have changed over this period and consequently may not be completely comparable. Nevertheless, numbers of active Ambassadors have been falling slightly since 2017/18. During this period targets have not been achieved for 3 out of the 4 years in which targets were set.

Figure 2-1: Number of active STEM Ambassadors 2016/17 – 2020/21



Source: SQW analysis of STEM Learning annual monitoring reports
The target was not included in 2019/20 contract, but it was reintroduced in 2020/21

2.18 The characteristics profile of STEM Ambassadors shows that they are a reasonably diverse group:

- Most active STEM Ambassadors are male (55%) with 45% female. As a proportion of the population this is not balanced, however as a proportion of women in the STEM workforce (24%[2]) this indicates that the STEM Ambassador programme successfully recruits females in STEM-related occupations
- The most common ethnicity of active STEM Ambassadors was 'White' (84%), followed by 'Indian' (4%), 'Black African', 'Mixed' and 'Chinese' (all 2%). 1% did not specify their

[2] See WISE analysis of Annual Population Survey statistics
https://www.wisecampaign.org.uk/statistics/updated-workforce-statistics-to-september-2020/

ethnic group, and the remaining 5% were spread between other non-white ethnic groups. This composition broadly reflects that of the whole population of England and Wales which has 85% of population identifying their ethnicity as White, with 3% Indian and 2% Black African for example[3]. It also reflects the higher proportion of Indian workers in STEM roles than in other sectors. People of other ethnic minorities tend to be under-represented in STEM[4].

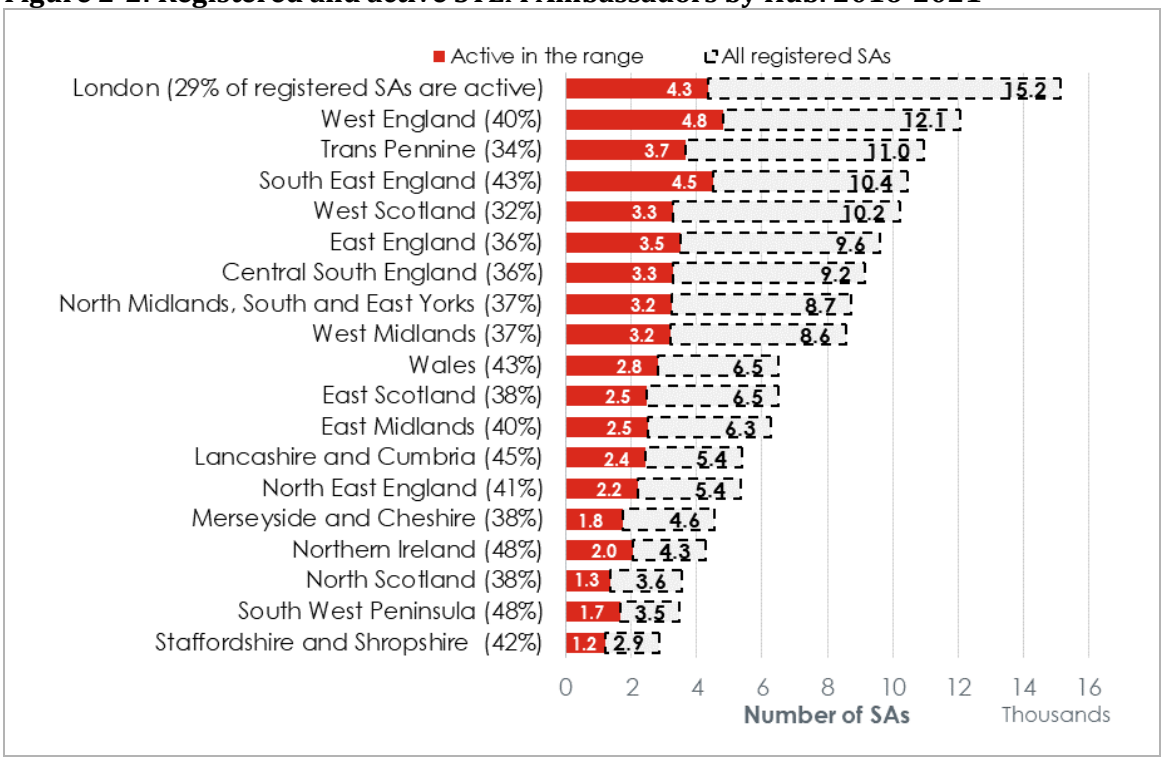
- Approximately two thirds of STEM Ambassadors are below 40 years old, one third are older than 40 years. This reflects a desire to encourage younger Ambassadors who might be able to connect better with young people than older Ambassadors.
- The proportion of STEM Ambassadors with a disability is not recorded and neither is their educational backgrounds
- 74% of active STEM Ambassadors are in full time employment, 13% are students, 4% in part-time employment, followed by apprentices, self-employed or retired (all 2% each). The final 3% were unemployed or classed as 'other'.

2.19 It is important to collect and review data describing the characteristics of STEM Ambassadors to ensure that this is a volunteer activity that is open to all and that volunteer training and development activities are inclusive and achieve participation from all groups. It is also important to note that young people should see that STEM is for everyone and therefore it is helpful for them to see diversity among the STEM Ambassadors who engage with their school, college or community setting. The progamme can engage in positive action to ensure that schools and colleges are able to connect with a range of Ambassadors who reflect the backgrounds and characteristics of their communities.

2.20 Annual reports do not show Hub level data. Digital platform data was used to explore activity at Hub level of the same period. It should be noted that Hubs cover different types of areas and numbers of schools, with the mean number of Ambassadors per Hub being 2.8k (Figure 2-2). This showed that between 2016 and 2021, 143k STEM Ambassadors were classed as 'registered', 38% of whom (54k) were 'active' at some point in this period.

[3] Office for National Statistics (2019) Population estimates by ethnic group and religion, England and Wales.
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/populationestimatesbyethnicgroupandreligionenglandandwales/2019
[4] APPG on Diversity and Inclusion in STEM (2020) The State of the Sector: Diversity and representation in STEM industries in the UK.
https://www.britishscienceassociation.org/Handlers/Download.ashx?IDMF=d7899dce-22d5-4880-bbcf-669c0c35bda6

Figure 2-2: Registered and active STEM Ambassadors by Hub. 2016-2021



Source: SQW analysis of STEM Learning data

STEM Ambassador activity

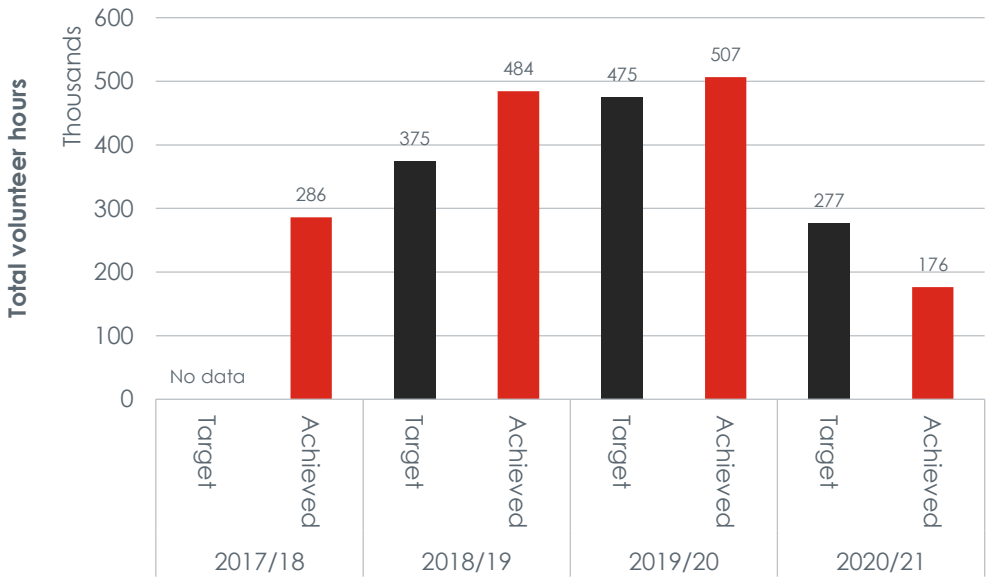
2.21 From 2016 to 2021, it is estimated that STEM Ambassadors delivered over 181k activities, engaging between 15.2m – 25.7m young people[5].

2.22 The number of hours volunteered by STEM Ambassadors over the period from 2017/18 to 2019/20 increased year on year. It is possible that the earlier totals reported prior to the digital dashboard under-reported actual hours as it would have been a more time-consuming task to collate this information. The drop in the number of hours reported in 2020/21 would reflect the effects of the lockdowns which were imposed at the start of the pandemic. This is despite a fall in the number of active Ambassadors suggesting that in year years preceding the pandemic fewer Ambassadors were delivering more hours.

2.23 The number of Ambassadors and hours reported varied a lot by Hub. On average, an active STEM Ambassador delivered 42 hours of volunteering time over the five-year period. Those Hubs with fewer STEM Ambassador's saw a higher average number of volunteering hours.

[5] Both estimates remove activities recorded to have 0 participants, whilst the lower end of the range excludes all activities with greater than 1k participants, and the higher end excludes all activities with greater than 10k. These adjustments were made because the data on participants is recorded prior to activities being delivered often resulting in either null or over-estimated participant values, as STEM Ambassadors are unable to predict attendance.

Figure 2-3: Delivery of targets relating to volunteer hours 2016/17 – 2021/22



Source: SQW analysis of STEM Learning annual monitoring reports

Engagement with schools and colleges

2.24 The STEM Ambassador programme has targets setting the proportion of schools and colleges in each Hub area that the programme is expected to reach. These targets are provided in Table 2-1 alongside their achievement over the past three years. Data in this table is drawn from annual monitoring reports regarding the reach of the programme. Reach is achieved through showing at least one STEM Ambassador activity taking place in the organisation each year. The table shows the effect of the pandemic on activity as the percentage of organisations reached is below target for each category. The exception is the proportion of hours volunteered in non-school settings which increased as informal organisations were looking for activities that they could safely and legally offer. Examples would be scout and guide organisation groups offering activities via Zoom in lieu of more traditional physical activities.

2.25 Since 2018-19 the number of schools and other organisations being reached has been increasing. The targets for reach into schools and colleges have not been fully achieved within this period.

2.26 The Ambassador programme has a lower target for the number of primary schools to be reached. In 20/21, the programme reached 23% of all primary schools compared with 59% of all secondary schools. However, it should be noted that there are significantly more primary schools than secondary schools. Therefore, the programme has engaged numerically

with more primary schools than secondary schools (23% of all primary schools = 3,862; 59% of all secondary schools = 2,040)[6]..

Table 2-1: Targets and actuals reported reach of STEM Ambassador programme

	Target	Actual % reached			
	% of organisations	2018-19	2019-20*	2020-21	Priority schools 2020-21
Primary	26	19	25	23	30
Secondary	80	60	70	59	73
College	70	61	63	61	n/a
Non-school **			71	85	

Source: STEM Learnng digital platform.
** target calculation based on 20-21 targets, but these were adjusted (downwards) in Sept 20 to reflect effect of Covid-19. This column may therefore overstate the actual targets.*
***For non-school settings the table shows targets set for the proportion of volunteer hours as the number of organisations or groups is unknown.*

2.27 One way in which the programme has sought to identify disadvantaged young people in schools is using the Department for Education's[7]. criteria for identifying schools that need additional support. Lists drawn against these criteria are then reviewed and amended through discussion between each Hub and STEM Learning. For example, schools that are graded Ofsted 4 and therefore need special measures are often excluded from these lists as their attentions are focussed on different priorities. Each Hub has a STEM Ambassador Priority School list that contains 15% of the total number of schools in that region, and progress is monitored against the expectation that there will be at least one STEM Ambassador engagement in 95% of Priority Schools.

2.28 Data on STEM Ambassador Priority Schools was centralised from 2020/21. Before that time each Hub maintained their own list and reported against that list. Priority schools were allocated an identifier in the dashboard data from 2020/21 and reporting could therefore be centralised. Table 2-1 shows that across the UK a lot of Priority Schools remain disengaged. Across all school types 54% of Priority Schools were reached in 2020/21 – although this was at 76% in 2018/19, with at least some of this decline likely due to Covid-19. The programme reaches a higher proportion of Priority Secondary Schools than Primary Schools.

2.29 Hub performance in reaching Priority Schools varied considerably:

- Engagement rates across all Hubs ranged from 34% to 74%

[6] DfE school census data reports there are 16,791 state funded primary schools, 3,458 state funded secondary schools and 1,005 state funded special schools in England in 2020/21. https://explore-education-statistics.service.gov.uk/find-statistics/school-pupils-and-their-characteristics
[7] They are identified as Science Learning Partnership Priority Schools (those with the lowest value-added score in England at Ofsted Grade 3 or above), proportion of students per cohort entered for Triple Science, National Centre for Computing Education (NCCE) national Priority Schools then Tier 3 and Tier 2 (combined with high FSM if needed).

- Engagement rates for primaries ranged from 11% to 67%, and the median was 27%
- Engagement rates for secondaries ranged from 56% to 96%, and the median was 73%.

Summary

- The review found that stakeholders appreciated the need for a centralised data collection system and were able to work with it, but there were some aspects of the system that they found troublesome. Data is designed around individual Ambassador inputs which provides counts of activity and a self-reported measure of satisfaction. The data design is less effective at reporting programmes of activity or, demand and supply by school, college or community organisation types, nor reach and repeat used across young people
- The number of active Ambassadors has been falling slightly since 2017/18 and the targets set for the number of Ambassadors is usually missed. The characteristics profile of STEM Ambassadors shows that they are a reasonably diverse group.
- The number of hours volunteered by STEM Ambassadors over the period from 2017/18 to 2019/20 increased year on year.
- The STEM Ambassador programme has targets setting the proportion of schools and colleges in each Hub area that the programme is expected to reach. Since 2018-19 the number of schools and other organisations being reached has been increasing. The targets for reach into schools and colleges have not been fully achieved within this period.
- Every Hub has a list of Priority Primary and Secondary Schools and colleges in their area. Across all school types 54% of Priority Schools were reached in 2020/21 – although this was at 76% in 2018/19, with at least some of this decline likely due to Covid-19.

3. Programme infrastructure

3.1 The STEM Ambassador programme is a national programme that spans all the UK and encourages participation from across all the STEM sectors. A national programme requires a robust infrastructure to direct, manage and deliver activity. The review was asked to explore whether structures offered strong and effective oversight, challenge and direction and how effective the infrastructure was at engaging with regional employers and schools. This section describes the infrastructure and how the national and Hub operating activities work to build partnerships with key stakeholders including regional employers.

The national infrastructure

3.2 The STEM Ambassador programme is funded by UKRI. Previously the programme was funded by the Department for Energy, Business and Industrial Strategy (BEIS) and its predecessors. Responsibility for the programme moved from BEIS to UKRI in 2019. The overall funding for the UK programme has remained the same (£5million per year) since that point.

3.3 The programme is delivered by STEM Learning based in York. They are the largest provider of STEM education and careers support in the UK. Supported by and working with Government, learned bodies, charitable trusts and employers, STEM Learning's organisational mission is to raise young people's engagement and achievement in STEM subjects. They run professional development courses for STEM teachers at the National STEM Learning Centre, maintain educational networks, share resources (via a resource bank for teachers and STEM Ambassadors) and run a range of other programmes (e.g. ENTHUSE, the STEM Learning Quality Mark, Aspire to STEM) alongside the STEM Ambassador programme. Most recently they established the National Centre for Computing Education delivered on behalf of the Department for Education[8].

3.4 Interviews with stakeholders during the scoping phase of the review suggested that the STEM Ambassadors programme had achieved very high 'brand awareness' among the STEM engagement community and beyond.

3.5 STEM Learning sub-contracts regional delivery of the STEM Ambassadors programme to 17 Hubs based across the UK; one each in Scotland, Wales and Northern Ireland and the rest across England. The value of these sub-contracts varies between years but is c.£2.7million across all Hubs. Organisations running the regional Hubs represent a diverse group by:

- Organisation type - including careers companies, science museums, private enterprises, higher education institutions and charitable organisations (including former Education Business Partnerships)

[8] STEM Learning Limited (2019) Annual report and financial statements for the year ended 31 July 2019.

- Scale - with the smallest covering three Local Authority areas through to one covering all of Scotland
- Length of experience of working with STEM Ambassadors or similar education and employer liaison - ranging from one to over 23 years.

3.6 STEM Learning manage the programme's national infrastructure including:

- Grant management including performance of regional hubs and quarterly reporting of progress against objectives to UKRI
- Development and maintenance of resources including the national digital platform, STEM Ambassador recruitment resources, mandatory centralised training and DBS checks for all new Ambassadors, and resources for Ambassadors to use
- Regional Network Leads who maintain links with Hubs to connect them with each other and with other STEM Learning programmes operating in their region. These are the people whom Hubs have most contact with. In Scotland, Wales, Northern Ireland liaison is directly with STEM Learning
- Regular communication from the centre to raise awareness of other opportunities being created nationally either by the STEM Learning or through association with other national partners
- Organising the national STEM Inspiration Awards with categories including 'Outstanding STEM Ambassador', and 'Inspirational STEM Employer'.

Fit with the wider STEM engagement sector

3.7 Stakeholders recognised the value of the programme to co-ordinate and standardise aspects of typical Ambassador activity. They recognised the value of having a single place to connect schools and colleges with Ambassadors, the fact that they have all been DBS checked and that they have had a standard induction programme. There was high 'brand recognition' with the STEM Ambassador programme being known as a large national programme that was free to access and focussed on helping schools to engage their students with STEM study and STEM careers.

3.8 However, they also noted that the STEM Ambassador programme was not the only such programme available to schools and colleges. There are numerous providers with multiple offers being marketed at schools and colleges who may feel overwhelmed by the scale and complexity of the offer. In 2016 an audit reported there were over 600 organisations involved in the UK STEM Education landscape[9]. The landscape is occupied by various volunteering schemes that had a range of different aims including:

[9] Royal Academy of Engineering and Lloyd's Register Foundation (May 2016) The UK STEM Education Landscape. https://www.raeng.org.uk/publications/reports/uk-stem-education-landscape

- Promoting awareness of subjects (particularly engineering)
- Connecting schools with professionals who were willing to talk about their careers or support employability activities
- Supporting subject learning through curriculum enrichment.

3.9 Some of these are local or regional initiatives while others had a national reach and high volumes of activity. Annex D provides examples of programmes such as Inspiring the Future and Speakers in Schools. There is therefore a desire to provide an efficient national network of STEM partners that seeks to ensure lack of duplication and effort setting up new schemes where infrastructure already exists.

3.10 Local and neighbourhood connections were also important to schools and colleges. It was likely that education providers and local employers would connect anyway to some extent even without the STEM Ambassador programme through personal connections developed through parents, alumni and governors. However, organically driven networks work best in areas rich in oportunity, while some localities will have lower employment level, lower skills levels and few STEM industries and so would struggle to build this without external intervention.

3.11 Universities were a major source of STEM engagement and inspiration and most ran some forms of outreach within their catchment area (see Case Study Box for University College London). There could be some connections between the Ambassador programme and the academic community (either in terms of membership or use of resources) but it is likely that a lot of activity happens in this space outside of the Ambassador programme. Reliance on university outreach might nevertheless continue to miss some areas where higher proportions of young people than average do not progress to higher education[10].

Case Study – University College London 50:50 Engineering engagement programme

Based in the Faculty of Engineering Sciences, at University College London (UCL), the programme runs each year c. 130 engineering projects, events and activities with over 500 primary and secondary schools in London and the UK, and between 600-800 UCL staff and students designing and delivering their activity programmes.

[10] Areas have been mapped by the Higher Education Funding Council for England as 'cold spots' of higher education participation.

The programme aligns with organisational values, notably UCL's Equality, Diversity & Inclusion Strategy, which has helped to ensure senior buy-in, garner support for the programme and enable it to deliver at scale. The 50:50 Engineering Engagement programme has been able to create a step change in the representation of girls and young people from ethnic minorities, across UCL's STEM activities and events

See Annex D for further information

3.12 It is likely that there is a lot of STEM-focused education and employer interaction beyond the STEM Ambassador progamme. The digital dashboard could under-report activity as Ambassadors may report to other schemes instead, or, once relationship is made with an activity organiser activities may develop organically outside of the SA programme.

3.13 The existence of the STEM Ambassador programme may prevent duplication and proliferation of schemes as the review was told that some programmes run on the premise that STEM Ambassadors can help support delivery (and therefore they do not need to create their own volunteer management structures). The Ambassador programme facilitates some initiatives (for example STEM Ambassadors are used extensively in CREST Awards), and complements others (such as British Science Week).

Regional and local infrastructure

3.14 The Hub network comprises a range of different organisation types who are each responsible for a collection of local authority areas. The network's design is the product of commissioning decisions made in previous iterations of the programme, and subsequently adapted, rather than an overarching considered strategy.

3.15 The review considered whether the national programme required a regional or local presence. Discussion with Hub teams and locality-based case studies (Annex C) revealed the significant amount of work that is done at a local and regional level to connect people to the digital platform. Hubs spend a lot of their time working with local employers and schools to raise awareness of the programme and find ways that Ambassadors can help deliver what schools want and maintain effective communications with each. For example, one said that they would talk through with a teacher the type of activity an Ambassador might be able to contribute to and how to describe it on the platform. They might then also alert some Ambassadors to that opportunity to make sure the request was fulfilled.

3.16 The presence of the platform alone would not be sufficient to connect activity organisers with STEM Ambassadors. It was clear that some form of Hub model was required which had local and well connected individuals to speak with employers, Ambassadors, schools, colleges and community groups, to drive people to use the platform.

3.17 As some form of local presence helps drive programme activity the next question becomes which scale of Hub works most effectively? Hubs manage large populations of active Ambassadors (Figure 2-3 showed this ranged from 1,200 to 4,300 active ambassadors in each Hub area). The review found that there does not appear to be an optimal scale of operations with no pattern between the scale of target achievement and the size of the target.

3.18 The locality-based case studies (Annex C) demonstrated that Hubs operating at a town level, across sub-regions or even nationally can all drive the programme forward but will adapt and develop their delivery model in a way that suits the needs of their networks. Those networks each had different patterns of engagement with education providers, major employers, Careers Hubs (being developed as a collaboration between Local Enterprise Partnerships (LEPs) and the Careers and Enterprise Company), science parks and other STEM engagement programmes.

3.19 Hubs needed to be able to connect with actions and strategic plans being made locally (for example Skills and Enterprise Strategies). In this sense the geographic coverage of the Hub should be at a scale that connects with other local strategic networks. In England for example, these can be small scale such as Careers Hubs[11] which are groups of schools and colleges that work together with an Enterprise Adviser to improve how they prepare young people for their next steps. Networks might also develop around skills strategies as part of mayoral Combined Authorities. Scotland meanwhile has national skills and careers infrastructures, but also regional skills planning. In this case there is a reasonable rationale for more smaller local Hubs (in England) that align with local skills infrastructures than already exist.

Resourcing

3.20 Each Hub is contracted by STEM Learning to deliver a share of what has been agreed at a national level with UKRI. The contract comprises a set of priority actions alongside delivery targets. Targets that are agreed nationally are included in each Hub contract (for example each Hub will have a target for number of active Ambassadors and volunteer hours). The value of each Hub's contract is calculated simply on the proportion of schools and colleges that are located in a Hub area. For example, a Hub that has 8% of educational establishments will be allocated 8% of the £2.7million available to Hubs. This formula is simple and transparent but it does not recognise that some areas will have greater challenges than others, for example with a higher absolute levels of deprivation, fewer larger STEM employers or where proportionately fewer young people access higher education (the 'cold spot' areas).

[11] Careers Hubs are organised as partnerships between The Careers and Enterprise Company and institutions with a stake in local economic growth (Local Enterprise Partnerships, Local and Combined Authorities).

Hub perspectives of the value of programme infrastructure

The four case study localities reported aspects of the support that they valued as well as aspects they would like to see improve:

- Quality reputation. Perceptions of the programme reported in the case studies mentioned that the programme was national, well respected and well-known and insisted on DBS checks for all Ambassadors. They felt this therefore meant that it was seen as a quality programme among their key partners and stakeholders.
- Promotion across programmes. Some areas said that STEM Learning could raise awareness of the STEM Ambassador programme with teachers within their CPD activity. Some thought that the STEM Ambassador programme had a lower profile in STEM Learning's communication compared with teacher cpd
- Website resources. An employer said they used the website resources as the basis for their engagement but they adapted them to suit their needs as they found them too 'academic'.
- Being based in York. This was seen as a positive because so many other programmes and national networks are based in London. A northern base gives it greater credibility in some geographies.
- Managing Hubs across regions. The Hubs bring different organisational strengths, experiences and ways of working. In some areas the regional networking of Hub leaders and teams was thought to be really helpful because they can share experiences, practice and resources. This helped remove the feeling of being isolated. The arrangements are different in Northern Ireland, Scotland and Wales.
- Digital communication software. STEM Learning have provided an email communication tool that Hubs use which has functionality so they can see who has engaged with which communications. They can follow up or target further communication accordingly. This gives them valuable insight into key messages and reach.
- The STEM Learning digital platform. The platform was said by many people to be useful in principle but not as smooth to use as it should be. Changes to the platform were said to be useful incremental improvements although communication with Hubs about planned and imminent changes was said to be unreliable.

See Annex C for more information

3.21 All Hubs reported that the programme funding was not generous. In fact, some said that the delivery of the STEM Ambassador programme was a loss leader that they maintained because

the networks were invaluable to their ability to attract and deliver other contracts. Their ability to deliver the Ambassador programme appeared to relate to three key factors:

- Staffing structures that enable core staff dedicated to the STEM Ambassador programme alongside other staff whose work can complement the programme and who contribute through fractional posts or providing other forms of practical support (such as key contacts, promotion of new opportunities or organisational systems).
- Hub managers for example said they needed sufficient administrative resource to periodically telephone Ambassadors to maintain a positive relationship with them, check they were still happy to be engaged with the programme and maintain their CRM systems
- Being able to call upon other resources within their organisations to share ideas, contacts, activity planning or other symbiotic activity. For example, working with a Careers Hub provides an opportunity to connect with all Careers Leaders in their schools, or working with a higher education partner provides a pool of Ambassadors who might connect with Priority Schools as part of their outreach activity.

Local networks

3.22 Most of the Hubs, and indeed members of the national team, have worked around science communication, enrichment and enhancement for several years. Their enthusiasm and commitment to the work was evident from the focus groups and locality based case studies that were part of the review's evidence base (Annex C). Being known in an area was an important aspect of programme delivery as it facilitates connectivity between people and their organisations.

3.23 One of the dangers associated with the STEM Ambassador contract has been its temporary nature. An initial three year contract has subsequently been extended by individual years. This makes it difficult to plan future activity but it also makes organisations vulnerable to losing staff whose connections have taken years to develop.

3.24 Conversely it was noted that, in some regions there has been quite a lot of turnover with the Regional Network Leads which makes continuity of communication about contract matters difficult for Hubs.

Ambassador recruitment

3.25 Anecdotally it is clear that some STEM Ambassadors have been volunteering their time for many years and are part of an experienced reliable workforce that Hubs can rely on to work with particular schools, to support other new Ambassadors or to trial new approaches. Others may volunteer for a shorter period perhaps as part of their employment status (for example student Ambassadors), their role (being an Apprentice Ambassador for example), personal circumstances or changes in employer priority.

3.26 Ambassadors are motivated by a range of reasons to volunteer, but stakeholders frequently recounted their desire to 'give something back' to their community was a key motivator. Others included it being part of an employer's expectation, a desire for personal self-development and wanting to understand young people and the education system better (not least for recruitment purposes).

3.27 Most Hubs reported that, simply in terms of numbers, they generally had no major difficulties in recruiting Ambassadors. However there were difficulties sometimes in finding Ambassadors in places where there were few STEM industries, and in finding Ambassadors with the same characteristics of young people studying in local schools and colleges. Some stakeholders said that this went beyond having a diverse group of Ambassadors, to needing people who spoke the same way as young people in an area (because they grew up in that area), or who were not the 'high-flyers' who might alienate young people regardless of how they looked or talked. This suggests that recruiting Ambassadors from local, possibly, smaller businesses that use STEM skills could be helpful as it might pick up people who have found jobs close to where they were educated, as well as apprentices and younger people.

Case Study – Speakers for Schools: Inspiration Programme

Speakers for Schools run two progammes: talks from influential figures (Inspiration Programme) and work experience (The Experience Programme). In order to recruit volunteers, the programme taps into the networks and contacts of its founders, board members and other speakers. Word of mouth is an important element of the programme and has resulted in the recruitment of high-profile, influential volunteers.

Speakers for Schools ensures that volunteers are supported throughout their engagement with the programme as it helps to get the best from them and improve the quality of their talks in schools. They do this by pairing all volunteers with a relationship manager who manages, supports and briefs them before they deliver any talks in schools. They are asked to do just one talk a year.

See Annex D for further information

3.28 It was suggested that there might be mismatches between requests for activities in more challenging schools or deprived places that were not being met by Ambassadors. There was however no data to help ascertain how prevalent this was.

3.29 The programme's success therefore relies not just on having a large number of Ambassadors available to activity organisers, but having Ambassadors in the right places with the right backgrounds who can communicate effectively with young people through what they say and demonstration of their life stories. As such, in some cases matching activity organisers to the right Ambassadors becomes something that benefits from human intervention (using the

knowledge of the Hub progamme workers), rather than relying solely on the technical robustness of an online portal.

Summary

- The STEM Ambassador programme is funded by UKRI. Responsibility for the programme moved from BEIS 2019. The overall funding for the programme has remained the same (£5million per year) since that point.
- The programme is delivered by STEM Learning. STEM Learning sub-contracts regional delivery of the STEM Ambassadors programme to 17 Hubs based across the UK; one each in Scotland, Wales and Northern Ireland and the rest across England.
- There are numerous providers with multiple offers being marketed at schools and colleges.
- The STEM Ambassador has achieved very high 'brand awareness' among the STEM engagement community and beyond. The national infrastructure provides several advantages including sharing tools and resources, and in the training of Ambassadors at scale.
- The Hub network comprises a range of different organisation types who are each responsible for a collection of local authority areas.
- Discussion with Hub teams and locality-based case studies revealed the significant amount of work that is done at a local and regional level to connect people to the digital platform.
- Hubs manage large populations of active Ambassadors, ranging from 1,200 to 4,300 active ambassadors. The review found that there does not appear to be an optimal scale of operations with no pattern between the scale of target achievement and the size of the target.
- The value of each Hub's contract is calculated simply on the proportion of schools and colleges that are located in a Hub area. The Hubs all reported that the programme funding was tight, with some Hubs viewing it as a loss leader.
- Most Hubs reported that, simply in terms of numbers, they generally had no major difficulties in recruiting Ambassadors. However there were difficulties sometimes in finding Ambassadors in places where there were few STEM industries, and in finding Ambassadors with the same characteristics as local young people.

4. Programme delivery and performance

4.1 The review was asked to consider a range of issues regarding the delivery, performance and performance management of the STEM Ambassador programme. This included exploring how well it reaches underserved groups, how the programme impacts upon young people's science knowledge and skills, how well the operating model enables its participants to report on its successes and measure progress towards achieving its aims and ambitions and how it uses evaluation to assess performance.

Ambassador activity

4.2 The ways in which STEM Ambassadors engage and encourage young people are diverse. They focus on either career inspiration (talking about their own work and the paths they took to get to their current position in a careers-talk or mentoring a young person in their university application for example), or science engagement (running hands-on practical exercises, or a STEM Club, or providing real world context to support STEM learning, create excitement about science generally or improve knowledge of a curriculum topic). In many cases activities combine elements of both to challenge perceptions of what STEM is and who it is for.

4.3 Statistical data regarding the focus of activity is captured by the digital platform (See Annex A).

- Four activity categories account for over 60% of all activity delivered. Across all settings, these were 'Hands on practicals' (21% of all activities),' 'STEM careers talks and/or advice (13%), 'Mentoring or support' (9%) and 'Support an exhibition or event' (8%). Activity categories include an 'Other' category which accounts for 19% of all activities reported. If this data were cleaned the proportion fitting these four activity types could be higher.
- The majority of STEM Ambassadors delivery time (86%) was in educational settings, compared to non-educational (14%). For educational activities, the majority of were delivered in Secondary schools (62%), followed by Primary (30%) and Post-16 (8%).
- The most common activity in non-educational settings was 'Supporting an exhibition or event' (30%), which differed from educational settings. Otherwise, the most frequent activities in both settings were largely in line with the total share of activities delivered, outlined above.

4.4 Quarterly reports submitted by Hubs to STEM Learning recount the wide range of actions that the Ambassador programme is delivering as well as new projects or interventions that are being developed. There is innovation encouraged by STEM Learning and developed by the Hubs as many recounted new ways to run Ambassador activities that are developed each year. Hubs often collaborate with regional Science Learning Partnerships and various employer engagement networks on a range of campaigns or events such as the Science Museum - Summer of Space, an Education Authority's Youth Service Conference, the British Council's

Seismic Citizenship project and 'Girls Who Code' community partnerships[12]. Other examples of innovation may be driven by private sector partners who want to create their own engagement programmes such as 3M Young Innovators Competition or Pfizer's Science in a Box.

Priority schools

4.5 There are a set of named state primary and secondary schools in each Hub area that have been identified using Department for Education Priority Schools criteria and Hubs are expected to work in at least 95% of them every year (compared to the 80% measure for all schools).

4.6 National data regarding Priority School engagement is available from the platform from 2020/21. Across all Hubs, only one Priority Post-16 School was identified. Across 16 of the 19 Hubs, 2.5k Priority Schools were identified, and just over half (1.3k) were then reported as engaged. Of those identified, the majority (54%) were secondary schools, followed by primary schools (46%). A greater proportion of the identified Priority Secondary Schools were engaged (73% of all) compared to primary schools (30%).

4.7 In 2020/21 1,066 STEM Ambassadors delivered activities in 1,319 Priority Schools. The five most common activities in Priority Schools were 'Mentoring or support' (23% of all hours in Priority Schools) followed by 'Employability skills sessions' (16%), 'Other' (14%), 'STEM careers talks' (9%) and 'STEM presentation' (7%). The major differences here compared to the most common activities delivered in all settings is that 'Hands on practicals' are no longer present in the top five most common activities in Priority Schools (whereas this activity forms 21% of all activities in all settings). Also, 'Mentoring' and 'Professional development of educators' are notably more common in Priority Schools (only 9% and 1% of all activities in all settings respectively).

4.8 The review found apparently minimal discussion about Priority Schools: they were not discussed in Hub or national reports beyond reporting the monitoring data. Neither was there a sense that as Priority Schools, they should be experiencing enhanced or more intensive, or more tailored STEM activities.

Covid-19

4.9 The STEM Ambassador programme has had to respond to the changing circumstances created by Covid-19 mitigation measures. The effects of the March 2020 lockdown were sudden and substantial as all educational establishments closed at a time when many schools traditionally run collapsed timetable days when lessons are suspended to create a day which is devoted to careers work or other enrichment activity. Any in-person activity was cancelled. The effects of the March 2020 lockdowns and subsequent lockdowns and social distancing measures have continued over a more extended period through to the autumn term of 2021 as schools

[12] Examples drawn from Hub Q4 2018/19 quarterly reports.

and colleges have continued to operate mitigation measures that included limiting on-site visits.

4.10 During this period there has been change in school priorities (focussing on educational recovery) and reduced demand for in-person careers interventions and enhancement and enrichment activiites. The impact of this on the STEM Ambassador programme and its response have been reported as:

- A reduction in the demand for STEM Ambassador time, either due to events being cancelled, or because they moved online (e.g. lower numbers are needed for a webinar compared with skills event or a careers fair)
- A change in the way that Ambassadors delivered their work. The shift to online delivery created a need for different types of engagement and activities. Hands-on practicals for example that worked in person may not have had the same appeal when demonstrated online. New tools and products needed to be developed to achieve the same objectives but using different materials
- The number of new Ambassadors registering in 2020 was lower than in previous years and may reflect the uncertainties of this period
- Hubs reported that some Ambassadors were able to offer volunteering hours to reach schools and colleges digitally that were otherwise inaccessible to them, while other Ambassadors were not able or did not want to engage in digital delivery
- Programme managers sought to increase work in informal settings (for example offering activities to groups that met outdoors) to compensate for lost activities in educational settings
- Delivery teams suffered illness and disruption themselves during this period.

4.11 Some elements of the move to online delivery were helpful. Notably, team meetings became more efficient and sites that were remote, or interests that were specialised could be met using digital delivery that was not possible in person. It is likely that blended approaches to delivery will become part of the offer into the future, although the expectation was that there would a substantial return to face to face delivery of some activities in particular. Stakeholders suggested that this was especially true of primary schools where younger pupils respond better to in-person activities than those that require onlne interaction. Most of the respondents in the locality case studies were keen to return to face to face engagement as soon as possible, saying that this was the best and most impactful way to make an impression on a young person.

Performance management

4.12 Hubs are required to collect and report satisfaction with the STEM Ambassador programme as reported by both Ambassadors and Activity organisers. This is used as a quality indicator

and impact measure in performance management processes and included in contractual expectations (see Annex B). Activity organisers are asked to provide scores out of 5 against a set of criteria that included enjoyment and satisfaction with the intervention, its contribution to learning objectives and achievement of links with the wider community.

4.13 Education based activity organisers rate the quality of their experience with the STEM Ambassador programme highly. Across all measures, feedback was on average rated at least 4 out of 5.

4.14 Other aspects of performance management include delivery against a set of KPIs and other work packages. Hubs are expected to provide updates of progress against both in their reporting. The form of these reports has evolved over time and to reflect each year's agreed priorities. Hubs approach the reports differently and while the majority use extensive open prose, some report directly against the KPIs and objectives, some provided detailed graphs and charts and others reflected on key learning.

4.15 Hubs quarterly reports requires them to provide a RAG rating of the extent to which they were satisfied with progress against a set of seven work packages outlined in their business plans and their KPIs (see Annex Table B-1). Analysis of Hubs Q4 2018/19 reports show that only one Hub indicated a Red (high risk) assessment that they would not achieve their KPIs, eight suggested an 'Amber' rating and nine a 'Green' rating. Nevertheless, Hub self-assessments reported satisfactory performance against the seven work packages. This suggests that while there is satisfaction with the scale and effectiveness of delivery of work packages, their achievement will not necessarily result in achievement of the KPIs.

4.16 Hubs in England report to their respective Regional Network Lead, while Northern Ireland, Scotland and Wales report directly to STEM Learning. In Summer 2021, reporting moved from quarterly to monthly to facilitate better communication, practice sharing and risk mitigation. Assuming progress is being achieved and reported against the Hub Action Plan their grant is released. There is a working rule that 30% of the grant is allocated to KPI achievement and the remainder to reports of progress against other work packages. There were examples of very proactive and helpful communication between a Regional Network Lead and their Hub such as, regular Hub group meetings to share experiences and good practice, and offering responsive and pragmatic solutions to emerging issues.

4.17 Reporting arrangements are evolving to find ways to continually improve them. However, the review found that there were ways in which reporting did not fully meet the needs of all stakeholders.

- Hubs reported that ad hoc requests to supply additional information have become regular. They say that these can be difficult to resource at short notice. Hubs said that as they had agreed their Action Plan with STEM Learning they should only be expected to report against actions included in those plans.
- Reports using word formats are quite long and it can be difficult to draw out the key actions, risks and innovations. A recent iteration using a survey tool to collate reports had

so many open questions that Hub respondents answered with very short responses which were too brief to provide meaningful information. Generally, reports should include statistical evidence or RAG ratings against key criteria and be asked to provide evidence to substantiate or explain these numeric assessments.

- Hub reports reviewed by SQW included relatively little discussion around activities focused on Priority Schools. Similarly, there were few observations about recruitment to diversify the STEM Ambassador community. There was however notable detail in reports about engagement with partner programmes such as the CREST award, Big Bang, British Science Week, Careers/Skills Fairs, several Employer-led events, and LEP/Local Authority events.
- Hubs have been asked additionally to provide 'good news stories' as a way of focussing on interesting developments. This is good and interesting practice, but they do not appear to be used systematically at a national level (for example as potential for social media or communications campaigns). There were however examples of regional social media campaigns reported (for example using the Science and Industry Museum in the North East to deliver a social media campaign during British Science Week, promoting what Ambassadors love about their STEM careers, with a particular focus on women in STEM).

Key performance indicators

4.18 Hubs focus on the measurable aspects of their delivery that are captured in a series of KPIs. This is important for them as the KPIs form part of their contract with STEM Learning. Targets are set for KPIs. The data informing KPI reporting comes from the digital dashboard and Hubs spend time encouraging Ambassadors to make sure their records are complete. The core KPIs have remained consistent for at least five years and focus on two elements:

- Number of volunteer hours
- Satisfaction with the STEM Ambassador service reported through formal feedback mechanisms by STEM Ambassadors and by organisations hosting them.

4.19 In addition to KPIs, there is a wider set of indicators that have been used over the period to assess progress against action plans. These indicators are not associated with measurable targets noting that indicators treated as targets have changed over the period. Annex B maps the use of different indicators over the review period. They provide information about the number and characteristics of registered STEM Ambassadors, those who are active and the number of activities that have been delivered. Table 4-2 reproduces the KPIs provided in the Q4 report by STEM Learning to UKRI for 2019/20 to show the list of KPIs and performance indicators and provide a sense of scale.

Table 4-1: KPIs and performance indicators (target and achieved) 2019/20.

KPIs	2019/2020 (Target)	2019/2020 (Achieved)
Total volunteer hours	475,207	506,755
Volunteer hours aligned to schools/colleges	356,405	421,563
Volunteer hours aligned to non-school groups	118,802	85,192
Volunteer hours aligned to organisation-led programmes	-	-
% STEM Ambassadors reported activity as good/very good	95%	94%
% Organisations reported activity as good/very good	98%	94%
Feedback response rate - STEM Ambassador	28%	27%
Feedback response rate - Organisation	20%	29%
Monitoring data		**2019/2020 (Achieved)**
Registered STEM Ambassadors		51,666
Approved STEM Ambassadors		39,343
% BME		14.56%
% Female		44.65%
% Under 35		58.29%
Active STEM Ambassadors		19,171
Total STEM Ambassador activities		43,166
STEM Ambassador participation		52,434

Source: STEM Learning Q4 report 2019-20 to UKRI

4.20 Neither the KPIs nor the performance indicators align with all the programme aims. There is no KPI for the number of young people supported, activity duration, or the proportion of activity organiser requests that have been fulfilled. There may be technical difficulties associated with collecting these data. However, other gaps are harder to understand, such as the number of Priority Schools experience multiple or repeat activiites within a year.

4.21 The review found that most of those involved in managing and reporting STEM Ambassador achievements thought the KPIs needed to be changed because they were not necessarily measuring what is important. The ways in which they needed to be changed were not fully explored in the review research design. However, good practice suggests that KPIs should align with a programmes aims and objectives, be measurable in ways that are robust and reproducible, and be used to provide the context for learning about what is working and identifying challenges and risk mitigation measures for what isn't.

4.22 Year on year delivery may result in efficiencies but the limits of these efficiencies may have been reached. It was recognised that maintaining core programme delivery requires ongoing dedicated resource due to churn in the Ambassador cohort and in school and college teams. .

4.23 In addition to delivering KPIs, Hubs have also been tasked with developing activities that complement core delivery and add value to the STEM Ambassador programme. However, Hubs told the review that recently it felt like they were being asked to do more for the same contract value. For example, the creation and delivery of training for Ambassadors nationally (as a way to retain them and provide them with added value) is in addition to local onboarding training that takes place. They called this 'mission creep'. Hubs recognised the value and appropriateness of the new initiatives, but were dismayed that additional requests were not accompanied by recognition of resource implications.

STEM Ambassador evaluation

4.24 STEM Learning have explored ways to assess the effect of STEM Ambassador engagement on young people, educational partners, or Ambassadors themselves. This includes: a report commissioned from IFF Research by BEIS[13] which created an impact logic model; a review of case studies of STEM Ambassador practice in schools[14] and feedback from STEM Ambassadors themselves[15]. That report set out a number of costed options, which have been implemented in part as a series of discrete investigations.

4.25 In some cases, Hubs provide examples of initiatives that they (or partners) have evaluated. STEM Learning have provided an evaluation toolkit to support and guide partners' evaluation activities on a voluntary basis. There was only one reference made to use of the toolkit during the review's consultations. Hubs did encourage its use after its launch (2018) and found it used by some schools and STEM Ambassadors in some Hub areas.

4.26 In most cases satisfaction or impact evidence is derived from feedback from individual young people (indirectly via STEM Ambassadors or activity organisers), emails or comments from teachers and other opportunistic feedback capture. Organisational case studies were used in some reports but the extent to which they included relevant statistical data to gauge scale or measure of impact (such as before and after tests of knowledge or attitude) was very limited.

4.27 During consultations with stakeholders and managers the issue of impact evaluation was raised. The conceptual challenges of capturing impact are widely recognised. STEM Ambassador engagements are often brief and are just one of probably several careers or enrichment opportunities that young people will experience during their lives while they study secondary school. Identifying the effect of a programme of interventions is challenging let alone being able to draw lines of attribution to a specific intervention. There will be some individuals for whom a specific interaction is crucial to their subsequent decisions, but they are unlikely to be typical, and research approaches may find them elusive.

4.28 Practical challenges were also reported by Hubs who said that any evaluation evidence required the collaboration of activity organises, teachers or tutors to distribute survey tools,

[13] IFF Research (2019) STEM Ambassadors Evaluation Report. Produced for BEIS.
[14] STEM Learning (2021) The Impact of STEM Ambassadors: School and STEM Ambassador Perspectives
[15] STEM Learning (2020) STEM Ambassadors: Impact on Ambassadors and Educators

provide access to host discussions, and / or capture and record feedback from young people or colleagues and then report this in a way that is GDPR compliant. Hubs said that activity organisers, teachers or tutors simply did not have the time to engage in capturing young people's feedback.

4.29 Stakeholders referenced emerging research and other insights that suggested more impactful interventions are those that take place over an extended period. For example, a STEM Club, a mentoring relationship or a programme of engagement that featured several diverse interventions over a sustained period. The review sought to understand what proportion of either Ambassadors or recorded activities might fit this description. However, the digital platform does not record activities in a form that made this analysis possible. It was only possible to say whether Ambassadors, over the five year period, had delivered activities in different years.

Case Study – The Boys and Girls Club of Lansing and the University of Michigan: Get City

Research has been an integral part of the programme since its inception, as it was co-designed by the Boys and Girls Club of Lansing and the University of Michigan. The partnership came together as the University of Michigan had a regional science centre that wanted to engage their local community, while the club wanted to build connections with external organisations.

One distinctive element of the programme, alongside supporting youth is its focus on learning what works. Several research papers informed by the GET City programme have been published. The programme is constantly in a feedback cycle to understand and adapt activity. It has changed over time as it has responded to the research literature and the developing needs and interests of youths and their communities.

See Annex D for more information

4.30 It might be possible for future iterations of the programme to establish a set of small pilots among different Hubs to build the evidence base that sustained interventions or specific approaches are associated with more impactful results.

Summary

- Four activity categories account for over 60% of all activity delivered. Across all settings, these were 'Hands on practicals' (21% of all activities),' 'STEM careers talks and/or advice (13%), 'Mentoring or support' (9%) and 'Support an exhibition or event' (8%).
- The major differences for Priority Schools compared to the most common activities delivered in all settings is that 'Hands on practicals' are no longer present in the top five

most common activities in Priority Schools (whereas this activity forms 21% of all activities in all settings).

- The review found apparently few discussions about Priority Schools: beyond reporting the key statistics they were not discussed in Hub or national reports.
- In most cases satisfaction or impact evidence is derived from feedback from individual young people (indirectly via STEM Ambassadors or activity organisers), emails or comments from teachers and other opportunistic feedback capture. More systematic evaluation evidence was recognised as a shortcoming, but also very challenging to gather.
- Education based activity organisers rate the quality of their experience with the STEM Ambassador programme highly. Across all measures, feedback was on average rated at least 4 out of 5.
- Covid-19 led to a decline in overall activity and a shift to online delivery. The latter brought some advantages which it is hoped will be maintained although the expectation is of a move back to face-to-face delivery in line with perceived demand from schools.
- Hubs are expected to provide updates of progress against both in their reporting. The form of these reports has evolved over time and to reflect each year's agreed priorities.
- KPIs relating to number of volunteer hours and satisfaction with the STEM Ambassador programme have remained consistent over time. There was dissatisfaction expressed that the KPIs did not align with programme aims and objectives and needed to be reviewed and revised.
- The review found that there were ways in which reporting did not fully meet the needs of all stakeholders due to changing focus and formats, and long narratives which did not address key issues or shortfalls.

5. Conclusions

STEM Ambassador programme performance

Number of STEM Ambassadors

5.1 The STEM Ambassador programme delivers at scale across the UK, and has done so for a number of years. Between 2016 and 2021, 143k STEM Ambassadors were classed as 'registered', 38% of whom (54k) were 'active' at some point in this period. The programme had been increasing the number of schools and colleges it engaged with year on year reaching 70% of all state-funded secondary schools in 2019/20. Since the pandemic these numbers have fallen but nevertheless the programme continued to engage with young people by redesigning their offer to transfer activities to digital platforms. There was an expectation that schools would return to demanding more face-to-face engagement activities in due course, but at the time of the evaluation fieldwork most schools, colleges and activity organisers were practicing social distancing measures that included limiting visitors.

5.2 Ambassadors are a diverse group with higher proportions of females than are in the STEM workforce and with most being under 40 years of age. The ethnic backgrounds of Ambassadors reflects the wider population and the STEM workforce, but not the ethnic profile of younger age cohorts. In general, the availability of Ambassadors is seen as sufficient to meet needs, but some issues were reported in a) areas with low STEM activity, b) in remote areas that did not have coverage of sufficient STEM Ambassadors, and c) by activity providers who would like to have Ambassadors from their local area. This suggests an on-going need to target Ambassador recruitment to fill gaps and to diversify the Ambassador pool.

STEM Ambassador reach

5.3 The data showed that the number of registered and active Ambassadors was declining but, perhaps more importantly, the number of hours being volunteered increased up to 2019/20 after which time the effects of the pandemic were observed in lower numbers of both. The increase in activity that was observed is encouraging.

5.4 The STEM Ambassador programme also has national targets for reach into schools and colleges. While activity and reach were increasing pre-Covid, these targets have not been reached since 2018. The target for secondary schools is much higher, at 80% of all schools, but in the last three years performance has not exceeded 70%. The primary school target is much lower, at 26%, reflecting that the programme started in secondaries and that there are many more primaries. While the targets set are as a percentage of schools in a Hub area, the number of primary schools reached by the programme exceeds the number of secondary schools. Performance against primary school targets is much closer to target, just a couple of percentage points adrift.

5.5 The programme expects at least one STEM Ambassador engagement in 95% of Priority Schools (defined using a combination of Department for Education criteria). Priority schools are those that are in challenging areas or where achievement in science is less than it should be. The data shows that a lot of Priority Schools remain disengaged. Some Hubs reach a much higher proportion of their Priority Schools than others: the difference between the lowest and highest performing Hubs on this measure was 34% compared with 74%. In 2020/21, 1,066 STEM Ambassadors delivered activities in 1,319 Priority Schools, which represents 54% of Priority Schools of all school types - although pre-Covid-19 this was at 76% in 2018/19. Even this better figure suggests a performance shortfall of around one quarter.

5.6 In terms of satisfaction, education-based activity organisers rated the quality of their experience with the STEM Ambassador programme highly. Across all measures, feedback was on average rated at least 4 out of 5.

Programme oversight and delivery infrastructure

STEM Ambassador brand awareness

5.7 The STEM Ambassador programme is one of many that seeks to connect young people with engaging insights into science mediated through a volunteer workforce. There are hundreds of other programmes and projects that schools, colleges and community groups can connect with. This landscape is also changing, not least for example with the emergence of Careers Hubs and trained and supported Careers Leads with volunteer 'Enterprise Advisers' in secondary schools.

5.8 In this crowded landscape the STEM Ambassador programme has high brand awareness – it is well known and well respected. This comes from its longevity, alongside having maintained good relationships with strategic partners at national level (through STEM Learning) and locally and regionally (through Hub activity).

National infrastructure – local networks

5.9 The national programme, with robust national infrastructure, helps to reduce duplication and inefficiency by connecting with other national programmes, for example to align STEM Ambassadors to support the delivery of CREST Awards. The co-ordination of STEM Ambassadors alongside other programmes by STEM Learning also creates efficiencies.

5.10 A national programme also creates efficiencies and a way to embed and develop quality. Tools and resources that can be used by STEM Ambassadors for different groups of young people to achieve different objectives can be hosted and shared nationally. Training of STEM Ambassadors can also be delivered at scale through the national infrastructure as can maintenance of DBS check information. IT systems to capture and handle data can benefit from national standardisation.

5.11 The STEM Ambassador programme aligns the strengths of a national programme with connected local and regional delivery. The Hubs vary in scale and experience. They bring a number of critical strengths to enable the national programme to work in local areas. The Hubs are often managed and run by people who are very well connected with schools, colleges, employers and local skills infrastructures in their areas. This set of local, personal relationships means that they can align their programmes with local projects and priorities.

5.12 However, the Hubs did report that the resources available to them through the STEM Ambassador programme are stretched. Over time expectations have changed and been added to around new approaches, innovation and wider engagement, but the requirement to operate the core programme has remained. Contracts have been renewed annually, but resources have remained fixed throughout this period.

5.13 Hubs needed to be able to connect with actions and strategic plans being made locally (for example Skills and Enterprise Strategies). In this sense the geographic coverage of the Hub should be at a scale that connects with other local strategic networks. However, the current patchwork nature of skills strategies makes this inherently challenging. In this context having a local Hub model which can engage at different levels is important, including the Regional Network Leads who are able to provide a view across several Hubs.

5.14 In performance terms, the review was not able to determine any relationship between the size of a Hub, number of schools and colleges covered, and its performance. This relationship is doubtless complicated by many other factors including the data issues described above, the time that the Hub and its staff have been in place and local context.

Performance management and reporting systems

5.15 The programme has delivered a national scale programme, consistently with multiple examples of repeat use of the programme by employers and activity organisers throughout the UK. Its operating model has a range of mechanisms to manage performance. These include monitoring activity through the dashboard, setting and reviewing action plans, and a regional reporting structure in England, with Hubs directly reporting to STEM Learning in Northern Ireland, Scotland and Wales.

Digital platform and data dashboard

5.16 Data about STEM Ambassador activity is held in a digital platform which is managed by staff at STEM Learning. The dashboard provides real time functionality with reporting capabilities. The design of the data system and GDPR considerations do however limit how the data can be used to manage performance. Its reliance on volunteer inputs means there may be gaps in what is reported and there is often a time lag between an activity and its reporting. This is probably inevitable.

5.17 More substantively, looking forward, is that it is better at reporting what STEM Ambassadors say they do, rather than how and to what extent organisations and young people engage with

the programme and whether needs are met. For example, there is a widely held view that repeated, sustained engagement is more impactful, but the system is not able to report where this occurs.

Key performance indictors and reporting systems

5.18 UKRI has agreed 15 aims and objectives for the STEM Ambassador programme which inform its grant agreement with STEM Learning. There are two sets of KPIs linked to contracted delivery. These relate to number of volunteer hours and satisfaction with the programme expressed by activity organisers and STEM Ambassadors. STEM Ambassadors submit the number of hours they volunteer preparing and delivering activities through the digital platform. Activity organisers are asked to provide scores out of 5 against a set of criteria that include enjoyment and satisfaction with the intervention, its contribution to learning objectives and achievement of links with the wider community. There are then a set of other metrics (some of which have target expectations) that provide a monitor of progress.

5.19 The KPIs themselves do not cover the range of aims and objectives of the STEM Ambassador programme and the review heard a widely held view that they needed to be revised to better reflect the achievements of the programme.

5.20 The reporting systems used between Hubs and STEM Learning, and then between STEM Learning and UKRI require extensive written reports. This includes the use of KPIs and RAG ratings. However, despite the effort that clearly goes in to assembling these reports, the review was struck by:

- The changes in structures making it difficult to build a picture over time
- Key lessons, risks and priorities becoming lost in the volume of paperwork
- A lack of consistency in reporting with numerical achievement of KPIs or RAG assessments not then being explained or discussed in reports
- The focus of reports to UKRI being on overall programme performance. While this is understandable as a core focus it was noticeable that differences between the effectiveness and quality of provision between Hubs was not covered in standard reports.

Programme delivery

Types of STEM Ambassador activity

5.21 The STEM Ambassador programme impacts upon young people's science knowledge and skills in a range of different ways. The programme serves young people at different ages in both primary and secondary schools and through a range of activities. Four activity categories account for over 60% of all activities reported (these are 'Hands on practicals', 'STEM careers talks and / or advice ', 'Mentoring or support', and 'Support an exhibition or event'. Most of this activity is done in educational settings (86% of all Ambassador time), and mostly in

secondary schools. In total, between 2016 to 2021, it is estimated that STEM Ambassadors delivered over 181k activities, engaging between 15.2m – 25.7m young people.

5.22 There is a different mix of activities in Priority Schools. Compared to the most common activities delivered in all settings, 'Hands on practicals' are no longer present in the top five most common activities in Priority Schools. Also, 'Mentoring' and 'Professional development of educators' are notably more common in Priority Schools.

Activity in Priority Schools

5.23 The review found limited discussion about Priority Schools when more would have been expected given the focus of the programme on reaching disadvantaged young people. These schools have been identified because they are listed as Priority Schools by the Department for Education for educational programmes (not including STEM Ambassadors). It seems counterintuitive to have a list of Priority Schools but requiring nothing different for those schools. The programme simply monitors the expectation that there will be a single STEM Ambassador activity in a higher proportion of Priority Schools compared with others. Priority schools may have specific challenges and may be harder to engage than other schools. They may therefore need an approach that is specifically tailored to their needs. The evidence that a different mix of activities occurs in Priority Schools compared with other schools also suggests that a tailored response would be useful. The STEM Ambassador Programme should consider how best to meet the needs of Priority Schools, both by identifying what those needs are (and how they might be different to other schools), and what additional support or resources STEM Ambassadors need to respond to those needs.

5.24 That said, evaluation of the impact of the programme on young people is recognised as very challenging but has not been fully realised. Challenges are associated with resourcing data collection (e.g. staff time needed to take registers or distribute and collect feedback surveys), and with attribution (because young people's choices are affected by a very wide range of factors in which the STEM Ambassador programme plays a small part). A STEM Learning evaluation tool to capture young people's feedback is used and reported in Hub reports occasionally, but this is not typical. This area requires further consideration around what is important to measure and achievable at reasonable cost.

5.25 The Covid-19 pandemic has clearly impacted on the programme, with:

- A reduction in the demand for STEM Ambassador time, as schools have closed and faced wider challenges
- A shift to online delivery, which created a need for different types of engagement and activities
- The number of new Ambassadors registering in 2020 was lower than in previous years

- Hubs reported that some Ambassadors were able to offer volunteering hours to reach schools and colleges digitally that were otherwise inaccessible to them, while other Ambassadors were not able or did not want to engage in digital delivery
- Programme managers sought to increase work in informal settings (for example offering activities to groups that met outdoors) to compensate for lost activities in educational settings
- Delivery teams suffered illness and disruption themselves during this period.

5.26 Many of these changes are likely to continue into the future. Digital delivery is likely to remain and will provide some advantages around accessibility. However, there was also an expectation of moving substantial amount of STEM Ambassador activity back to more traditional delivery methods.

6. Future programme options

6.1 The review of STEM Ambassadors was commissioned to provide reflections on its delivery with specific reference to overall performance, the role of Hubs, what it adds to STEM infrastructure and what the future options for the programme might be. This section provides a set of recommendations based on reflections around recent programme delivery, followed by consideration of different strategic options that might be considered as the next stage for the programme. The section starts by revisiting the aims associated with the STEM Ambassador programme as this sets important context for the consideration of future actions.

Programme aims

6.2 The programme has a set of aims that are understood by its stakeholders to be a combination of careers information and science inspiration, to make informed subject and career decisions and to help young people engage with STEM regardless of their future career choice. These were understood by all the stakeholders that participated in the review from national stakeholders to those that contributed to the locality case studies.

6.3 The written aims for the programme were explored by the review. UKRI aims and objectives for the programme are written as a set of 15 aims and objectives used in the grant funding agreements between URKI and STEM Learnng. These combine a list of high-level strategic aims with operational objectives including the following:

- Aim 1. Maintain the STEM Ambassadors service to schools and non-school organisations, individual volunteers and employers
- Aim 2. Increase young peoples' engagement with STEM subjects, especially those from disadvantaged backgrounds
- Aim 3. Raise awareness amongst young people of the wide range of careers opened up to them by studying STEM at school
- Aim 4. Continue to build and strengthen relationships with employers to support increased engagement with the Programme
- Aim 10.To recruit and deploy STEM Ambassadors from a diverse range of employers, ensuring a wide range of STEM sectors and careers are represented.

6.4 STEM Learning are tasked with using evaluation insights to improve future activiites. The 2019 Evaluation Report and its associated logic model[16] are based on a set of aims for the programme developed from interview testimony, The stated aims for the STEM Ambassador programme are not presented on its website, or within recent evaluaton or impact reports commissioned by STEM Learning.

[16] IFF Research (2019) STEM Ambassadors Evaluation Report. Produced for BEIS.

6.5 Given the importance stated by STEM Learning about their use of the IFF logic model in their evaluation work (see Annex A), it is notable that the IFF report body described an additional set of aims which included:

- to increase awareness and interest in STEM among children and young people
- to inspire and encourage the next generation to pursue STEM careers, in order to help address the STEM skills shortage in the UK
- to ensure young people of all genders, ethnicities, ages and levels of disadvantage receive this inspiration and encouragement
- to enhance relationships between STEM employers and STEM experts and organisations
- to develop STEM staff (through participation in the programme as STEM Ambassadors).

6.6 The aims and objectives of the STEM Ambassador programme are very broad. This creates opportunities for experimentation and for Hubs to focus on priorities that are relevant to their locality. However, from the perspective of the review, having a broad range of aims and objectives created challenges in assessing the extent to which they have been met (how important is it that the STEM Ambassador programme engage young people from disadvantaged backgrounds? How important is it that Ambassadors come from a diverse range of employers? Does it matter if the programme raises awareness but not the attractiveness of STEM careers?).

6.7 This ambiguity of focus was compounded by the lack of written rationale for the programme. In the past the prevailing narrative was around the pipeline of STEM skills through the education system and into the workplace. Policy narrative indicated that there were insufficient people with suitable skills available to STEM employers. One solution was to increase the number of people entering that skills pipeline. This is the rationale presented in the IFF evaluation research which places the programme in the context of skills shortages and skills gaps:

'To sustain the future economy, investment in the future workforce will be vital to economic success, requiring early interventions to encourage and inspire young people to pursue STEM (or even STEAM more widely) subjects in school, through university and as a career'.
IFF Research (2019) STEM Ambassadors Evaluation Report p.1.

6.8 The move to UKRI has prompted a re-appraisal of the programme and how it might fit with their organisational mission. Part of UKRI's mission is public engagement with science, arts and humanities. The STEM Ambassador programme is the largest component of UKRI's public engagement investments and their strategy[17] is itself under review.

[17] UKRI (2019) UKRI vision for public engagement. https://www.ukri.org/wp-content/uploads/2020/10/UKRI-1610202-Vision-for-public-engagement.pdf

6.9 Therefore, there are two key possible issues that the programme is seeking to address: 1) to provide careers information and inspiration to address the skills pipeline; or 2) to engage the public in the importance of science to their lives. The distinction is important as it should drive the range of audiences and activities. Going forward, a clear rationale for the programme is needed.

Future options

6.10 The review considered the operation of the STEM Ambassador programme and the extent to which it achieved its objectives. It also considered future options for the development of the programme but was not commissioned to test options with delivery teams or other stakeholders.

6.11 The review did not consider a cessation of the STEM Ambassador programme because its systems and checks are recognised to add value. Neither did it consider de-nationalisation because UKRI's remit covers all four nations.

6.12 All the options require a period of strategic reflection to define the nature of the public problems that the STEM Ambassador programme can address on behalf of UKRI. We recommend that a short review be undertaken to articulate the rationale for the programme in the context of it being a UKRI programme and how if at all this should link to UKRI's public engagement strategy. Fundamental questions need to be addressed and conclusions clearly stated or re-stated. These include two fundamental choice's both of which imply decisions regarding targeting:

- Is the STEM Ambassador programme primarily about ensuring young people are aware of the career options that continued STEM study make available to them? Or is it primarily about nurturing a future generation who are passionate about research and innovation i.e. linking with UKRIs public engagement strategy? These are not mutually exclusive questions but is an matter of emphasis. The answer to this question will affect the type of engagement activities that STEM Ambassadors prioritise.

- Is the STEM Ambassador programme universal such that every school or college or community organisation that wants or needs an Ambassador gets one? Or, it is a programme which specifically targets those places or people who come from disadvantaged backgrounds and / or have low science capital? Again, this is not necessarily a dichotomy – a programme can be universal but with more intensive or more speciic support for targeted groups. The answer to this question does however affect the number of organisations that STEM Ambassadors engage with and the scale of its interventions.

Re-framing programme aims

6.13 The review primarily considered operational improvements to achieve current aims and objectives. In doing so it raises questions around whether those aims and objectives should remain the same for the future. This section therefore presents a way to think about a more fundamental re-framing of the STEM Ambassador programme.

6.14 The four aims for the programme as set in the review's terms of reference were:

- To increase young peoples' engagement with STEM subjects, especially those from disadvantaged backgrounds
- To raise awareness amongst young people of the wide range of careers opened up to them by studying STEM at school
- To build and strengthen relationships with employers to support increased engagement with the Programme
- To recruit and deploy STEM Ambassadors from a diverse range of employers, ensuring a wide range of STEM sectors and careers are represented.

6.15 The first two aims define the purpose of the programme. The second two aims describe ways in which that purpose will be achieved – they are 'how' rather than 'what' and could apply equally to Aim 1 as Aim 2.

6.16 The review has therefore considered whether the programme could be reframed either as *primarily* a STEM engagement programme or as *primarily* a careers information programme as a way to explore how refining the aims might impact on programme scale and activities. This is not meant to imply that the programme should only deliver one or the other aim but it is important to explore how they are different, and how the STEM Ambassador programme might be structured to ensure its achieves its aims.

Increase engagement with STEM subjects

6.17 The first aim is to increase young people's engagement with STEM subjects, especially those young people from disadvantaged backgrounds. The rationale for this aim would lie in the notion of science capital[18]. Science capital is accumulated as young people learn about science (and STEM) through family interactions, exposure to media and literature, and to extra-curricula activities such they assume that science is 'for them'. There is an equity perspective to science capital as it is associated with young people who have more resources, more family support. A lack of science capital can be associated with economically deprivation although it is by no means exclusively experienced by young people from these backgrounds.

[18] The concept of science capital was explored in the ASPIRES research programme: Archer Ker, L, Osborne, JF, Dillon, JS, DeWitt, J, Willis, B & Wong, B (2013), Interim Research Summary, ASPIRES Project: What shapes children's science and career aspirations age 10-13? King's College London.

6.18 The aims of science engagement interventions, including those that seek to build science capital are varied but include:

- increasing the supply of STEM skills to help the country to meets its pressing need for a sufficient number of highly skilled STEM professionals to meet economic goals and societal challenges.
- building STEM literacy to enable people to participate actively in society and make informed decisions
- positive outcomes for disadvantaged young people whose lives can be transformed as they aspire to STEM-related educational and professional trajectories[19]

6.19 A programme that sought to increase engagement with STEM subjects might have a range of key characteristics. For example:

- It would not necessarily be a universal offer as there is an expectation of targeting
- It would be important to ensure engagement across all STEM subjects (biology, physics, chemistry, maths, computing and design and technology). An offer closely linked to the core curriculum alongside enrichment and extension type activities might be useful for schools and colleges
- The offer would need to be differentiated by Key Stage to ensure it was appropriate to the needs of different groups of learners and different curricula
- STEM Ambassador interventions would include hands-on practical, and applied theory approaches and training and support resources would focus on ensuring they had the skills and support to deliver such inputs.
- The programme would primarily be connecting with science and maths teachers.
- The programme could be appropriate for pupils in primary schools and for informal settings
- Employers would be asked to engage on the basis of the application of STEM knowledge in their business or industry.
- The need to ensure that the STEM Ambassador workforce represent the community they serve in terms of equality and diversity and inclusion characteristics remains important.

[19] Godec, S. and Archer, L. (2021) Informing UKRI's STEM Inspiration and Youth Engagement work. UKRI (unpublished).

Case Study – Mystic Aquarium: STEM Mentoring

Sea Research Foundation (SRF) is a non-profit organisation focused on conservation, education, research, and youth development. It aims to provide mentoring and academic enrichment to underserved youth by implementing its STEM group mentoring programmes. These seek not only to build STEM skills in youth but also foster conservation-minded citizens of the future.

STEM Mentoring is a structured group mentoring program where mentors (aged 12 +) and mentees (aged 6-10) meet over the course of a year and complete STEM activities. Each group of four mentees is matched with at least one mentor. Mentor groups meet once a week for a year and complete STEM activities in the presence of a Programme Coordinator. The STEM Activities are designed by Mystic Aquarium and their partners. Mentors are trained, families are involved and visits to STEM attractions and a celebration event are part of the programme.

Devolving the STEM Mentoring programme to local organisations means they can tailor it to the local cohorts of young people, which vary significantly by location.

See Annex D for further information.

Raise awareness of the wide range of STEM-enabled careers

6.20 Alternatively, a programme could focus on the second aim, to ensure that young people are aware of the range of careers that are open to them if they continue their STEM studies. This aim has clear resonance with the Government Careers Strategy[20] with is underpinned by the Gatsby benchmarks. All state schools and colleges have a statutory obligation to implement the strategy. The Careers and Enterprise Company is funded by government to support them to do so with strategic partnerships with the LEPs, a regional network of staff, training, and support for nominated 'Careers Leads' in each school. The rationale for a careers-focussed STEM Ambassador strategy would be to address the issues that accompany inadequate careers knowledge such as thinking that STEM careers to be 'not for me', to discourage stereotypical thinking, and address the knowledge gaps that exist around STEM-led educational and career pathways – including technical education.

6.21 A programme that sought to raise awareness amongst young people of the wide range of careers that available following STEM study might have a range of key characteristics. For example:

[20] Department for Education (2017) Careers strategy: making the most of everyone's skills and talents. https://www.gov.uk/government/publications/careers-strategy-making-the-most-of-everyones-skills-and-talents

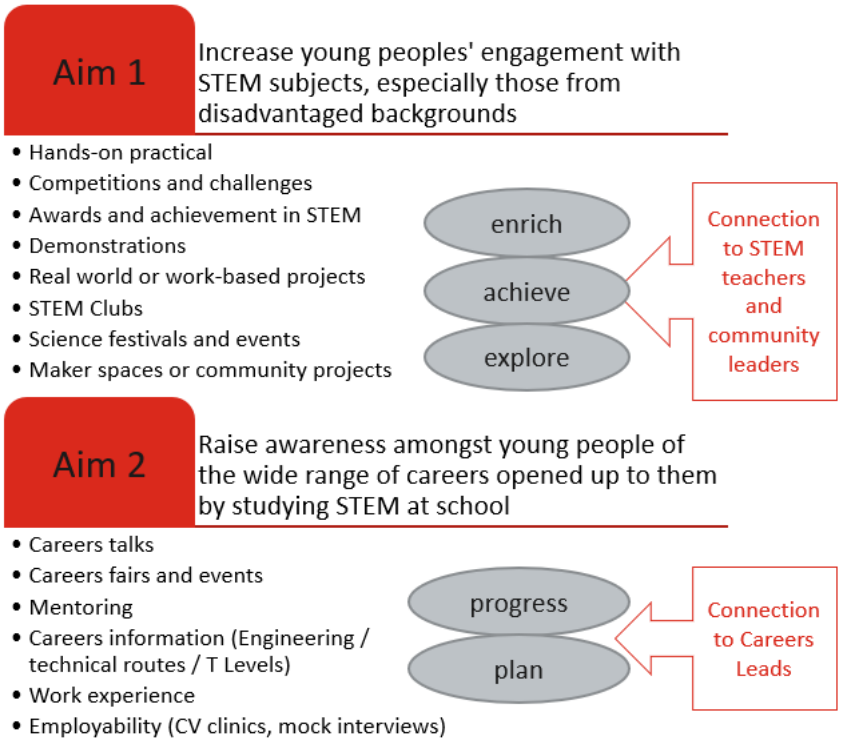
- The Careers Strategy is for all young people so it would be challenging to make a case for a programme being targeted to only some young people
- Schools and colleges understand the Gatsby benchmarks and this, along with it being a statutory obligation, create an environment where links with employers are valued by schools and colleges
- It would be important to ensure that a wide range of careers were well represented, including industries that rely on STEM skills (engineering, manufacturing, computing) and those where STEM skills are valued transferrable skills
- Any programme would need to be carefully constructed to offer effective career-related learning in primary schools that helped children to understand 'who they could become and helping them to develop a healthy sense of self'[21]
- The programme would primarily be connecting with science and maths teachers
- The offer would be differentiated by key stages to reflect the points in their educational careers when young people make their GCSE subject choices and then their 18+ destination choices
- The programme would primarily be connecting with nominated Careers Leads
- Employers would be asked to engage to help raise careers awareness, enhance employability of young people and mentor them in their applications
- The need to ensure that the STEM Ambassador workforce represent the community they serve in terms of equality and diversity and inclusion characteristics remains important.

6.22 Figure 6-1 summarises the types of activity that might be associated with each 'aim', and who the connectors would be. The purpose of the first aim (to increase engagement with STEM), would be to encourage young people to explore scientific ideas, to enrich and contextualise their experience of the curriculum, to build their knowledge and skills to help them in adult life, achieve examinations outcomes and consequently help them to achieve their potential. The purpose of the second aim (to raise career awareness) would be to help young people to make informed career plans to ensure smooth transitions throughout their education experiences.

6.23 We recommend that UKRI undertake a discussion of these questions informed by conversations with other stakeholders from both the STEM engagement community and the career guidance community.

[21] Kashefpakdel, E. Rehill, J. and Hughes, D. (2018) What works? Career-related learning in primary schools. The Careers and Enterprise Company. https://www.careersandenterprise.co.uk/media/m42pwir3/what-works-in-primary.pdf

Figure 6-1: Summary of strategic options



Source: SQW

Recommendations for operational improvements

6.24 Notwithstanding the need to address fundamental questions about priority aims, the review was tasked with making a series of recommendations relevant to recent periods of delivery. In this section we make a set of recommendations relevant to infrastructure, delivery and performance.

6.25 **Review communications and feedback mechanisms to create communication loops between UKRI, STEM Learnng and Hubs**. The Hub managers had a strong relationship with STEM Learning but appeared to be more distant to UKRI. A clearer line of communication from UKRI via STEM Learning to operational teams should be considered so that Hubs can share their successes and key issues at a strategic level and so that UKRI can articulate their vision and share developments with operational teams. The Hubs provide feedback from their clients to STEM Learning and this is reported upwards. However, there is no formal mechanism for STEM Learning to capture feedback from Hubs regarding the national activiites that they run. We recommend that UKRI instigate stronger feedback mechanisms that involve occasional meetings with Hubs.

6.26 **Review whether demand for STEM Ambassador activity fits the supply of STEM Ambassadors by geography, characteristics and scale.** The more Ambassadors are available the greater the chance that someone will be able to fulfil a request for an activity. While large numbers of Ambassadors are in place it was not possible to say whether this was

sufficient to meet demand or to undertake more proactive work to create demand. STEM Learning suggested that one way to explore this would be examine requests for activity go unfilled. Further investigation into the scale and nature of any such gaps would be helpful. In addition, while personal characteristics of Ambassadors are recorded this does not provide a profile of their usefulness with respect to STEM skill, job role or sector. These would also be useful to capture. We recommend that a pilot exploration of gaps and profiles be undertaken in a small number of Hubs to ascertain the viability and utility of such an exercise nationally.

6.27 **Encourage engagement with other national and local networks to connect skills and careers stakeholders at both national and local level.** The locality case studies showed that some LEPs were very active in encouraging education and employer partnerships while others were less so. Similarly, some LEPs have invested significantly into supporting Careers Hubs with the Careers and Enterprise Company while others have their own structures or have been slower to engage. There is a growing network of Careers Hubs that have formal links with named schools, place volunteers into those schools so that they can advise on ways to engage with employers and provide training opportunities[22]). We recommend exploring potential for more consistent closer working relationships with LEP skills teams and Careers Hubs at both national and local level.

6.28 **Maintain the number of Hubs to provide stability but commit to a review once programme rationale and aims have been resolved.** Delivery in Scotland was recently rationalised from three Hubs to one. This generated questions about the future contracting preferences of STEM Learning and whether there was a case for reducing further the number of Hubs to create fewer, larger Hubs. The review found little evidence that the scale of operation determined its success in delivery and achieving KPIs. The locality case studies suggested that regardless of the size of the parent organisation, having networked people who were known to key local stakeholders and were able to network with them was very important. Discussions about organisational restructure and review creates uncertainty and Hubs may find they lose key staff as a consequence. We therefore recommend that there is a case to commit to Hub stability until wider strategic issues are resolved.

6.29 **Create named or 'branded' STEM Ambassador packages of activity that can be trialled, reviewed, marketed and scaled up to create a set of options that schools and colleges can engage with and subsequently tailor**. The case studies that the review considered (see Annex D) all have a set of named programmes. There might be an oportunity to create 'branded' programmes of engagement, or formalise alliances with other programmes to offer a clear menu of options for activity organisers to select. Local tailoring of interventions would be possible. There might be incentives in contracts to encourage focussing on particular year groups, places or schools. There might also be options to encourage individual or small groups of Hubs to pilot and evaluate these branded programmes. We recommend that UKRI with STEM Learning consider ways to segment their offer into branded packages of activities.

[22] SQW (2020) Enterprise Adviser Network and Careers Hubs Evaluation Report prepared for The Careers and Enterprise Company.

6.30 **Recognise resource implications of additional activities, and if necessary scale back some actions to introduce new activities**. The maintenance of an up to date network of contacts in schools and colleges as well as a cadre of trained, DBS checked and ready STEM Ambassadors is a demanding job as there will naturally be churn within both the Ambassador and educational workforces. If additional activities or projects are introduced, they may take time away from this core activity. Any additional requests need careful management. Some Hubs may be better placed to deliver specific requests (for a training activity or material for a social media campaign for example), and it might be possible to allocate responsibilities accordingly. Not every Hub needs to deliver every additional request. Recognising resource implications does not necessarily mean providing additional funding but could be recognition through target-setting or moderation of other performance measures. We recommend that STEM Learning actively manage what is requested of Hubs and agree a tailored package of activity with each, spreading developments across the network.

6.31 **Expand the use of impactful sustained interventions**. The need to focus on impact was a feature of many consultations undertaken during the review. That impact might be greater, or at least easier to identify, through sustained interventions was commonly cited. Further work using action research or other forms of practitioner engagement[23] should be resourced to incentivise the creation and delivery of sustained interventions with schools, colleges and community groups. These would also provide a body of practice that could be the focus of impact research and evaluation.

6.32 **Focus on Priority Schools by investigating their experiences of the programme, with a view to developing an offer tailored to their needs**. Currently the Department for Education's Priority School status is only used to identify schools in need, but this does not afford them priority status within the STEM Ambassador programme (in terms of resources or targeted activity). We recognise that in practice, Hubs may well be working hard to reach their population of Priority Schools. But there is no clear rationale established for why STEM Ambassadors should work with these schools and colleges, what they should expect to achieve and whether resources should be weighted towards these schools.

6.33 It would also be helpful to understand how Priority Schools experience the programme and whether their experience is any different to any other school. Are they part of a network, do they work with the Hub to develop bespoke solutions to the issues they face, do they have multiple Ambassadors delivering multiple activities? We recommend an investigation into the experiences of Priority Schools and Hubs with a view to recommending a strategic plan for engagement with Priority Schools.

6.34 **Review KPIs to ensure they reflect the broad aims and objectives of the programme, while maintaining the broader set of performance measures that are reported**. The performance indicators reflect what can be measured and reported using the digital platform.

[23] Action research is a collaborative and participative method of investigation that is focussed on exploring the effectiveness of a specific action. It is often used by teachers and tutors to improve their own, or a team's educational practice.

Current data capture systems provide a useful range of insights into the number of active Ambassadors, their characteristics, activities and the number of hours they volunteer. For consistency and continuity, we recommend that current measures continue to be recorded and reported.

6.35 **Rationalise reporting arrangements so that each KPI is given a statistical measure, progress towards strategic priorities are RAG rated and any written narrative is aligned to these**. Monitoring reports are used primarily to ensure delivery of a contract. What is reported should align with what has been contracted. Statistical measures (outputs or more subjective RAG assessments of progress) should be accompanied by a brief commentary that sets out any barriers and enablers that explain what is being reported. An assessment of risks associated with contract delivery can be part of this report. Additional reporting, for example to identify examples of effective practice, innovative new ideas, case studies or good news stories can follow a different system and may be required less frequently. We recommend a review of the use and utility of current reporting systems (from Hubs to STEM Learning and from STEM Learning to UKRI) to create shorter monthly reports whose purpose is to review the contract.

6.36 **Adapt data capture systems so that reports drawn from it provide insight into a wider range of key strategic priorities including number and type of schools that have multiple engagements or engage regularly with the programme.** Data systems were set up to measure and report on numbers of STEM Ambassadors actively engaged with the programme. The review was told that formerly this was the key metric. However, as the programme has developed this becomes necessary but not sufficient as there are other aspects of the programme that are of both strategic and operational interest. These include issues of demand (were all requests for activity provided for?), sustained interventions (do Ambassadors deliver a programme of interventions or 'one-off' talks or events), sustained relationships with activity organisers (which schools and colleges use the Ambassador programme regularly and intensively?). It also includes the numbers of characteristics of individual young people reached by STEM Ambassadors. We recommend that the design of the data capture systems be revisited to reflect delivery of sustained key objectives. A trial that looked at how current infomation might be analysed would be necessary to scope any additional changes that would be required to the digital platform to make this happen.

6.37 **Improve data quality through provision of advice for those inputting data and regular data cleaning**. Within the data reported from the digital platform, some fields report very high instances of 'other' when pre-defined categories are used. This limits the utility of such data. We recommend that additional advice or data cleaning is undertaken to enhance data accuracy.

Summary

6.38 The review has suggested several options that are available to UKRI to align the STEM Ambassador programme with its strategic aims, and to continue to support and enhance the work that Ambassadors across the country for young people. It found there to be a network of committed, skilled and passionate individuals who are keen to continue to promote the programme and see it make a difference. Fundamentally the Ambassador programme is doing what it has done successfully for many years but a review and a refresh is timely for strategic reasons.

Annex A: Data profile of the STEM Ambassador programme

A.1 SQW worked with STEM Learning to extract data from their digital platform 'dashboard' which would provide a robust profile of Ambassador activity over time. Data is input to the dashboard via a portal by STEM Ambassadors and by activity organisers in both educational and community settings. This is the same portal they used to register Ambassadors and it holds data about each Ambassador, their DBS status, and the activities that they log.

A.2 The data provided by STEM Learning covers the five-year period 01/04/2016 to 31/03/2021, except from Priority Schools' data, which covers 2020-21 only. As the programme has developed the way that data is captured has also changed. For example, the digital platform was introduced in 2018 which meant all Ambassadors needed to re-register and this may have contributed to an observable fall in the number of registrations at that time due to the removal of STEM Ambassadors who were no longer actively engaged with the progamme.

A.3 Data on STEM Ambassadors is typically split between 'registered' and 'active' Ambassadors, with active STEM Ambassadors being those that have delivered at least one activity within the five-year period. Most of the analysis below focuses on 'active' STEM Ambassadors only, especially when linked to delivery of activities. In this analysis Ambassadors are considered inactive two years after they are registered for DBS if they report no activity.

Number of Ambassadors

A.4 As of the 31st of March 2021, the total number of registered and active STEM Ambassadors was 53k and 11k respectively. From 2016, registered STEM Ambassadors had increased annually, apart from in 2019 to 2020, with absolute growth of 22% over the five years. Inversely, the number of active STEM Ambassadors decreased each year, apart from 2019 to 2020, with a net decrease of 57% from 2017 to 2021. Some of these trends may have been affected by the registration process that was required with the introduction of the digital platform and which may have seen numbers of 'registered but not active' fall off the tally.

A.5 The number of volunteer hours delivered increased from 286k in 2018 to a peak of 506k in 2020, despite numbers of active STEM Ambassadors decreasing up to 2019. This suggests that those STEM Ambassadors that were active, were used more extensively. This might either have been working across several schools, colleges and community groups, or doing more sustained work with one or two. Volunteer hours dropped significantly from 2020 to 2021 (-65%), largely to due to Covid-19 restrictions. They will take some time to recover as schools and colleges have continued to implement social distancing restrictions at least through to the end of 2021 (when evaluation fieldwork was completed).

A.6 In total from 2016 to 2021, 143k STEM Ambassadors had been classed as 'registered', and 54k were 'active' (38% of all). The percentage of active Ambassadors varied from 32% to 48% across the Hubs.

A.7 Of the 19 Hubs, London had the greatest number of STEM Ambassadors (11% of all registered STEM Ambassadors, 8% of all active STEM Ambassadors), followed by West England (8% of registered, 9% of active) and Trans Pennine (8% and 7%). North Scotland, the South West Peninsula and Staffordshire hosted the lowest number of STEM Ambassadors (2% of all registered STEM Ambassadors each).

A.8 Hubs with more active and registered STEM Ambassadors delivered more activities overall. Also, Hubs with more active STEM Ambassadors tended to deliver more of the less common activities, including 'Grand Challenges', 'Space', 'Training', 'STEM Clubs' and 'Professional Development'.

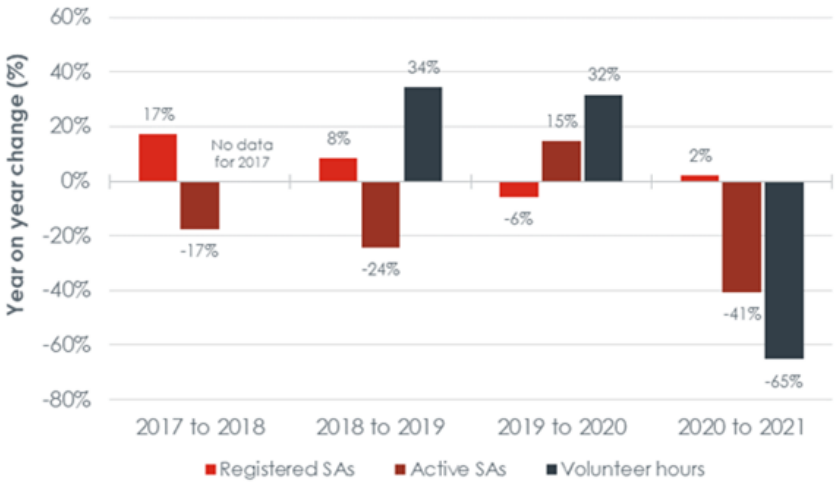
A.9 On average, an active STEM Ambassador delivered 42 hours of volunteering time over the five-year period. Older STEM Ambassadors and STEM Ambassadors based in Hubs with fewer active STEM Ambassadors tended to have higher individual mean volunteering hours.

A.10 The data was not interrogated to see whether there was any correlation between STEM Ambassador characteristics and the number of hours they volunteered or the number of years over which they remained active.

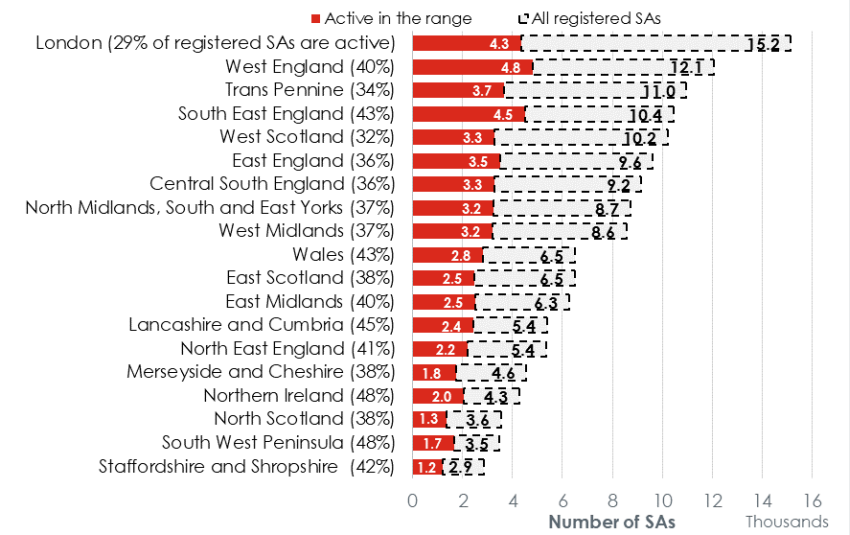
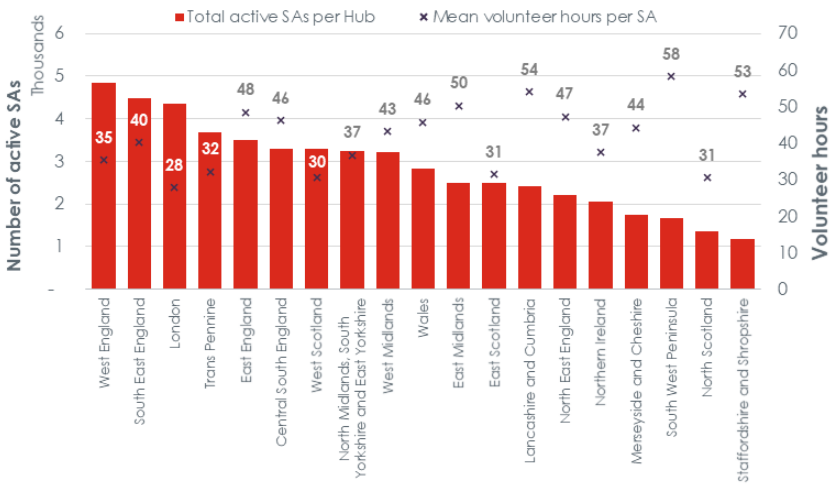
Table A-1: Analysis of STEM Ambassador activity at the programme and Hub level

Description	Data
Number of registered and active STEM Ambassadors, and volunteer hours at a programme level The number of registered STEM Ambassadors increased each year, apart from in 2019 to 2020, which saw a 6% drop. There has been an absolute increase of 22% over the five years. On the other hand, there has been a 57% decrease active STEM Ambassadors from 2017 to 2021. Each year saw a drop on the previous, apart from 2019 to 2020 (+15%). This is the inverse of the trend for all registered STEM Ambassadors. Also, despite decreasing numbers of active STEM Ambassadors, the number of volunteer hours increased annually until 2021, which significant fall in volunteer hours likely to due to the Covid-19 restrictions limiting activity.	

Year[24]	Number of registered SAs	Number of active SAs	Number of volunteer hours
2017	43,106	26,748	No data
2018	50,523	22,076	286,141
2019	54,751	16,702	384,610
2020	51,666	19,171	506,755
2021	52,794	11,391	176,479



[24] This data is from STEM Learning's Q4 programme level reports and cover activity for the entire annual delivery period (i.e. April to March), The Q4 reports are published in April, however data for 2019 was published in March and only covers the period up until February 2019.

Description	Data
STEM Ambassadors per Hub The number of active and registered STEM Ambassadors varies greatly between Hubs, with the lowest number of active STEM Ambassadors being 1.2k (Staffordshire and Shropshire), and the highest being 4.8k (West England). London, West England, and Trans Pennine host a quarter of all active STEM Ambassadors (24% of all STEM Ambassadors). The mean number of active STEM Ambassadors per Hub was 2.8k, and 7.5k for registered STEM Ambassadors, giving an average activity rate of 38%.	
Volunteer hours per STEM Ambassador & Hub On average, an active STEM Ambassador delivered 42 volunteer hours over the five-year period. Mean hours per STEM Ambassador increased with age, with STEM Ambassadors >60 yr. old delivering more than twice as many hours than STEM Ambassadors <30 yr. old (83hrs vs 31hrs). Higher mean volunteering hours per STEM Ambassador was weakly correlated with Hubs that had fewer active STEM Ambassadors, indicating STEM Ambassadors at Hubs with fewer STEM Ambassadors did more volunteering.	

Age (years)	Average Hours per SA
>60	82.8
50-59	56.2
40-49	48.6
30-39	33.1
<30	30.5

Ambassador Churn

A.11 From 2016 to 2021, there has been a net increase of 14.8k active STEM Ambassadors. In total, 19k STEM Ambassadors left the register and 33.5k joined, meaning the churn rate for the period was 57%. However, net change of active STEM Ambassadors has not been consistent throughout, shown by initial year on year net increases (2016 to 2018), followed by a phase of net annual decreases (2019 to 2020).

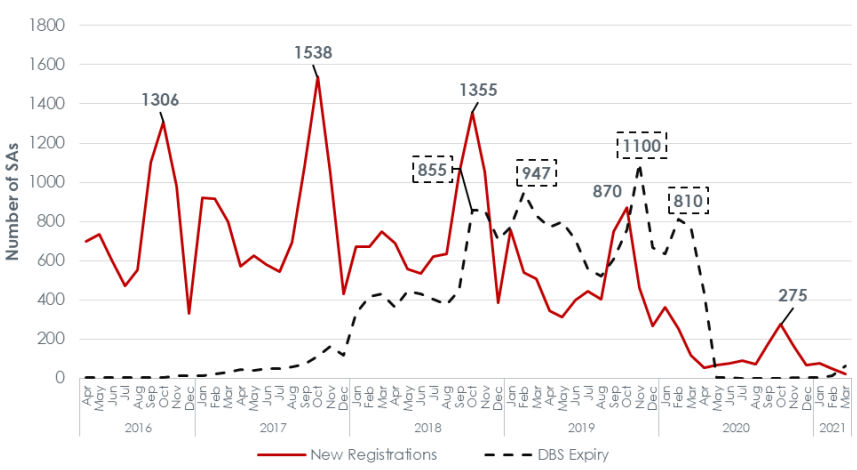
A.12 Over the last five years, the annual churn rate has been increasing, driven by registrations of new STEM Ambassadors dropping from late 2018 onwards, whilst DBS expiries increased up to mid-2020. The reasons for this will include the effects of a change in how registers were maintained to keep the data more current which occurred between 2018 and 2019. This meant that 'lapsed' STEM Ambassadors were, over that period removed from the registers. It is likely that the lower churn rates reported in 2016 and 2017 did not reflect the true state of churn. It is also likely that the various effects of the pandemic (including extending DBS certificates and shifting employment patterns and priorities) will have had an effect on recruitment and retention of STEM Ambassadors since 2020.

Table A-2: Ambassador churn data

Description	Data

Ambassador churn
From 2016 to 2018, the annual churn rate of active Ambassadors remained low.
From 2019 to 2020, churn rate soared, with each year seeing a net decrease in STEM Ambassadors.

Year	N of new active SA registrations	N of DBS expiries for active SAs	Net change in active SAs	Annual churn rate
2016 (April – Dec)	6,770	49	+6,721	1%
2017	9,745	765	+8,980	8%
2018	8,966	6,053	+2,913	68%
2019	6,045	9,032	-2,987	149%
2020	1,768	2,661	-893	151%
2021 (Jan – Mar)	148	80	+68	54%
Entire period (2016 – 2021)	33,442	18,640	+14,802	56%

Description	Data
Registrations and DBS expiries for Active Ambassadors Registrations of active STEM Ambassadors tends to peak between Q3-Q4 annually, likely due to more active marketing and recruitment to align with the academic year starting. From 2018 to mid 2020, registrations were dropping, whilst DBS expiries increased. As the pandemic hit the UK in Q2 2020, DBS expiries dropped to almost null, whereas registrations began to rise again.	**New registrations and DBS expiries** 

Activities delivered, split by STEM Ambassador characteristics

A.13 It should be noted that the way that data is compiled affects its interpretation. For example, there will be some double counting of activities because each Ambassador logs an activity they have participated in, and consequently multiple Ambassadors could log the same activity (such as contributing a shift to a careers fair). We therefore know the number of Ambassadors that have done multiple activities, but we do not know the total number of activities. In addition, it relies of volunteers and busy activity organisers inputting data which means that there could be a delay between an actiivty being delivered and it being logged, or even activity not being logged leading to an under-reporting of activity.

A.14 Of the 15 different activities STEM Ambassadors could record (excluding 'Other'[25]), five activities accounted for two thirds of all those delivered. These were 'Hands on practical' (21% of all delivered), 'STEM careers talk and/or advice session' (13%), 'Mentoring' (9%), 'Support for an exhibition or event' (8%) and 'Employability skills session' (7%). The high proportion of activities recorded as 'other' (19%) could be addressed through a combination of having fewer, broader categories; better guidance for STEM Ambassadors completing the reports, and more consistent data cleaning to assign responses that were incorrectly categorised as 'other' into a pre-existing category.

[25] Activities recorded as 'Other' accounted for approximately 19% of all activities. The data does not confirm the details of 'Other' activities.

A.15 The majority of all activities were delivered in educational settings, within which engagement with secondary schools was more common than primary and post-16 settings. Approximately 70% (38k) of all active STEM Ambassadors delivered multiple activities over the five-year time period, and 30% (16k) delivered 'one-off' activities[26].

A.16 There are more active male STEM Ambassadors then female (55% to 45%), however female STEM Ambassadors delivered more activities, indicating female STEM Ambassador had greater levels of involvement. By ethnicity, STEM Ambassadors were relatively evenly spread across all activities, with activities delivered by STEM Ambassadors in each ethnic group closely matching overall trends.

A.17 Three quarters of active STEM Ambassadors were in full time employment, and delivered between 66% to 86% of all activities. The most common activities delivered by Student STEM Ambassadors (13% of all active STEM Ambassadors) were 'Hands on practical's', 'STEM clubs' and 'Training'. Retired and Self-employed STEM Ambassadors (4% of all STEM Ambassadors) delivered relatively more of the less frequent activities, including 'Grand Challenges', 'Information and Advice sessions' and 'Space'.

A.18 36% of all activities delivered required less than 10 hours of STEM Ambassador delivery and preparation time, 21% required 10-19 hours, 20% took 20-39 hours and 24% required 40 hours.

Table A-3: Activities delivered by STEM Ambassadors, split by characteristics (2016-2021)

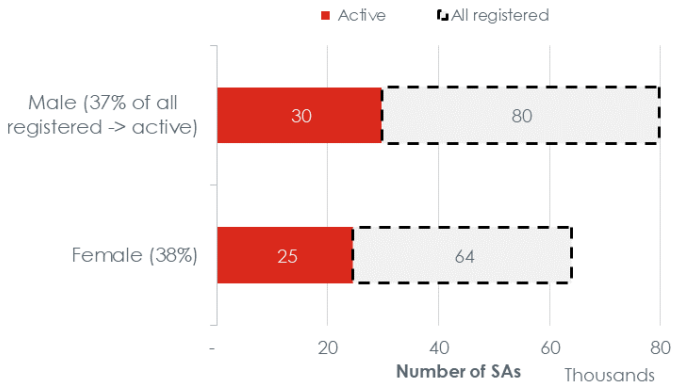
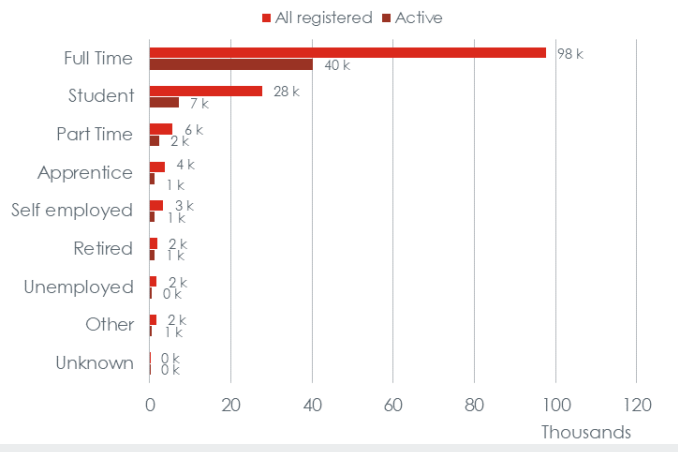
All STEM Ambassadors

Most commonly delivered activities:

- Five activities account for over two thirds of all activity delivered. Across all settings, these were 'Hands on practicals' (21% of all activities), 'Other' (19%), 'STEM careers talks and/or advice (13%), 'Mentoring or support' (9%) and 'Support an exhibition or event' (8%).
- The majority of STEM Ambassadors delivery time (86%) was in educational settings, compared to non-educational (14%). For educational activities, the majority of were delivered in Secondary schools (62%), followed by Primary (30%) and Post-16 (8%).
- The most common activity in non-educational settings was 'Supporting an exhibition or event' (30%), which differed from educational settings. Otherwise, the most frequent activities in both settings were largely in line with the total share of activities delivered, outlined above.
- Most Hubs delivered a similar mix of activities, with the majority having at least four of the top five activities delivered across the programme in their own top five. Wider activities most frequently recorded by Hubs were 'STEM presentations', or 'Interactive STEM sessions', with 13 of the 19 Hubs having these in their top five.

[26] The data does not confirm whether 'sustained' engagements were delivered as a linked programme of activities, or if the repeat activities were distinct from one another.

All STEM Ambassadors

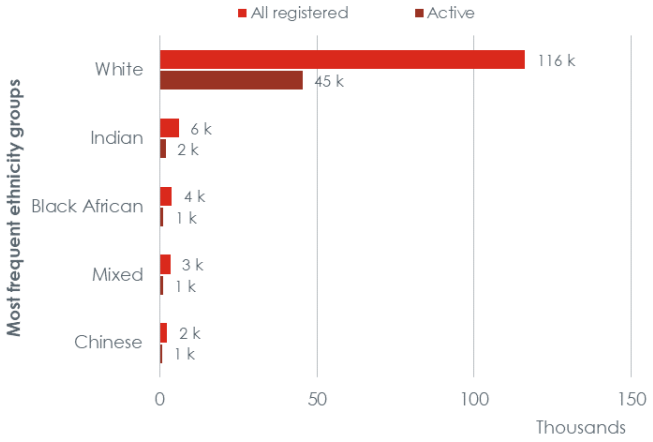
Description	Data
Gender • The majority of active STEM Ambassadors were male (55% to 45% female). However, female STEM Ambassadors were involved in the delivery of 53% of activities, compared to 47% of males, indicating female STEM Ambassadors were more active. • For example, of all 'Hands on practicals' delivered, 53% were by female STEM Ambassadors and 47% by males. Similarly, for 'STEM careers talks' (52% by female STEM Ambassadors compared to 48% male), 'Mentoring or support' (59% to 41%), and 'Employability skills sessions' (54% to 46%). • Only for 'Interactive STEM sessions' and 'Training activities' did more males deliver sessions than females (54% delivered by male STEM Ambassadors for both, in line with the share of males in the population)	
Employment status: • 74% of active STEM Ambassadors are in full time employment, 13% are students, 4% in part-time employment, followed by apprentices, self employed or retired (all 2% each). The final 3% were unemployed or classed as 'other'. • STEM Ambassadors in full time employment delivered the majority of activities (between 70-80%), which is to be expected given the dominance of this group. Proportions of activities delivered by all other active STEM Ambassadors also tended to be mostly in line with their relative share in the population. • However, relative to their total number active retired STEM Ambassadors delivered a higher	

All STEM Ambassadors

share of 'Grand Challenges' and 'Professional development activities' (10% and 7% of all activities respectively).

Ethnicity:

- The most common ethnicity of active STEM Ambassadors was 'White' (84%), followed by 'Indian' (4%), 'Black African', 'Mixed' and 'Chinese' (all 2%). 1% did not specify their ethnic group, and the remaining 5% were spread between other non-white ethnic groups.
- This composition broadly reflects that of the whole population of England and Wales which has 85% of population identifying their ethnicity as White, with 3% Indian and 2% Black African for example[27].
- The proportions of STEM Ambassadors delivering activities by ethnicity tended to be closely in line with the number of STEM Ambassadors per ethnic group, with between 77% to 88% of all activities being delivered by 'White' STEM Ambassadors.



Age:

- Approximately two thirds of STEM Ambassadors are below 40 years old, one third are older than 40 years.

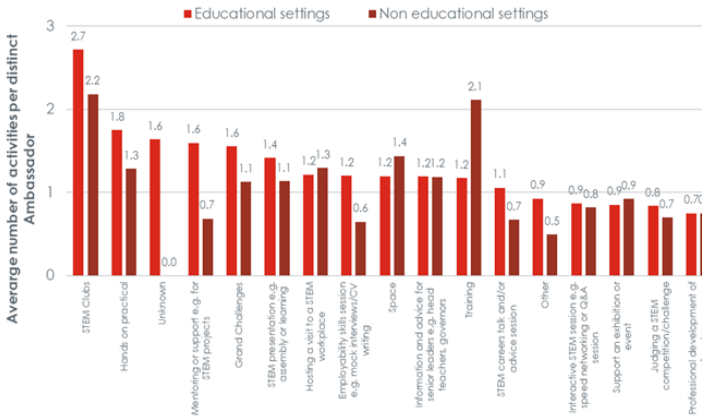
Younger STEM Ambassadors (<40) were relatively evenly distributed across each activity, however STEM Ambassadors above the age of 40 tended to deliver a greater proportion (approx. 50%) of the lesser common activities, such as 'training', 'professional development for educators' and 'information and advice for senior leaders'.

	All STEM Ambassadors		Active STEM Ambassadors	
Age bracket	N	% of all	N	% of all
<30	58,718	41%	21,111	39%
30-39	42,691	30%	14,575	27%
40-49	21,219	15%	8,964	17%
50-59	13,304	9%	6,081	11%
>60	7,170	5%	3,431	6%
Unknown	530	0.4%	137	0.3%

[27] Office for National Statistics (2019) Population estimates by ethnic group and religion, England and Wales. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/populationestimatesbyethnicgroupandreligionenglandandwales/2019

All STEM Ambassadors

Average number of activities per Ambassador (educational and non-educational settings)
Active STEM Ambassadors delivered more activities in educational settings. Activities STEM Ambassadors had delivered most in both settings were 'STEM clubs' and 'Hands on Practicals'. 'Training' was the only activity that more STEM Ambassadors had completed in non-educational settings.



Activities in Priority Schools (2020-21 only)

A.19 Across 16 of the 19 Hubs[28], 2.5k Priority Schools were identified, and just over half (1.3k) were then reported as engaged. Of those identified, the majority (54%) were secondary schools, followed by primary schools (46%). Across all Hubs, only one Priority post-16 school was identified.[29]

- A greater proportion of the identified Priority Secondary Schools were engaged (73% of all) compared to primary schools (30%).
- The Hub with the highest rate of Priority School engagement was North Midlands, South and East Yorkshire (74% of all Priority Schools identified were engaged), and the lowest was West England (34%)[30].
- Hubs in the north and central south of England tended to have higher engagement rates, whereas Hubs in the midlands had the lowest.
- There was a slight correlation between Hubs with the greatest number of active STEM Ambassadors, and lower levels of engagement with both Priority Primary and Secondary Schools.
- There was also a slight correlation between Hubs with more identified Priority Schools having lower levels of engagement.

A.20 The five most common activities in Priority Schools were 'Mentoring or support' (23% of all hours in Priority Schools) followed by 'Employability skills sessions' (16%), 'Other' (14%), 'STEM careers talks' (9%) and 'STEM presentation' (7%). The major differences here compared to the most common activities delivered in all settings is that 'Hands on practicals' are no longer present in the top five in Priority Schools (whereas this activity forms 21% of all activities in all

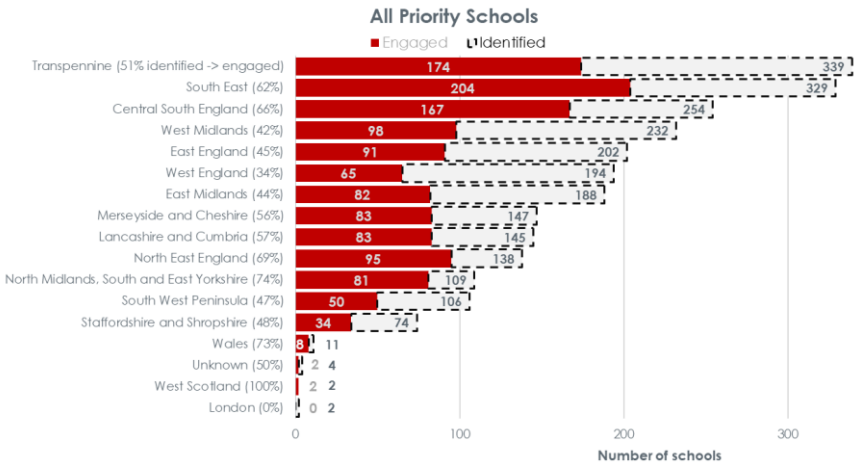
[28] No Priority School data was available for the North and East Scotland Hubs. Additionally, Priority School data included an 'Unknown' Hub category, which is not included in the analysis.
[29] The North Midlands, South and East Yorkshire Hub has a target of one post-16 Priority School, and engaged with one.
[30] Removing Hubs with targets of <20 Priority Schools, whom either has very low or very high engagement rates, therefore appearing as outliers. These included Wales, West Scotland and London.

settings). Also, 'Mentoring' and 'Professional development of educators' are notably more common in Priority Schools (only 9% and 1% of all activities in all settings respectively).

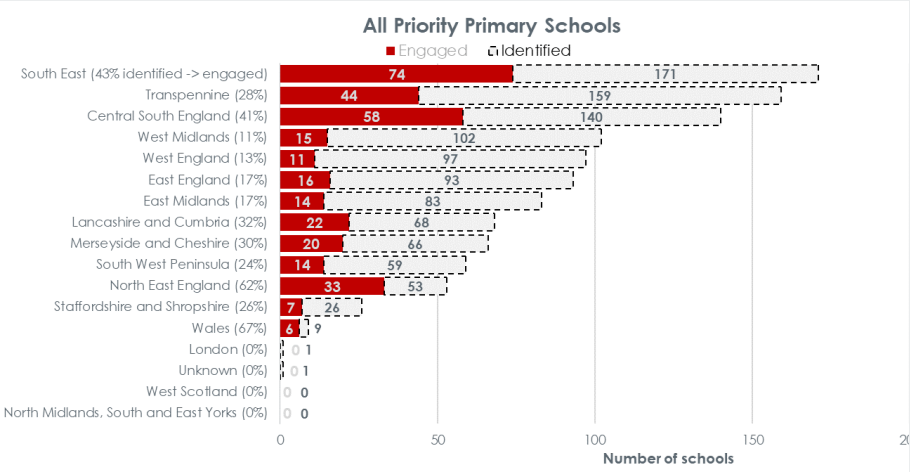
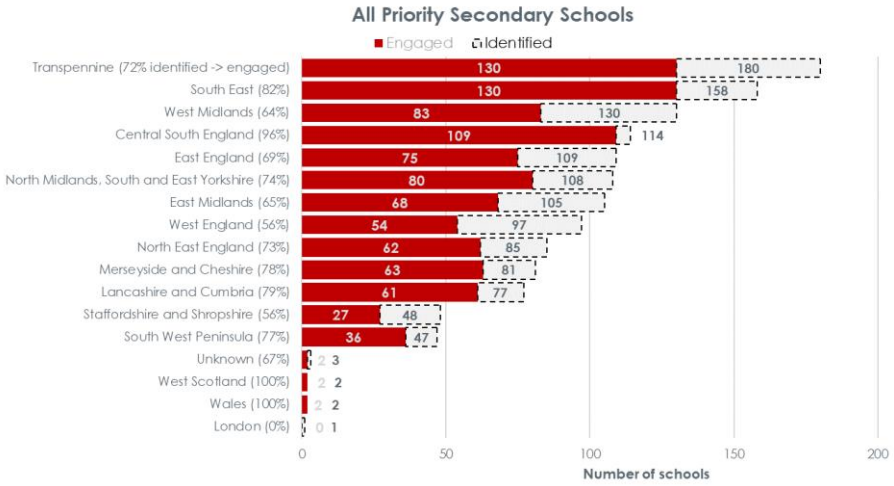
A.21 At this stage, we do not have data on activities delivered in Priority Primary and Secondary Schools. However, the differences between activities delivered in all settings and Priority Schools may reflect the balance of Priority Primary and Secondary Schools, and/or that Priority Schools may be targeted with activities suited for smaller groups,

- 1,066 STEM Ambassadors delivered activities in 1,319 Priority Schools. The age, ethnicity and gender characteristics of STEM Ambassadors delivering activities in Priority Schools is largely in line with characteristic trends of STEM Ambassadors delivering all activities. Meaning white, female and younger (i.e. below 39 years old) STEM Ambassadors were all majority characteristics of STEM Ambassadors delivering activities in Priority Schools, as well as in other settings.

Table A-4: Priority school engagement data (2020-21 only)

Description	Data
All Priority Schools targeted, and engaged by Hub (2020-21) Hubs had varying numbers of identified Priority Schools, ranging from 339 to 2. Engagement rates across all Hubs ranged from 34% to 74%, and the median was 51%[31]. In total, 54% of identified Priority Schools were engaged.	

[31] Removing Hubs with targets of <20 Priority Schools, whom either had very low or very high engagement rates, therefore appearing as outliers. These included Wales, West Scotland and London.

Description	Data
Priority Primary schools targeted, and engaged by Hub (2020-21) 334 Priority Primary Schools were engaged out of 1,128 identified (30%). Engagement rates ranged from 11% to 67%, and the median was 27%. The greatest share of primary schools engaged were in the south of England.	
Priority Secondary schools targeted, and engaged by Hub (2020-21) 984 Priority Secondary Schools were engaged out of 1347 identified (73%). Engagement rates ranged from 56% to 96%, and the median was 73%. The greatest share of Priority Secondary Schools engaged was in the north and south east of England.	

Description	Data

Activities delivered in Priority Schools

'Mentoring or support', 'Employability skills sessions' and 'Other' accounted for 53% of all STEM Ambassador hours in Priority Schools.

The most common activities in Priority Schools differed from those in all schools, with a notable reduction in the share of **'hands on practicals'** and **'professional development of educators',** and an increase in **'mentoring'** and **'employability sessions**.'

Activity	% of SA hours in Priority Schools[8]	% of SA hours in all educational settings
Mentoring or support e.g. for STEM projects	**23%**	**14%**
Employability skills session e.g. mock interviews/CV writing	**16%**	**6%**
Other	14%	15%
STEM careers talk and/or advice session	9%	11%
Support an exhibition or event	9%	6%
STEM presentation e.g. assembly or learning	7%	6%
Interactive STEM session e.g. speed networking or Q&A session	4%	3%
Professional development of educators	**4%**	**1%**
STEM Clubs	4%	2%
Hands on practical	**3%**	**23%**

Characteristics of STEM Ambassadors delivering activities in Priority Schools

The age, ethnicity and gender characteristics of STEM Ambassadors delivering activities in Priority Schools is largely in line with characteristic trends of STEM Ambassadors delivering all activities.

Age	N of SAs in Priority Schools	%
<30	489	44%
30-39	247	23%
40-49	168	16%
50-59	122	11%
>60	60	6%

Ethnicity	N of SAs in Priority Schools	%
White	869	82%
Indian	55	5%
Black African	28	3%
Mixed	21	2%
Other Asian	20	2%
Chinese	19	2%
Prefer not to say	18	2%
Pakistani	11	1%
Other	17	2%

Gender	N of SAs in Priority Schools	%
Female	578	54%
Male	488	46%

Engagement and feedback

A.22 From 2016 to 2021, it is estimated that STEM Ambassadors delivered over 181k activities, engaging between 15.2m – 25.7m young people (YP)[32].

A.23 Prior to an activity being delivered, STEM Ambassadors input the number of participants they expect to engage. On average, activities engaged between 84 to 139 YP each. 'Exhibitions', 'career talks' and 'STEM competitions' engaged the most (ranging between approx. 100 to 500 YP), whereas 'STEM workplace visits', 'mentoring or support' and 'STEM clubs' engaged the least (between 20 to 35).

A.24 The split between STEM Ambassadors preparation time and delivery time varied per activity and setting. In total, activities in non-educational settings required more preparation time. In educational settings, preparation time ranged from 40% to 10% of the total time recorded, whereas for activities in non-educational settings it ranged from 97% to 15%.

A.25 After activities are delivered, STEM Learning collate 'satisfaction feedback' data from STEM Ambassadors and the activity organiser.

A.26 Ambassadors give feedback for three sets of measures linked to 1) the outcomes of their activities for participants, 2) their own personal development and 3) the support they received. In terms of achieving anticipated outcomes, Ambassadors awarded activities in non-educational settings lower scores than those in educational settings. Ambassadors also awarded scores for 'Support from the STEM Ambassadors website' and 'Hub' being almost two points lower than all other average scores.

A.27 Activity organisers gave feedback on a different set of measures, linked to the impacts achieved for participants, the activity organisers themselves, the support received, and wider feedback. Scores were generally high across all measures (4+ out of 5), and alternate to the trends for STEM Ambassador feedback. Scores were slightly higher and less varied in non-educational settings compared to educational.

A.28 The measures given the lowest scores for activities in educational settings were in 'wider impacts', and were related to outcomes for parents, and wider providers of youth activities. Measures given the lowest scores for activities in non-educational settings were 'learning about the workplace and developing skills'.

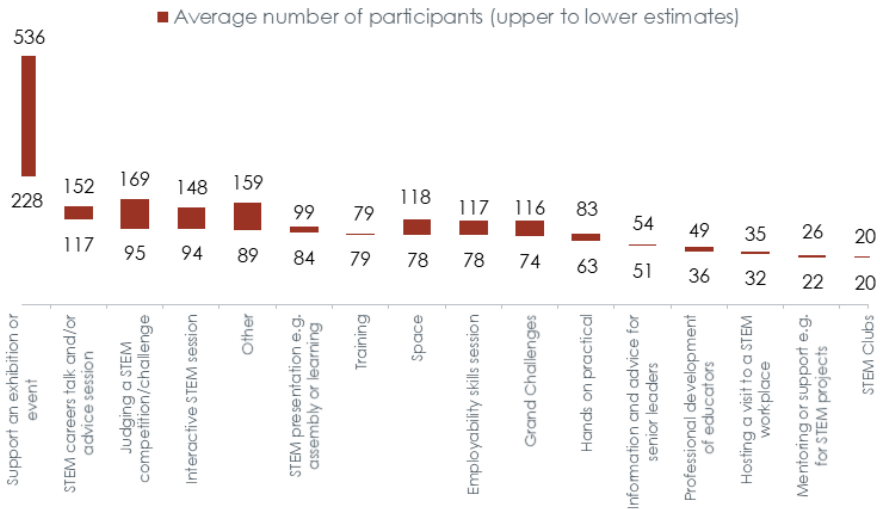
[32] Both estimates remove activities recorded to have 0 participants, whilst the lower end of the range excludes all activities with greater than 1k participants, and the higher end excludes all activities with greater than 10k. These adjustments were made because the data on participants is recorded prior to activities being delivered often resulting in either null or over-estimated participant values, as STEM Ambassadors are unable to predict attendance.

Table A-5: Engagement and feedback

Participants per activity

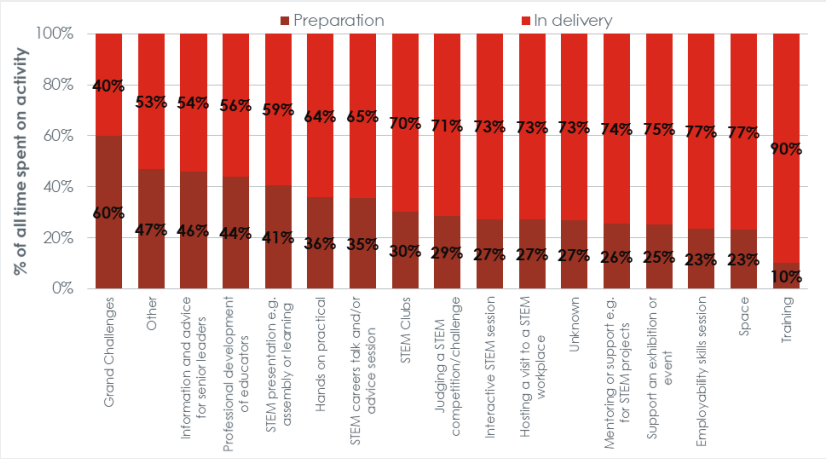
Across all activities, the mean number of participants ranged from 536 (support for exhibition or event) to 20 (STEM clubs).

The mean number of participants for all activities was between 84 (lower estimate) to 139 (upper).



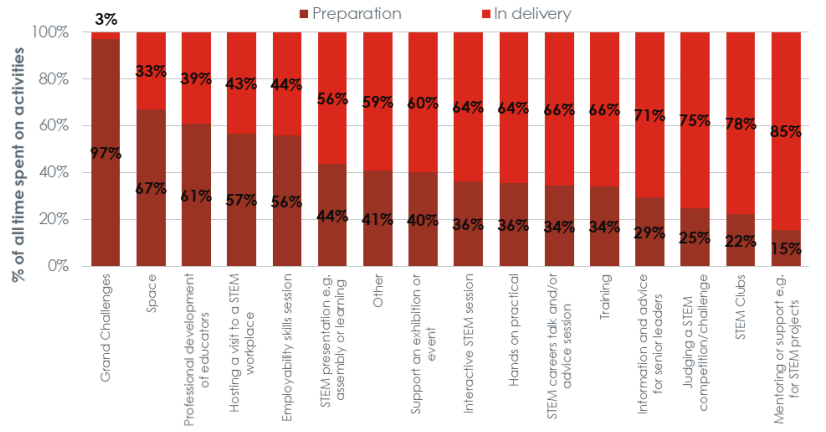
Preparation vs delivery time (educational)

For all activities in educational settings, 66% of STEM Ambassador time was logged as delivery, and 34% in preparation. Some individual activities did vary considerably from the average.



Preparations vs delivery time per activity (Non educational)

For all activities in non-educational settings, 60% of STEM Ambassador time was logged in delivery, and 40% in preparation.



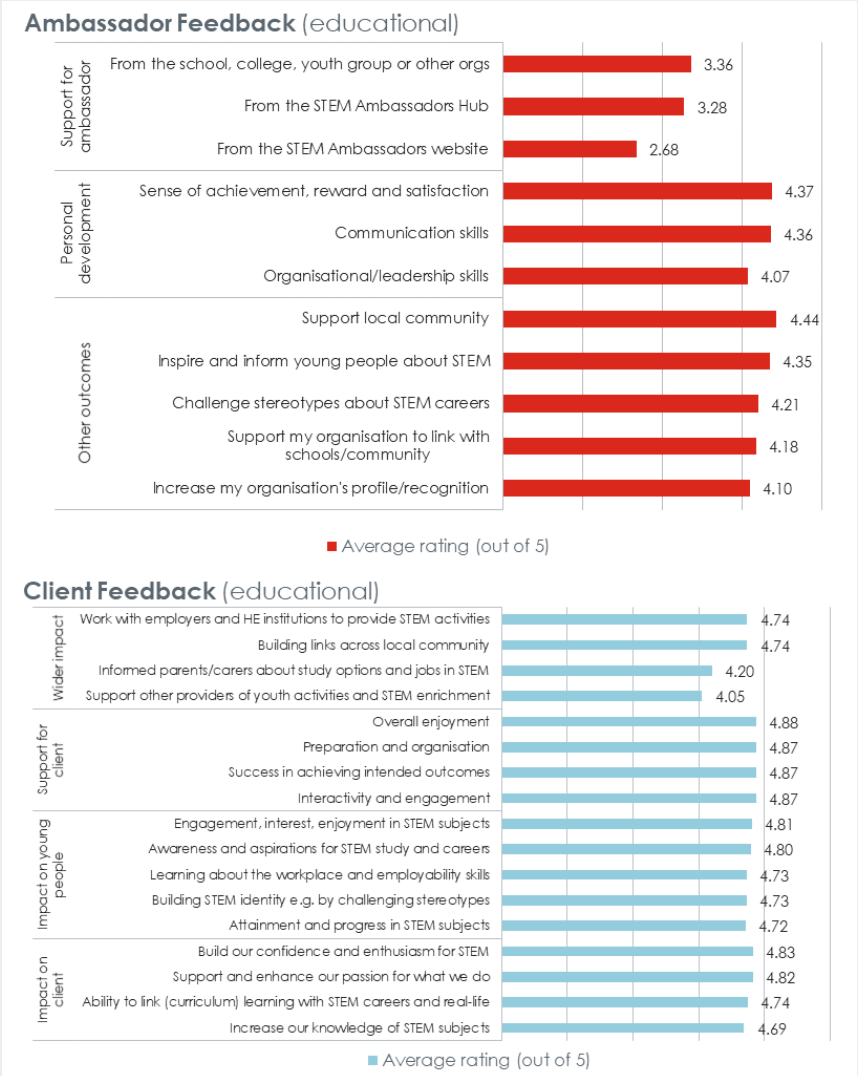
Feedback from Educational settings

On average STEM Ambassadors rated all 'personal development' and wider 'other outcomes' at 4+ out of 5.

Measures within 'support for Ambassadors' categories were rated lowest (3.5-), notably 'From the STEM Ambassadors website' and 'Hub' (2.68 and 3.28).

Of activity organiser (client) feedback, all measures received ratings of 4+.

Several measures in 'wider impacts' were ~0.7 percentage points lower than the majority of others. These were related to outcomes for parents, and wider providers of youth activities.[33]

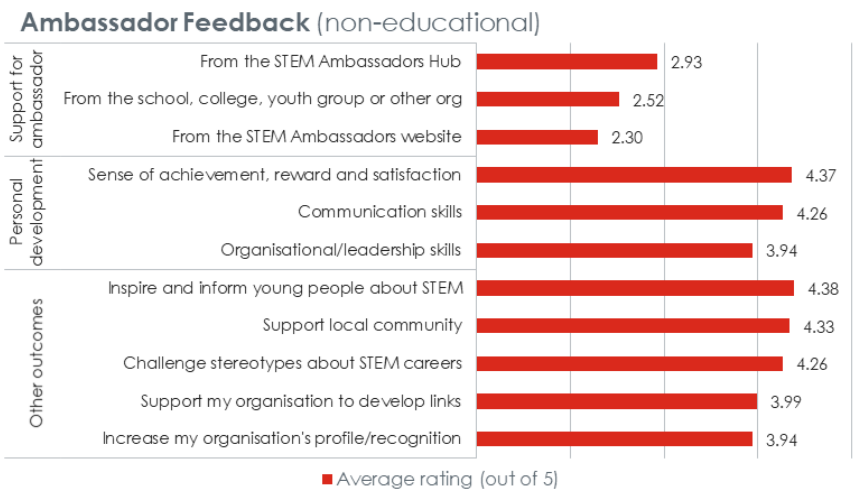


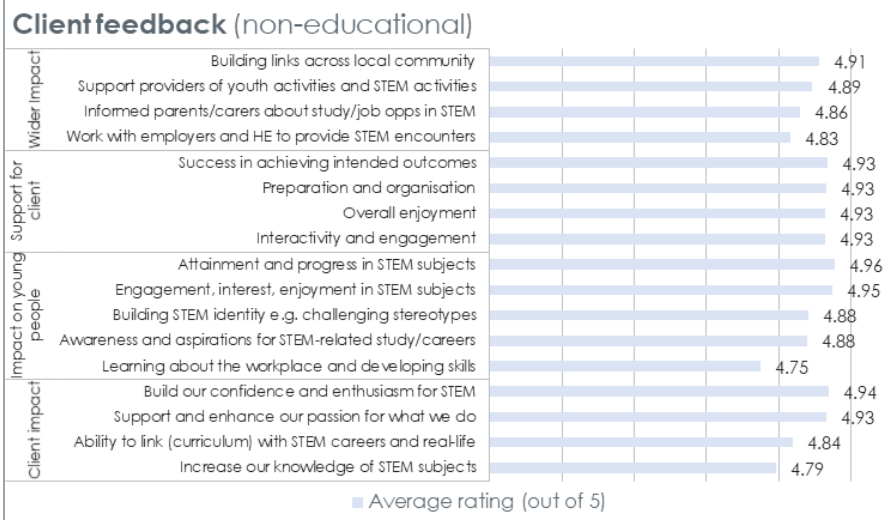
[33] The feedback data we received does not confirm whether 'n/a' responses are permitted during the data collection process, and if so, are recorded in these averages which would lessen the score shown here.

Feedback from non-educational settings

Overall, Ambassadors gave slightly lower feedback scores to events in non-educational settings, notably in support received from the programme and the website, and outcomes for their own organisation.

Client feedback was again generally high, and overall slightly higher than scores given for activities in educational settings. Average scores given by activity organisers (clients) for non-educational activities tended to be more varied, and the lowest score (0.1 percentage points below most) was 'learning about the workplace and developing skills'.





Annex B: STEM Ambassador KPIs

B.1 STEM Learning report progress against a set of KPIs. The data informing these measures is drawn from the data dashboard. Performance measures are reported separately to monitoring data.

B.2 Table B-2 logs information about different KPIs over a period of six years. Some of the KPIs are targets (those that are indicated with either red or green cells) and information is available about the targets and actuals for the green cells. The remainder are metrics that are not targets but are tracked. The core KPIs have remained consistent over this period, with additional information provided in terms of contribution to schools and colleges compared with community groups added from 2019/20. Whilst progress relating to Priority School reach is monitored, neither the KPIs nor monitoring data report how well the programme serves underserved people.

B.3 Hubs quarterly reports requires them to provide a RAG rating of the extent to which they were satisfied with progress against a set of seven work packages outlined in their business plans and their KPIs. Analysis of Hubs Q4 2018/19[34] reports is presented in Table B-1.

B.4 The RAG ratings reflect an assessment of whether the Hub is assessed to be either an emergent, sustained, or high-performing Hub. The assessment is based on their fit against a set of descriptors of seven pillars that are defined in the STEM Learning Regional Network Strategy. These relate to impact, financial sustainability, evidence-informed, staff skills and expertise, strong delivery infrastructure, and an integrated offer.

Table B-1: Count of RAG ratings for KPIs and seven work packages[35]

	Red	Amber	Green	N/A
Achievement of KPIs	1 (5%)	8 (42%)	9 (47%)	1 (5%)
Increasing use of STEM Learning enabling tools to deliver the programme	-	2 (11%)	17 (89%)	-
Increasing quality of engagement	-	2 (11%)	17 (89%)	-
Increasing employer engagement	-	1 (5%)	18 (95%)	-
Increasing and improving collaborative working SLPs and others	-	-	19 (100%)	-
Improving quality of evidence of impact	-	4 (21%)	15 (79%)	-
Communications	-	-	19 (100%)	-
SAH delivery plans	-	1 (5%)	18 (95%)	-

[34] SQW received a full set of reports from the 19 Hubs that existed then for Q4 2018/2019. These were reviewed as they were more typical than those relating to Q4 2019/20 and those for 2020/21 were not all available at the time of analysis

[35] Red: SAH performance doesn't / barely meets the high performing criteria and requires significant improvement.
Amber: SAH performance satisfactorily meets high performing Hub criteria but could improve.
Green: SAH performance clearly meets the high performing Hub criteria.

Source: SQW analysis of Hubs reports Q4 2018/19

B.5 The seven work packages aggregate themes derived from the 15 aims and objectives of the programme that comprise the basis of grant agreements between UKRI and STEM Learning. These are:

1. Maintain the STEM Ambassadors service to schools and non-school organisations, individual volunteers and employers.
2. Increase young peoples' engagement with STEM subjects, especially those from disadvantaged backgrounds.
3. Raise awareness amongst young people of the wide range of careers opened up to them by studying STEM at school.
4. Continue to build and strengthen relationships with employers to support increased engagement with the Programme.
5. Maintain the "STEM Ambassadors" name and strengthen its recognition.
6. To use feedback on STEM Ambassador activities from schools and other organisations to inform the evaluation and apply learning to improve future activities.
7. To communicate planned changes positively to key partners and stakeholders. This will include the Project's focus, its medium term vision and how the changes will benefit stakeholders.
8. STEM Ambassadors Hubs to be actively supporting and encouraging individual volunteers, employers and others in terms of local and regional skills priorities and school/college issues.
9. To build, maintain and continually develop a STEM Ambassador population which reflects the Hub area's population in terms of size, gender and diversity and its current, emerging and foreseeable future skills profiles and needs.
10. Recruit and deploy STEM Ambassadors from a diverse range of employers, ensuring a wide range of STEM sectors and careers are represented.
11. Build and improve links between STEM Ambassador Hubs, Computing Hubs and Science Learning Partnerships to connect to schools/colleges and in particular young people considered "hard to reach".
12. Build stronger links with schools, other organisations engaging with young people, local communities and employers to gain clear lessons for future development of the Project and increase potential links with external funders.
13. Understand educators and the STEM Ambassador community's skills and preferences in terms of school/college/volunteering engagement.
14. STEM Ambassadors, schools and non-school organisations and employers to be interacting effectively through the digital platform seeing benefits in terms of communications, recording of activity and impact, access to resources and support, and convenience.
15. Build and embed digital engagement activities to diversify reach, increase the breadth of the STEM Ambassador service and provide opportunities which can be used during school closures.

Table B-2: Availability of KPI data from documentation provided 2016/17 - 2021/21.

Theme	KPI / Monitoring data / Progress indicator	Year (s) the KPI/ performance indicator has been reported					
		2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
STEM Ambassador Population	Active STEM Ambassadors	Y	Y	Y	Y	Y	Y
	Registered STEM Ambassadors	N	N	N	Y	Y	N
	Approved STEM Ambassadors	N	N	N	Y	Y	N
	% Women	Y	Tracked	Tracked	Y	Y	Track
	% BAME	Y	Tracked	Tracked	Y	Y	Track
	% Under 35 years old	Y	Tracked	Tracked	Y	Y	Track
STEM Ambassador Engagement	Volunteer hours	Y	Y	Y	Y	Y	Y
	Total STEM Ambassador activities	Y	Tracked	Tracked	Tracked	Tracked	Tracked
	STEM Ambassador participation	N	N	N	Y	N	N
	Total volunteer hours supporting (or aligned to) schools and colleges	N	N	N	Y	Y	Y
	Volunteer hours supporting (or aligned) to non-school groups	N	N	N	Y	Y	Y
	Volunteer hours aligned to organisation-led programmes	N	N	N	Y	N	N
	% of non-school volunteer hours (as a % of total volunteer hours)	Y	Y	Y	Y	Track	N
	Breakdown of activities	Tracked	Tracked	Tracked	Tracked	Tracked	N
	Careers Event (% of all activities)	Y	Tracked	Tracked	Tracked	Tracked	N
	Workshop/Challenge (% of all activities)	Y	Tracked	Tracked	Tracked	Tracked	N
	Subject Talk (% of all activities)	Y	Tracked	Tracked	Tracked	Tracked	N
	Curriculum support (% of all activities)	Y	Tracked	Tracked	Tracked	Tracked	N
Schools reached (as a % of all state funded UK schools)	Primary school engagement	Y	Y	Y	Y	Y	Y
	Secondary school engagement	Y	N	Y	Y	Y	Y
	Priority School engagement (monitored by Hubs and SL))	Y	Y	Y	Y	Y	Y
	FE Engagement	Y	Y	Y	Y	Y	Y
Impact	STEM Ambassador Feedback Response rate	Y	Y	Y	Y	Y	Y

	Organisation feedback response rate	Y	Y	Y	Y	Y	Y
	% STEM Ambassadors reported activity as good/very good	N	N	N	Y	Y	N
	% Organisations reported activity as good/very good	N	N	N	Y	Y	N
	Positive impact on educators/wider school or college environment	Y	Y	N	N	N	N
	Positive impact on young people's understanding of STEM careers	Y	Y	N	N	N	N
	Positive impact on young people's uptake of STEM subjects post-16	Y	Y	N	N	N	N
	Positive impact on STEM Ambassadors	Y	Y	N	N	N	N
	Positive impact on employers	Y	Y	N	N	N	N
Wider themes (only seen post 2020)	Social Media engagements	N	N	N	N	Y	N
	Website Visits	N	N	N	N	Y	N
	STEM Ambassador resources	N	N	N	N	Y	N
	Engagement with the STEM Ambassador Community	N	N	N	N	N	Track
	Number of Ambassadors undertaking training activities	N	N	N	N	N	Track
	Number of Ambassadors delivering multiple engagements	N	N	N	N	N	Track
	Number of Ambassadors delivering longer term engagements	N	N	N	N	N	Track
	Number of Employers signed up for the partnership functionality	N	N	N	N	N	Track

Annex C: Locality based case studies

Background

C.1 A set of four locality-based case studies were undertaken that explored how Hubs support and engage networks of schools, informal learning providers, employers and Ambassadors to achieve programme objectives. Our approach to these case studies was to emphasise the need to learn about how things work at an operational level, what was working well and how STEM Ambassadors were adding value to STEM enhancement and enrichment in different localities. The case studies were selected following nomination from STEM Learning for a set of sites that were:

- a good example of either 1) providing inspiration in disadvantaged localities or 2) offering a set of sustained interventions between STEM Ambassadors and young people, or 3) use of digital innovations to extend the reach of STEM Ambassadors
- a mix of areas that covered both urban or suburban areas as well as remote rural or coastal areas
- a pro-active and engaged network from which examples of good practice can be drawn
- not already participating in evaluation work and willing to get involved.

C.2 The four case study localities were:

- Blyth, a North East coastal town characterised by having high levels of economic and social deprivation alongside emerging opportunities with investments in green energy
- Derby, a manufacturing-based economy with major engineering employers, but, as an Opportunity Area, educational attainment is below what would be expected
- East Kent, an area with rich STEM opportunities and a strong network (or 'ecosystem') of employers, researchers and innovation but with some communities in isolated deprived areas
- Glasgow, an urban area with areas of affluence alongside areas of concentrated disadvantage and deprivation.

C.3 Each case study included interviews with people drawn from:

- the Hub operations team
- local stakeholders (e.g. Local Enterprise Partnerships (LEPs) skills leads, Careers and Enterprise Company Hub Lead or Enterprise Advisers, Chambers of Commerce)
- teachers, tutors and activity organisers in educational settings
- activity organisers in informal settings
- employers and/or STEM Ambassadors

Hub organisations

C.4 As with the Hubs across the UK, the four case study Hubs had a range of different characteristics. Two were set up as charities, one was based in a university and one was described as a 'mission led' business support company limited by guarantee. They all delivered other activities alongside the STEM Ambassador work including supporting CREST awards[36], working with the Careers and Enterprise Company and delivering in-school careers programmes, undertaking research and consultancy and running other programmes for young people. The networks and relationships developed for STEM Ambassador work supported and were supported by their other programmes.

C.5 The Blyth Hub had a different model as it was smaller operation than the other regional Hubs. It was run by one person with a Board to direct and support their activiites and was developed as a demand-led approach to a set of circumstances peculiar to the locality. It was highly localised and able to connect many community and stakeholder groups as result.

Strategic partnerships

C.6 Each Hub operates in areas with different economic development structures. One Hub has connections with two LEP areas, one of them being more actively engaged in careers work than the other. Another said that they too had good relationships with an active and engaged LEP. Both of these organisations mentioned having good relationship with their local Chambers but limited programme engagement. The university based STEM Ambassador team described their primary networks as associated with the research and innovation, and education networks. Meanwhile Scotland has different economic development infrastructure compared with other UK nations. The Scottish Hub recently expanded to cover the whole country and its strategic relationships were with the Scottish government and regional improvement collectives. Hub partners therefore bring their own networks to the programme and are able to adapt and respond to opportunities created through the unique configuration of their local strategic landscape.

C.7 Some areas in England were better connected with their local Careers Hub(s) than others. The potential for both to work closely together was mentioned in one locality as a way to create efficiencies and reduce burden in schools who were said to be frequently 'overwhelmed' by the offers they receive for careers or STEM engagement and enrichment.

Operational partnerships

C.8 The nature of operational partnerships vary in each area quite considerably.

C.9 In Blyth the focus of the local Hub is to connect schools and young people with the wide range of new STEM related opportunities that are being created, associated with renewable energy including offshore energy. There are major employers, a very proactive LEP, the National Centre for Computing Education and Offshore Renewable Energy (ORE) Catapult who are all actively

[36] CREST Awards are run by the British Science Association and aim to inspire young people to think and behave like scientists and engineers. https://www.crestawards.org/what-is-crest

involved in drawing in local young people and their families to the opportunities that are being created in the area. It is a small area with a high profile and well-connected STEM Ambassador lead and all partners (perhaps with the exception of the informal sector) know of each other and how they can contribute to their collective agenda.

C.10 Derby has a well-established Hub which have been working with employers and schools across parts of East Midlands for many years. Partnership working is well established with key employers in Derby e.g. Rolls Royce, Goldman Sachs, Destination Chesterfield, Army, Derby University and others. The area builds on its manufacturing base to encourage STEM engagement and enrichment in schools and key partners, including D2N2 LEP are very active. For example, Rolls Royce started a maths mentoring programme which gained a lot of traction with schools and STEM Ambassadors and became a bit too big for Rolls Royce to coordinate. Consequently, the LEP got involved and their enterprise coordinators helped coordinate it. The LEP also is actively involved in promoting its Careers Hubs (partly funded by the Careers and Enterprise Company), employs several enterprise coordinators who work with volunteer enterprise advisers (several of whom are also STEM Ambassadors), run a network of Cornerstone employers (40 key employers across their area) and connect with schools and colleges across the area. There is therefore a lot of 'natural crossover' between the work of the LEP and its Career Hubs and the STEM Ambassador programme.

C.11 In East Kent, the university-based Hub team have strong relationships with schools, employers and STEM Ambassadors in the area. A key factor in this was reported by a stakeholder to be that the Hub team have been operating in the area for many years so have had time to build relationships, as well as a good reputation. The Hub team have cultivated strong links with a number of key employers who are very engaged such as the Operations Director from APS group who has been an active STEM Ambassador for nine years.

C.12 The Hub team is able to tap into and add to a local 'STEM ecosystem' through their partnership with Discovery Park, a life-sciences business park located in Kent. Discovery Park runs a school steering group, a Skills Hub and an Events Hub that bring together local organisations in the STEM education space, including the Hub Team. Discovery Park is working with the Hub team and other local organisations to develop a skills strategy for the area. Also, the Hub team and Discovery Park share contacts and links between each other. Both organisations have a wide network of contacts across STEM industry and education. They connect schools in need of STEM support, with potential volunteers or STEM Ambassadors.

C.13 The Hub lead organisation in Scotland is SERCC[37]. SERCC is charity based in Scotland and which works in the education sector. It has a broad portfolio of services including provision of professional learning for teachers, an Advisory Service and wider STEM engagement activities. SSERC use their national networks to deliver the STEM Ambassador service, these include Education Scotland's STEM Industry in the North project, Lantra Scotland's Forestry Week, and The Institute of Physics' Big bounce event. One staff member manages communications across

[37] SSERC is formally constituted as a not-for-profit company limited by guarantee and a registered Scottish Charity. All 32 Scottish Local Authorities are members of the company. https://www.sserc.org.uk/

the wider STEM Ambassador network. The team have good relationships with many schools and other organisations and are actively fostering these relationships in new areas that they have taken on when they became the sole Hub in Scotland (where previously they were one of three).

Aims for STEM Ambassador programme

C.14 The different localities all expressed a set of core common aims and ambitions. All case study stakeholders were dedicated to the idea that young people in state education benefit from interactions with people who use their STEM skills or work in STEM areas. Employers wanted to be involved because it provides them an opportunity to demonstrate their commitment to a locality whilst also developing their staff and building a good reputation. Hub leads and teams showed remarkable resilience over a difficult period and remained dedicated and enthusiastic about the Programme.

C.15 They also expressed their purpose with different emphases across the four areas. In Blyth the emphasis was on '*sparking interest*' and '*creating opportunities to raise awareness and enthuse children, parents and communities*'. The need to work with families and communities in an area that had seen loss of STEM jobs and generations of unemployment was critical. In Derby respondents emphasised the careers learning and the transferrable skills that studying STEM for longer bring to them and how those skills are used in the real world. For example, one respondent said '*pupils need to realise that they don't need a career in maths to do certain roles that require maths, they just need to understand how maths work*'. Building young people's understanding of work and the skills you need in work was strongly emphasised. This was similar to the responses in Scotland where employability was a key emphasis with, in addition, recognition of employers' needs to fulfil their corporate social responsibility goals and enrich the roles of their employees. In East Kent the STEM Ambassador team were driven by a social equity mission and to encourage diversity and inclusion in STEM careers and education by providing young people with interactions with a diverse range of STEM Ambassadors.

Delivery issues and priorities

C.16 The locality teams talked about a range of similar delivery issues;

- Managing a volunteer workforce. The Hub teams said it was important to value and put time into managing their STEM Ambassadors, to onboard them quickly after they register on the digital platform, offer training and communicate regularly (preferably with some face to face to ensure Ambassadors have opportunities to volunteer in ways that they feel comfortable).
- Retaining Ambassadors was important as it builds skills and is more efficient than constantly recruiting. Some Ambassadors have been with the programme a long time or volunteer very many hours. Using these people effectively as champions or mentors was said to be important.
- The importance of key employers. The localities all had a small number of relatively large or influential employers who provided STEM Ambassadors and other networking benefits to the programme.

- Recognising the needs of industry. Ensuring that schools and others recognise the needs of volunteers from industry. For example, they need to have sufficient notice of a request to build it into their diaries (one said at least 4 to 6 weeks in advance). It was important to recognise that this was a two-way conversation that was not just about what the Ambassador can do for the school but how their participation met their own or their organisation's development needs.
- Delivering to challenging targets. Targets vary but placing STEM Ambassadors into c. 80% of secondary schools, 20% of primary schools and 95% of all Priority Schools is challenging as it requires almost universal working knowledge of the programme among school STEM or careers teams.
- Geographic coverage. Most Hubs cover wide geographies and some areas were said to be 'coldspots' in terms of the availability of STEM Ambassadors in particular places.
- DBS checking – Some DBS forms are checked via the Hub which creates a workload that needs to be managed
- Capturing impact. This was something that they wanted to do but found it difficult to do in practice. Some respondents used general verbal feedback to get a sense of how their activity or engagement had gone. Others could recite micro-level 'feel good' stories. Hearing and capturing these stories was said to be a 'really powerful' form of impact measure.

Support from STEM Learning

C.17 The localities had a range of comments to make about STEM Learning.

- Promotion across programmes. STEM Learning were said to be effective at supporting science teachers through their other programmes. They could therefore raise awareness of the STEM Ambassador programme through their marketing and during delivery of training. The downside to this is that a lot of their external communication was thought to be about teacher CPD rather than the Ambassador programme which can make it appear like a lower priority
- Website resources. With reference to resources available on the website, an employer said they used the resources as the basis for their engagement but they adapted them to suit their needs as they found them too 'academic'.
- Being based in York. This was seen as a positive because so many other programmes and national networks are based in London. A northern base gives it greater credibility in some geographies.
- Quality reputation. Perceptions of the programme reported in the case studies mentioned that the programme had high brand awareness associated with it being national, well respected and well-known, also that it was known to insist on DBS checks for all

Ambassadors. They felt this therefore meant that it was seen as a quality programme among their key partners and stakeholders.

- Managing Hubs across regions. The Hubs bring different organisational strengths, experiences and ways of working. In some areas the regional networking of Hub leaders and teams was thought to be really helpful because they can share experiences, practice and resources. This helped remove the feeling of being isolated. The arrangements are different in Northern Ireland, Scotland and Wales.
- Digital communication software. STEM Learning have provided an email communication tool that Hubs can use which has functionality for Hubs to see who has engaged with which communications so that they can follow up or target further communication accordingly. This gives them valuable insight into key messages and reach.
- The STEM Learning digital platform. The platform was said by many people to be useful in principle but not as smooth to use as it should be. Changes to the platform were said to be useful incremental improvements although communication with Hubs about planned and imminent changes was said to be unreliable.

The effects of Covid-19

C.18 The national lockdowns associated with the Covid-19 pandemic meant that schools and colleges were closed for extended periods during the summer term in 2020 and again in 2021 when traditionally quite a lot of enrichment activity takes place. Even when schools were re-opened, many have been focused on school recovery and have not welcomed visitors as part of their social distancing measures.

C.19 The move to providing digital experiences was welcomed by some as it meant that some young people (for example those in 'cold spots') could access engagement with a STEM Ambassador in a way that they could not have done before. While some Ambassadors were said to prefer this way of engaging, it was not the case for all. In fact, most of the localities were keen to return to face to face engagement as soon as possible saying this was the best and most impactful way to make an impression on a young person.

Annex D: Case studies of international practice

D.1 A series of five case studies was undertaken to provide examples of practice and different models of delivery. A long list of potential case studies was drawn up based on SQW resarch and expertise, recommendations from a 'Think Piece' provided by researchers at UCL for UKRI and nominations from stakeholders and UKRI. A list of 25 options was reduced to five that were chosen on the basis of their relevance in scale and scope to the STEM Ambassador Programme.

D.2 Each case study comprised a review of websites and a literature search alongside an interview with the project management lead. The five case studies and the key contacts are summarised in Table D-1.

Table D-1: Case studies participating in the STEM Ambassador programme review

Organisation: Project	Project	Location	Interviewee role
Education and Employers	Inspiring the Future	England and Wales	Director of Operations and Programmes, Education and Employers.
Mystic Aquarium	STEM Mentoring	USA	Director of STEM Programs, Mystic Aquarium.
Speakers for Schools	Inspiration Programme	England, Wales and Scotland	Education and Policy Director, Speakers for Schools.
The Boys and Girls Club of Lansing and the University of Michigan	Get City	Michigan, USA	Professor & Chair, Educational Studies, University of Michigan. Research Scientist, University of Michigan.
University College: London	50:50 Engineering Engagement Programme	London and South East England	Head of Education Engagement, Faculty of Engineering Sciences, University College London.

Source: SQW

D.3 The case studies have been written up to focus on a particular aspect of practice that is relevant to the STEM Ambassador review and the future strategic options for the programme. Each case study also includes a resources section to guide further reading.

Education and Employers: Inspiring the Future

D.4 Education and Employers is a UK based charity launched in 2009 which aims to "provide young people with the inspiration, motivation, knowledge, skills and opportunities they need to help them achieve their potential". Inspiring the Future is its flagship service and it also runs Primary Futures, and Inspiring Governance. Table C-2 provides summary data relating to the case study.

Table D-2: Summary data for Inspiring the Future

	Key data
Web address	https://www.inspiringthefuture.org/
Delivery organisation	Education and Employers (https://www.educationandemployers.org/)
Funder	The Bank of America is the lead corporate sponsor. Others have included AKO Foundation, Education and Skills Funding Agency, Commercial Education Trust, JP Morgan, The Dulverton Trust and Edge Foundation.
Geography	England and Wales
Date founded	2009
Funding received/ yearly turnover (£)	Total Education and Employers income for financial year ending 31st March 2020: £2,238,047[38] to run all its programmes (Inspiring the Future, Primary Futures, and Inspiring Governance)
Number of beneficiaries	19,788 teachers registered and 2,000,000+ young people reached[39]
Number of volunteers	68,851 volunteers registered[40]

The platform and Education and Employers research

D.5 Inspiring the Future works on the premise that there is a latent willingness for state schools and employers/ employees to collaborate for career-related learning if barriers can be removed. The project aims to remove these barriers and facilitate collaboration between teachers and employer volunteers through a simple-to-use online platform.

D.6 Volunteers complete a 5-minute registration process via the on-line bespoke platform to provide information about their jobs, the sector they work in, which locations they would be happy to cover, and a range of other questions about who they are and what activity they might be happy to take part in. They are also asked which organisation they are from and this information is collated by Education and Employers to be shared with the volunteers' employers in order to help them evidence their CSR activity. The volunteers are not DBS checked as there is always a teacher present when they go into schools.

[38] https://register-of-charities.charitycommission.gov.uk/charity-details/?subid=0&regid=1130760
[39] As reported on their website. Timescales unclear https://www.inspiringthefuture.org/
[40] As reported on their website. Timescales unclear https://www.inspiringthefuture.org/

D.7 There is also registration process for schools to express their interest in the programme. Once schools are registered there is a short process for advertising new activities which asks details about where they are based, the number of volunteers they need, the activity that they are planning, when it will happen, and the year groups, numbers and ages of the children. Schools can then search the database of volunteers to select individuals who they would like to take part in whatever activity they are planning, be it a careers insights talk, careers fair, subject-focused activity or another activity type.

D.8 The online platform includes resources for volunteers and schools including information and expectations around the programme, training webinars, information pdfs and pre-recorded resources.

D.9 Inspiring the Future is a relatively low-resource inspiration programme to run. The platform reportedly has low maintenance costs. The programme itself requires low administrative and support inputs as its design is essentially 'self-service', it does not manage onboarding, training, DBS checking, and it expects both schools and volunteers to access the resources that they need. The project team provide active support to match and maintain relationships with volunteers and schools and undertake school-based training. There are very occasionally volunteers who do not meet standards of good practice but this is not widespread as volunteers have to meet certain criteria to join, are given access to information and training materials through the portal, and have voluntarily signed up positively committed to the aims of the programme.

D.10 Inspiring the Future is an evidence-led programme that benefits from being situated within Education and Employers. This is an organisation that undertake research, and actively network with their research community on education and employer engagement to inform education policy and practice.

Resources

Percy, Chris, and Martin Rogers. The Value of Volunteering: Volunteering in education and productivity at work. Education and Employers (Jan. 2021). https://www.educationandemployers.org/wp-content/uploads/2020/12/The-Value-of-Volunteering-final-8th-Jan-2021-1.pdf

Mann, Anthony, et al. Primary Futures: connecting life and learning in UK primary education. Education and Employers (May 2017), https://www.educationandemployers.org/wp-content/uploads/2017/05/Primary-Futures-research-essay-2017-Mann-Kashefpadkel-Iredale.pdf.

Education and Employers. Inspiring The Future – Connecting schools and colleges with volunteers from the world of work. Accessed 20 Dec. 2021.

Mystic Aquarium: STEM Mentoring

D.11 Sea Research Foundation (SRF) is a non-profit organisation focused on conservation, education, research, and youth development. It aims to provide mentoring and academic enrichment to underserved youth by implementing its STEM group mentoring programmes. These seek not only to build STEM skills in youth but also foster conservation-minded citizens of the future. Over the past decade, SRF has partnered with more than 100 Boys & Girls Clubs, YMCAs, school districts, and other youth-serving organizations The case study organisation is Mystic Aquarium, Connecticut who deliver one of SRF's programmes. Table D-4 provides key data relating to the SRF programme.

Table D-3: Summary data for STEM Mentoring

	Key data
Web address	https://stemmentoringprogram.org
Delivery organisation	Mystic Aquarium (part of Sea Research Foundation, Inc.)
SRF Funder	The Office of Juvenile Justice and Delinquency Prevention (under the U.S. Department of Justice's Office of Justice Programs)
SRF Geography	Typically, 40-50 locations across many states in the USA
Date founded	2015
Funding received/ yearly turnover (£)	Approximately $1m a year
Number of beneficiaries	In a typical year, approximately 1,000 youths aged 6-10
Number of volunteers	In a typical year, approximately 250+ mentors aged 12+

Community delivery and having a structured programme

D.12 STEM Mentoring is a group mentoring program where mentors and mentees meet over the course of a year and complete STEM activities. It is run by Mystic Aquarium, with the aim of helping young people achieve better social, academic, and behavioural outcomes, and increase their knowledge and interest in STEM subjects and careers.

D.13 STEM Mentoring is a structured programme. Each group of four mentees is matched with at least one mentor. Mentor groups meet once a week for a year and complete STEM activities in the presence of a Programme Coordinator. The STEM Activities are designed by Mystic Aquarium and their partners and cover introductory STEM topics, renewable energy, endangered species, and others chosen for their potential to engage the mentees. Approximately every two months, a STEM enrichment activity is run, where the Programme Coordinator, mentors, and mentees visit sites with STEM significance such as museums, universities, zoos, or any other relevant site.

D.14 Delivery of the STEM Mentoring programme is devolved to local youth-serving organisations such as Boys & Girls Clubs and YMCAs that apply for yearly subawards. The programme is flexible to allow organisations to tailor who they recruit as mentors to their specific

circumstances. For example, as explained by the interviewee, one organisation might partner with a bank, inviting their employees to mentor the organisation's youth. Another organisation might partner with a church whose congregation is asked to volunteer. Another organisation might be based in university towns, so the students would serve as mentors. Many organisations also recruit teens from within their own membership to serve as cross-age peer mentors. This flexibility in the programme helps organisations recruit enough mentors, as some have difficulty recruiting due to being in rural areas, on military bases, or in high-crime neighbourhoods.

D.15 Devolving the STEM Mentoring programme to local organisations means they can tailor it to the local cohorts of young people, which vary significantly by location. For example, one of the South Dakota sites serves Native American young people living in poverty, including many who are being raised by single parents or grandparents. In one of the Baltimore sites, the vast majority of mentees are African American. One of the Alaska sites on a military base serves young people who tend to be white and from higher income families that lack parental time due to military deployments.

D.16 The STEM Mentoring programme engages families throughout the implementation period. This includes information sessions for participating youth, families, and mentors to kick off the programme. Each STEM Mentoring module includes resources for youth to share with family members at home, including websites, games, online videos, and printed books on STEM topics. Families are also invited to participate in some STEM enrichment activities during the programme year.

D.17 The programme concludes each year with a graduation event that brings mentees, mentors, programme staff, and family members together to celebrate the year and to close the mentoring relationship. Mentees present mentors with certificates of appreciation; mentees receive certificates of graduation; and all receive a photograph of their mentor group and a magnetic picture frame to commemorate the experience.

Resources

Kupersmidt, Janis, and Rebecca Stelter. Research-informed recommendations for youth mentoring programs with a science, technology, engineering, or mathematics focus, (2018), Https://files.eric.ed.gov/fulltext/ed594110.pdf.

STEM Mentoring, https://stemmentoringprogram.org. Accessed 20 Dec. 2021.

Speakers for Schools: Inspiration Programme

D.18 Founded in 2010 by ITV's Political Editor, Robert Peston, Speakers for Schools is a registered charity. It aims to end educational inequality by giving all young people access to the same prestigious networks available to the top fee-paying schools in the UK. Through talks from influential figures (Inspiration Programme) and work experience (The Experience

Programme) the organisation links state school students to industry-leading companies to help level the playing field for young people of all backgrounds. Table D-4 provides key data relating to their Inspiration Programme.

Table D-4: Summary data for the Inspiration Programme

	Key data
Project name	The Inspiration Programme
Web address	https://www.speakersforschools.org/
Delivery organisation	Speakers for Schools
Funder	The Law Family Charitable Foundation[41]
Geography	England, Wales and Scotland
Date founded	October 2011
Funding received/ yearly turnover (£)	Income received for financial year ending 31 August 2020: £893,382[42]
Number of beneficiaries	Since 2011: 1,100,000 students reached through 8,656 school talks
Number of volunteers	1,700 speakers working with 3,371 state schools and colleges

Volunteer support

D.19 The Inspiration Programme is one of the experiences offered by Speakers for Schools. It is a UK wide programme where people who are prominent in their field give talks in state schools to inspire young people. The project was set up on the basis that young people in private schools often have several opportunities to meet with people from a range of careers, but that this is not the case for all young people in state schools. The project was set up to help redress this imbalance and this remains the focus of the project. It targets disadvantaged schools in particular and uses publicly available data to select those schools including Ofsted data and whether schools are based in disadvantaged areas. Since 2011, it has reached a high proportion of all state schools having engaged with 3,371 state schools and colleges[43].

D.20 The programme requires the volunteers to be senior people who are successful and prominent in their field. In order to recruit volunteers, the programme taps into the networks and contacts of Robert Peston, the founder of Speakers for Schools, board members and other speakers. Word of mouth is an important element of the programme and has resulted in the recruitment of high-profile, influential volunteers. Whilst this has proved effective at building a large cohort of volunteers it is less effective at reaching and recruiting senior people from diverse backgrounds.

[41] About us - Speakers for Schools
[42] https://register-of-charities.charitycommission.gov.uk/charity-details/?regId=1150411&subId=0
[43] DfE school census data reports there are 3,458 state funded secondary schools and 1,005 state funded special schools in England in 2020/21. https://explore-education-statistics.service.gov.uk/find-statistics/school-pupils-and-their-characteristics

D.21 Speakers for Schools ensures that volunteers are supported throughout their engagement with the programme as it helps to get the best from them and improve the quality of their talks in schools. They do this by pairing all volunteers with a relationship manager who manages, supports and briefs them before they deliver any talks in schools.

D.22 The cohort of volunteers often have busy schedules and many other commitments outside of the Inspiration Programme. To ensure the Inspiration Programme accommodates this, Speakers for Schools ask volunteers to do only one talk a year. They have found that keeping the requirements on the volunteers to a minimum helps to enable many to take part and over longer periods of time.

Resources

Speakers for Schools. Speakers for Schools - Our Home. Accessed 20 Dec. 2021.

The Boys and Girls Club of Lansing and the University of Michigan: Get City

D.23 The Boys & Girls Club (BGC) of Lansing began in 1964 as the Boys Club of Lansing. Local businesses established an activity centre targeting underprivileged street youth. Its focus has remained to support youth from disadvantaged circumstances, who lack appropriate resources and role models for success in school and/or employment. It runs several different education programmes including Power Hour (to create engaging homework help), STEM Computer Science (to introduce young people to creative computing) and GET City which is based in an Innovation lab and makerspace and runs a series of after-school clubs. Table D-5 provides an overview of the organisation.

Table D-5: Summary data for GET City

	Key data
Project name	GET City
Web address	https://www.bgclansing.org/education
Delivery organisation	The Boys and Girls Club of Lansing and the University of Michigan
Funder	Federal grants and community foundation grants
Geography	Lansing, Michigan
Date founded	2006
Number of volunteers	Not reported

Building research into the programme

D.24 The GET City programme provides sustained informal engineering design experiences for youth with advanced digital technology, maker spaces and a network of experts to advance their understanding of and interest in energy and engineering, and to take action on the issues

they care about in their lives and communities. It provides a programme focussed on STEM learning that is complemented by others run through the Boys and Girls club which support study skills and provide career information and guidance.

D.25 Research has been an integral part of the programme since its inception, as it was co-designed by the BGC[44] Lansing and the University of Michigan. The partnership came together as the University of Michigan had a regional science centre that wanted to engage their local community, while the club wanted to build connections with external organisations.

D.26 The programme has continued to be run in partnership. The key stakeholder at the University of Michigan works closely with the president of the BGC Lansing and together they plan and shape the youth programme. In terms of delivery, BGC Lansing provide the venue among other resources and the University of Michigan staff the programme with students from their university.

D.27 One distinctive element of the programme, alongside supporting youth is its focus on learning what works. They have published several research papers informed by the GET City programme as listed in the Resources section. The programme is constantly in a feedback cycle to understand and adapt activity. It has changed over time as it has responded to the research literature and the developing needs and interests of youths and their communities. The content of their programme is led by epistemology and methodology. This means that they are more interested in designing, testing and adapting how the young people learn, than focusing on teaching particular topics.

D.28 The youth who take part in the programme are included as active participants in the research, learning and teaching. They are treated as the co-designers of the programme. Their opinion is valued by the programme facilitators, and they are encouraged to be as active as possible. The programme facilitators value coproduction and involving youth in their exploration of science education theory, and how it works in practice. They have co-presented and written papers with the young people. They also view youth participants as powerful teacher educators, and a group of the young people have run sessions for teachers at the Michigan State university.

Resources

Calabrese Barton, Angela, et al. “Youth as community science experts in green energy technology.” Afterschool Matters (2013) https://files.eric.ed.gov/fulltext/EJ1016811.pdf. Accessed Dec. 2021.

Calabrese Barton, Angela, et al. “Citizen(s’) Science: A response to “The Future of Citizen Science". Democracy & Education, vol. 20, no. 2,

[44] Boys and Girls Clubs are community centres that offer programmes for youth aged 5-17 including homework clubs, sports and youth development.

https://democracyeducationjournal.org/cgi/viewcontent.cgi?referer=https://scholar.google.com/&httpsredir=1&article=1044&context=home. Accessed Dec. 2021.

Calabrese Barton, Angela, et al. "Science learning as participation with and in a place." Moving the Equity Agenda Forward, vol. 5 (2013), https://doi.org/10.1007/978-94-007-4467-7_12. Accessed Dec. 2021.

Calabrese Barton, Angela, et al. Becoming community science experts in green energy technologies. http://stelar.edc.org/sites/stelar.edc.org/files/GET%20City%20ITEST%20white%20paper.pdf. Accessed Dec. 2021.

Penuel, William R. "Research–practice partnerships as a strategy for promoting equitable science teaching and learning through leveraging everyday science." Science Education, vol. 101, no. 4 (2017), Research–practice partnerships as a strategy for promoting equitable science teaching and learning through leveraging everyday science - Penuel - 2017 - Science Education - Wiley Online Library. Accessed Dec. 2021.

Boys and Girls Club of Lansing. https://www.bgclansing.org/education. Accessed 20 Dec. 2021.

University College London. 50:50 Engineering Engagement Programme

D.29 The Faculty of Engineering Sciences at University College London initially developed the 50:50 programme to attract a more diversity in its student population. It has been championed by the Head of Education Engagement at UCL Engineering, who has also been instrumental in establishing and driving the 50:50 Engineering Engagement Strategy. Table D-6 provides summary data relating to the programme.

Table D-6: Summary data for 50:50 Engineering Engagement Programme

Project name	Key data
Web address	https://www.ucl.ac.uk/engineering/strategic-priorities
Delivery organisation	UCL
Funder	UCL
Geography	London
Date founded	2014
Funding received/ yearly turnover (£)	-
Number of beneficiaries	The strategy has been implemented across 134 STEM programmes, events and activities, with over 6,000 children and young people and 529 schools across the UK

Project name	Key data
Number of volunteers	Between 600-800 UCL Engineering staff and students design and deliver the activities every year.

Source: SQW and https://www.ucl.ac.uk/engineering/strategic-priorities

Link with organisational values

D.30 The UCL 50:50 Engineering Engagement Programme aims to strengthen and diversify the engineering workforce, by encouraging children and young people from a wide range of backgrounds, especially young girls, to consider career pathways both 'in' and 'from' engineering. The programme also aims to increase school teachers' knowledge, skills and confidence around engineering topics, and to increase the knowledge of relevant stakeholders on how to inspire young people around engineering and technology.

D.31 Requiring 50% participation of girls across all STEM engagement programmes was not just about getting a 50:50 gender balance. It was about sending a strong message in the classroom, at home and to society about breaking down stereotypical messages that have created invisible barriers affecting young people's confidence and career choices. Over the years, the programme evolved to include equal representation across a range of other characteristics.

D.32 Based in the Faculty of Engineering Sciences, at University College London (UCL), the programme runs each year c. 130 engineering projects, events and activities with over 500 primary and secondary schools in London and the UK, and between 600-800 UCL staff and students designing and delivering their. activity programmes. The projects, events and activities have provided young people with the opportunity to:

- Design solutions for contextualised engineering challenges providing real world learning opportunities to enrich the school curriculum
- Problem-solve in real contexts relevant to young people
- Engage with engineering skills and design processes in practical hands-on experience in laboratories, promoting learning through experimental engineering
- Work with expert role models: engineers, scientists, undergraduate and postgraduate engineering students from diverse backgrounds
- Engage with cutting edge STEM research and enable young people to discover exciting STEM career pathways

D.33 Activities have been delivered in primary and secondary schools to young people in all year groups. The programme takes a whole school approach and works with the same schools and pupils over time in a meaningful, sustained manner.

D.34 The programme aligns with organisational values, notably UCL's Equality, Diversity & Inclusion Strategy, which has helped to ensure senior buy-in, garner support for the programme and enable it to deliver at scale. The 50:50 Engineering Engagement programme

has been able to create a step change in the representation of girls and young people from ethnic minorities, across UCL's STEM activities and events. In fact, the programme was designed to action the aims of the 50:50 Engineering Engagement Strategy and has been central in its delivery. The impact of the 50:50 strategy and programme together with the alignment with organisational values has helped to encourage staff and students to take part, which is crucial as they are responsible for designing and delivering the programmes, events and activities.

D.35 The programme has reached a large scale due to the passion, enthusiasm and support from UCL Engineering academic and research staff, undergraduate and postgraduate students and the senior leadership team.

Resources

Sally Day and Elpida Makrygianni. 50:50 participation in pre-19 engineering education. https://gender-summit.com/attachments/article/1346/Day_GS9Eu.pdf. Gender Summit (November 2016)

Gender Disparity in Engineering (page 14). EngineeringUK briefing report https://www.engineeringuk.com/media/1691/gender-disparity-in-engineering.pdf (July 2018)

Cinnabar Consultancy. UCL 50:50 UCL Engineering Engagement Strategy; Evaluation study. (December 2018)

UCL. "Pioneering UCL Engineering 50:50 Engagement strategy recognised by Engineering UK." UCL Engineering (25 Oct. 2018), https://www.ucl.ac.uk/engineering/news/2018/oct/pioneering-ucl-engineering-5050-engagement-strategy-recognised-engineeringuk. Accessed 20 December 2021.

Creating a step change in the representation of girls and women in science and engineering | Unesco IIEP Learning Portal. http://learningportal.iiep.unesco.org/en/blog/creating-a-step-change-in-the-representation-of-girls-and-women-in-science-and-engineering. Accessed 20 Dec. 2021

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SQW

SQW is a leading provider of research, analysis and advice on sustainable economic and social development for public, private and voluntary sector organisations across the UK and internationally. Core services include appraisal, economic impact assessment, and evaluation; demand assessment, feasibility and business planning; economic, social and environmental research and analysis; organisation and partnership development; policy development, strategy, and action planning. In 2019, BBP Regeneration became part of SQW, bringing to the business a RICS-accredited land and property team.
www.sqw.co.uk

Oxford Innovation

Oxford Innovation is a leading operator of business and innovation centres that provide office and laboratory space to companies throughout the UK. The company also provides innovation services to entrepreneurs, including business planning advice, coaching and mentoring. Oxford Innovation also manages investment networks that link investors with entrepreneurs seeking funding from £20,000 to £2m.
www.oxin.co.uk