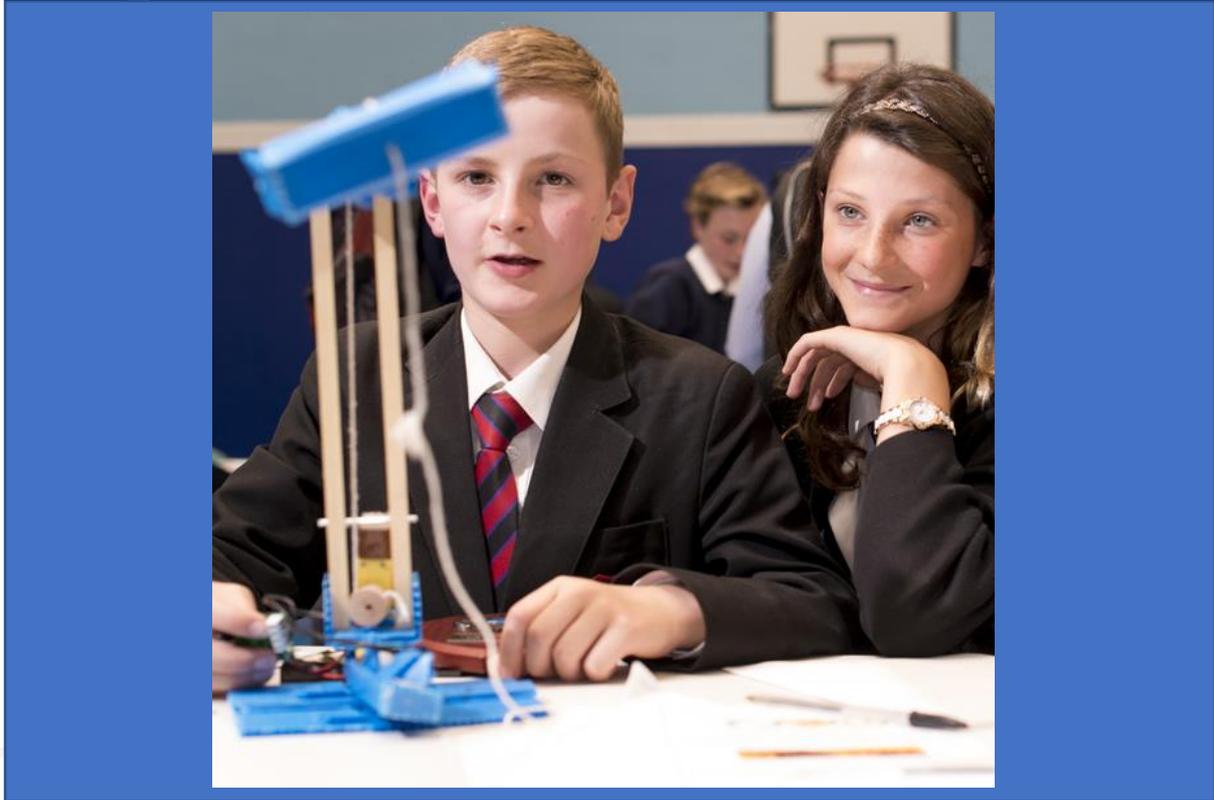


Evaluation of the impact of the STEM Ambassadors programme upon STEM Ambassadors



Dr Hannah Blake
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December 2022

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Hanson, J., Moore, N., Clark, L., & Neary, S. (2021). ['An evaluation of the Northeast of England pilot of the Gatsby Benchmarks of good career guidance'](#). Derby: University of Derby

Hanson, J., Neary, S., and Blake, H. (2021). ['Personal Guidance Fund Evaluation: Final Report'](#). London: The Careers & Enterprise Company.

Hanson, J. and Burke, C. (2020). ['Addressing unrealistic optimism with counterfactual reasoning in an employability module in higher education'](#). Journal of Applied Research in Higher Education, pp. 1-35.

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Executive Summary

STEM Learning has a commitment to supporting and developing STEM education across the United Kingdom, part of which involves bringing STEM role models into schools and non-educational settings in the form of STEM Ambassadors. The variety of activities that STEM Ambassadors participate in include workshops, delivering practical activities and supporting STEM clubs. There are over 30,000 Ambassadors across the UK from a range of backgrounds who volunteer to inspire and engage young people to pursue careers and further studies in science, technology, engineering and mathematics (STEM) subjects.

The purpose of this project was to evaluate the STEM Ambassadors programme to investigate STEM Ambassadors' experiences with the programme, and the impact that their volunteering has upon Ambassadors themselves and those they engage with. This was done through reviewing the annual survey of STEM Ambassadors distributed by STEM Learning and analysing the data fed back by active STEM Ambassadors. Through this evaluation the aims were to explore:

- The impact of the STEM Ambassadors' volunteering upon their personal development, career progression and personal benefits;
- STEM Ambassadors' perception of the impact of their volunteering upon other people;
- The impact of the COVID-19 pandemic on the programme and the effects of the shift to virtual engagement upon engagement, uptake of activities, and Ambassadors' experiences.

The project evaluation found that the majority of STEM Ambassadors who completed the 2022 survey were found to be in full-time employment, closely followed by retired Ambassadors and often had 20+ years of work experience. STEM Ambassadors often came from larger organisations with employee numbers of more than 1,000, with some employers exceeding 10,000+ employees. Volunteer hours varied, and a higher number of volunteer hours were generally found within the 0-5 hours, 6-10 hours or 21+ hours brackets.

Motivations of the STEM Ambassadors were often drawn from wanting to raise awareness of STEM amongst young people, with inspiring the next generation as the top motivation for all volunteers. There were no significant correlations found to link motivations and volunteer demographics. The Ambassadors rated medium to high benefits for both young people and educators, and were less likely to see benefits for their employers. Increased awareness of STEM subjects and careers were seen to be among the strongest perceived benefits for young people, with some volunteers explaining the feedback they had received from the educators and young people. The STEM Ambassadors and the STEM Ambassador programme were also believed to be highly beneficial to educators, with Ambassadors explaining that it helped to link STEM and curriculum learning to real life.

Most STEM Ambassadors thought that their volunteering role brought them improved skills, particularly regarding communication skills. The analysis found that there was a correlation between years' work experience and skills gained, with individuals with fewer years' work experience reporting larger skills gains generally. Career progression was thought to have been helped through their volunteering; however, this was particularly important for student STEM Ambassadors. Many STEM Ambassadors expressed that they gained a sense of achievement, reward and satisfaction from raising the profile of STEM with young people.

COVID-19 was reported to have affected STEM Ambassadors in terms of engagement and delivery. For many Ambassadors, the pandemic had seen a move to virtual delivery, for which the Ambassadors had mixed feelings. Some Ambassadors reported that the pandemic had affected their ability to volunteer and the volunteering opportunities available, with others expressing the impact of COVID-19 on communication between organisations and schools.

The STEM Ambassador programme was generally very well received by the Ambassadors who responded to the 2022 survey, with many expressing how they believed their role played a positive impact on engaging schools and young people in STEM activities and learning and their work encouraged young people to explore STEM careers.

Recommendations

- Educators need to be given more insight and guidelines into what is to be expected from the STEM Ambassadors: Ambassadors reported feeling that their role was often mistaken for a substitute teacher.
- A hybrid approach for the programme works well for the Ambassadors. Whilst many believe face-to-face volunteering is more impactful, for others virtual allows flexibility for both Ambassadors and educators. Using a hybrid approach allows for more hands-on activities to be delivered in a face-to-face format and sessions such as presentations can be delivered virtually.
- The sharing of impact data would be appreciated by STEM Ambassadors to allow them to see the proof of the impact of their volunteering on young people. This could be done through the delivery of the findings from impact evaluations via newsletters.

Background

STEM subjects are important in schools because they serve as the fertile ground from which research and innovation, future technical workers and industry leaders will be nurtured. These workers are critical to the economy because STEM subjects underpin the foundation of many sectors which rely on the knowledge and skills developed in science, technology, engineering, and maths subjects.

Although STEM careers have experienced some of the highest levels of growth of any industry (e.g. EDF, 2016) and STEM is shortly expected to become one of the largest employment sectors in the world, the UK's STEM skills shortage is long-standing and well-documented. Advances in the STEM sector brings significant numbers of new career prospects, for which there are a lack of individuals to fill the roles. This shortage costs employers £1.5 billion a year in additional training costs, recruitment, temporary staffing and inflated salaries (STEM Learning, 2018), and this shortage of new people entering these careers could reduce foreign investment (Department for Business, Energy and Industrial Strategy, 2017). Furthermore, the workforce in these STEM careers lacks diversity. Women make up less than a quarter of the core STEM workforce in the UK (WISE, 2019), and black academics made up 1.8% of STEM academic staff in the UK in 2018-19 (Royal Society, 2021). In 2018 the Institute of Engineering and Technology (IET) found that nearly 30% of LGBTQ+ people would not consider a career in STEM due to fear of discrimination and disabled people represent only 5% of the engineering workforce (Campaign for Science and Engineering, 2018) compared to 14% of the wider workforce (All Party Parliamentary Group, 2020).

Education is key to building a good career, and this is why STEM features explicitly in the [Gatsby benchmarks](#) (Holman, 2014) and why organisations such as STEM Learning exist, who continue to make STEM career-related learning and STEM careers visible, attractive and accessible to all young people. STEM education presents students with an opportunity to be innovative and challenge their knowledge, and gives young people an opportunity to develop and use these skills in a future job. Educators and volunteers such as STEM Ambassadors, play

an important role in engaging students and opening their mind to new and innovative future careers.

Between 2011 and 2020 acceptances to computer science courses had risen by nearly 50% and acceptances to engineering courses had risen by 21%, suggesting that the early STEM uptake in schools across the UK is having an impact on choices made for higher education (DfE, 2021). What is perhaps more significant is that the number of women accepted into STEM higher education courses had increased by 49% between 2010 and 2020, and in the same 10-year period the number of 18-year-olds from disadvantaged backgrounds accepted onto full-time undergraduate STEM courses increased by 79%.

These figures demonstrate that with a range of provision that includes teacher CPD, ENTHUSE Partnerships and the STEM Ambassador Programme, it is vital that STEM Learning continues to develop their understanding of what is impactful through evaluation. The STEM Ambassadors programme is a great asset to both young people and the Ambassadors who engage with it. There are currently over 30,000 STEM Ambassadors in the UK: all volunteers who dedicate their time, knowledge and expertise free of charge to act as role models to the younger generation and inspire them into STEM subjects and careers. From leading careers workshops to judging competitions, delivering practical activities or supporting STEM clubs these volunteers are key in raising interest and aspiration in STEM subjects, courses and jobs.

Evaluating the impact can come in a variety of forms - be it increased motivation and attainment for young people, or job satisfaction and pride in one's work for STEM Ambassadors (Corporate Citizenship, 2010; STEM Learning, 2019), and it is often dependent on a certain individual at a specific point and time (Mann *et al.*, 2018). Measuring impact can show the value an organisation is delivering to its stakeholders and beneficiaries and demonstrate that, in the case of the STEM Ambassador programme, it is a worthwhile investment and is achieving its purpose.

Methods

This evaluation of the impact of the STEM Ambassadors programme upon STEM Ambassadors took place through a survey which explored the experiences of STEM Ambassadors volunteering through the programme.

The main aim of the project was to evaluate the impact that the programme has upon the Ambassadors' skills and professional development, as well as their motivations and the barriers that they face. STEM Learning conducts an annual survey to capture feedback from STEM Ambassadors, and the iCeGS team worked with STEM Learning's Monitoring and Evaluation Team to review the 2021 survey questions ready for its 2022 distribution. iCeGS then analysed the returned data to investigate:

- Motivations for being a STEM Ambassador and the barriers to volunteering
- The impact of the STEM Ambassadors' volunteering upon their personal development, career progression and personal benefits
- STEM Ambassadors' perception of the impact of their volunteering upon other people
- The impact of the COVID-19 pandemic on the programme and the effects of the shift to virtual engagement upon engagement, uptake of activities, and Ambassadors' experiences.

The 2022 edition of the survey was distributed in April 2022 and was open for STEM Ambassadors to complete for approximately one month. Whilst much of the 2021 survey was deemed to be worthy of keeping the same for the 2022 iteration, several suggestions were made regarding the addition of new questions and minor changes to pre-existing ones. COVID-19 related questions that were relevant in the 2021 survey were either reframed or removed to suit the changing situation. Other changes included adding years of work experience. The survey was administered by STEM Learning and distributed to STEM Ambassadors who had completed an activity between 1st August 2020 and 31st July 2021. This timeframe was chosen as it aligned with the corresponding period for the 2021 survey and gave sufficient timing to allow for any impacts to emerge which the Ambassadors were able to draw on in their survey responses.

Findings

The survey findings are set out below in the following format:

1. Sample characteristics
2. Outcomes and Impacts
3. How is the STEM Ambassador programme being used?

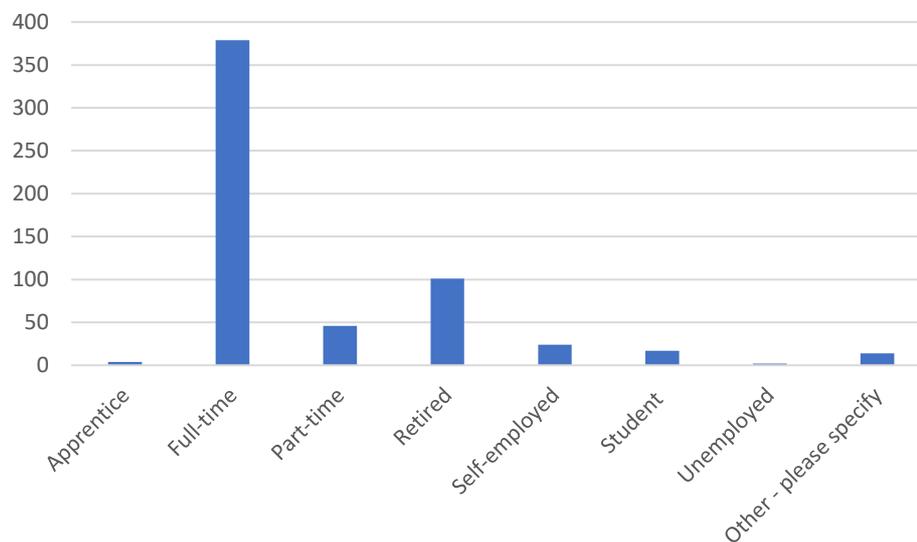
Sample characteristics

In the 2021 survey, 1078 responses to the STEM Ambassador survey were submitted. For the 2022 survey, 587 full responses were received. There were several partial responses to the 2022 survey, however, the decision was made to only analyse the fully complete responses as this still allowed for a significant response rate.

The 2021 survey generated 1,078 complete responses (a completion rate of 7% out of 15,273 surveys sent out) in comparison to the 2022 survey where 587 complete responses were received (a completion rate of 5% out of 11,223 surveys sent out). While it was hoped that a similar number of responses would be received to the 2021 edition the lower response rate in 2022 may be due to STEM Ambassadors having less time available given the lack of COVID-19 lockdowns and return to in-person working.

Of the 587 survey respondents the majority (n=379/65%) stated that they were employed full time, with the second most common occupation type being retirees (n=101/17%) (Figure 1). Individuals who were self-employed, unemployed or students made up a small number of the responses, and while 14 individuals chose 'Other', several stated that they were technically retired but also participated in consultancy work.

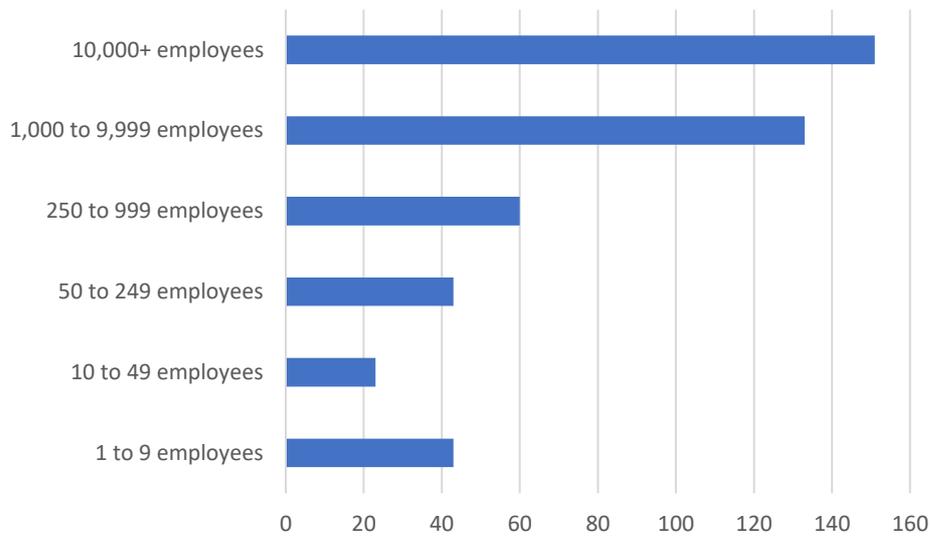
Figure 1: Number of STEM Ambassadors from each employment type who completed the survey.



It was clear from the survey results that many of the STEM Ambassadors who completed the survey were experienced individuals, with 323 respondents stating that they had more than 20 years of career experience.

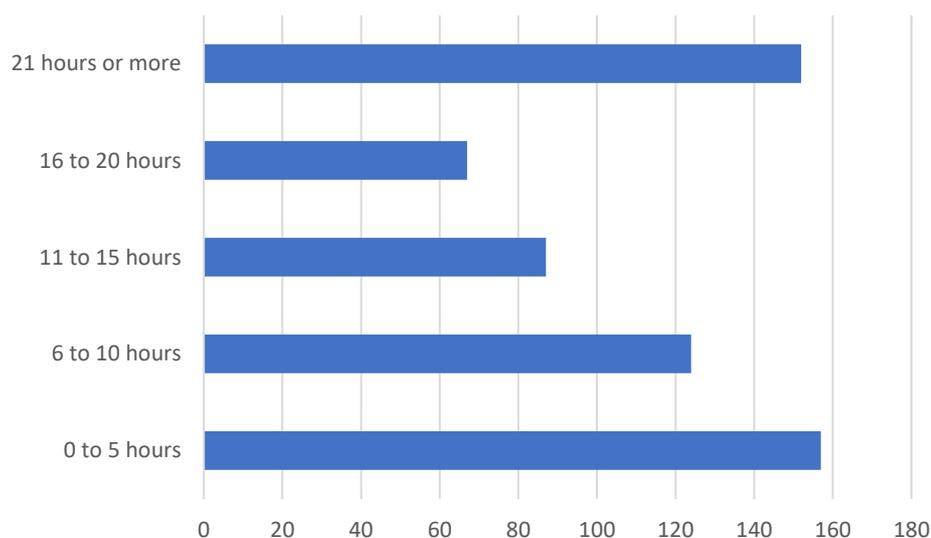
STEM Ambassadors came from a range of employer backgrounds: 151 Ambassadors were employed at an organisation with more than 10,000 employees, closely followed by 133 Ambassadors who were part of an organisation of between 1,000 and 9,999 employees. Fewer Ambassador volunteers were from smaller organisations (Figure 2).

Figure 2: Size of organisations and STEM Ambassador numbers.



The distribution of STEM Ambassadors' reported volunteering hours between August 2020 and July 2021 reflects what was also found in the 2021 survey. In both surveys the number of hours volunteered was highest at either end of the spectrum, with most Ambassadors either volunteering between 0 to 10 hours or more than 21 hours.

Figure 3: Approximate hours spent volunteering as a STEM Ambassador, including any preparation time, between August 2020 and July 2021.



Outcomes and Impacts

In general, many of the findings from the 2022 report reiterated the responses from the 2021 survey.

Motivations and Barriers

STEM Ambassadors were asked to select their top three motivations for being a STEM Ambassador from a list of 12 options which included an 'Other' option. The majority of respondents to the survey were motivated by the opportunity they had been given to help the younger generation (Table 1). As in the 2021 survey, **'Inspiring the next generation'** remains the top motivation for volunteering (83% in 2021 and 73% in 2022), closely followed by **'Improving young people's understanding of STEM careers'** (25% in 2021 and 63% in 2022) and **'Sharing my passion for my subject with others'** (45% in 2021 and 41% in 2022).

Table 1- Frequency of STEM Ambassadors selecting a motivation as one of their top three motivations for volunteering in 2022.

Inspiring the next generation	73%
Improving young people's understanding of STEM careers	66%
Sharing my passion for my subject with others	41%
Gaining a sense of achievement, reward and satisfaction	31%
The chance to challenge stereotypes about studying and working in STEM	23%
Promoting diversity in my sector	18%
Supporting the local community	18%
Supporting my organisation to develop links with schools/local communities	9%
Improving my communication or presentation skills	8%
Increasing my organisation's profile/recognition	7%
Improving my leadership skills	3%
Other	3%

There was little consistent correlation between the probability of choosing any of the top three motivations in Table 1 and STEM Ambassadors' employment status or years of experience (Appendix 1a). There were no statistically significant correlations for improving STEM careers understanding. In general, those with more career experience (p-value < 0.10) or who were retired (p-value < 0.05) were more likely to select "Inspiring the next generation"

as one of their top three reasons. Retired respondents were more likely to select “Sharing my passion” (p-value < 0.01).

Impact and Effect on others

Young people

Ambassadors were asked to rate the level of impact that they thought their volunteering had on the young people they engaged with. Nearly 85% of STEM Ambassadors stated that they were aware to some extent of the impact that they had on young people, and over **85% of STEM Ambassadors reported that their volunteering had medium or high impacts upon young people**. Of STEM Ambassadors who reported an impact 72% **believed their volunteering impacted the young people in terms of increasing their awareness of STEM subjects**, 70% thought **young people’s knowledge of STEM related careers was increased**, and 55% believed it **challenged young people’s stereotypes of the type of people who work in STEM related careers**. These proportions remain broadly consistent with the responses received from the 2021 survey where 73%, 65% and 56% were reported respectively.

STEM Ambassadors were given the opportunity within the survey to comment on the impact of their engagement. The Ambassadors who felt their volunteering had impacted young people elaborated further by explaining how they saw the impact in person.

‘The staff regularly tell me of the excitement and anticipation they receive from their pupils when they know I am attending the school to carry out STEM investigations that integrate with the topics they are studying.’

‘On a re-visit arrival, I enjoy being greeted by students I have done workshops with before; and some have even shown me projects and research they have done after my presentation. That is a win-win feel good factor.’

However, other Ambassadors were less willing to state that their volunteering was impactful as they did not think that they had any way of proving this.

'I find it very hard to judge the impactfulness or otherwise of my volunteering. The teachers are always very polite and grateful but this doesn't tell me anything about my impact on the children and whether I could do things differently and better.'

'It feels that I am encouraged to record my volunteering hours, in order to demonstrate the impact I have made, yet I (and maybe no-one) really knows the impact we have on the attendees.'

Where Ambassadors were less sure about the impact that they had made on the young people, this was often put down to needing more detailed feedback from those they had engaged with. STEM Ambassadors have stated that they would personally benefit from knowing what about their session was enjoyable and what could be improved.

Educators

Many STEM Ambassadors also reported medium or high impacts upon the educators they work with. Of those who reported impact, 65% of Ambassadors believed their volunteering **enabled educators to link curriculum learning with STEM careers and real-life contexts**, and 55% said it **increased the educators' knowledge of STEM subjects**. The options perceived to be least impactful were **enhancing educators' passion for teaching STEM subjects** (27% in 2021 and 31% in 2022) and **improving educators' relationships with local employers and HEIs and/or enabling them to build links across the community** (36% in 2021 and 30% in 2022).

An explanation for why **enhancing educators' passion for teaching STEM subjects** was seen as being least impactful could be attributed to the experiences some of the Ambassadors have had with schools, where the Ambassadors feel that they are being brought in to take a session as a substitute for a teacher. One Ambassador stated *'it is important that schools and colleges*

do not see STEM Ambassadors as 'free' teachers or childminders' and that teachers and schools *'need to recognise the importance of IT as a subject and generate interest in advance'*.

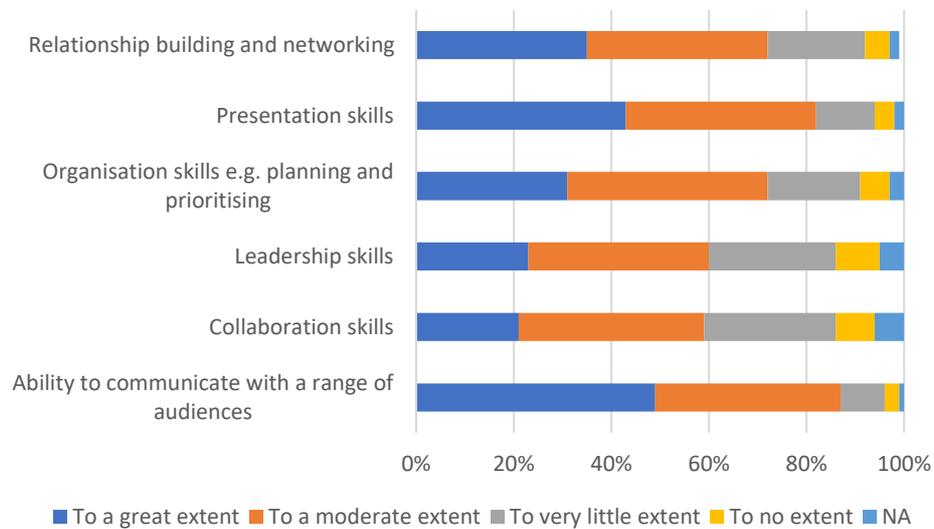
Employers

In the 2022 survey, 45% of STEM Ambassadors said **their volunteering had a medium or high impact on their employers**, which was 2% less than the previous year. STEM Ambassadors who said that they had an impact on their employer were asked to identify areas where they thought impact took place. 68% of these said it **raised the employers' profile in the community**, 49% said it **increased brand awareness**, 36% thought it **improved staff development**, and only 10% believed that it **improved staff retention**.

Impacts and effects upon STEM Ambassadors

STEM Ambassadors were asked to rate how their STEM Ambassador volunteering impacted their own skills. From the sample of respondents who described themselves as being employed or students (n=470), the majority of respondents reported that the STEM Ambassador programme had to some extent positively impacted their skills. 96% of respondents stated that the STEM Ambassador programme enhanced their **ability to communicate with a range of audiences** to either a little, moderate or great extent and 49% stating it had improved to a great extent. The 2021 survey responses were 91% and 58% respectively (Appendix 1b).

Figure 4: Proportions of STEM Ambassadors who gave each rating for each skill (all in employment and students).



Ambassadors also strongly rated their gains in **presentation skills** and **relationship building and networking**, with over 90% of respondents in each category agreeing that the programme helped them to at least some extent.

Ambassadors were particularly aware of the professional benefits that their role had or could bring them, as about 41% of in-work respondents stated that the programme had either a moderate or great impact on their **career progression**. This number was even larger for student STEM Ambassadors, for whom 76% of respondents stated that the programme had either a moderate or great impact on their **career progression**, however this sample size was much smaller at only 17 respondents.

Ambassadors in work who reported fewer years of career experience also tended to report larger skill gains as a result of participating in the programme, with the exception of collaboration skills and relationship building skills where the relationship has the same direction but is not statistically significant (Appendix 1c). The strongest relationship is with presentation skills where those with 16-20 years experience on average reported just below a moderate gain (35% report a great gain), whereas the majority of those with 0-5 years experience or less reported a great gain (67%). The regression results (shown in Table 2) imply

that someone 20 years more experienced would on average report a gain one level lower, e.g. moderate gain rather than a great gain in presentation skills or no gain compared to very little gain.

Table 2: Linear regression results for reported skills gain vs years of experience.

Skill	Co-efficient	P-value	Sample size
Ability to communicate with a range of audiences	-0.03	0.00	393
Collaboration skills	-0.02	0.07	373
Leadership skills	-0.04	0.00	378
Organisation skills e.g. planning and prioritising	-0.04	0.00	391
Presentation skills	-0.05	0.00	392
Relationship building and networking	-0.01	0.55	389

As in 2021, more time spent volunteering was associated with higher reported skills gains. For example, of the Ambassadors who spent 0-5 hours volunteering between August 2020 and July 2021 (n=128) 83% stated that their **ability to communicate with a range of audiences** was improved to either a moderate or great extent. By comparison, 86% of Ambassadors who volunteered for between 16-20 hours or 21+ hours (n=56 and 108 respectively), believed their communication skills were improved to either a moderate or great extent.

Interestingly, the majority of STEM Ambassadors also reported that they participated in other volunteering activities outside the Ambassador programme. Nearly 54% of respondents stated that only 'a small amount' or 'some' of their volunteering is undertaken through the Ambassador programme.

Barriers to Ambassadors' volunteering were also examined, as survey respondents were asked **what prevents them from volunteering more as a STEM Ambassador**. 43% said that

they did not have enough time to volunteer and 39% reported said that **their volunteering had been affected by the COVID-19 pandemic**. 15% of Ambassadors stated that they thought there was a **lack of demand for STEM Ambassadors in their area**, and some Ambassadors explained that *‘the concept of STEM [Ambassadors] is excellent, but the marketing of all activities in the [local] area needs to be massively improved’*. One Ambassador thought their retired status restricted their volunteering through the programme *‘lots of activities are directed at people in work’*. Another Ambassador explained that due to the COVID-19 pandemic they found that their *‘STEM [Ambassador] experience has been somewhat tainted by the Covid pandemic with communications very poor due to the changes in teacher working practices’*.

Impact on professional development

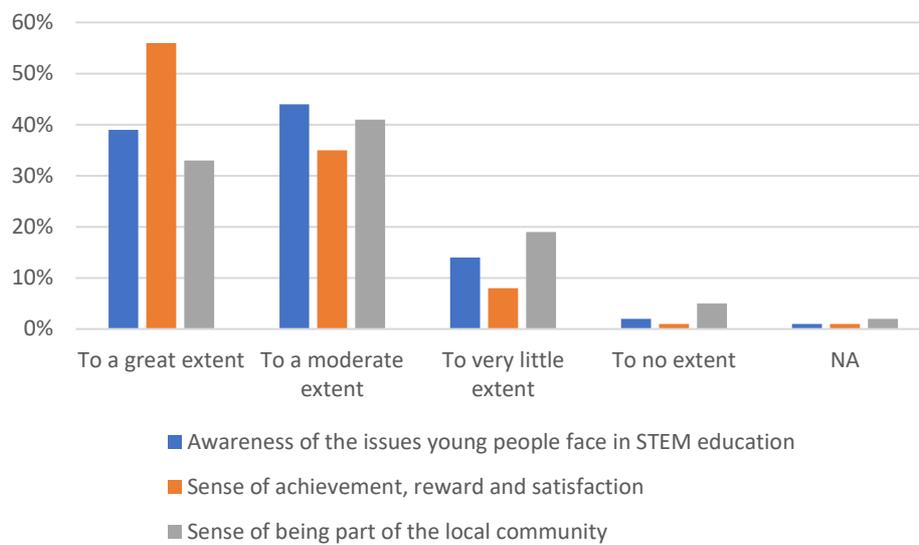
Employed and student STEM Ambassadors were asked to reflect on how their volunteering had impacted their professional development, with differences arising in the responses of the two cohorts. 91% of employed STEM Ambassadors agreed that their role helped them to **create or improve links with local schools and educators** to at least some extent. While slightly fewer students (82%) agreed. Perhaps unsurprisingly, a greater proportion of students (76%) found that **volunteering supported their career progression** to a moderate or great extent, while only 40% of employed respondents stated the same. It is important to note here the variation in sample size between these two cohorts, n=449 respondents in employment compared to n=17 students.

84% of those in work stated that they saw an **increase in job satisfaction** as a result of the STEM Ambassador role and 77% saw an **increase in morale in the workplace**. For students, 94% of respondents reported **increased confidence in their abilities** and 83% reported **increased satisfaction with their studies**.

Benefits for the personal development of STEM Ambassadors

All STEM Ambassadors completing the survey were asked about what benefits they saw the STEM Ambassador programme having on their personal development, and most reported experiencing benefits (Figure 5).

Figure 5: Perceived benefits for personal development.



98% of STEM Ambassadors agreed that they gained a **sense of achievement, reward and satisfaction** from being a STEM Ambassador, with 97% agreeing that the programme gave them **an awareness of the issues young people face in STEM education**. This was closely followed by 93% of individuals believing that their STEM Ambassador volunteering gave them **a sense of being part of the local community**.

The experience that STEM Ambassadors have had with the STEM Ambassador programme has been positive, with 74% of Ambassadors stating that they have **promoted the programme to others** and many respondents writing that they have tried to encourage participation in the scheme by recommending it to their colleagues.

When asked **how their employer supports their volunteering**, 65% of employed respondents (n=285/460) stated that their employer allows them to have time off for volunteering. However, STEM Ambassadors' employers generally were not proactive in supporting or promoting their volunteering with 40% stating that their employer actively promotes volunteering activities and only 20% reporting that their employer shares good practice.

The effect of COVID-19 upon STEM Ambassadors and delivery methods

Survey respondents were asked about their delivery of activities during the 18-month period up to May 2022. For many activities, **virtual delivery took place more frequently than in-**

person. One notable exception was interactive classroom sessions, where 61% of volunteers had participated in this activity its delivery was relatively evenly split between virtual and face-to-face. 264 respondents had engaged with STEM Presentations, of which 67% had been conducted virtually. Likewise, with mentoring where 194 respondents had engaged in this activity, 77% had done so virtually and 23% had face-to-face.

As with the 2021 results, STEM Ambassadors relayed a far less positive feeling towards virtual activities than face-to-face activities. Of those Ambassadors who had delivered both face-to-face and virtual sessions, a significant number of respondents stated that they believed **face-to-face delivery was more impactful than virtual delivery**: 92% of respondents stated that face-to-face is more impactful upon them personally, and 97% stated that face-to-face is more impactful upon those they engage with. When respondents were asked for their perspectives on virtual vs face-to-face delivery, there was agreement that both face-to-face and virtual delivery allowed them to deliver to a range of audiences. However, more Ambassadors agreed that **they found the activity rewarding (n=221 vs n=205) and young people were more engaged (n=217 vs 179) with face-to-face delivery.**

How is the STEM Ambassador programme being used?

To further understand how the STEM Ambassador programme is being used we performed a deep-dive analysis of five key questions to understand trends across demographics, job sectors and experience levels. The five key questions were as follows:

1. Does remote delivery of STEM Ambassador activities affect the impact on young people?
2. Do levels of virtual volunteering and preference for delivery depend on employment status?
3. Do some sectors/sizes of employers provide more support for volunteering?
4. Do STEM Ambassadors with more supportive employers report doing more hours or higher levels of collaboration?
5. Do STEM Ambassadors with different employment categories have different motivations for volunteering?

1. How do reported benefits for young people vary by whether STEM Ambassadors did a greater amount of remote delivery?

When asked directly, volunteers strongly prefer face-to-face activities. They report a greater willingness to support face-to-face activities and higher levels of engagement from young people (Table 3).

Table 3: STEM Ambassador scores by delivery modes for different aspects of programme experience (1-4 star score where 1 = strongly disagree and 4 = strongly agree).

	Average star score		St. deviation of score		Number of scores	
	Face-to-face	Virtual	Face-to-face	Virtual	Face-to-face	Virtual
I am able to work with a wide range of audiences	3.50	3.50	0.71	0.78	220	209
I feel confident trying new methods or activities	3.38	3.04	0.75	0.97	218	204
I find the activity rewarding	3.79	2.96	0.46	0.95	221	205
I would like to do more of this type of engagement in future	3.67	2.78	0.67	1.09	218	207
The young people are really engaged	3.56	2.64	0.60	0.95	217	179

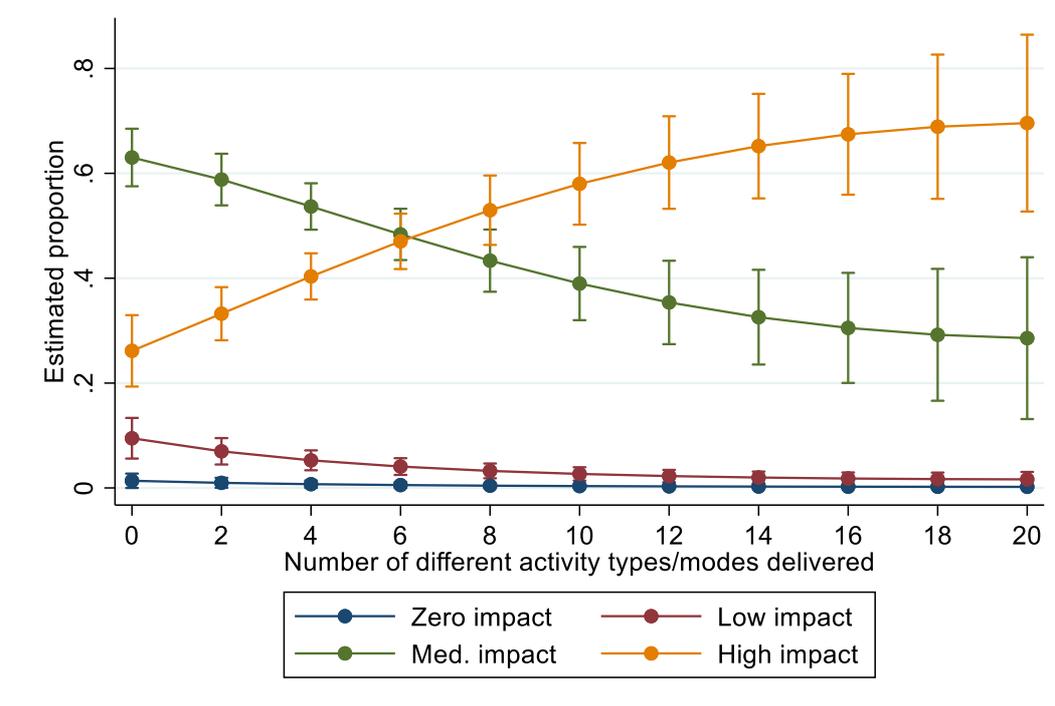
This same finding is also identified indirectly, suggesting that results are not a direct result of personal preferences. Volunteers were asked about 16 different activities and whether they supported each one either face-to-face or virtually. Volunteers who reported doing a greater proportion of their activities virtually were less likely to report a “high impact” on young people in general, which remained valid and statistically significant when controlling for the total number of different types of activities/delivery modes supported (up to a total of 32, with an average of 4.6 different types of activity per Ambassador).

This finding was explored further with an ordinal logistic regression where the outcome variable was whether Ambassadors reported zero, low, medium, or high impact on young people (Appendix 1d). For instance, controlling for the overall volume of activity, the model estimates that 36% of respondents would report a high impact if all of their activities had been delivered virtually, compared to 53% if all of their activities had been delivered face-to-face instead (p -value < 0.01, $n=513$). Nonetheless, it is possible that an optional, blended

approach to remote delivery, outside of the forced and strained conditions of pandemic lockdown, may give rise to different preferences and reported benefits.

A greater number of delivered activity types was strongly correlated with reporting higher impacts on young people (see Figure 6, with 95% confidence intervals shown as error bars).

Figure 5: Proportion of Ambassadors reporting impact upon young people.



Examining the top four types of activity (Interactive classroom session; STEM presentation / Q&A; Mentoring; Festival, exhibition, or public event), there was no statistically significant difference in the level of impact reported on young people once the Ambassadors' overall diversity of activity delivered and proportion delivered virtually were controlled for.

2. Do levels of virtual volunteering and preference depend on employment status?

Retired STEM Ambassadors reported a smaller proportion of their volunteering was carried out virtually than full-time or part-time employees (52% vs 69% and 65% respectively; p -value < 0.01) (Appendix 1e). They were also slightly more opposed to doing more virtual volunteering compared to face-to-face, but the differences were small and not statistically

significant – none of the groups favoured virtual volunteering overall (Appendix 1f). The sample sizes are not large enough to comment on other employment status types.

3. Do some sectors or sizes of employer provide more support for STEM Ambassador volunteering?

We define the level of support provided by an employer as the number of types of support the Ambassador reported out of the following list of 10 possible ways of supporting volunteering:

- Allows time off for volunteering
- Actively promotes/highlights volunteering opportunities
- Provides resources and activities for me to use in my engagements
- Allows activities to be hosted at the site
- Has a pre-existing relationship with local schools
- Has a dedicated staff member for managing volunteers
- Shares good practice
- Promotes STEM Ambassadors at inductions for new staff
- Runs training/information sessions
- Provides a structured volunteering programme

Focusing just on respondents with an employer (e.g. apprentices, full-time employees, and part-time employees; n=429), we find no statistically significant differences between sectors with over 20 respondents (Appendix 1g). However, larger employers were on average identified as providing greater levels of support (p-values < 0.05 once organisation size exceeds 250 employees) (Appendix 1h).

Table 4 Employer size vs. level of employer support reported by STEM Ambassador volunteers

Employer size	Average level of support (higher=better)	Standard deviation	Sample size
1 to 9 employees	1.41	1.14	22
10 to 49 employees	1.91	1.95	22
50 to 249 employees	1.71	1.52	42
250 to 999 employees	2.73	2.50	60
1,000 to 9,999 employees	2.82	2.51	133
10,000+ employees	3.33	2.56	150
Total	2.76	2.43	429

4. Do volunteers with more supportive employers report more engagement?

Volunteers with more supportive employers were much more likely to report collaboration with other STEM Ambassadors (p -value < 0.01, $n=429$) (Appendix 1i). For instance, someone reporting 5 out of 10 possible types of employer support would typically have a 63% chance of reporting collaboration, compared to only 37% for someone reporting 1 out of 10 possible types of employer support. They are also more likely to volunteer slightly more hours, but the relationship is not strongly statistically significant (Appendix 1j).

More supportive employers are also associated with a greater volume of activity types volunteered for, but with no distinction between face-to-face or virtual activity modes. In both cases, an employer providing seven more types of support is associated with a respondent reporting one extra face-to-face activity and one extra virtual activity (p -values < 0.01; $n=429$) (Appendix 1k). There is no statistically significant correlation between the level of employer support and the proportion of activity types/modes that were delivered virtually.

5. Do Ambassadors with different employment categories have different motivations for volunteering as a STEM Ambassador?

For the small sample of students ($n=17$), their top motivations were improving young people's understanding of STEM careers and sharing their passion for the subject, whereas inspiring the next generation was typically a much more common motivation among all other groups (only examining groups with a sample size over 10).

Table 5 Motivations for volunteering as a STEM Ambassador across types of employment

Top motivation for volunteering	Full-time employee	Part-time employee	Retired	Self-employed	Student
Inspiring the next generation	38%	33%	48%	46%	6%
Improving young people's understanding of STEM careers	28%	35%	24%	17%	29%
Sharing my passion for my subject with others	8%	9%	14%	4%	24%
The chance to challenge stereotypes about studying and working in STEM	8%	13%	3%	13%	6%
Gaining a sense of achievement, reward and satisfaction	5%	2%	6%		12%
Promoting diversity in my sector	5%	4%		4%	12%
Supporting the local community	3%		2%	13%	
Other - please specify	1%	2%	3%	4%	6%
Improving my communication or presentation skills	1%				6%
Supporting my organisation to develop links with schools/local communities	1%	2%			
Improving my leadership skills	1%				
Increasing my organisation's profile/recognition	1%		1%		
Sample size	379	46	101	24	17

Conclusions and Recommendations

Many of the findings from the 2021 edition of the STEM Ambassador survey were echoed in the 2022 survey. The survey results demonstrate that the STEM Ambassador programme does have an impact upon STEM Ambassadors themselves, who feel that their volunteering is also impactful upon the young people they engage with.

STEM Ambassadors reported that:

- Their top motivation for volunteering was to inspire the next generation
- They saw medium to high benefits and impact for young people and educators and supported this with feedback from those they engaged with
- It is highly beneficial for educators to be able to link STEM and curriculum learning to real life

- Their personal development skills increased through volunteering, particularly communication skills.
- The programme was impactful in terms of career progression, which was particularly noted by student STEM Ambassadors
- COVID-19 impacted the programme and its delivery. Whilst virtual overtook face-to-face delivery, STEM Ambassadors believed face-to-face delivery to be more impactful than virtual

Recommendations

The STEM Ambassadors programme is highly regarded by STEM Ambassadors, with many of the volunteers relaying positive experiences about their volunteering as an Ambassador.

Despite this there are a few recommendations that have emerged through data analysis:

- Educators need to be given more insight and guidelines into what is to be expected from the STEM Ambassadors: Ambassadors reported feeling that their role was often mistaken for a substitute teacher
- A hybrid approach for the programme works well for the Ambassadors. Whilst many believe face-to-face is more impactful, for others virtual allows flexibility for both Ambassadors and educators. Using a hybrid approach allows for more hands-on activities to be delivered in a face-to-face format and sessions such as presentations can be delivered virtually.
- Sharing of impact data would be appreciated by STEM Ambassadors to allow them to see the proof of the impact of their volunteering on young people. This could be done through the delivery of the findings from impact evaluations via newsletters.

References

Campaign for Science and Engineering (2018) *Policy Review: Diversity*

Department for Business, Energy and Industrial Strategy (2017) *A Short Guide*. National Audit Office

Department for Education (2021) *More young people are taking STEM subjects than ever before*. The Education Hub.

EDF (2016) *Jobs of the Future*. Social Market Foundation

Holman (2014) *Gatsby Good Career Guidance*.

Royal Society (2021) *Ethnicity STEM data for students and academic staff in higher education*.

STEM Learning (2018) *Impact Report*

STEM Learning (2019) *Impact Report*

The Institution of Engineering and Technology (2019) *IET Skills and Demand in Industry: 2019 Survey*.

WISE (2019) *One Million Women in STEM in the UK*. 2019 Workforce Statistics.

Appendix 1

- A. Correlation analysis and hypothesis testing for null effect p-values based on a logistic regression with heteroskedasticity-robust standard errors, with the dependent variable being a binary variable taking value 1 if that particular top three motivation was selected and 0 otherwise. Independent variables are years of experience (continuous variable) and employment status (factor variable; reference value full-time employed as most frequent). For some employment statuses, the small sample size hinders the analysis and perfect predictors are dropped on the basis they reflect small sample size issues rather than a deterministic relationship that would be sustained in larger samples. N=507-511 as a result of this and dropping respondents who did not answer the relevant employment questions, typically years of career experience which is not relevant for all respondents. The sample is too small to analyse sector responses directly.
- B. Denominator for illustrative 2021 comparison is the full sample responding to the communication question, includes those saying “very little” (as opposed to “little”), “to no extent” and “NA” (n=859).
- C. Robust linear regression with reported skills benefit as a dependent variable (0 = no gain; 1= very little gain; 3 = moderate gain; 4 = great gain) and number of years career experience as the independent variable. Analysis excludes those who did not answer the question or marked the skill as not applicable. P-value reflects the hypothesis of a null relationship. Moving average lines reviewed to confirm the suitability of linear modelling. Results direction and statistical significance are the same if the reported skills benefit is analysed using an ordinal logistic regression.
- D. P-values reported for null effect hypotheses from an ordinal logistic regression with two independent variables: the number of different types/modes of activity a respondent reports participating in and the proportion of activity types/modes reported as being participated in virtually. Standard errors adjusted for possible heteroskedasticity. Analysis excludes the 53 volunteers who said they did not know and the further 21 who did not report any of the main coded activity types.
- E. Linear regression of employment status (as a factor variable, with full-time employed as reference category) onto proportion of activity types/modes reported as delivered virtually, using robust standard errors. P-values reported for the hypothesis of null effect.
- F. Measuring preference by the 1-5 star rating given in response to “I would like to do more of this type of engagement in future” as the difference between the answer for virtual delivery minus the answer for face-to-face delivery. This difference is used as the dependent variable in the same linear regression as above. P-values reported for the hypothesis of null effect.

- G. Linear regression with robust standard errors, with independent variable as sector (factor variable; reference case the most common response “professional, scientific and technical activities”) and dependent variable as the level of employer support designed as above (continuous, from 0-10). P-values reported for the hypothesis of null effect. Some sectors had a p-value < 0.1, but only where they had fewer than 20 respondents, placing significant uncertainty over how strongly this correlation would persist in a larger sample.
- H. Linear regression with robust standard errors, with independent variable as size (factor variable; reference case 1-9 employees) and dependent variable as the level of employer support designed as above (continuous, from 0-10). P-values reported for the hypothesis of null effect.
- I. Logistic regression with robust standard errors, with dependent variable as whether reported collaboration (Yes=1; No=0) and independent variable as the level of employer support designed as above (continuous, from 0-10). P-values reported for the hypothesis of null effect.
- J. Modelled using an interval regression for number of hours volunteered with employer support entered as a linear independent variable (the squared term was not statistically significant and was dropped). P-value for a hypothesis of null effect < 0.10 with robust standard errors (n=429). The estimated relationship is the equivalent of volunteering for 13.3 hours instead of 11.9 hours for a shift in employer support from 1 to 5 out of 10 types of support asked about.
- K. Linear regression with robust standard errors, with dependent variable as the number of activity types volunteered for each type (analysed separately) or proportion of activity delivered virtually, with the independent variable being the employer support factor as used above.