Report

STEMNET

An evaluation of the impact of STEMNET's services on pupils and teachers

Suzanne Straw
Ruth Hart
Jennie Harland

November 2011

How to cite this publication:

Straw, S., Hart, R. and Harland, J. (2011). *An evaluation of the impact of STEMNET's services on pupils and teacher.* Slough: NFER

Published in November 2011
by the National Foundation for Educational Research,
The Mere, Upton Park, Slough, Berkshire SL1 2DQ
www.nfer.ac.uk

ISBN: 978-1-908666-03-1

Contents

Executive summary

1. Introduction

This executive summary presents the key findings from the evaluation of the impacts of STEMNET's services on pupils and teachers, which was undertaken by the National Foundation for Educational Research between April and July 2010.

STEMNET's vision is to increase young people's choices and chances through science, technology, engineering and mathematics. STEMNET runs three programmes to help realise its vision:

- STEM Ambassadors Programme
- management of After-School Science and Engineering Clubs (ASSECs) funded by DCSF (now DfE) and support to all STEM Clubs through the STEM Clubs Network
- brokerage of STEM enhancement and enrichment activities.

2. Methodology

The evaluation focused on STEMNET's three key programmes and the methodology comprised:

- a telephone survey of 500 teachers of STEM subjects
- a paper survey of 176 pupils who had taken part in activities that involved a STEM Ambassador in the past 12 months
- a paper survey of 419 pupils who are taking part in a STEM Club
- case-study visits or telephone interviews with teachers, and, where appropriate, interviews/focus groups with pupils, in 14 schools that had been involved with STEM Ambassadors, run a STEM Club and/or accessed brokerage support
- support for STEMNET's nine Regional Directors with the analysis of impact data that they had collected from a range of schools within their region.

3. Key findings: STEM Ambassadors

3.1 Impacts of the STEM Ambassadors Programme on pupils reported by teachers

- **Teachers were generally very positive about the impacts of the STEM Ambassadors Programme** on their pupils, with the rank order of impacts they reported almost exactly mirroring that of pupils.
- **The highest rated impacts on pupils that teachers reported were[1]:**
  - **increased engagement and interest in STEM subjects** (reported by 86 per cent of teachers)
  - **increased knowledge and understanding of STEM subjects/concepts/topics** (reported by 83 per cent of teachers)
  - **increased awareness of the STEM employment and career options available** (reported by 67 per cent of teachers)
  - **increased awareness of the STEM study options available** (reported by 62 per cent of teachers).

[1] Based on percentage of teachers reporting that this impact had been realised 'to a great extent' or 'to some extent'.

3.2 Impacts of the STEM Ambassadors Programme on pupils reported by pupils

- **Pupil reported impacts were particularly notable, considering the fact that just less than half of those surveyed (47 per cent) had only seen an Ambassador once**. Much more could be achieved with ongoing and sustained contact with Ambassadors.
- **The highest rated impacts reported by pupils were:**
  - **increased enjoyment of, and interest in, STEM subjects**
  - **increases in what they knew about the STEM subjects**
  - **increased awareness of careers that involve STEM**
  - **increased interest in studying STEM subjects post-16 or in higher education**.
- However, **fairly significant differences by subject emerged with larger proportions of pupils reporting that impacts had been achieved 'to a great extent' or 'to some extent' in science and design and technology as opposed to engineering and maths.** STEM Ambassador activities are less likely to focus on, or make links to, engineering and maths.
- The survey data suggests that **pupils who have seen an Ambassador four times or more are more positive than those who have seen an Ambassador between one and three times**.

3.3 Impacts of the STEM Ambassadors Programme on teachers

- The **two key impacts for teachers of involvement with STEM Ambassadors were**[1]:
  - **increased ability to relate STEM lessons to real world applications of the subjects** (reported by 69 per cent of teachers)
  - **personal development (for example changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects** (reported by 67 per cent of teachers).

3.4 Schools' engagement with the STEM Ambassadors Programme

- **The most common reason for engaging with the STEM Ambassadors Programme was to enhance the curriculum**, a reason given by more than a third of the teachers surveyed.
- **STEM Ambassadors were most often involved in specific activities such as STEM days** (reported by two-thirds of teachers), followed by 'to support curriculum delivery in certain areas' and 'to be involved in a STEM Club'.
- **A large proportion of teachers (82 per cent) had used STEM Ambassadors for one off activities. Just less than half (41 per cent) had built a relationship** with one or more STEM Ambassadors who came into school repeatedly.

3.5 Pupils' engagement with STEM Ambassadors

- **The largest proportion of pupils surveyed, nearly half (47 per cent), had seen an Ambassador just once**.
- **The vast majority of pupils (92 per cent) had seen an Ambassador at their school. Less than one in ten had seen an Ambassador within the workplace.**
- **The largest proportion of pupils (61 per cent) had seen an Ambassador give a talk**, 39 per cent had seen an Ambassador when he/she helped deliver a special STEM activity and 34 per cent had taken part in a practical activity with an Ambassador.

3.6 Satisfaction with the STEM Ambassadors Programme

- Almost **three-quarters of teachers (71 per cent) felt that STEMNET's or contract holders' support in finding suitable STEM Ambassadors was 'very useful' or 'useful'**.
- **Teachers were very satisfied with the contribution of STEM Ambassadors, with 88 per cent rating the contribution as 'very useful' or 'useful'**.
- **Pupils were very positive about the activities that they had taken part in with STEM Ambassadors, with almost three-quarters (74 per cent) rating them as 'very good' or 'good'.**

4. Key findings: STEM Clubs

4.1 Impacts of STEM Clubs on pupils reported by teachers

- The **highest rated impacts that teachers reported were**[1]**:**
  - **increased engagement and interest in STEM subjects** (reported by 93 per cent of teachers).
  - **increased knowledge and understanding of STEM subjects/concepts/ topics** (reported by 93 per cent of teachers)
  - **increased skills in practical work** (reported by 89 per cent of teachers)

4.2 Impacts of STEM Clubs on pupils reported by pupils

- **The highest rated impacts reported by pupils were:**
  - **increased awareness of careers that involve STEM**
  - **increased enjoyment of, and interest in, STEM subjects**
  - **increases in what they knew about the STEM subjects.**

- Similar to the STEM Ambassadors pupil survey, **fairly significant differences by subject emerged, with larger proportions of pupils, again, reporting that impacts had been achieved 'to a great extent' or 'to some extent' in science and design and technology, as opposed to engineering and maths**. The case-study data suggests that many clubs are 'science' clubs, with fewer examples of 'engineering' clubs, which would go some way to explaining these differences. In addition, many schools seem to be at the early stages of working across department and curriculum areas.
- The survey data suggests that **pupils who have been attending a STEM Club for more than a year are more positive than those who have been attending for less than a year. In addition, it seems that, over time, activities are undertaken that involve engineering and maths, or that the relationship between the disciplines becomes more evident**, as pupils are less likely to report that the activities that they have undertaken are 'not relevant to' these two subjects.
- **Higher proportions of pupils attending STEM Clubs compared to those involved in activities with a STEM Ambassador reported all of the impacts. This is likely to be related to the more in-depth and sustained nature of the STEM Clubs intervention**.

4.3 Impacts of the STEM Clubs Programme on teachers

- The **two key impacts for teachers of involvement with their school's STEM Club were the same as those for STEM Ambassadors[1]:**
  - **increased ability to relate STEM lessons to real world applications of the subjects** (reported by 76 per cent of teachers)
  - **personal development (for example changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects** (reported by three-quarters of teachers).

4.4 Schools' engagement with the STEM Clubs programme

- **Science was the most common subject which STEM Clubs (both ASSECs and other clubs) focused on,** followed by engineering, design and technology and maths. Less than half of the clubs focused on maths.
- **Most STEM Clubs targeted pupils in Key Stage 3 with the main focus tending to be pupils in years 7 and 8**. Around half of the STEM Clubs were open to all pupils who were interested rather than being targeted at particular groups such as: gifted and talented; boys or girls; under achievers.
- **Nearly three-quarters of teachers running ASSECs (70 per cent) had received support from STEMNET or a contract holder and 80 per cent of these teachers rated the support as 'very useful' or 'useful'**. 30 out of the 51 teachers running other clubs rated the support that they had received from STEMNET to run the club as 'very useful' or 'useful'.
- **The vast majority of teachers (around 90 per cent) were planning to continue running their STEM Club**.

4.5 Pupils' engagement with STEM Clubs

- The largest proportions of pupils surveyed had been attending a STEM Club for about a year or for more than a year (36 per cent and 35 per cent respectively).
- **Pupils had been involved in a wide variety of activities with large numbers involved in designing and making something (89 per cent), practical experiments or investigations (81 per cent)** or working on a long-term project (70 per cent).
- **Just under half of the pupils surveyed (49 per cent) reported that people in STEM jobs helped with the club, whilst 39 per cent reported that the club was run and delivered by teachers**.

4.6 Satisfaction with the STEM Clubs programme

- **Almost three-quarters of teachers (74 per cent) running ASSECs and other STEM Clubs had used the STEM Clubs website, with over half of these teachers (57 per cent) rating it as 'very useful' or 'useful'**.
- Just over a fifth of teachers (22 per cent) had involved STEM Ambassadors in their STEM Club to support staff to run the club, or to lead sessions**. Half of the 50 teachers who had used STEM Ambassadors rated their contribution as 'very useful' or 'useful'**.
- **Pupils were very positive about their STEM Club with a very high proportion, 94 per cent, rating their club as 'very good' or 'good'. Indeed, two-thirds (65 per cent) rated it as 'very good'.**
- **81 per cent of pupils said that they would recommend their STEM Club to other young people**.

5. Key findings: Brokerage

5.1 Engagement and satisfaction with the brokerage service

- **Teachers were particularly satisfied with the support from the brokerage service in making them aware of the range of enhancement and enrichment opportunities available to them**, with more than three-quarters of teachers who had engaged with the service (77 per cent) rating this support as 'very useful' or 'useful'.
- Two-thirds of teachers who had used the service rated the help to access enhancement and enrichment opportunities as 'very useful' or 'useful'.
- **A high proportion of teachers who had used the service, four out of five (84 per cent), were planning to use the brokerage service again**.
- The case-study data suggests that more could be done to make schools aware of the service and the range and level of support that can be provided.

5.2 Impacts of brokerage service on teachers

- **Teachers were very positive about the impacts of the brokerage service**. More than four out of five teachers (86 per cent) who had used the brokerage service reported that it had increased their and other teachers' awareness of the STEM enhancement and enrichment opportunities available and how to access them 'to a great extent' or 'to some extent'.
- **More than three-quarters of the teachers surveyed (76 per cent) who had used the brokerage service reported that it had increased their and other teachers' knowledge and understanding of the benefits of STEM enhancement and enrichment activities 'to a great extent' or 'to some extent'.**

6. Key messages

The evidence gathered during the evaluation activities demonstrates that STEMNET's services are of a high quality, and that they are leading to a range of positive outcomes for both teachers and pupils. Notably, involvement in STEM Clubs and/or interactions with STEM Ambassadors is increasing pupils' interest in STEM, as well as developing their knowledge of the subjects, practical skills and generic transferable skills (e.g. team-working, problem-solving) which are of key importance to their future employability. There is also some evidence that involvement in STEM Clubs and interaction with STEM Ambassadors can increase attainment in STEM subjects and progression to STEM subjects. In relation to STEM Ambassadors, the evaluation suggests that more ongoing and sustained contact with STEM Ambassadors could lead to even greater impacts for pupils.

The evidence also suggests some issues to consider in the future, in particular relating to the place of mathematics within STEM. However, this is of relevance not only to STEMNET, but also to the wider community of organisations involved in STEM education.

1. Introduction and methodology

1.1 Introduction

This report presents the findings from the evaluation of the impacts of STEMNET's services, which was undertaken by the National Foundation for Educational Research between April and July 2010.

The primary aim of the evaluation was to explore the impacts of the services that are provided by STEMNET on pupils and teachers.

1.2 Methodology

The evaluation comprised both quantitative and qualitative methods, which included:

- a telephone survey of 500 teachers of STEM subjects
- a paper survey of 176 pupils who had taken part in activities that involved a STEM Ambassador in the past 12 months
- a paper survey of 419 pupils who are taking part in a STEM Club
- case-study visits or telephone interviews with teachers, and, where appropriate, interviews/focus groups with pupils, in 14 schools that had been involved with STEM Ambassadors, run a STEM Club and/or accessed brokerage support
- support for STEMNET's nine Regional Directors with the analysis of impact data that they had collected from a range of schools within their region.

More details on the methodology are provided in Appendix 1.

Appendix 2 provides details on the background and characteristics of the teacher and pupil survey respondents.

Appendix 3 provides additional data tables from the three surveys.

2. The work of STEMNET

This section provides an overview of STEMNET's work including its vision, aims and objectives, and its three key programmes. It also includes data on the scale of its activities.

2.1 Vision, aims and objectives

STEMNET's vision is to increase young people's choices and chances through science, technology, engineering, and mathematics.

STEMNET's purpose is to be a recognised leader in enabling all young people to achieve their potential in science, technology, engineering and mathematics (STEM) by:

- ensuring that all young people, regardless of background, are encouraged to understand the excitement and importance of STEM in their lives, and the career opportunities to which the STEM subjects can lead
- helping all schools and colleges across the UK understand the range of STEM enhancement and enrichment opportunities available to them and the benefits these can bring to everyone involved
- encouraging business, organisations and individuals wanting to support young people in STEM to target their efforts and resources in a way that will deliver the best results for them and young people.

2.2 STEMNET's programmes

STEMNET runs three programmes to help realise its vision:

- STEM Ambassadors Programme
- management of After-School Science and Engineering Clubs (ASSECs) funded by DCSF (now DfE) and support to all STEM Clubs through the STEM Clubs Network
- brokerage of STEM enhancement and enrichment activities.

The **STEM Ambassadors Programme** is STEMNET's flagship programme which aims to make a real difference to the delivery of STEM subjects to young people. STEM Ambassadors are people from STEM backgrounds who volunteer and give their time freely to act as inspiring role models for young people. They can contribute both to regular lessons or participate in extra-curricular activities such as STEM Clubs, careers days and visits. The STEM Ambassadors Programme enables teachers to make links in the curriculum to how STEM is practised in the world of work, illuminating applications across a range of careers.

As of July 2010, there were nearly 22,000 approved Ambassadors offering their time and support to promote STEM subjects to young learners. STEMNET aims to make every school in the country aware of the programme, and to provide over 27,000 STEM Ambassadors nationwide, by March 2011.

The **After-School Science and Engineering Clubs** (ASSECs) programme was created by the Government in March 2006 to inspire Key Stage 3 pupils (ages 11-14) to learn and enjoy science and engineering. This was in direct response to the concerns of employers regarding a shortage of science and technology skills within the workforce. Originally, 250 schools piloted the scheme. The programme was expanded to include 500 clubs by September 2008 due to its early success. Each club has received £17,000 over a two year period.

Each ASSEC was expected to have approximately 20 participants which meant that around 10,000 pupils have been involved in the scheme each year.

A consortium of partners has been involved in the scheme which includes:

- The Association for Science Education - providing Field Officer support for the Clubs Coordinator
- British Science Association - employing a dedicated Clubs Coordinator and developing a clubs website
- Association for Science and Discovery Centres – developing a clubs-specific handbook on how to run a Science and Engineering Club
- Network of Science Learning Centres - providing club leaders and teachers with clubs-specific training
- Specialist Schools and Academies Trust – providing expertise on science and technology specialist schools.

STEMNET has managed the project on behalf of the consortium and has acted as a primary contact for schools.

STEMNET also manages the STEM Clubs Network on behalf of DfE. It allows all secondary schools in the country to be able to access the latest in:

- best practice information
- professional advice
- shared resources
- key contacts
- personal support.

Schools are encouraged to affiliate to the STEM Clubs Network, whether they have an established club or are starting out from scratch. Membership is also available to schools that are running single discipline clubs (e.g. a Chemistry Club or Engineering Club) or are part of a recognised clubs scheme such as Young Engineers.

Club leaders can access case studies and information via the STEM Clubs Network website to assist them in exploring cross-curricular working opportunities.

STEMNET also co-ordinates 52 organisations - STEMNET contract holders - across the country to fulfill a **brokerage role for enhancement and enrichment activities** to schools. Through strong links with business organisations, the brokerage service aims to ensure that all schools and colleges can offer their pupils programmes which support the curriculum and increase the quality and quantity of pupils moving into further STEM education, training and employment.

An enhancement and enrichment STEM activity is one that provides schools with opportunities to deliver more relevant content in an exciting and challenging way. This might be by enabling pupils to engage in real-world STEM activities, such as:

- designing cars or designing an invention in a 'Dragon's Den' scenario
- computer modelling natural disasters
- analysing data from a simulated situation such as an earthquake
- a maths or science magic show
- chemistry camps
- architecture workshops
- a work placement in industry.

Alternatively, it might involve bringing a real scientist, engineer or mathematician into the classroom to provide a direct link of personal experience between STEM in the classroom and the world outside.

2.3 Key Performance Indicators (KPIs)

STEMNET's performance to date in relation to its Key Performance Indicators (KPIs), as at the end of June 2010, is highlighted in Table 2.1 below. As can be seen, STEMNET is very close to meeting the majority of its targets and has more than met its target in relation to the number of employers engaged (via STEM Ambassador representation).

Table 2.1: STEMNET's progress to KPIs as at end of June 2010

Key Performance Indicator (KPI)	Baseline 1st April 10	Actual 30th June 10	Target 30th June 10	Target 31st March 11
Number of current STEM Ambassador volunteers	20,339	21,733	22,128	27,000
Number of approved STEM Ambassadors	15,707	17,664	17,912	23,000
Percentage of secondary schools engaging with STEM Ambassadors over last 12 months (rolling)	55.4%	64.8%	65%	80%
Number of secondary schools affiliated to the STEM Clubs Network	675	1100	1241	2000
Percentage of secondary schools for which STEMNET has STEM enhancement and enrichment engagement information	97.4%	99%	100%	100%
Number of employers engaged with STEMNET (via STEM Ambassador representation)	1958	2301	2100	2500

3 Impacts of STEM Ambassadors Programme on pupils

This section explores the data that has been gathered from the teacher survey and the STEM Ambassadors pupil survey, in addition to the case-study interviews with schools, in relation to the impacts on pupils of being involved in activities with STEM Ambassadors. Section 3.2 explores the impacts reported by teachers. This is followed by section 3.3, which provides an overview of the impacts reported by pupils. Section 3.4 then goes on to provide a greater level of detail in relation to impacts reported by pupils, making comparisons by the different STEM subjects.

This section includes selected tables from the survey data to illustrate the findings. Further tables can be found in Appendix 3. The quantitative data is supplemented, and complemented, by qualitative data in the form of perspectives from the case-study schools. This qualitative data is presented in shaded boxes.

3.1 Key findings

- Teachers were generally very positive about the impacts of the STEM Ambassadors Programme on their pupils.
- Pupil reported impacts were particularly notable, considering the fact that just less than half (47 per cent) of those surveyed had only seen an Ambassador once. Much more could be achieved with ongoing and sustained contact with Ambassadors.
- The rank order of impacts reported by teachers almost exactly mirrored that of pupils.
- The highest rated impacts that teachers reported were:
  - increased engagement and interest in STEM subjects (86 per cent reported that this impact had been realised 'to a great extent' or 'to some extent')
  - increased knowledge and understanding of STEM subjects/concepts/topics (83 per cent reported that this impact had been realised 'to a great extent' or 'to some extent')
  - increased awareness of the STEM employment and career options available (67 per cent reported that this impact had been realised 'to a great extent' or 'to some extent')
  - increased awareness of the STEM study options available (62 per cent reported that this impact had been realised 'to a great extent' or 'to some extent').
- The lowest rated impacts were increased attainment in STEM subjects and actual participation in STEM subjects post-16 and in STEM employment (which 36 per cent and 34 per cent of teachers respectively reported had been achieved 'to a great extent' or 'to some extent'). Increases in pupils' attainment can take some time to be realised and teachers may therefore be less confident in reporting this impact. In addition, many other factors influence pupils' progress and attainment. In relation to participation, pupils need to be at a transition point for teachers to see what study and career choices they are making. However, it is worth noting that a number of studies have reported an association between levels of motivation and interest in

subjects (which have been very positively impacted by pupils' contact with STEM Ambassadors) and attainment and participation (for example Kuyper *et al*.[2], 2000; Simpkins *at al*., 2006[3]).

- The highest rated impacts reported by pupils were:
  - increased enjoyment of, and interest in, STEM subjects
  - increases in what they knew about the STEM subjects
  - increased awareness of careers that involve STEM
  - increased interest in studying STEM subjects post-16 or in higher education.
- However, fairly significant differences by subject emerged with larger proportions of pupils reporting that impacts had been achieved 'to a great extent' or 'to some extent' in science and design and technology as opposed to engineering and maths. For example, across the four impacts noted above, the pupils reporting that the impacts had been achieved 'to a great extent' or 'to some extent' ranged from 44 per cent to 61 per cent for science and 22 per cent to 31 per cent for maths.
- However, it is worth noting that larger proportions of pupils felt that the activities they had been involved in with a STEM Ambassador had not been relevant to engineering or maths as opposed to science and design and technology.
- A cross-tabulation of pupils by how many times they have seen a STEM Ambassador suggests that pupils who have seen an Ambassador four times or more are more positive than those who have seen an Ambassador between one and three times.

3.2 Overview of teacher reported impacts of STEM Ambassadors on pupils

The teachers surveyed were asked to rate the extent to which a range of key impacts on pupils had been realised as a result of their involvement in activities with STEM Ambassadors. Their responses are shown in Table 3.1 below. What is very interesting and reassuring to note is that that the order of importance of **the impacts reported by teachers is almost exactly mirrored by those of pupils** – see section 3.3 below.

The highest rated **impact for pupils that emerged from the teacher survey was increased engagement and interest in STEM subjects**, with more than eight out of ten teachers (86 per cent) reporting that this impact had been realised 'to a great extent' or 'to some extent', with over half of the teachers (56 per cent) saying that this impact had been achieved 'to a great extent'. The second most commonly reported impact was **increased knowledge and understanding of STEM subjects/concepts/topics, which 83 per cent of teachers reported had been achieved 'to a great extent' or 'to some extent'** (and, again, over half of the teachers surveyed (51 per cent) said that this impact had been achieved 'to a great extent').

[2] Kuyper, H., van der Werf. M.P.C. and Lubbers, M.J. (2000). Motivation, meta-cognition and self-regulation as predictors of long-term educational attainment. *Educational Research and Evaluation*, 6: 181–205

[3] Simpkins, S. D., Davis-Kean, P. E., & Eccles, J. S. (2006). Math and science motivation: A longitudinal examination of the links between choices and beliefs. *Developmental Psychology, 42*, 70–83.

The next two most commonly reported impacts were increased awareness of the STEM employment and careers options available to them and increased awareness of the STEM study options available to them.

Other impacts that more than half of the teachers surveyed felt were being realised 'to a great extent' or 'to some extent' included (in rank order):

- increased skills e.g. in practical work
- increased motivation to study STEM subjects post-16 and in higher education
- increased motivation to enter STEM employment/apprenticeships.

Table 3.1: Teachers using STEM Ambassadors reporting pupil impacts had been achieved 'to a great extent' or 'to some extent'

Subject	Achieved to a great extent %	Achieved to some extent %
Increased engagement and interest in STEM subjects	56	30
Increased knowledge and understanding of STEM subjects/concepts/topics	51	32
Increased awareness of the STEM employment and careers options available	43	24
Increased awareness of the STEM study options available	30	32
Increased skills e.g. in practical work	27	30
Increased motivation to study STEM subjects post-16 and in higher education	31	26
Increased motivation to enter STEM employment/apprenticeships	26	28
Increased attainment in STEM subjects	12	24
Actual participation in STEM subjects post-16 or in STEM employment	13	21
N = 165		

A series of single response questions.
A filter question: all those teachers who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents gave at least one response to this question.
Only responses' to a great extent' and 'to some extent' shown. A table showing all response options can be found in Appendix 3.
Source: NFER Teacher Survey, 2010 (N =500).

Impacts reported by smaller proportions of teachers included: increased attainment in STEM subjects (which 36 per cent of teachers reported had been achieved 'to a great extent' or 'to some extent') and actual participation in STEM subjects post-16 or in employment (which a third of teachers (34 per cent) reported had been achieved 'to a great extent' or 'to some extent'). This is likely to relate to the fact that increases in pupils' attainment can take some time to be realised and teachers therefore feel less confident in reporting this

impact. In addition, many other factors influence pupils' progress and attainment. In relation to participation, pupils need to be at a transition point for teachers to see what study and career choices they are making. However, it is worth noting that a number of studies have reported an association between levels of motivation and interest in subjects (which have been very positively impacted by pupils' contact with STEM Ambassadors) and attainment and participation (for example Kuyper *et al*., 2000[3]; Simpkins *at al*., 2006[4]). Simpkins *et al.* focus on maths and science in particular.

Additional impacts of STEM Ambassadors that small numbers of teachers mentioned included the development of transferable skills, such as socialising or interaction amongst different groups of pupils, and improved team work. They also mentioned the impact of positive role models in STEM.

3.3 Overview of impacts of STEM Ambassadors reported by pupils

The pupils surveyed were asked about a range of impacts that being involved in activities with STEM Ambassadors may have resulted in. **Three key impacts that emerged were: increased enjoyment of, and interest in, STEM subjects; an increase in what they knew about the STEM subjects; and increased awareness of careers that involve STEM.** These impacts were followed by **increased interest in studying STEM subjects post-16 or in higher education.**

Differences by subject emerged, with **larger proportions of pupils reporting that impacts had been achieved 'to a great extent' or 'to some extent' in relation to science and design and technology, as opposed to engineering and maths.** A lower proportion of pupils reporting positive impacts in relation to maths was particularly evident. However, **larger proportions of pupils reported that the activities that they had been involved in were 'not relevant to' engineering or maths, as opposed to science and design and technology**.

Table 3.2: Pupils involved in activities with STEM Ambassadors reporting impacts had been achieved 'to a great extent' or 'to some extent'

Subject	Enjoyment and interest	What you know about the subject	Awareness of careers	Motivation to study	Interest in STEM careers
Science	61%	61%	59%	44%	31%
Design and Technology	44%	44%	46%	39%	
Engineering	35%	33%	34%	30%	
Maths	22%	23%	31%	24%	

A series of single response questions.
A filter question: all those who had taken part in activities with a STEM Ambassador.
A total of 153 respondents gave a response to these questions.
Only responses' to a great extent' and 'to some extent' shown.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N=176).

A cross-tabulation analysis of a) pupils who had been involved in activities with STEM Ambassadors four or more times as opposed to once, or two to three times, and of b) pupils in different year groups, showed some small differences. However, because the numbers of pupils in different categories are small, the findings need to be treated with caution. It does seem, though, that pupils who have been involved in activities with a STEM Ambassador four times or more are more positive about the impacts that they have realised. Additionally, pupils in years 7-9, as opposed to those in years 10-13, are generally more positive about the extent to which impacts in all of the areas shown in the table above have been realised.

As mentioned above in section 3.2, it is worth noting that **the ordering of impacts reported by pupils almost exactly mirrored that of teachers.** Also interesting to note is that the ordering of impacts noted by the pupils involved in the STEM Ambassadors and STEM Clubs survey was almost identical, with the exception of increased awareness of careers in STEM, which was the third ranking impact for pupils participating in the STEM Ambassadors survey and the first impact for pupils taking part in the STEM Clubs survey. As might be expected, higher proportions of pupils attending STEM Clubs reported all of the impacts, which is likely to be related to the more in-depth and sustained nature of the intervention. Being in mind, however, that nearly half (47 per cent) of pupils had only seen a STEM Ambassador once, the impacts noted by pupils are very positive and suggest that much more could be achieved with more ongoing and sustained use of STEM Ambassadors.

3.4 Further analysis of impacts of STEM Ambassadors on pupils

This section provides more analysis on the impacts reported by teachers, and, in particular, by pupils taking part in the STEM Ambassadors survey, with a focus on highlighting differences in the strength of impact by the different STEM subjects. It explores impacts in relation to increases in: engagement/enjoyment and interest in STEM subjects; knowledge, understanding and skills; awareness of study and career options; motivation to study STEM subjects post-16 or in higher education; and motivation to enter STEM careers/employment/apprenticeships.

3.4.1 Engagement/enjoyment and interest in STEM subjects

The **key impact of STEM Ambassadors on pupils that emerged from the teacher survey was increased engagement and interest in STEM subjects**, with almost nine out of ten teachers (86 per cent) reporting that this impact had been realised ‘to a great extent’ or ‘to some extent’. **An increase in their enjoyment of, and interest in, STEM subjects was also the top impact noted by pupils,** alongside increases in what they knew about the STEM subjects.

As suggested in section 3.3, some fairly significant differences became apparent in relation to impacts on pupils' enjoyment of, and interest in, the different STEM subjects. **Involvement with a STEM Ambassador had made the most difference in relation to enjoyment of, and interest in, science, followed by design and technology**. However, it seems that this can be explained by the fact that **activities delivered by STEM Ambassadors have not always been relevant to maths, engineering or design and technology**, with the main focus being on science.

Six out of ten pupils (61 per cent) felt that that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their enjoyment of, and interest in, science, with a fifth feeling that it had made 'a great difference'. Only six per cent of pupils felt that the activities had not been relevant to science.

Forty-four per cent of pupils felt that that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their enjoyment of, and interest in, design and technology, with just over a quarter (26 per cent) feeling that it had made 'a great difference'. However, 17 per cent of pupils felt that the activities had not been relevant to design and technology.

Lower proportions of pupils felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their enjoyment and interest in engineering and maths which, as mentioned previously, seems to partly relate to the fact that the activities they had been involved in were not targeted at these subjects. Just over a third of pupils (35 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their enjoyment of, and interest in, engineering. However the same proportion felt that the activities had not focused on engineering. Just over a fifth of pupils (22 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their enjoyment of, and interest in, maths. However, like engineering, almost a third of pupils (29 per cent) felt that the activities had not been relevant to maths.

Table 3.3: Difference STEM Ambassadors have made to pupils' enjoyment of, and interest in…

	A great difference %	Some difference %	Only a small difference %	No difference %	Activities haven't been relevant to this %	No response %	Total %
Science	20	41	16	13	6	4	100
Design and Technology	26	18	11	17	17	10	100
Engineering	20	15	5	8	35	17	100
Maths	5	17	15	24	29	10	100
N = 155							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those who had taken part in activities with a STEM Ambassador.
A total of 153 respondents gave at least one response to these questions.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N = 176).

3.4.2 Knowledge, understanding and skills

Increases in pupils' knowledge and understanding of STEM subjects/concepts/topics as a result of STEM Ambassador activities was the second most commonly reported impact by teachers, which 83 per cent of teachers reported had been achieved 'to a great extent' or 'to some extent'. **An increase in what they knew about the STEM subjects was also the highest ranking impact noted by pupils,** alongside increased enjoyment of, and interest in, STEM subjects. Teachers also reported increased skills in practical work (which 57 per cent of teachers reported had been realised 'to a great extent' or 'to some extent').

The picture is very similar in relation to the impact of STEM Ambassador activity on what pupils know about the STEM subjects with science, followed by design and technology, being the most positively impacted subjects. Again, though, it seems that the lower proportions of pupils reporting positive impacts for engineering and maths relates to the fact that the activities they have undertaken with STEM Ambassadors have not focused so much on these subjects.

Six out of ten pupils (61 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to what they knew about science with just over a fifth (21 per cent) feeling that it had made 'a great difference'. Following science, 44 per cent of pupils felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to what they knew about design and technology, with nearly a quarter (23 per cent) feeling that it had made 'a great difference'. However, just over a fifth of pupils (21 per cent) felt that the activities had made 'no

difference' and 17 per cent of pupils felt that the activities were not relevant to design and technology.

An encouraging third of pupils felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to what they knew about engineering with just under a fifth (19 per cent) feeling that it had made 'a great difference'. However, just over a third of pupils (34 per cent) felt that the activities were not relevant to engineering.

Relative to the other STEM subjects, a low proportion of pupils, 23 per cent, felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to what they knew about maths. Indeed, only eight per cent of pupils felt that taking part in activities with STEM Ambassadors had made 'a great difference' to their knowledge of maths. In addition, just under a fifth of pupils (18 per cent) felt that the activities had made 'only a small difference' and almost a quarter (23 per cent) felt that they had made 'no difference'. However, more than a quarter of pupils (28 per cent) felt that the activities were not relevant to maths.

Table 3.4: Difference STEM Ambassadors have made to what pupils know about…

	A great difference %	Some difference %	Only a small difference %	No difference %	Activities haven't been relevant to this %	No response %	Total %
Science	21	40	19	11	6	4	100
Design and Technology	23	21	8	21	17	9	100
Engineering	19	14	10	6	34	17	100
Maths	8	15	18	23	28	8	100
N = 155							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those who had taken part in activities with a STEM Ambassador.
A total of 153 respondents gave at least one response to these questions.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N = 176).

3.4.3 Awareness of study and career options

The third and fourth most commonly cited impacts on pupils reported by teachers were increased awareness of the STEM employment and career options available to them (which 67 per cent of teachers felt had been achieved 'to a great extent' or 'to some extent') **and increased awareness of the STEM study options available to them** (which 62 per cent of teachers felt had been achieved 'to a great extent' or 'to some extent').

Similarly, **an increased awareness of careers involving STEM was the third most commonly reported impact by pupils**.

Again, differences emerged by subject, with science and design and technology being the most positively impacted, and larger proportions of pupils feeling that the activities that they had been involved in had not been relevant to maths and engineering as opposed to science and design and technology.

Table 3.5 shows that well over half of the pupils surveyed (59 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their awareness of careers involving science, with just over a quarter (26 per cent) feeling that it had made 'a great difference'.

Nearly half of the pupils surveyed (46 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their awareness of careers involving design and technology, with a fifth (19 per cent) feeling that it had made 'a great difference'. However, just under a fifth of pupils (17 per cent) felt that the activities had not been relevant to design and technology.

Table 3.5 also shows that just over a third of pupils (34 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their awareness of careers involving engineering, with 17 per cent feeling that it had made 'a great difference'. However, more than a third of pupils (34 per cent) felt that the activities had not been relevant to engineering, which partly explains the lower proportion of pupils reporting impacts.

Just under a third of pupils (31 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their awareness of careers involving maths, but only nine per cent felt that it had made 'a great difference' and 17 per cent reported that it had made 'no difference'. However, a quarter of pupils felt that the activities had not been relevant to maths, which partly explains the lower proportion of pupils reporting impacts.

Table 3.5: Difference STEM Ambassadors have made to pupils' awareness of careers involving STEM

	A great difference %	Some difference %	Only a small difference %	No difference %	Activities haven't been relevant to this %	No response %	Total %
Science	26	33	20	10	6	5	100
Design and Technology	19	27	12	15	17	10	100
Engineering	17	17	6	7	34	19	100
Maths	9	22	19	17	25	8	100
N = 155							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those who had taken part in activities with a STEM Ambassador.
A total of 153 respondents gave at least one response to these questions.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N = 176).

Box 1. Case-study perspectives: What impacts are STEM Ambassadors having on pupils?

A range of impacts on pupils were evident in case-study schools as a result of contact with STEM Ambassadors. These included:

- **increasing awareness of the applications of STEM in the real world**

'Guest appearances from [adults] *who aren't the people the pupils see through the day can be powerful, in that they realise that there is a little bit more to* [the world of science] *… not just your science teacher in your classroom'* (Head of Science, Case study 6).

'They [Ambassadors] *can bring knowledge and experience … It is an eye-opener for the children … it is really just for the children to have something different from their normal teacher, people who can talk about their lives, what they do in their work'* (Teacher, Case study 9).

'It gives us an insight of how they [Ambassadors] *work. I think if you see it out in real life you can see how it works'* (Year 10 pupil, Case study 12).

'*Bringing Ambassadors in is brilliant, you have got this interaction with the adult world. These people have a lot of experience from different aspects of engineering, different parts of industry, not just engineering, and so they bring that expertise into the classroom*' (Teacher, Case study 12).

- **increasing awareness of the wide range of STEM-related opportunities and careers**

'The STEMNET people were excellent in sorting out our requirements, and we had some excellent Ambassadors in. The students made some interesting comments that they hadn't realised there were so many different jobs you could do with science. Some of the students reported that they hadn't really considered careers in science, but they were now looking at it, because they'd seen a totally different view from what is normally projected: people actually talking about how interesting their jobs were, and what they did with them' (Teacher, Case study 2).

'*It's had the effect that I was hoping to create: it effectively has raised an interest in STEM careers. Inevitably when you get students and Ambassadors working together, the Ambassadors are quite often graduates, in their early 20s, the students will talk to them about their jobs, what they do. I think that's really important because students can ask questions about their jobs that they wouldn't be able to ask under other circumstances'*

(Assistant headteacher/engineering teacher, Case study 8).

'*I think it gave them an idea of where they could go with what they were learning in school, to put it in context and see it as the jobs and the design problems that people face and using science and engineering to overcome those problems*' (Science teacher, Case study 8).

'*They did tell us a lot more about different types of engineering and what they do. We got a big list of different engineering jobs, so it's a wide range of different jobs that you can do with engineering. I didn't really know about engineering jobs, I thought engineering was just mechanical'* (Year 10 pupil, Case study 8).

'*It was good because she* [the Ambassador] *is an engineer, so she knows what it's like being one, so it's good to have an insight*' (Year 10 pupil, Case study 8).

'*It opens up the vision about what engineering is. Students have a preconceived idea of what engineering is, they see it as the heavy engineering, the dirty side of engineering. I think that students now have realised there are many different aspects of engineering. It has opened the door and made them realise how vast engineering is and so they started to look at it as a much wider field*' (Teacher, Case study 12).

'The thing about the Ambassadors is to raise the expectations of some of our pupils, to show them that having a science background is something worthy and [through which] *they can have a good living'* (Head of Science, Case study 5).

3.4.4 Motivation to study STEM subjects post-16 or in higher education

Pupils' increased motivation to study STEM subjects post-16 and in higher education was the fifth most commonly reported impact by teachers (joint with increased skills in practical work), with 57 per cent of teachers reporting that this impact had been realised 'to a great extent', or 'to some extent', through pupils' engagement with STEM Ambassadors. Similarly, this impact featured as the fourth ranking impact reported by pupils.

Again, pupils' responses showed that science and design and technology were the most positively impacted, with larger proportions of pupils feeling that the activities were not relevant to maths and engineering, as opposed to science and design and technology.

Forty-four per cent of pupils felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their interest in studying science in the future, with 16 per cent feeling that it had made 'a great difference'. However, a larger proportion of pupils, 46 per cent, felt that it had made 'only a small difference' (21 per cent) or 'no difference' (25 per cent).

Thirty-nine per cent of pupils felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their interest in studying design and technology in the future, with just under a fifth (19 per cent) feeling that it had made 'a great difference'. However, just under a quarter of pupils (23 per cent) felt that it had made 'no difference'. Just under a fifth of pupils (18 per cent), though, felt that the activities that they had been involved in had not been relevant to design and technology.

Just under a third of pupils (30 per cent) felt that taking part in activities with a STEM Ambassador had made 'a great difference' or 'some difference' to their interest in studying engineering in the future, with 14 per cent feeling that it had made 'a great difference'. However, more than a third of pupils (35 per cent) felt that the activities had not been relevant to engineering.

Again, activities seemed to have the least impact on pupils' interest in studying maths in the future, with just less than a quarter of pupils (24 per cent) feeling that the activities had made 'a great difference' or 'some difference' to their interest in studying maths in the future, and only ten per cent of pupils feeling that it had made 'a great difference'. A much higher proportion of pupils, 41 per cent, felt that the activities had made 'only a small difference', or 'no difference'. Just over a quarter of the pupil sample (26 per cent) felt that the activities had made 'no difference' to their interest in studying maths. However, similar to engineering, it seems that, in some cases, STEM Ambassador activities are not overtly relevant to maths, with just over a quarter of pupils (26 per cent) feeling that this was the case.

Table 3.6: Difference STEM Ambassadors have made to pupils' interest in studying STEM subjects in the future

	A great difference %	Some difference %	Only a small difference %	No difference %	Activities haven't been relevant to this %	No response %	Total %
Science	16	28	21	25	6	5	100
Design and Technology	19	20	11	23	18	9	100
Engineering	14	16	7	12	35	17	100
Maths	10	14	15	26	26	9	100
N = 155							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those who had taken part in activities with a STEM Ambassador.
A total of 153 respondents gave at least one response to these questions.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N = 176).

3.4.5 Motivation to enter STEM careers/employment/apprenticeships

Pupils' increased motivation to enter STEM employment/ apprenticeships was the sixth most commonly reported impact by teachers, with just over half of the teachers surveyed (54 per cent) reporting that these impacts had been realised 'to a great extent', or 'to some extent', through pupils' engagement with STEM Ambassadors. Similarly, increased interest in entering a STEM career featured as the fifth ranking impact reported by pupils. **Just under a third of the pupils surveyed (31 per cent) agreed that they were more interested in choosing a career that involved**

STEM, and just under a fifth (19 per cent) felt that they possibly were. However, just under half of the pupils surveyed (48 per cent) were not at the time of the survey more interested in a STEM career, or did not know.

Table 3.7: Difference STEM Ambassadors have made to pupils' interest in a STEM career

Are you now more interested in choosing a career that involves science, technology, engineering or maths?	N	%
Yes	48	31
Possibly	30	19
No	40	26
Don't know	34	22
No response	3	2
Total =	**155**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who had taken part in activities with a STEM Ambassador.
A total of 152 respondents answered this question.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N = 176).

4. Impacts of STEM Clubs on pupils

This section explores the data that has been gathered from the teacher survey and the STEM Clubs pupil survey, in addition to the case-study interviews with schools, in relation to the impacts on pupils of being involved in a STEM Club. Section 4.2 explores the impacts reported by teachers. This is followed by section 4.3, which provides an overview of the impacts reported by pupils. Section 4.4 then goes on to provide a greater level of detail in relation to impacts reported by pupils, making comparisons by the different STEM subjects.

This section includes selected tables from the survey data to illustrate the findings. Further tables can be found in Appendix 3. The quantitative data is supplemented, and complemented, by qualitative data in the form of perspectives from the case-study schools. This qualitative data is presented in shaded boxes.

4.1 Key findings

- Teachers who were running both ASSECs and their own funded STEM Clubs were very positive about the impacts of STEM Clubs on pupils.
- The top three impacts reported by teachers were the same as those reported by pupils, but the ordering was slightly different.
- The highest rated impacts that teachers reported were:
  - increased engagement and interest in STEM subjects (93 per cent reported that this impact had been realised 'to a great extent' or 'to some extent')
  - increased knowledge and understanding of STEM subjects/concepts/topics (93 per cent reported that this impact had been realised 'to a great extent' or 'to some extent')
  - increased skills e.g. in practical work (89 per cent reported that this impact had been realised 'to a great extent' or 'to some extent')
  - increased awareness of the STEM study options available (63 per cent reported that this impact had been realised 'to a great extent' or 'to some extent').
- The lowest rated impacts were increased attainment in STEM subjects, increased motivation to enter STEM employment/apprenticeships and actual participation in STEM subjects post-16 or in STEM employment (which 40 per cent, 36 per cent, and 22 per cent of teachers respectively reported had been achieved 'to a great extent' or 'to some extent'). Increases in pupils' attainment can take some time to be realised and teachers may therefore be less confident in reporting this impact. In addition, many other factors influence pupils' progress and attainment. In relation to participation, pupils need to be at a transition point for teachers to see what study and career choices they are making. However, it is worth noting that a number of studies have reported an association between levels of motivation and interest in subjects (which have been very positively impacted by pupils' participation in STEM Clubs) and attainment and participation (for example Kuyper *et al*., 2000[3]; Simpkins *at al*., 2006[4]).
- The highest rated impacts reported by pupils were:

  - increased awareness of careers that involve STEM
  - increased enjoyment of, and interest in, STEM subjects
  - increases in what they knew about the STEM subjects
  - increased interest in studying STEM subjects post-16 or in higher education.
- However, similar to the STEM Ambassadors pupil survey, fairly significant differences by subject emerged, with larger proportions of pupils, again, reporting that impacts had been achieved 'to a great extent' or 'to some extent' in science and design and technology, as opposed to engineering and maths. Impacts were much less likely to be noted in relation to maths. For example, across the three impacts relating to enjoyment of, and interest in, what pupils knew about the subject, and increased interest in studying STEM subjects post-16 and in higher education, the pupils reporting that the impacts had been achieved 'to a great extent' or 'to some extent' ranged from 69 per cent to 76 per cent for science, and 41 per cent to 44 per cent for maths.
- However, it is worth noting that larger proportions of pupils noted that activities that they had been involved in had not been relevant to engineering or maths, as opposed to science and design and technology. The case-study data suggests that many clubs are 'science' clubs, with some examples of 'engineering' clubs, which would go some way to explaining these differences. In addition, many schools seem to be at the early stages of working across department and curriculum areas. Time and the physical location of departments can be key barriers to cross-department working.
- A cross-tabulation of pupils by how long they had been attending the STEM Club suggested that pupils who have been attending a STEM Club for more than a year are more positive than those who have been attending less than a year. In addition, it seems that, over time, activities are undertaken that involve engineering and maths, or that the relationship between the disciplines becomes more evident, as pupils are less likely to report that the activities that they have undertaken are 'not relevant to' these two subjects.
- Pupils in years 7-9 tended to be more positive than those in years 10-11 about the majority of impacts that had been realised across the different STEM subjects. However, the exception was engineering, where pupils in years 10-11 were more positive about the impacts of the STEM Club (in relation to their enjoyment of, and interest in, engineering, what they knew about engineering and their interest in studying engineering). Pupils in years 10-11 were also more positive about their increased awareness of STEM careers and improvements in their grades.
- The ranking of impacts noted by the pupils involved in the STEM Ambassadors and STEM Clubs survey was also almost identical, with the exception of increased awareness of careers in STEM, which was the third ranking impact for pupils taking part in the STEM Ambassadors survey, but the top ranking impact for pupils taking part in the STEM Clubs survey.
- Higher proportions of pupils attending STEM Clubs compared to those involved in activities with a STEM Ambassador reported all of the impacts. This is likely to be related to the more in-depth and sustained nature of the STEM Clubs intervention.

4.2 Overview of teacher reported impacts of STEM Clubs on pupils

All of the teachers involved in running a STEM Club, either funded through the ASSECs programme or not, were asked about the impacts that had been realised for pupils as a result of them attending the STEM Club. They were asked to say to what extent a range of key impacts had been realised. Their responses are shown in Table 4.1 below. What is very interesting and reassuring to note is that that the **top three impacts reported by teachers were the same as those reported by pupils** although the ordering was slightly different – see section 4.3 below.

The **first two key impacts that teachers reported had been realised for pupils by attending a STEM Club were increased engagement and interest in STEM subjects and increased knowledge and understanding of STEM subjects/concepts/topics.** For both of these impacts, the vast majority of teachers (93 per cent) reported that impacts had been realised 'to a great extent' or 'to some extent', with 66 per cent and 59 per cent respectively reporting that impacts had been realised 'to a great extent'.

These two impacts were followed by increased skills (e.g. in practical work), which 89 per cent of teachers reported had been realised 'to a great extent' or 'to some extent', with 63 per cent reporting that this impact had been realised 'to a great extent'.

The fourth most commonly mentioned impact was pupils' increased awareness of the STEM study options available to them and what they involve, which 63 per cent of teachers reported had been realised 'to a great extent' or 'to some extent', with nearly a third (30 per cent) reporting that it had been realised 'to a great extent'.

Other impacts, reported by less than half of teachers were, in rank order:

- increased awareness of the STEM employment and careers options available to them
- increased motivation to study STEM subjects post-16 and in higher education
- increased attainment in STEM subjects
- increased motivation to enter STEM employment/apprenticeships
- actual participation in STEM subjects post-16 or in STEM employment/apprenticeships.

As mentioned earlier in relation to the STEM Ambassadors Programme, the lower proportion of teachers reporting impacts in relation to attainment is likely to relate to the fact that increases in pupils' attainment can take some time to be realised and teachers therefore feel less confident in reporting this impact.

In addition, many other factors influence pupils' progress and attainment. In relation to participation, pupils need to be at a transition point for teachers to see what study and career choices they are making. However, it is worth noting that a number of studies have reported an association between levels of motivation and interest in subjects (which have been very positively impacted by pupils' participation in STEM Clubs) and attainment and participation (for example Kuyper *et al*., 2000[3] Simpkins *at al*., 2006[4]). Simpkins *et al.* focus on maths and science in particular.

Table 4.1: Teachers reporting pupil impacts from STEM Club attendance that had been achieved 'to a great extent' or 'to some extent'

Subject	Achieved to a great extent %	Achieved to some extent %
Increased engagement and interest in STEM subjects	66	27
Increased knowledge and understanding of STEM subjects/concepts/topics	59	34
Increased skills e.g. in practical work	63	26
Increased awareness of the STEM study options available	30	33
Increased awareness of the STEM employment and careers options available	20	29
Increased motivation to study STEM subjects post-16 and in higher education	23	25
Increased attainment in STEM subjects	13	27
Increased motivation to enter STEM employment/apprenticeships	15	21
Actual participation in STEM subjects post-16 or in STEM employment	9	13
N = 230		

A series of single response questions.
A filter question: all those teachers who were running STEM Clubs.
A total of 230 respondents gave at least one response to this question.
Only responses' to a great extent' and 'to some extent' shown. A table showing all response options can be found in Appendix 3.
Source: NFER Teacher Survey, 2010 (N =500).

A total of 119 teachers also reported a range of additional impacts. The most commonly mentioned, which were mentioned by more than ten teachers, were, in order of popularity: positive social impacts; increased confidence and self-esteem; allowing pupils to undertake activities they would not do otherwise; and improved teamwork. Other impacts noted by small numbers of teachers, i.e. between one and four teachers, were, in rank order: pupils taking on responsibilities; being able to draw on the support of outside teachers; additional funding; and additional support.

BOX 2. Case-study perspectives: What impacts are STEM Clubs having on pupils?

In most schools the focus has been on establishing and developing clubs, rather than compiling evidence of impact. However, both club leaders and participants perceived a range of positive outcomes from involvement in the club as highlighted below.

- Though pupils' decisions to join the club suggest some pre-existing **interest in science**, there was a widespread belief that this was nurtured and amplified by the clubs: *'I think it is making people more enthusiastic, giving them sort of more enquiring minds'* (Science teacher, Case study 5).
- Teachers and other interviewees saw the clubs as encouraging participating pupils to **choose to study science**: *'push*[ing] *science further up the list of subjects they* [pupils] *want to do'* (Club coordinator, Case study 1). In addition, these pupils fulfilled a broader ambassadorial role, promoting engagement with science in the wider school community.
- Pupils in one school had **gone on to study the Diploma in Engineering** as a result of their experiences with an engineering–focused club. As one of them explained: '…*by doing it we took the engineering course, the diploma, which was really good, because it really, like, inspired us to do engineering because we all enjoyed it'* (Pupil, Case study 12).
- There was a broad consensus that club members had improved their **practical skills, knowledge, and understanding**, with one interviewee commenting: *'You can see that there is a difference from those who are* [not] *in the STEM Club when it comes to understanding, and when it comes to actually doing investigations, things like that – 'hands-on' activities – they are more 'up for it', and they are more organised* [and able] *to get around things, problems that they're given'* (Biology teacher, Case study 1). Referring to their club's trip to CERN, another interviewee commented: *'There was an introductory talk … and when* [the speaker] *was asking A-level questions, our students answered and the A-level students* [from another school] *didn't! And they got the answers right, obviously not to high detail, but they managed to respond'* (Club leader, Case study 10).
- There were reports of pupils **transferring the knowledge** they had gained from club activities into the classroom, with one interviewee commenting that: *'All of them, academically, are achieving in line with, or even better than what was projected, because they're transferring knowledge across … Where they might work with designing something at the club or on a STEM activity, or when we take them out of school, they come back and transfer that to their lessons … One of* [the students] *made a comment that they now understood the topic of forces in science, because they'd done that at one of the events, and had linked the two together'* (Club coordinator, Case study 3).
- Pupils were also seen to be starting to **make the links between science and technology**.
- The development of new skills and extension of scientific knowledge was seen as having impacts on pupil performance and **achievement**, with several interviewees noting how club members had moved up a 'set' in science.
- Interviewees observed parallel improvements in young people's **communication skills**, with one science teacher, for example, remarking: *'Pupils become good communicators of science'*. Several interviewees described how their clubs had provided older pupils with **opportunities to take on responsibility** and organise or lead activities for younger children. For example, one interviewee remarked: '*We've got year 9 students leading year 8 students, which in itself is great* [and we're seeing] *all the benefits you get from leadership, and responsibility – the maturity and the confidence that you get* (Head teacher, Case study 7).
- Involvement with the clubs was perceived by several interviewees as impacting positively on pupils' **confidence** both as scientists and more generally:
  - '*Pupils who attend STEM Clubs are more willing to stretch themselves and ask more probing questions'* (Science teacher, Case study 4).
  - *'We do have some shy people...* [and] *it – the STEM Club – builds courage into*

them. When they do building and presentations, when they're presenting in front of everyone, it builds courage' (Pupil, Case study 3).

- Referring to their club's trip to CERN, one interviewee commented: *'It had a huge impact, that trip … it was amazing. Most of the kids were quite shy and timid outside their natural environment and the trip just made them so much more confident. It was just a complete difference, in terms of how students behaved … the first year. 7s have started to move away from the club, but their interest in science doesn't seem to have waned, it's just that they've* [developed] *other interests …* [it seems] *the Science Club may have improved their confidence to move into new areas'* [Club leader, Case study 10].
- An interviewee from another case-study school where the club had engaged in off-site activity similarly reported that: '*For some of the students from the school this would be a new experience, as they may never have ventured far from home before. It's quite a big character-building experience for them. Apart from the skills that they learn, and the enthusiasm they come back with, to join in other projects, the whole experience has been terrific'* (Club coordinator, Case study 3).

- One club coordinator noted how well represented girls, including Muslim girls, were in their club. For several of the latter group, the extra-curricular activities offered by the club were some of the first their families had been happy to allow them to participate in and seen the benefits of (Club coordinator, Case study 3). In other schools too, **girls were reported as playing a prominent role**: *'Normally girls take a back seat in lessons, but in the club, the girls are leading, they're taking a more active function'* (Head of Science, Case study 1).

4.3 Overview of impacts of STEM Clubs reported by pupils

The pupils surveyed were asked about a range of impacts that attending their school's STEM Club may have resulted in. **Three key impacts that emerged were: increased awareness of careers that involve STEM; increased enjoyment of, and interest in, STEM subjects; and an increase in what they knew about the STEM subjects**. These impacts were followed by **increased interest in studying STEM subjects post-16 or in higher education.** Differences by subject emerged, with **larger proportions of pupils reporting impacts in relation to science and design and technology, as opposed to engineering and maths.** Impacts were much less likely to be noted in relation to maths. However, **larger proportions of pupils reported that the activities that they had been involved in were 'not relevant to' engineering or maths, as opposed to science and design and technology**. The case-study data (see Box 7) suggests that many clubs are 'science' clubs with some examples of 'engineering' clubs which would go some way to explaining these differences. In addition, many schools seem to be at the early stages of working across department and curriculum areas. Time and the physical location of departments can be key barriers to cross-department working.

Table 4.2: Pupils involved in STEM Clubs reporting impacts had been achieved 'to a great extent' or 'to some extent'

Subject	Awareness of careers	Enjoyment and interest	What know about	Motivation to study	Interest in careers	Higher grades
Science	82%	76%	75%	69%	49%	28%
Design and Technology		71%	71%	66%		
Engineering		61%	64%	58%		
Maths		41%	42%	44%		

A series of single response questions.
Only responses' to a great extent' and 'to some extent' shown.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

As mentioned above in section 4.1, it is worth noting that **the top three impacts reported by pupils were the same as those reported by teachers, although the order was slightly different.** For pupils, awareness of STEM careers was the top impact whereas this was the fifth impact reported by teachers.

A cross-tabulation analysis of pupils who had been attending the STEM Club for less than a year as opposed to those who had been attending for more than a year and of pupils in years 7-9 as opposed to 10-11 was undertaken, and this showed some small differences.

It is interesting to note that, when comparing pupils who had been attending the STEM Club for less than a year with those who had been attending for more than a year, **pupils who had been attending for more than a year were more positive about the majority of the impacts having been realised**. In addition, it seems that, over time, more activities are undertaken that involve maths and engineering, as pupils are less likely to report that the activities they have undertaken are not relevant to these two subjects.

Also of interest is the fact that **pupils in years 7-9 are generally more positive about the majority of the impacts having been realised across the different STEM subjects**. However, the main exception is engineering, where pupils in years 10-11 are more positive than pupils in years 7-9 regarding: the extent to which attending the STEM Club has impacted on their enjoyment of, and interest in, engineering; what they know about engineering; and their interest in studying engineering in the future. Pupils in years 10-11 were also more positive about an increase in their awareness of STEM careers and improvements in their grades.

Also interesting to note is that the ordering of impacts reported by the pupils involved in the STEM Ambassadors and STEM Clubs survey was also almost identical, with the exception of increased awareness of careers in STEM, which was the third ranking impact for pupils participating in the STEM Ambassadors survey, but the top ranking impact for pupils taking part in the

STEM Clubs survey. Higher proportions of pupils attending STEM Clubs reported all of the impacts; this is likely to be related to the more in-depth and sustained nature of the STEM Clubs intervention.

4.4 Further analysis of impacts of STEM Clubs on pupils

This section provides more analysis on the impacts reported by teachers and by pupils in the STEM Clubs survey, with a particular focus on highlighting differences in the strength of impact by the different STEM subjects. It explores impacts in relation to increases in: knowledge, understanding and skills; engagement/enjoyment and interest in STEM subjects; awareness of study and career options; motivation to study STEM subjects post-16 or in higher education; motivation to enter STEM careers/employment/ apprenticeships; and attainment.

4.4.1 Knowledge, understanding and skills

Increased knowledge and understanding of STEM subjects/concepts/ topics was one of the top ranking impacts that teachers reported had been realised by pupils attending a STEM Club. A very high proportion of teachers (93 per cent) reported that this impact (and increased engagement and interest in STEM subjects) had been realised 'to a great extent', or 'to some extent'. Linked to pupils' increased knowledge and understanding, a high proportion of teachers reported that their pupils had also **increased their skills, for example in practical work**, with 89 per cent of teachers reporting that this impact had been realised 'to a great extent', or 'to some extent'.

Pupils were also very positive regarding the impact that attending the STEM Club had made to what 'they know about' the STEM subjects. This was also the top ranking impact reported by pupils, alongside increased enjoyment of, and interest in, the STEM subjects. **Pupils were particularly positive regarding the impact of the STEM Club on what they knew about science and design and technology.**

Over three-quarters of pupils (79 per cent) felt that attending their school's STEM Club had made 'a great difference', or 'some difference', to what they knew about science, with 39 per cent feeling that it had made 'a great difference'. Similarly, 71 per cent of pupils felt that attending the STEM Club had made 'a great difference', or 'some difference', to what they knew about design and technology, with 35 per cent feeling that it had made 'a great difference'.

In addition, a very encouraging 64 per cent of pupils felt that that attending the STEM Club had made 'a great difference', or 'some difference', to what they knew about engineering, with over a third (38 per cent) feeling that it had made 'a great difference'.

In contrast to the above, it seems that STEM Clubs are having less impact on what pupils know about maths. Table 4.3 shows that a much smaller proportion of pupils than for the other subjects (42 per cent) felt that attending the STEM Club had made 'a great difference', or 'some difference' to what they knew about maths, with only 14 per cent feeling that it had made 'a great difference' and just under a fifth of pupils (18 per cent) feeling that attending the STEM Club had made 'no difference' to what they knew about maths.

Table 4.3: Difference STEM Club has made to what pupils know about...

	A great difference (%)	Some difference (%)	Only a small difference (%)	No difference (%)	Activities haven't been relevant to this (%)	No response (%)	Total %
Science	39	40	11	7	4	3	100
Design and Technology	35	36	7	7	5	5	100
Engineering	38	26	7	7	9	9	100
Maths	14	28	21	18	6	6	100
N = 419							

A series of single response questions.
Due to rounding, percentages may not sum to 100.
A total of 419 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Clubs (N=419).

Pupils also noted a range of skills that they had gained by attending the STEM Club. They had **gained both useful skills that related directly to STEM subjects, such as undertaking practical work and experiments, as well as developing the transferable skills which are much needed by employers, such as working with others in a team, solving problems and communication**.

Large proportions of pupils felt that they had become better at undertaking practical work and experiments and working with others in a team (83 per cent and 73 per cent of pupils respectively). In addition, two-thirds of the pupils surveyed felt that they had become better at problem solving and learning about new areas that they did not know about before (67 per cent and 66 per cent respectively). In addition, over half of the pupils (57 per cent) felt that they were better at communicating with other people. Just under half of the pupils surveyed (49 per cent) felt that they were better at collecting and looking at information and a quarter felt that they were better at writing reports based on what they had found out.

Table 4.4: Things pupils identify as being 'better at' as a result of attending their school's STEM Club

	N	%
Doing practical work and experiments	347	83
Working with others in a team	307	73
Solving problems	279	67
Learning about new areas that I didn't know about before	278	66
Communicating with other people	239	57
Collecting and looking at information	204	49
Writing reports based on what I've found out	105	25
Other	79	19
N = 419		

As more than one response could be provided, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs (N=419).

4.4.2 Engagement/enjoyment and interest

Alongside increased knowledge and understanding of STEM subjects/ concepts/topics, **pupils' increased engagement and interest in STEM subjects** was the top ranking impact reported by teachers, with 93 per cent of teachers reporting that this impact had been realised 'to a great extent', or 'to some extent', as a result of pupils' participation in a STEM Club. **An increase in their enjoyment of, and interest in, STEM subjects was also the top ranking impact for pupils,** alongside increases in what they knew about the STEM subjects.

In relation to their enjoyment of, and interest in, the different STEM subjects, attending a STEM Club had particularly impacted on pupils' enjoyment of, and interest in, science and design and technology. **Just over three-quarters of pupils (76 per cent) felt that attending the STEM Club had made 'a great difference' or 'some difference' to their enjoyment of, and interest in, science**, with over a third (35 per cent) feeling that it had made 'a great difference'.

Similarly, **71 per cent of pupils felt that attending the STEM Club had made 'a great difference', or 'some difference', to their enjoyment of, and interest in, design and technology**, with, once again, over a third (38 per cent) feeling that it had made 'a great difference'.

Very encouragingly, **attending a STEM Club had also impacted very positively on pupils' enjoyment of, and interest in, engineering** with just under two-thirds of pupils (61 per cent) feeling that it had made 'a great difference', or 'some difference', and well over a third (39 per cent) feeling that it had made 'a great difference'. However, 14 per cent of pupils felt that STEM Club activities had not been relevant to engineering.

However, it seems that **STEM Clubs are having less of an impact on pupils' enjoyment of, and interest in, maths,** with a smaller proportion of

pupils, 41 per cent, feeling that attending the STEM Club had made 'a great difference', or 'some difference', to their enjoyment of, and interest in, maths, and only 12 per cent feeling that it had made 'a great difference'. Conversely, larger proportions of pupils felt that attending the STEM Club had made 'only a small difference' (almost a quarter, 23 per cent), or 'no difference' (17 per cent) to their enjoyment of, and interest in, maths. In addition, 15 per cent of pupils felt that STEM Club activities had not been relevant to maths.

Table 4.5: Difference STEM Club has made to pupils' enjoyment of, and interest in...

	A great difference (%)	Some difference (%)	Only a small difference (%)	No difference (%)	Activities haven't been relevant to this (%)	No response (%)	Total %
Science	35	41	12	5	5	3	100
Design and Technology	38	33	14	8	4	3	100
Engineering	39	22	9	7	14	9	100
Maths	12	29	23	17	15	5	100
N = 419							

A series of single response questions.
Due to rounding, percentages may not sum to 100.
A total of 419 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Clubs (N=419).

4.4.3 Awareness of study and career options

The fourth and fifth most commonly mentioned impacts by teachers were pupils' increased awareness of the STEM study options available to them and what they involve, and increased awareness of the STEM employment and careers options available to them, which 63 per cent and 49 per cent of teachers respectively reported had been realised 'to a great extent', or 'to some extent'.

Pupils, however, were much more positive regarding the impact that attending the STEM Club had had on their awareness of careers involving STEM. As Table 4.6 below shows, **82 per cent of pupils reported that attending the STEM Club had made 'a great difference', or 'some difference', to their awareness of careers involving STEM, with over a third of pupils (38 per cent) reporting that it had made 'a great difference'.**

Table 4.6: Difference STEM Club has made to pupils' awareness of careers involving STEM

	N	%
A great difference	160	38
Some difference	184	44
Only a small difference	45	11
No difference	17	4
Activities haven't been relevant to this	2	1
No response	11	3
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs (N=419).

4.4.4 Motivation to study STEM subjects post-16 or in higher education

Nearly half of the teachers surveyed (48 per cent) felt that pupils' increased motivation to study STEM subjects post-16 and in higher education had been realised 'to a great extent', or 'to some extent', through their involvement in a STEM Club. Pupils were much more positive when responding to this question and, **very encouragingly, attending a STEM Club seems to have a very positive effect on pupils' interest in studying STEM subjects post-16 or in higher education,** with the picture being particularly positive for science and design and technology.

Table 4.7 shows that over two-thirds of pupils (69 per cent) felt that attending the STEM Club had made 'a great difference' or 'some difference' to them studying science post-16 or in higher education, with a very encouraging two-fifths of pupils (41 per cent) feeling that it had made 'a great difference'.

Similarly, two-thirds of pupils felt that attending the STEM Club had made 'a great difference', or 'some difference', to them studying design and technology post-16 or in higher education with, again, over two-thirds of pupils (37 per cent) feeling that it had made 'a great difference'.

Also positive were pupils' responses in relation to engineering, with 58 per cent of pupils feeling that attending the STEM Club had made 'a great difference', or 'some difference', to their interest in studying engineering in the future, with almost a third (32 per cent) feeling that it had made 'a great difference'. However, a higher proportion of pupils felt that the STEM Club has not been relevant to engineering (12 per cent) as opposed to not being relevant to science and design and technology (both three per cent).

Again, it seems that STEM Clubs are having less of an impact in terms of maths with a smaller proportion, 44 per cent, of pupils feeling that attending the STEM Club had made 'a great difference', or 'some difference', to their interest in studying maths in the future, with only a fifth saying that it had made 'a great difference'. 18 per cent of pupils felt that it had made 'only a

small difference' and just over a fifth (21 per cent) felt that it made 'no difference'. Twelve per cent of pupils felt that the club had 'not been relevant' to maths.

Table 4.7: Difference STEM Club has made to pupils' interest in studying STEM subjects in the future

	A great difference (%)	Some difference (%)	Only a small difference (%)	No difference (%)	Activities haven't been relevant to this (%)	No response (%)	Total %
Science	41	28	13	12	3	3	100
Design and technology	37	29	11	15	3	5	100
Engineering	32	26	11	11	12	9	100
Maths	20	24	18	21	12	5	100
N = 419							

A series of single response questions.
Due to rounding, percentages may not sum to 100.
A total of 419 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Clubs (N=419).

4.4.5 Motivation to enter STEM careers/employment/apprenticeships

More than a third of teachers (36 per cent) felt that increased motivation to enter STEM employment/apprenticeships had been realised 'to a great extent' or 'to some extent' through their pupils' involvement in the school's STEM Club. **Again, pupils provided a more positive response when asked if they were now more interested in a career involving STEM as a result of attending the STEM Club, with almost half of the pupils surveyed (49 per cent) responding 'yes'.** An additional 31 per cent of pupils felt that they were possibly more interested and 11 per cent did not know. Only seven per cent of pupils said that they were not more interested in a career involving STEM as a result of attending the STEM Club.

Table 4.8: Difference STEM Club has made to pupils' interest in a STEM career

As a result of attending a STEM Club, are you now more interested in choosing a career that involves science, technology, engineering or maths?	N	%
Yes	206	49
Possibly	130	31
No	29	7
Don't know	46	11
No response	8	2
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs (N=419).

Pupils were asked what STEM careers they were more interested in and the broad career areas and jobs that they mentioned are shown, in order of popularity, below. Engineering was the most popular choice and, as has been found in other surveys of young people regarding careers, the physical sciences did not feature strongly in their choices.
Careers that young people were now more interested in, in order of popularity, included:

- engineering (general)
- science (general)
- designer (general)
- doctor/surgeon
- medicine (general)
- programmer/software engineer
- cars/race engineer/mechanic
- teacher
- architect
- aerospace/engineer/aeronautics
- vet
- technology (general)
- physicist
- chemist
- space scientist.

In addition to the more popular choices shown above, a wide range of careers in very specific areas of STEM were also mentioned by pupils. These included specific branches of engineering such as mechanical, civil, structural, chemical, maritime and sound engineering. Similarly, a range of specific science disciplines were also mentioned. These included biology, forensic science, genetics, neuro-science, astrophysics, nuclear physics, zoology, meteorology and entomology.

4.4.6 Attainment

A very encouraging 40 per cent of teachers reported that pupils' increased attainment in STEM subjects had been realised 'to a great extent', or 'to some extent', through their involvement in the school's STEM Club.

Again, very encouragingly, over a quarter of pupils (28 per cent) felt that they were getting better marks and grades in STEM subjects as result of their participation in a STEM Club, with a further 41 per cent feeling that

their marks and grades had possibly improved. Only six per cent of pupils did not feel that their marks and grades had improved and a quarter (24 per cent) did not know if they had improved or not.

Table 4.9: The impact of attending a STEM Club upon marks or grades

Have you been getting better marks or grades in STEM subjects since joining the STEM Club?	N	%
Yes	116	28
Possibly	171	41
No	25	6
Don't know	101	24
No response	6	1
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs (N=419).

Comparing pupils who had been attending the STEM Club for less than or more than a year shows that positive impacts on grades may be more likely to be realised over time. Thirty-four per cent of pupils who had been attending the STEM Club for more than a year, compared to 25 per cent who had been attending for a year or less, felt that they were now getting better grades as a result of attending the STEM Club.

5. Impacts of STEMNET's services and programmes on teachers

This section explores the data that has been gathered from the teacher survey, in addition to the case-study interviews with schools, in relation to the impacts of STEMNET's services and programmes on teachers. Section 5.2 presents teachers' views on the impacts of the brokerage service. This is followed by section 5.3 which looks at the impacts of the STEM Ambassadors Programme. Section 5.4 then goes on to explore the impacts of STEM Clubs on teachers.

This section includes selected tables from the survey data to illustrate the findings. Further tables can be found in Appendix 3. The quantitative data is supplemented, and complemented, by qualitative data in the form of perspectives from the case-study schools. This qualitative data is presented in shaded boxes.

5.1 Key findings

Brokerage service

- Teachers were very positive about the impacts of the brokerage service.
- More than four out of five teachers (86 per cent) who had used the brokerage service reported that it had increased their and other teachers' awareness of the STEM enhancement and enrichment activities available and how to access them 'to a great extent' or 'to some extent'.
- More than three-quarters of the teachers surveyed (76 per cent) who had used the brokerage service reported that it had increased their and other teachers' knowledge and understanding of the benefits of STEM enhancement and enrichment activities 'to a great extent' or 'to some extent'.

STEM Ambassadors

- Although lower proportions of teachers reported impacts on themselves than on their pupils as a result of engaging with STEM Ambassadors, it does seem that the involvement of STEM Ambassadors in schools is resulting in some important impacts for teachers.
- The two key impacts for teachers of involvement with STEM Ambassadors were:
  - increased ability to relate STEM lessons to real world applications of the subjects (which over two-thirds of teachers (69 per cent) reported had been achieved 'to a great extent' or 'to some extent')
  - personal development (for example changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects (which two-thirds of teachers (67 per cent) reported had been achieved 'to a great extent' or 'to some extent').

- Other impacts that half or more than half of the teachers surveyed who had had involvement with a STEM Ambassador reported were:
  - increased knowledge and understanding of current STEM debates/concepts/topics
  - increased understanding of current applications of STEM within the workplace
  - increased awareness of STEM study options
  - increased awareness of STEM employment and career options.

STEM Clubs

- As with STEM Ambassadors, lower proportions of teachers reported impacts on themselves than on their pupils as a result of involvement in their school's STEM Club. However, involvement in STEM Clubs is also resulting in some important impacts for teachers.
- The two key impacts for teachers of involvement with their school's STEM Club were the same as those for STEM Ambassadors:
  - increased ability to relate STEM lessons to real world applications of the subjects (which over three-quarters of teachers (76 per cent) reported had been achieved 'to a great extent' or 'to some extent')
  - personal development (for example changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects (which three-quarters of teachers reported had been achieved 'to a great extent' or 'to some extent').
- The other impacts that more than half of the teachers surveyed who were involved in their school's STEM Club reported were, again, similar to those reported by teachers who had used STEM Ambassadors. They were:
  - increased knowledge and understanding of current STEM debates/concepts/topics
  - increased understanding of current applications of STEM within the workplace
  - the development of skills and capabilities in delivering practicals
  - increased awareness of STEM study options.

5.2 Impacts of the brokerage service on teachers

Teachers were asked to say to what extent the support that they had received from the brokerage service had: increased their and other teachers' awareness of the STEM enhancement and enrichment opportunities available and how to access them; and increased their and other teachers' knowledge and understanding of the benefits of STEM enhancement and enrichment activities. High proportions of teachers agreed that these impacts had been realised. **More than four out of five teachers surveyed (86 per cent) who had used the brokerage service reported that it had increased their and other teachers' awareness of the STEM enhancement and enrichment opportunities available and how to access them** 'to a great extent' or 'to some extent'**.** More than three-quarters of the teachers surveyed (76 per cent) who had used the brokerage service also reported that it had **increased their and other teachers' knowledge and understanding of the benefits of**

STEM enhancement and enrichment activities 'to a great extent' or 'to some extent'.

Table 5.1: Impacts of brokerage service on teachers

	Not at all %	To a small extent %	To some extent %	To a great extent %	Don't know %	No response %	Total %
Increased awareness of STEM enhancement and enrichment opportunities available and how to access them	5	9	35	51	0	0	100
Increased knowledge and understanding of the benefits of STEM enhancement and enrichment activities	7	15	34	42	2	0	100
Other	13	5	17	24	41	0	100
N = 186							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those teachers who had used the brokerage service.
A total of 186 respondents gave at least one response to these questions.
Source: NFER Teacher Survey, 2010 (N = 500).

In an open question on impacts, smaller numbers of teachers also offered details of other impacts. They included: 'We have done some more activities or events as a result of the service'; 'It has improved our networking'; 'This has saved us time'; 'Good support for CREST awards'; 'Staff have been enthused'; 'It has raised the profile of STEM within the school'; and 'It has improved awareness of STEM subjects'.

When asked to rate the extent to which the impacts they had reported were attributable *solely* to the brokerage support that they had received, with 1 being not at all and 5 being entirely, just under half of the teachers surveyed (48 per cent) gave a positive response of a 4 or 5 and just under a third (30 per cent) gave a 3. Only 15 per cent felt that the impacts were also partly attributable to other activities that they had been involved in.

5.3 Impacts of STEM Ambassadors on teachers

The teachers surveyed were asked to rate the extent to which a range of key impacts had been realised for themselves and other teachers as a result of their involvement in activities with STEM Ambassadors. As might be expected, lower proportions of teachers reported impacts from STEM Ambassadors on themselves than on pupils, feeling that the activity was primarily targeted at engaging their pupils. However, having said this, it seems

that the involvement of STEM Ambassadors in schools is also resulting in some important impacts for teachers.

Table 5.2 shows that the key impact for teachers as a result of them working with STEM Ambassadors is **increased ability to relate STEM lessons to real world applications of the subjects.** Over two-thirds of the teachers surveyed (69 per cent) reported that this impact had been realised 'to a great extent' or 'to some extent', with 41 per cent reporting that it had been achieved 'to a great extent'. **The next most commonly reported impact was personal development** (for example changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects which two-thirds of teachers (67 per cent) reported had been achieved 'to a great extent' or 'to some extent', with a third of teachers reporting that it had been achieved 'to a great extent'.

Other impacts reported to have been achieved 'to a great extent' or 'to some extent' by half or more than half of the teachers surveyed included:

- increased knowledge and understanding of current STEM debates/concepts/topics
- increased understanding of current applications of STEM within the workplace
- increased awareness of STEM study options
- increased awareness of STEM employment and careers options.

Impacts reported to have been achieved 'to a great extent' or 'to some extent' by just less than half of the teachers surveyed were:

- the development of skills and capabilities in delivering practicals based on real world examples
- increased awareness of the skills and capabilities required by employers.

Table 5.2: Impacts of STEM Ambassadors Programme on teachers

	Not at all %	To a small extent %	To some extent %	To a great extent %	Don't know %	No response %	Total %
Increased ability to relate STEM lessons to real world applications of the subjects	11	8	28	41	12	0	100
Personal development (e.g. changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects	14	12	34	33	8	0	100
Increased knowledge and understanding of current STEM debates/concepts/topics	21	7	36	27	9	0	100
Increased understanding of current applications of STEM within the workplace	15	12	36	28	10	0	100
Increased awareness of STEM study options	24	12	27	24	13	0	100
Increased awareness of STEM employment and careers options	18	15	27	23	18	0	100
The development of skills and capabilities in delivering practicals based on real world examples	28	12	25	21	14	0	100
Increased awareness of the skills and capabilities required by employers	22	10	28	18	21	0	100
Other	15	4	10	18	53	0	100
N = 165							

A series of single response questions.
Due to rounding, percentages may not sum to 100.
A filter question: all those teachers who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents gave at least one response to these questions.
Source: NFER Teacher Survey, 2010 (N = 500).

Additional impacts of STEM Ambassadors that small numbers of teachers mentioned included, in order of popularity: improved networking; more resources available; encouragement to continue to use STEM Ambassadors in the future; improved general teaching skills; personal development in relation to teaching STEM subjects; good general CPD; and extra manpower.

When asked to rate the extent to which the impacts they had reported were attributable *solely* to STEM Ambassador activities, with 1 being not at all and 5 being entirely, over half of the teachers surveyed (54 per cent) gave a positive response of a 4 or 5 and almost a third (31 per cent) gave a 3. Only 13 per cent felt that the impacts were also partly attributable to other activities that they had been involved in.

BOX 3. Case-study perspectives: What impacts are STEM Ambassadors having on teachers?

- Teachers also experienced some impacts from working with STEM Ambassadors and these principally related to Ambassadors as a source of **STEM knowledge and expertise**:

  '*What you are doing with the Ambassadors at the end of the day is using their expertise, they're the knowledge base, we tend to use it like that*' (Assistant headteacher/engineering teacher, Case study 8).

- Teachers also, like their pupils, stand to gain **increased knowledge and understanding of STEM opportunities and careers** as a result of working with STEM Ambassadors. This enhanced knowledge helps teachers to discuss with their pupils the wider applications of STEM learning and associated career opportunities, as this teacher explains:

  '*One thing I've got out of it is that I have a much clearer understanding about a whole range of different careers. Because of that and because I'm teaching the engineering and the technology subjects lower down, I can discuss with students about possible career directions. So it's the information, advice and guidance side of it, for me, has been much more focused, much sharper. It's useful*' (Assistant headteacher/engineering teacher, Case study 8).

- STEM Ambassadors also offer **additional capacity to help schools provide STEM enhancement and enrichment activities**. Support from STEM Ambassadors, on some occasions, has enabled schools to provide a STEM enrichment opportunity which may otherwise have been prevented due to the challenges of releasing and funding the release of teaching staff. In one school, two year groups had been able to access STEM enrichment as part of Lab in a Lorry due to STEM Ambassadors providing additional staffing support to run the facility:

  'We couldn't have staffed it, we couldn't have taken two staff off timetable for five days, we just wouldn't have been able to do it without those STEMNET volunteers. We couldn't have run it without their additional support' (Head of Science, Case study 6).

5.4 Impacts of STEM Clubs on teachers

The teachers surveyed were asked to rate the extent to which a range of key impacts had been realised for themselves and other teachers as a result of their involvement in their school's STEM Club. As might be expected, lower proportions of teachers reported impacts from the STEM Club on themselves than on pupils, feeling that the activity was primarily targeted at engaging their pupils. However, having said this, it seems that the involvement of teachers in STEM Clubs is also resulting in some important impacts for teachers.

BOX 4. Case-study perspectives: What impacts are STEM Clubs having on teachers and other adults?

- Adults involved with the clubs expressed **enjoyment** of the pupils' enthusiasm and one non-teaching club leader remarked: *'I've certainly gained a lot from it, in fact I would say it's one of the motivators for me deciding to go into teaching … the enthusiasm that the kids show was really inspiring'* (Club leader, Case study 10).
- Some teacher interviewees attributed new or **improved relationships** with pupils to the club.
- One teacher interviewee saw the club as helping them develop a more **cross-curricular perspective.**
- Several interviewees noted that the club had proved a source of **ideas for the classroom**: *'When you are searching for activities you come across other activities … things you can build into the curriculum' (*Science teacher, Case study 5).
- One non-specialist teacher of physics said involvement in the club had added to their **subject knowledge** in that area, and *'made me want to learn more about physics'* (Biology teacher, Case study 1). A head of department similarly commented that *'It's also a learning curve for the teachers'* (Head of Science, Case study 1).
- **Professional recognition** was a further benefit, or as one interviewee put it: *'Senior management have said to me personally, 'We're really pleased that you are running the Science Club' …* [So] *it will get me some brownie points'* (Science teacher, Case study 5).
- However, running a club can also place considerable demands on the leader/coordinator, and have a **substantial cost in terms of time**: '*It's a phenomenal amount of time! But if you didn't love going out with the kids who love science, then you're probably in the wrong job! You're getting the students to love science as much as you do'* (Science teacher, Case study 2).
- Several interviewees saw the existence and activities of the club as impacting positively on the **profile and status of their department**, with one interviewee commenting that *'It increases our profile in the school'* (Head of Science, Case study 5) and another that *'There's been lots of press about the work that the Science Club has done, and I think it has upped the profile* [of the department]*, yeah'* (Club leader, Case study 10).
- Some schools had found their club and its activities to be **a 'draw card' when interacting with feeder primaries***: 'Because our school is situated near a girls' school, we are trying to encourage more and more girls from our feeder schools to come to us. When our school runs the 'taster days' for primaries,* [the STEM Club] *is quite a feature of what we do'* (Club coordinator, Case study 3). A few club leaders have aspirations around becoming more involved in transition work.

Table 5.3 shows that the **key impact that has emerged for teachers is increased ability to relate STEM lessons to real world applications of the subjects**, with over three-quarters of teachers (76 per cent) reporting that this impact had been realised 'to a great extent', or 'to some extent', with nearly half of the teachers (47 per cent) saying that this impact had been achieved 'to a great extent'. **The next most commonly reported impact was personal development** (for example changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects which three-quarters of the teachers reported had been achieved 'to a great extent', or 'to some extent', with 43 per cent reporting that this impact had been achieved 'to a great extent'.

Other important impacts reported to have been achieved 'to a great extent' or 'to some extent' by more than half of the teachers surveyed included:

- increased knowledge and understanding of current STEM debates/concepts/topics
- increased understanding of current applications of STEM within the workplace
- the development of skills and capabilities in delivering practicals
- increased awareness of STEM study options.

Table 5.3: Impacts of STEM Clubs on teachers

	Not at all %	To a small extent %	To some extent %	To a great extent %	Don't know %	No response %	Total %
Increased ability to relate STEM lessons to real world applications of the subjects	10	10	29	47	5	0	100
Personal development (e.g. changes in confidence, motivation, enthusiasm, attitudes, aspirations) in relation to teaching STEM subjects	9	13	32	43	3	0	100
Increased knowledge and understanding of current STEM debates/concepts/topics	14	13	42	27	4	0	100
Increased understanding of current applications of STEM within the workplace	18	14	37	25	6	0	100
The development of skills and capabilities in delivering practicals based on real world examples	17	18	34	25	7	0	100
Increased awareness of STEM study options	22	15	37	18	8	0	100
Increased awareness of STEM employment and careers options	17	12	29	18	24	0	100
Increased awareness of the skills and capabilities required by employers	21	10	26	16	27	0	100
Other	23	2	12	27	37	0	100
N = 230							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those teachers who had engaged with the STEM Clubs Programme (ASSECs and non-ASSECs).
A total of 230 respondents gave at least one response to these questions.
Source: NFER Teacher Survey, 2010 (N = 500).

Other impacts reported by over 40 per cent of teachers included: increased awareness of STEM employment and career options (which 47 per cent of teachers reported had been achieved 'to a great extent' or 'to some extent',

with 18 per cent reporting that it had been achieved 'to a great extent'); and increased understanding of the skills and capabilities required by employers (which 42 per cent of teachers reported had been achieved 'to a great extent' or 'to some extent', with 16 per cent reporting that it had been achieved 'to a great extent').

Additional impacts reported by small numbers of teachers (between 1 and 13 teachers), in rank order included:

- improved cross-curricular links
- improved relationships with pupils
- increasing teachers' own skills/good professional development
- ability to develop learning beyond the curriculum
- access to good information and advice
- additional resources
- increased enthusiasm through working with more interested or motivated pupils
- getting more staff involved
- some good trips
- improved networking
- raised awareness of STEM.

When asked to rate the extent to which the impacts they had reported were attributable *solely* to involvement in the STEM Club, with 1 being not at all and 5 being entirely, 68 per cent of the teachers surveyed gave a positive response of a 4 or 5, with just over a quarter (26 per cent) giving a 3. Only four per cent felt that the impacts were also partly attributable to other activities that they had been involved in.

6. Pupil impact data collected by individual schools

Many of the schools which engage in STEM enhancement and enrichment activities through STEMNET collect data to monitor the effectiveness and impacts of the activities. This section of the report draws together examples of such impact data, and highlights cases where monitoring data collected by schools suggests that impacts are occurring as a result of STEMNET programmes.

6.1 Key findings

- Despite the small-scale nature of the data, and the variation in robustness between datasets, there is evidence suggesting that there are positive impacts for pupils arising from STEM Clubs and interactions with STEM Ambassadors.
- There is evidence that STEM Club participants are outperforming their peers in STEM subjects, from school datasets comparing comparison groups of similar non-participating pupils to members of a STEM Club.
- Although less quantitative evidence was gathered by schools linking STEM Ambassadors to pupil attainment, there is some evidence that their involvement (especially working with small groups or individuals) has a positive impact on pupil attainment in those subjects or tasks that Ambassadors were involved with.
- There is evidence that STEM Clubs play an important role in encouraging pupils to progress to STEM subjects in Key Stage 4.
- Some schools have administered questionnaires to explore the impacts of STEM activities, and the data from these schools suggests that STEM Clubs, STEM Ambassadors and other enhancement and enrichment activities have positive impacts on attitudes to STEM (e.g. interest in STEM subjects; interest in future STEM study and careers).

The various sources of data presented in this section are drawn from individual schools. The data have been given directly to an NFER researcher during a case-study visit, or forwarded to STEMNET Regional Directors who, in turn, have passed the data on to the NFER.

The level of sophistication of data collection varies considerably between schools. Some collect no data on STEM programmes, and their potential impacts within the school, while other schools collect basic data such as attendance data and one-off attitudinal surveys. At the more sophisticated end of the data collection spectrum, some schools examine the attainment and progression of pupils participating in STEMNET activities, against a matched cohort of their non-participating peers.

Many of the datasets are necessarily small, due to the relatively small number of pupils participating in activities such as STEM Clubs. These datasets cannot be held up to sophisticated statistical scrutiny, and do not necessarily

represent findings that can be generalised across all schools participating in STEMNET enhancement and enrichment activities. Additionally, there may be other initiatives and programmes occurring at these schools that are impacting upon pupils. Of the various data sources from individual schools that were received by the research team, some of the more robust examples inform the analysis and examples provided below.

As the data presented below shows, pupil participation in STEMNET enhancement and enrichment activities does appear to be leading to positive impacts for pupils in the areas of performance and attainment, progression onto further STEM study and attitudes toward STEM subjects.

6.2 Pupil attainment

A number of schools have linked information on pupil participation in STEM Clubs with pre-existing datasets on attainment. These include Fischer Family Trust data, Standard Attainment Test data and Assessing Pupils' Progress data.

Most of the school datasets analysed for this report revealed that STEM Club pupils were outperforming their peers. This is unsurprising, though, given that there is likely to be some level of self-selection effects in the data. Some STEM Clubs are open to any interested pupils, while others are more focussed toward particular attainment groups, or underrepresented groups. Regardless of the target make-up for a particular STEM Club, those pupils who volunteer their time to participate in the club are most likely to be those who are already interested in, or receptive to, STEM subjects.

In an effort to circumvent such self-selection effects, some schools have compared the attainment of STEM Club pupils with a cohort of similarly achieving pupils, or matched individuals who are not involved in the STEM Club. Data collected in this fashion gives a much stronger indication that the positive impacts observed can be attributable to pupils' involvement with their school's STEM Club.

The following boxes contain examples of such impacts. Within most of the datasets received, where comparisons were made against a comparison group of pupils, **it appears that pupils involved in STEM Clubs are outperforming their similar non-participating peers**.

STEM Club pupils outperform their top set peers

An Academy from the North West running a STEM Club has compared the academic progress made in science of club members against a comparison group of other pupils. All pupils are in a top set year eight class who have had exposure to the same teaching throughout the year. Fourteen of the pupils have been involved in the STEM Club and associated enrichment activities, fifteen have not.

The performance data is based on SAT question tests and APP tasks. The data shows that the average starting point for the two groups at the end of 2008/09 is identical (5.2). However, after a year's exposure to the club, members have progressed to a higher level (6.2) than the comparison group who have not participated (5.9).

STEM Club pupils progress faster towards their target grades

At a South East specialist technology college, a STEM Club is run which is part of the first cohort of After-School Science and Engineering Clubs, funded by DCSF (now DfE). The school compared the attainment of 15 pupils who had taken part in the club, with 15 of a similar ability on the same courses who had not participated. At the point of comparison, pupils had completed two out of three units of biology, chemistry and physics at GCSE.

Whilst on average both groups of pupils were not yet meeting their target grades, the club pupils were closer than the comparison pupils in all subjects, suggesting that the club is having a positive impact on their attainment:

- in biology, club pupils on average were a third of a grade below their target, whilst non-club pupils were almost a grade below their target
- in **chemistry**, club pupils on average were just under two-thirds of a grade (0.6) below their target, whilst non-club pupils were over a grade (1.1) below their target
- in **physics**, club pupils on average were around a quarter (0.27) of a grade below their target, whilst non-club pupils were just over half (0.53) a grade below their target.

STEM Club pupils consistently outperform peers of similar ability

A West Midlands college holds specialisms in science, as well as mathematics and computing. There is an After-School Science and Engineering Club that involves years eight and nine, and which has carried out activities such as building a Greenpower car. The school has compared the current levels of pupils who attend the club in science, technology and maths with non-participating pupils who were at a similar level when the club started.

The data shows that, in general, pupils who are participating in the club have a higher points score, and have therefore made more progress, than pupils who were not involved:

- final Key Stage 3 data for the 12 pupils (based on Fischer Family Trust data and teacher assessments) who joined the club in September 2007 shows that they are ahead of their peers who started at a similar level by 0.2 of a level in science and maths, and 0.3 of a level in technology
- 2010 data for the 11 pupils (based on Fischer Family Trust data and teacher assessments) who joined the club in September 2008 shows that they are ahead of their peers who started at a similar level by 0.3 of a level in science, 0.2 of a level in maths, and 0.1 of a level in technology
- 2010 spring interim report data for the 11 pupils (based on Fischer Family Trust data and teacher assessments) who joined the club in September 2009 shows that they are ahead of their peers who started at a similar level by 0.1 of a level in science and maths, and are at the same level in technology.

This suggests that the club has had a positive impact on the performance in these three subjects.

STEM Club pupils perform better against their targets than non-participating pupils with similar targets

A Yorkshire and Humber specialist technology college runs an After-School Science and Engineering Club (ASSEC). The school has compared the triple science attainment of the nine pupils who have been involved in the club against 21 other pupils with similar targets in the cohort.

After the pupils' first modules covering biology, chemistry and physics, the group as a whole were over performing against their targets by an average of half (0.53) of a grade. However, STEM Club participants were performing much better against their targets, on average gaining 1.75 grades against their targets. This suggests that participation in the club is having a positive impact on their attainment in triple science.

STEM Club pupils have made more progress in science than their peers

A Technology College in the South West started a STEM Club in January 2009, and has gathered data on the science performance of the ten pupils who attend against a comparison group of ten of their peers. The evidence demonstrates that pupils attending the STEM Club have made greater progress in science than those who have not attended:

- increases in pupils' levels in science between years seven to eight were on average 1.2 for STEM Club participants, compared to 0.8 for the comparison group
- increases in pupils' levels in science between years eight to nine were on average 3.1 for STEM Club participants, compared to 2.4 for the comparison group.

The majority of the members of the club (nine out of ten) are gifted and talented pupils. It is notable that the only attendee who is not gifted and talented is below his target grades in all subjects except science and DT, which are the subjects most likely to be influenced by attending the club.

There appears to be less quantitative data collected by schools on the impacts of STEM Ambassadors on pupil attainment. This is unsurprising, given that it can be very difficult to attribute impacts on pupil attainment to Ambassador interactions which are likely to occur more occasionally, and involve a greater number of pupils than STEM Clubs.

However, the following examples show that pupils and teachers do feel that Ambassador interactions help with pupils' learning, further reinforcing the findings of the NFER STEM Ambassadors pupil survey.

STEM Ambassadors contribute to the success of a new Applied Science BTEC programme

In an effort to increase the number of pupils who achieve a C grade or higher at GCSE level science, an academy in the South West devised a BTEC Certificate in Applied Science that would suit the pupils who did not achieve a level 5 at Key Stage 3. The course was introduced in September 2008-9 to four classes. Since then, seven classes have completed both the BTEC and GCSE courses and they have been given a questionnaire asking them about their experiences on the courses. This has been completed by 55 pupils.

The BTEC course differed from the GCSE as pupils completed coursework assignments rather than exams, some classes were split into single sex groups, and all BTEC classes have had at least one visit to a STEM-related workplace, and one visit from someone working in a STEM field. Overall, the BTEC has been successful, and the school's data predicts that 95 per cent of pupils will achieve a higher grade in BTEC than GCSE.

The involvement of STEM Ambassadors has been a part of that success. The teacher

overseeing the BTEC notes that the visits have helped to engage and motivate the pupils, and nearly two-thirds (37) of the pupils who completed the questionnaire felt that the visits had helped them with their learning.

STEM Ambassadors help pupils achieve better than predicted

A specialist science school in the East Midlands has used STEM Ambassadors to support learning. For example, as part of their GCSE Applied Science coursework, pupils are required to research two industries. As the school has found it increasingly difficult to take pupils out to visit companies to help with this element of coursework, they arranged for two STEM Ambassadors to come into the school in the autumn term 2009 (one from Bombardier Transportation and one from Rolls-Royce). The Ambassadors came to the school and gave talks on their companies as well as answering questions from the pupils. Staff sent the Ambassadors a list of the types of questions the pupils have to answer as part of their coursework in advance so that they could prepare appropriate talks.

The teachers felt that, in addition to gaining significant benefits from the visits, pupils also gained in terms of performing better than expected in their coursework. Eleven of the nineteen pupils achieved a grade C for their coursework, against a prediction based on Fischer family Trust data that only three pupils would achieve this.

Sustained Ambassador intervention helps raise the attainment of the most able pupils

A high performing school in Yorkshire and Humber enjoys 71 per cent of pupils attaining five GCSEs at A* to C (including English and maths). However, progression of pupils is only measured as satisfactory, and the school attribute this to the under-performance of their most able pupils. One approach to tackling this under-performance has been to use STEM Ambassadors to work with the most able pupils as they complete their GCSE coursework module in design and technology. Each Ambassador was assigned two or three pupils and supported and advised the pupils over a period of some 20 weeks (Oct 09 – Feb 10). This support consisted of a 30 minute meeting on average every 3 weeks.

The results were that the pupils who were mentored showed a better rate of progress than those who were not supported in this way, when compared to the previous cohort. In 2009 (prior to Ambassador involvement with the most able) the most able group under-performed by 1.9 grades while the cohort average under-performance was 1.6 grades. By 2010 (with the Ambassadors supporting the most able) the degree of under-performance overall was no longer so marked with the overall group under-performing by 0.7 grades. In addition, the most able group only under-performed to the same extent on average (0.7 grades) as the rest of the cohort. The only difference in the way in which the course was delivered between the years was the inclusion of the STEM Ambassador support for the most able. This suggests that the Ambassador involvement has had a positive impact on the performance of those who were mentored.

6.3 Pupil progression onto further STEM study and employment

A smaller number of schools currently collect data on the progression of pupils participating in STEMNET enhancement and enrichment activities onto further STEM study and employment. Such data includes measures such as, for example: the proportion of pupils going on to take triple sciences at GCSE; the proportion of pupils choosing to study a Diploma in Engineering; or the proportion of pupils entering STEM-related apprenticeships.

The capture and analysis of such data does not yet appear to be widespread amongst schools. Teachers report that the chief reason for this is their relatively recent engagement with STEM Ambassadors or STEM Clubs.

Progression data, especially A-level subject choices and employment destination information, takes some time to emerge following enrichment interventions undertaken during Key Stage 3.

Having said this, the data received from a number of schools shows positive relationships between progression to further STEM study and employment and participation in STEM Clubs. It is difficult to determine the exact extent to which participation in STEM Clubs has led to these positive outcomes (for example, interested pupils may have progressed onto further STEM study even if they had not participated in the club). However, feedback from teachers and contextual information provided indicates that **STEM Clubs do play an important part in encouraging pupils to continue into further STEM study**.

The following examples show cases where data has been collected, indicating the impact of STEM Clubs on pupil progression.

A STEM Club, with involvement from Ambassadors, encourages pupils to pursue engineering

A specialist technology college in the East of England, with around 1500 pupils aged from 11 to 18 years has been using STEM Ambassadors. Despite being in a rural area the school has significant STEM Ambassador involvement in clubs and within the curriculum. The school was funded by DCSF (now DfE) to run an After-School Science and Engineering Club (ASSEC), which they focused on engineering. The aim was to encourage pupils to take up vocational study options in engineering (principally the Diploma in Engineering) which was being newly introduced to the curriculum.

The club has had a significant impact on uptake. All 20 pupils involved in the club opted to take an engineering option following their participation. Interviews with a sample of pupils showed that the club had been the key factor in their decision. Pupils had been initially attracted by the activities on offer (e.g. building cars), and after experiencing the activities and understanding what engineering is, had decided to pursue it further. Some were intending to pursue different aspects of engineering at degree level, and then for a career.

Participation in STEM Club leads to increases in pupils studying triple science

A college in the South East has specialisms in science and engineering, and runs a successful After-School Science and Engineering Club funded by DCSF (now DfE). The club is known as the PEST (Practical, Exciting, Science and Technology) Club and has run weekly in term-time since 2007, with between 20 and 25 pupils attending each week.

The uptake of triple science has increased markedly since pupils who have been involved in the PEST Club have reached their year ten options. In 2006, seven pupils chose triple science, and by 2009 the number had increased to ten. However, the first cohort of pupils who had the chance to be involved in the PEST Club chose their options in 2010, and the number of pupils increased to 23. For 2011, 25 pupils have chosen triple science. The dramatic increase in uptake correlates with the first PEST club cohort choosing their options, and the increase has been sustained, suggesting that the PEST Club has had an impact on the uptake of triple sciences.

Majority of a college's STEM Club pupils go on to study triple science

A College in the West Midlands holds specialisms in science, as well as mathematics and computing. There is an After-School Science and Engineering Club that involves year eight and nine pupils, which has carried out activities such as building a Greenpower car. The school has gathered data on whether club members undertake triple science or the double science award for GCSE.

The data shows that the majority of pupils who have participated in the club go on to study triple science, rather than the double award. For example:

- of the eleven pupils who participated in the club from September 2008, three-quarters have chosen triple science
- of the eleven pupils who started attending the club in 2009, it is anticipated that nearly all will be studying triple science.

This suggests that the club plays a role in confirming and/or increasing pupils' interest in studying science.

Examples of STEMNET activities impacting employment outcomes of pupils are quite rare. The time lag between a school-based intervention (often in Key Stage 3) and pupils entering employment is considerable, and within the context of many potential influences, attribution of the impact to a particular intervention is difficult.

There are some emerging indicators of impact, however, as the box below shows. In the case of an East of England high school, it appears that STEMNET brokerage activities and STEM Ambassadors are leading to some pupils pursuing engineering apprenticeships at a local employer.

STEMNET brokered relationship with local employer

Three years ago a specialist technology college in the East of England for pupils aged 14 to 19 started running the Applied Science GCSE, and STEMNET brokered a relationship with Sizewell (the nuclear power station) to provide STEM Ambassadors to support the delivery of the GCSE. The school developed a good relationship with Sizewell, and consequently started to run the Diploma in Engineering with Sizewell's support.

Sizewell are keen to recruit apprentices from the Diploma in Engineering, as pupils have a grasp of the activities that take place at the plant, and have learnt skills that will be directly applicable. However, recruitment is carried out nationally, not by the local team. Despite this, one apprentice was recruited from the first cohort, two from the second cohort, and five are being interviewed from the 2009/10 cohort. This suggests that the course is preparing pupils well, and helping them to gain an apprenticeship at Sizewell.

6.4 Pupil attitudes

A number of schools have administered pupil questionnaires to explore the impacts of their STEM enhancement and enrichment activities. Once again, caveats apply to the interpretation of this data. The questionnaires have generally gathered responses from small numbers of pupils, and difficulties in attributing causality to STEMNET interventions remain.

Notwithstanding these caveats, the questionnaire data collected by schools suggests positive impacts resulting from STEMNET interventions such as brokerage of activities and STEM Clubs. Such positive impacts include:

- increased interest in studying triple science at GCSE
- increased interest in studying science at university and pursuing science-related employment
- higher importance attached to STEM by STEM Club members, relative to their peers
- STEM Club members feeling that participation in the club has made them more excited about science.

The validity of these findings is reinforced by their general congruence with the results of the NFER STEM Clubs and STEM Ambassadors pupil surveys.

Examples of such data collected by individual schools are presented below.

STEMNET brokered activities positively influence pupil attitudes across a network of schools

Funding was secured by a school in the North East to enhance and enrich the science curriculum for Key Stage 3 pupils in a group of schools and to enthuse them into wanting to study triple science both at GCSE and A-level. To date, the project has involved five schools in the North East.

Since September 2009, six events have been held such as 'Hands on Science', the Faraday Engineering Challenge Day, and the 'Where Science Can Take You' event.

A total of 532 questionnaires were completed by pupils before the programme of activities began, and again after each activity. The surveys show that:

- interest in taking triple science at GCSE generally increased throughout the programme of events. Interest in taking science at A-level also increased
- interest in science generally increased throughout the programme of events
- pupil ratings of how important science is for the future generally increased throughout the programme of events
- interest in studying science at university, and doing a science-based job also generally increased throughout the programme.

Although the increases were small, the data indicates that attitudes generally became more positive the more events that the pupils attended. The uptake of triple science at GCSE for 2010-11 has also noticeably increased in four of the five participating schools, and in one school remained the same.

STEM Club members from a North West school appear more positive about STEM than their peers

An Academy in the North West has a STEM Club, and has compared the responses of year eight club members to a STEM attitudes survey against a comparison group of other pupils. Eleven respondents have been involved in the STEM Club and associated enrichment activities, compared against a group of 33 non-participating year eight pupils.

Whilst it is not possible to demonstrate change over time, as the survey was administered only once, the data demonstrates that a greater proportion of club members were positive about STEM than their peers:

- all STEM Club respondents (11) agreed that STEM subjects are important, compared with around three-quarters of other pupils (25)
- all but one STEM Club respondents (10) agreed that STEM subjects are important to their future, compared with just over half of other pupils (19)
- STEM Club members had higher levels of engagement in STEM outside school (e.g. reading about STEM, watching STEM-related TV programmes, using the internet to find out about STEM) than their peers who were not involved in the STEM Club.

Almost all pupils from a STEM Club in the South East feel that the club has made them more excited about science

A school in the South East carried out a survey of participants attending its PEST (Practical, Exciting Science and Technology) Club and the majority of participants (95 per cent) indicated that the club had made them more excited about science.

Additionally, attitude data from science lessons based on teacher assessments shows that PEST Club members have more positive attitudes than non-participants. On a scale of excellent, good, satisfactory and poor, the majority of PEST Club members (75 per cent) had excellent attitudes, with the remainder having good attitudes. The attitudes of all pupils are considerably less positive, with only 30 per cent having excellent attitudes, 32 per cent good attitudes, 19 per cent satisfactory attitudes, and 19 per cent poor attitudes. This suggests that the PEST Club could be having a positive impact on pupils' attitudes to science.

7. Teachers' engagement and satisfaction with STEMNET's services and programmes

This section explores the data from the teacher survey in relation to teachers' engagement and satisfaction with STEMNET's services and programmes. It covers: the STEM Ambassadors Programme, STEM Clubs – both those funded under the After-School Science and Engineering Clubs (ASSECs) programme and others – and STEMNET's brokerage service. This section includes selected tables from the survey data to illustrate the findings. Further tables can be found in Appendix 3. The survey data is supplemented, and complemented, by qualitative data in the form of perspectives from the case-study schools. This qualitative data is presented in shaded boxes.

7.1 Key findings

Engagement and satisfaction with the STEM Ambassadors Programme

- The most common reason for engaging with the STEM Ambassadors Programme was to enhance the curriculum, a reason given by more than a third (35 per cent) of the teachers surveyed. Other frequently expressed reasons were: to inspire pupils and raise their aspirations; and to provide pupils with a better understanding of the world of work.
- STEM Ambassadors were most often involved in specific activities such as STEM days (reported by two-thirds (65 per cent) of teachers), followed by 'to support curriculum delivery in certain areas' and 'to be involved in a STEM Club'.
- STEM Ambassadors had been used with every year group from reception to year 13, but were most commonly used with years 7 to 12.
- On average, STEM Ambassadors would visit the school once a term (reported by over half of the teachers surveyed (52 per cent) who had engaged with STEM Ambassadors).
- A large proportion of teachers (82 per cent) had used STEM Ambassadors for one-off activities. Just less than half (41 per cent) had built a relationship with one or more STEM Ambassadors who came into school repeatedly.
- Almost three quarters of teachers (71 per cent) felt that STEMNET's or contract holders' support in finding suitable STEM Ambassadors was 'very useful' or 'useful'.
- Just under a half of teachers (47 per cent) felt that STEMNET's or contract holders' advice regarding how best to use STEM Ambassadors was 'very useful' or 'useful'.
- Teachers were very satisfied with the contribution of STEM Ambassadors, with 88 per cent of teachers responding that they were 'very satisfied' or 'satisfied'.
- A similar proportion of teachers (85 per cent) were planning to use STEM Ambassadors again.

Engagement and satisfaction with the STEM Clubs programme

After-School Science and Engineering Clubs (ASSECS)

- 179 out of the 500 teachers surveyed had an ASSEC in their school.
- Science was the most common subject which ASSECs focused on, which 92 per cent of teachers reported. This was followed by engineering (63 per cent), technology (62 per cent) and maths (48 per cent).
- Nearly half of all ASSECs (46 per cent) were open to all pupils in Key Stage 3.

- Almost two-thirds of teachers (65 per cent) involved in ASSECs had taken part in Science Learning Centre training and 84 per cent rated the training as 'very useful' or 'useful'.
- Nearly three-quarters of teachers (70 per cent) involved in ASSECs had received support from STEMNET or a contract holder and 80 per cent of these teachers rated the support as 'very useful' or 'useful'.
- A high proportion of teachers (89 per cent) were planning to continue running the STEM Club after their funding ended.

Other STEM Clubs

- 51 of the teachers surveyed ran their own STEM Club in school.
- Science was, again, the most common subject which the clubs focused on, with 44 out of the 51 teachers reporting that their club focused on science. This was followed by engineering (reported by half of the teachers surveyed (25)), technology (reported by just under half of the teachers surveyed (23)) and maths (reported by 20 out of the 51 teachers).
- The majority of these STEM Clubs were targeted at pupils in Key Stage 3, with the main focus being pupils in years 7 and/or 8. Pupils with particular characteristics were not generally targeted, with clubs, instead, being open to all pupils who were interested.
- 30 out of the 51 teachers rated the support that they had received from STEMNET as 'very useful' or 'useful'.
- A high proportion of teachers (47 out of 51) were planning to continue running their STEM Club.

Views of all STEM Club teachers on STEM Clubs website and contribution of STEM Ambassadors

- Almost three-quarters of teachers (74 per cent) running ASSECs and other STEM Clubs had used the STEM Clubs website, with over half of these teachers (57 per cent) rating it as 'very useful' or 'useful'.
- Just over a fifth of teachers (22 per cent) had involved Ambassadors in their STEM Club to support staff to run the club, or to lead sessions. Half of the 50 teachers who had used STEM Ambassadors rated their contribution as 'very useful' or 'useful'.

Engagement and satisfaction with the brokerage service

- Teachers were particularly satisfied with the support from the brokerage service in making them aware of the range of enhancement and enrichment opportunities available to them, with more than three-quarters of teachers who had engaged with the service (77 per cent) rating this support as 'very useful' or 'useful'.
- Two-thirds of teachers who had used the service rated the help to access enhancement and enrichment opportunities as 'very useful' or 'useful'.
- Support in relation to helping teachers to access specific opportunities to link into the curriculum was seen as the least effective aspect of the service, with just under half of the teachers who had used the service (49 per cent) rating this aspect as 'very useful' or 'useful'.
- A high proportion of teachers who had used the service, four out of five (84 per cent), were planning to use the brokerage service again.
- The case-study data suggests that more could be done to make schools aware of the service and the range and level of support that can be provided.

7.2 Engagement and satisfaction with the STEM Ambassadors Programme

Teachers had engaged with the STEM Ambassadors Programme for a wide variety of reasons. **The most common reason for engaging with the STEM Ambassadors Programme, which over a third of teachers (35 per cent) gave, was to enhance the curriculum**. This was followed by:

- to inspire pupils and raise their aspirations (26 per cent of teachers)
- to provide pupils with a better understanding of the world of work (24 per cent)
- to encourage pupils to consider STEM-related careers (16 per cent)
- to help pupils understand better the STEM study and career options available to them (16 per cent)
- to help teachers relate what pupils were learning to real life situations and work contexts (16 per cent)
- to motivate pupils to study STEM subjects further (15 per cent).

Other, less common, reasons for engagement (in order of popularity) included:

- to increase links with outside organisations
- to support events or projects, including science-related events or practical projects
- to improve knowledge, or the profile, of science in the school
- to access more resources
- to receive funding or an award as a result
- to provide role models
- because Ambassadors directly approached the school
- to stretch more able children
- to engage female pupils
- because parents requested Ambassadors
- because a local university involved the school.

STEM Ambassadors were most commonly used in school by involving them in specific activities such as STEM days (reported by 65 per cent of teachers). This was followed by 'to support curriculum delivery in specific areas' which was reported by 45 per cent of teachers and 'to be involved in a STEM Club', reported by 16 per cent of teachers. Other reasons, in order of popularity, included: careers advice; to increase interest in STEM; Ambassadors giving talks; and to help with certain awards.

BOX 5. Case-study perspectives: How are schools using STEM Ambassadors?

Schools were using STEM Ambassadors in a range of ways to enrich and enhance the curriculum and to support extra-curricular activities in school. Activities involving Ambassadors ranged in size, from events involving the whole school to a handful of pupils, ranged in the age ranges of pupils involved and also in the longevity of the STEM Ambassador involvement, from one-off events to activities over a series of sessions. Some examples of how case-study schools are using STEM Ambassadors include:

- a group of 6th form Diploma in Engineering students have worked with an engineering graduate (STEM Ambassador) in a university setting to design, develop and run STEM activities for younger pupils in the school
- a group of three Ambassadors from STEM industry have facilitated a science-themed debating event for year 9s and year 12s. The event featured a carousel of sessions focused on the theme of Darwin and Darwinian ideas. The sessions were facilitated by the Ambassadors, drawing on their own experiences of research and working in STEM industry. Pupils had opportunities to ask Ambassadors questions about their jobs and roles throughout the event
- STEM Ambassadors are involved in running STEM Clubs. For example, one school has a weekly STEM Club run entirely by Ambassadors who are apprentices from a local company
- as part of other STEM schemes, such as Go4SET and the Engineering Education Scheme (EES), Ambassadors from local STEM industry have worked with small groups of pupils to help them solve real-life engineering problems over a series of sessions. As part of the project, Ambassadors have supported the activities, given talks on their careers and organised student visits to their company or university
- STEM Ambassadors from a range of professions have provided presentations and question and answer sessions as part of a careers fair/event for school pupils.

STEM Ambassadors had been used with every year group from reception to year 13. However, teachers had mainly used them with years 7 to 12. Teachers had most commonly used STEM Ambassadors with year 9 (45 per cent of teachers) followed by year 10 (38 per cent); year 8 (33 per cent); year 11 (30 per cent) years 7 and 12 (both 26 per cent).

Table 7.1: Year groups which have had contact with a STEM Ambassador

	N	%
Reception	5	3
Year 1	8	5
Year 2	9	5
Year 3	18	11
Year 4	21	13
Year 5	20	12
Year 6	26	16
Year 7	43	26
Year 8	55	33
Year 9	75	45
Year 10	62	38
Year 11	50	30
Year 12	43	26
Year 13	31	19
Don't know	6	4
No response	0	0
N = 165		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those teachers who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents answered at least one item in this question.
Source: NFER Teacher Survey (N = 500).

On average STEM Ambassadors would visit the school once a term, as reported by just over half of the teachers surveyed (52 per cent). One in six of the teachers surveyed (16 per cent) reported that STEM Ambassadors would visit twice per term. Small numbers of teachers reported that STEM Ambassadors would visit more than three times and up to 15 times a term. Two teachers reported that STEM Ambassadors would visit more than 20 times a term.

82 per cent of teachers reported that they had used STEM Ambassadors for one-off activities, whilst 41 per cent of teachers said that they had built a relationship with one or more Ambassadors who came into school repeatedly. Over a quarter of teachers (28 per cent) said that they used an Ambassador to provide ongoing support to the same group of pupils over a period of time, for example pupils attending a STEM Club.

Teachers were asked to rate on a scale of 1 to 5 (where 1 was 'not at all useful' and 5 was 'very useful'): a) the usefulness of STEMNET/contract holders in relation to finding suitable STEM Ambassadors and b) the usefulness of STEMNET/contract holders in providing advice on how best to use STEM Ambassadors. **In relation to the usefulness of STEMNET/contract holders' support regarding finding suitable STEM**

Ambassadors, 71 per cent of teachers gave a 4 or 5 rating, with just under half (49 per cent) giving a 5 rating. However, 12 per cent of teachers said that the support was not needed or not offered.

Ratings of the support of STEMNET/contract holders in relation to providing advice regarding how best to use STEM Ambassadors were a little less positive, but this was partly due to the fact that just less than a fifth of the teachers (19 per cent) reported that they did not need this type of support. However, just under a half of the teachers surveyed (47 per cent) provided a rating of 4 or 5.

Table 7.2: Ratings of the support provided by STEMNET/contract holder in relation to…

	1 = not at all useful	2	3	4	5 = very useful	Support not offered	Support not needed	No response	Total
	%	%	%	%	%	%	%	%	%
a) finding suitable STEM Ambassadors	1	4	12	22	49	4	8	0	100
b) provision of advice regarding how best to use STEM Ambassadors	3	7	18	19	28	5	19	0	100
N = 165									

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those teachers who had received support from STEMNET/contract holder.
A total of 165 respondents gave at least one response to these questions.
Source: NFER Teacher Survey, 2010 (N = 500).

Table 7.3 below shows that **teachers were very satisfied with the contribution of STEM Ambassadors, with 88 per cent providing a rating of 4 or 5 and more than two-thirds (67 per cent) giving the top rating of a 5**.

Table 7.3: Levels of satisfaction with the contribution of STEM Ambassadors

	N	%
1 = not at all satisfied	3	2
2	5	3
3	13	8
4	34	21
5 = very satisfied	110	67
Total =	**165**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those teachers who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents answered this question.
Source: NFER Teacher Survey 2010 (N = 500).

BOX 6. Case-study perspectives: What has helped schools use STEM Ambassadors effectively?

In consultations around effective working with STEM Ambassadors, a number of key features emerge about what works, including:

- **collaboration with the teacher** to ensure the Ambassador activity is relevant and appropriately pitched to the pupils:
  '*First of all I thought that this was going to be hard work, working with outside people, but actually they're incredibly enthusiastic people. I've worked with them talking about the activities, they're concerned about the pitch and making sure it's right for 14 year olds and they came in - and that's been really nice. That's above and beyond what I'd expect actually. So I've got three Ambassadors from industry coming in. I said to them if students ask you anything about what you do, why you do it, then please go off on a tangent because that's what we want really, them seeing the big wide world*' (Raising Achievement Coordinator, Case study 7).

  '*…we have guidelines in terms of our relationships, which is people are always met, there is always a cup of tea...There is always a thank you letter, the learning objectives are always clear. There is always a phone call a little while beforehand saying, 'have you got everything you need?' and 'you know what kids are going to be like?', and talking people through it, so that the links that we have work…'* (Head of Engineering, Case study 12)

  'His [the Ambassador's] *commitment all the way through in terms of helping to design the materials, coming over here, working with us, coming in on the day, working with the students – fantastic'* (Teacher, Case study 12).

  '*Sometimes they* [Ambassadors] *come in and they do an activity and it doesn't quite work, we discuss it and we say we will try this next time and I think over the years we have developed some really good activities*' (Teacher, Case study 12).

- **Ambassador's personality and qualities** in terms of their enthusiasm and ability to relate to, and engage, young people and pitch their delivery appropriately. As this teacher explains:
  'The ones we've worked with have been absolutely fantastic, really, really good, very professional, very tuned in. One of the things we sometimes find when you're working with people from industry they tend to pitch the level very high, at their normal working level. You've got to adjust that, particularly if you're working with year 9 or year 10 students. But I've been very impressed with that side of it, so I don't know whether that's part of the training' (Assistant headteacher/engineering teacher, Case study 8).

  '*We have had some retired Ambassadors who have come in and have interacted with the students brilliantly because they understand the student and the wants of the student, and what makes them tick and what switches them on. They interact with students on the same level, and I think that is what it is, they have got this mutual understanding, mutual respect. One of your biggest things is bringing your language down, a lot of people don't realise that if you are working with say, year 9, their language level is quite low*' (Teacher, Case study 12).

- **Ambassadors being CRB checked and trained in working with school-age young people**. Teachers found the fact that STEM Ambassadors were pre-recruited and screened by STEMNET an effective feature of the programme, making it easily accessible.

- **Directory of Ambassadors from a range of professions**. Teachers valued the breadth of expertise and coverage of a range of STEM professions within the STEM Ambassadors network. While some schools had come into contact with STEM Ambassadors initially through other STEM schemes (e.g. Engineering Education Scheme (EES) and Lab in a Lorry), others had made direct requests to STEMNET for support with a particular activity or support of a particular nature and had been subsequently put in contact with the Ambassador/s:

  *'That has really made the difference**.** That's been lovely finding out about that network where you can just let somebody know at STEMNET and they just put it on the letter and*

then you get emails very, very quickly from people - the most amazing people – who want to be part of your day, and who are fantastic to work with' (Raising Achievement coordinator, Case study 7).

- **The process of matching schools with Ambassadors**. In one case-study example, where a teacher had failed to be successfully put in contact with an Ambassador, they had been required to complete a form specifying in only brief detail the nature of the STEM activity they sought Ambassador support with. There may thus be benefits in ensuring the process of matching schools with Ambassadors is sufficiently flexible: allowing teachers to 'sell' their ideas for STEM activities to attract Ambassadors and present requests that are sufficiently open and undefined to enable opportunities for teachers and Ambassadors to jointly tailor and develop ideas for STEM enrichment for pupils.

More than four out of five respondents (85 per cent) were planning to use STEM Ambassadors again and 12 per cent said that they would possibly use them. Only five teachers (three per cent) said that they would not use STEM Ambassadors again. The reasons why these five teachers were not planning to use STEM Ambassadors again included: 'The school is finishing with engineering'; 'There has not been a project where they are needed'; 'The session was ten minutes and it was not engaging'; 'He/she never stayed the whole session'; 'He/she came a couple of times and never came back'; 'One was very good but the others were semi-retired and not very good and found it difficult networking with youngsters'.

7.3 Engagement and satisfaction with the STEM Clubs Programme

BOX 7. Case-study perspectives: What sort of STEM Clubs are schools running?

- Some case-study schools reported running STEM Clubs for many years, others were established in response to the funding opportunity presented by the After-School Science and Engineering Clubs (ASSECs) programme (or subsequently).
- As such, some clubs had been able to draw upon generous resources, whilst others were much more 'shoe-string' operations, with access to quite limited funds and support.
- The majority were referred to as 'science', rather than 'STEM' clubs (there was one example of an 'engineering' club). This appeared to be due to the perceived difficulties of working across curriculum areas or departments – for example, one interviewee from within a science department expressed concern about being seen as 'stepping on the toes' of other departments or colleagues (e.g. design & technology, maths): *'I haven't particularly promoted it as a 'STEM' Club – you know, talking about the engineering and mathematics options'* (Science teacher, Case study 5). In addition, time and the physical location of STEM departments within schools can be key barriers to cross-department working.
- Clubs were established and led by a range of adults including: teaching staff; support staff in pastoral roles and laboratory technicians; and visiting students from regional higher education institutions. It seems that whilst a STEM background is important, non-teaching staff can, and do, run vibrant and well-organised clubs.

7.3.1 After-School Science and Engineering Clubs (ASSECs)

One hundred and seventy nine teachers surveyed were from schools that had a STEM Club funded under the After-School Science and Engineering Clubs (ASSECs) programme. They were asked about their STEM Club and the effectiveness of the support that they had received to run it. As mentioned in section 2.2, the ASSECs programme was created by the Government in March 2006 to inspire Key Stage 3 pupils (ages 11-14) to learn and enjoy science and engineering. By September 2008, the programme included 500 schools.

Science was the most common subject which ASSEC STEM Clubs focused on, with 92 per cent of teachers reporting that their STEM Club focused on science. This was followed by engineering (63 per cent) and technology (62 per cent). Just less than half of STEM Clubs, 48 per cent, focused on maths.

Nearly half of STEM Clubs (46 per cent) were open to all pupils in the Key Stage 3 range targeted by STEM Clubs. The others targeted particular year groups within Key Stage 3 and/or particular types of pupils (and a small number targeted Key Stage 4 or beyond and primary children). Within Key Stage 3, pupils in years 7, 8 or 9 might be targeted. Schools also targeted: girls or boys; pupils with the potential to achieve well in STEM subjects but who currently were not; pupils who were likely to progress onto STEM subjects; pupils with enthusiasm for one or more STEM subjects; and less able pupils.

BOX 8. Case-study perspectives: Which pupils have been involved in STEM Clubs?

- Case-study schools' clubs, many of which were ASSECs, predominantly targeted Key Stage 3 pupils, in particular year 7s. Girls were considered well represented in the membership of most clubs.
- Year group aside, clubs in case-study schools appear to have been broadly open access, with a self-selecting membership, though some clubs have asked aspirant members to write a letter of application explaining why they would like to join.
- Though the clubs did not, on the whole, explicitly target high achievers or 'gifted and talented' pupils, in practice their members tended to be relatively able and engaged members of the cohort. There were of course a few exceptions, with one interviewee reporting: *'We have had a few more challenging students join, and they are still attending and actually quite enthusiastic*' (Club leader, Case study 10).
- The size of school laboratories, and staffing, were key factors in limiting the membership of clubs. Most could accommodate a maximum of 20 pupils.
- Whilst in several schools demand initially exceeded capacity, most had found that over time membership had fallen away to a more manageable 10-15 pupils, who varied in the regularity of their attendance and – where the club was open to more than one year group – were generally at the beginning of Key Stage 3.

Almost two-thirds of the teachers surveyed (65 per cent) had taken part in training through their Science Learning Centre to help them run their

school's STEM Club, whilst over a third (35 per cent) had not taken up this opportunity. When asked to rate this training on a scale of 1 to 5 (where 1 was 'not at all useful' and 5 was 'very useful'), **84 per cent of teachers rated the training they had received as a 4 or 5, with over half (56 per cent) rating it as a 5**. Eleven per cent rated it in the middle as a 3, with only five per cent rating it as a 2 or 1.

Almost three-quarters (70 per cent) of teachers had also received support from STEMNET, either from a Regional Director or a contract holder. Again, teachers were asked to rate this support on a scale of 1 to 5. Table 7.4 shows that a high proportion, **80 per cent of teachers, rated the support that they had received from STEMNET as a 4 or 5, with 60 per cent giving it the highest rating of a 5**.

Table 7.4: Ratings of usefulness of STEMNET's support for ASSECs

	N	%
1 = not at all useful	1	1
2	3	2
3	22	17
4	25	20
5 = very useful	75	60
Total =	**126**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those teachers running an ASSEC who had received support from STEMNET.
A total of 126 respondents answered this question.
Source: NFER Teacher Survey (N = 500).

When asked whether they planned to continue running the STEM Club after their funding ended, **almost nine out of ten respondents (89 per cent) reported that they would continue running their STEM Club** and seven per cent said that they possibly would. Where clubs were not being continued, this seemed to be primarily related to lack of funding. The high proportion of teachers reporting that they would continue their STEM Club reflects very positively on the effectiveness and impacts of the STEM Clubs Programme and its delivery in schools.

7.3.2 Other STEM Clubs

Fifty-one teachers surveyed were from schools that had a STEM Club but which was not funded under the ASSECs programme and they were asked about their STEM Club and the effectiveness of the support that they had received to run it.

In STEM Clubs not funded under the ASSECs programme, science was, again, the most common subject which was focused on, with 44 of the 51 teachers reporting this. The subjects which, again, had a lower level of

focus were: engineering (reported by 25 teachers); technology (23 teachers) and maths (20 teachers).

The majority of STEM Clubs not funded under the ASSECs programme targeted pupils in Key Stage 3 with, within this key stage, the primary focus being years 7 and/or 8. More than half of the teachers (28) reported that their STEM Club focused on year 7 with a similar number (27) saying that they focused on year 8. In many cases, STEM Clubs focused on pupils in year 7 and year 8 rather than one or the other. Nineteen teachers reported that they focused on year 9. Only small numbers of teachers responded that their STEM Club targeted year 10 (five teachers), year 11 (two teachers), years 12 (two teachers) and year 13 (one teacher). Nine teachers reported that their STEM Club was not targeted at a specific year group.

STEM Clubs not funded under the ASSECs programme tended to be open to all pupils who were interested, with 38 teachers (three-quarters) reporting this. Of the remaining teachers, there were a range of groups that these STEM Clubs targeted. This included: gifted and talented pupils, high achievers, especially in maths, and pupils willing to work hard; pupils who had the potential to do well in one or more STEM subject but who were not achieving their potential; pupils who were likely to progress onto STEM subjects; pupils who were currently less engaged or interested in STEM lessons; girls; pupils whose first language is not English; environmental studies pupils; pupils already taking part in STEM subjects; years 5 and 6; and year 11.

Those teachers who had received support from STEMNET to help run the club were asked how they would rate the usefulness of the support on a scale of 1 to 5 (where 1 was 'not at all useful' and 5 was 'very useful'). Table 7.5 shows **that over half of the teachers (30 out of 51) rated the support that they had received from STEMNET as a 4 or 5**.

Table 7.5: Ratings of usefulness of STEMNET's support for non-ASSECs

	N
1 = not at all useful	8
2	3
3	10
4	17
5 = very useful	13
Total =	**51**

Due to rounding, percentages may not sum to 100.
A filter question: all those teachers running other STEM Clubs (non-ASSECs).
A total of 51 respondents answered this question.
Source: NFER Teacher Survey (N = 500).

A high proportion of teachers running their own STEM Club, 42 out of 51, were aware of the STEM Clubs Network and only nine teachers were not.

A very high proportion of teachers, 47 out of 51, reported that they planned to continue running their STEM Club with four reporting that they possibly would. No teachers reported that they definitely would not be running the club in the future.

7.3.3 Views of all STEM Clubs teachers

All teachers running STEM Clubs, either with ASSECs funding or through their own school's funding, were asked questions regarding use of the STEM Clubs website and of STEM Ambassadors.

When asked if they had used the STEM Clubs website**, almost three-quarters (74 per cent) said that they had used the STEM Clubs website** and an additional three per cent were not sure if they had. Those teachers who had used the website were asked to rate its usefulness on a scale of 1 to 5 (where 1 was 'not at all useful' and 5 was 'very useful'). Over half of the teachers surveyed (**57 per cent) rated the usefulness of the website as a 4 or 5, with just under a third (32 per cent) rating it as a 5**.

Table 7.6: Ratings of usefulness of the STEM Clubs website

	N	%
1 = not at all useful	7	4
2	15	9
3	50	29
4	43	25
5 = very useful	55	32
Total =	**170**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those teachers who have used the STEM Clubs website.
A total of 170 respondents answered this question.
Source: NFER Teacher Survey (N = 500).

Ninety-eight teachers expanded on what they found useful about the website and the most common response was new ideas for activities and projects, which was mentioned by half of the teachers (49). This was followed by the ability to share information and see what other schools are doing, mentioned by 32 teachers. Other responses made by smaller numbers of teachers were, in rank order: access to resources; contacts; and information on setting up a club.

All teachers who were running STEM Clubs were also asked whether they had involved STEM Ambassadors in the club. **Just over a fifth of teachers (22 per cent, 50 teachers), had involved STEM Ambassadors in the club.**

Where STEM Ambassadors had been used, they were primarily involved in supporting staff to run the club by attending or leading sessions. This was followed by providing materials for use by the club, running the club, providing advice to staff (for example in relation to real-world applications of learning) and arranging industry visits. Other reasons mentioned included: supporting activities run on a particular day or helping with a project or event; to raise awareness of careers by giving a talk; to judge competitions; to provide STEM Challenge advice; to support the Flying Start Challenge; and to provide particular expertise.

A pattern did not really emerge regarding how often STEM Ambassadors participated in STEM Clubs. It ranged from once a year, or less, to around once a term, to every club session. A large proportion of teachers reported that there was regular involvement from the same Ambassadors, but teachers also reported lots of different one-off visits from different Ambassadors.

When asked to rate the effectiveness of STEM Ambassadors on a scale of 1 to 5 (where 1 was 'not at all effective' and 5 was 'very effective'), of the 50 teachers who responded **half felt that it was very effective, giving a 5 rating.** A further 18 teachers rated the effectiveness as a 4. Only five teachers gave a 3 rating (i.e. in the middle) and two gave a 1 or a 2.

BOX 9. Case-study perspectives: What has helped schools 'grow' STEM Clubs and activities?

- Schools have found even small **grants** helpful, with these allowing them to buy basic chemicals etc. Larger grants have enabled clubs to develop more ambitious and attention-grabbing plans.
- **Activity boxes**, where club co-ordinators had been able to get hold of them, were generally welcomed, though not seen by all interviewees as that exciting or valuable.
- **Training**, such as that provided by regional Science Learning Centres, was viewed favourably: *'I found that quite valuable – talking to other club leaders and getting ideas'* (Club leader, Case study 10).
- A few interviewees referred to the STEM Directories and their plans to use them as a source of ideas for their club.
- Not all schools had made use of the **STEM Clubs website** at the time of the evaluation although those that had used them found the information on other clubs' activities useful. One interviewee who was familiar with the site identified areas for further development: *'At first I really liked it, and then the more I used it, being technical, I found more limitations with it. For example, I really wanted to use it for recording the registers of who attended the Club, and that feature is quite poorly implemented on the website. So we've had no data about who's been attending recently, 'cause we stopped collecting it through our normal means … we still use it to record the projects we've been involved in and to advertise certain parts of the club … to a certain extent we did look through them* [other clubs' activities] *and get some inspiration, but mostly the kids came up with ideas and we added ours to them, so it's been quite self-directed'* (Club leader, Case study 10).
- Personal contact with **STEMNET staff** was valued highly, with one interviewee describing the relationship with STEMNET as helping in a number of ways: *'giving the support, giving encouragement, and I think probably also that sense of ownership,* [and that] *because you're belonging to something, you're also a little bit accountable as well.*

> *I'm sure that's had an impact in making things, in making sure there's a continuation – it's not fizzled out, because you know you've got STEMNET calling you in three months saying 'What are you doing, how's it going?''* (Head teacher, Case study 7).

7.4 Engagement and satisfaction with the brokerage service

Teachers who had engaged with the brokerage service were asked to rate the support that they had received on a scale of 1 to 5, where 1 was 'not at all useful' and 5 was 'very useful'. Teachers were generally very positive, but there were some aspects of the support that they were more satisfied with than others. In particular, **they felt that the support to raise their awareness of the range of enhancement and enrichment opportunities available to them was particularly useful** (with more than three-quarters of teachers, 77 per cent, rating this aspect of support as a 4 or 5 and 41 per cent rating it as a 5).

In terms of help to access enhancement and enrichment opportunities, two-thirds of teachers rated this support as a 4 or 5, with just under a third (31 per cent) rating it as a 5. However, it seems that support in relation to helping teachers to access specific opportunities that they require to link into the curriculum is viewed as a little less effective, with just under half of the teachers surveyed (49 per cent) rating this service as 4 or 5.

Table 7.7: Ratings of usefulness of support of STEMNET/contract holders in…

	1 = not at all useful	2	3	4	5 = very useful	No response	Total
	%	%	%	%	%	%	%
a) making you more aware of the range of enhancement and enrichment opportunities available	4	2	17	36	41	0	100
b) helping you to access enhancement and enrichment opportunities	3	4	26	35	31	0	100
c) helping you to access specific opportunities that you require to link into the curriculum	10	10	31	25	24	0	100
N = 186							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all those teachers who had received support from STEMNET/contract holder.
A total of 186 respondents gave at least one response to these questions.
Source: NFER Teacher Survey (N = 500).

Four out of five teachers (84 per cent) were planning to use the brokerage service again to access information, advice and support. An additional 12 per cent reported that they would possibly use it. Only three per cent of teachers (6 teachers) said that they would not use the service again. The reasons that these teachers gave for not using the service again included: 'I am doing and finding things myself'; 'I receive a high volume of correspondence and it's difficult to read through all the material I am sent'; 'I am not aware of a direct contact point'; 'Ambassadors are not coming back to me'; and 'We're too busy planning a merger with another school'.

BOX 10. Case-study perspectives: What are teachers' experiences of the brokerage service?

- Case-study schools had different levels of understanding of the STEMNET brokerage service. Indeed some teachers were not always clear if an external representative they had had contact with was the STEMNET contract holder or not. **Teachers were not necessarily conversant with the term and/or functioning of the brokerage service**.
- Where teachers were clearer about the STEM brokerage service they had usually had some form of initial meeting with a STEMNET contract holder about the service, been at a STEM event/meeting where they received a presentation on the service or simply received email alerts and updates about STEM activities to a key contact within the school.
- Schools' experiences of the brokerage service included:
  - an initial meeting with the contract holder/Regional Director where it was explained to them how the organisation operated and the opportunities available through the service. In one school this meeting had also involved an audit of existing STEM enhancement and enrichment provision in the school and advice around how to develop this provision
  - a presentation at a local authority Heads of Science meeting from the contract holder on the support available and a briefing on the service
  - email alerts to a specific member of staff in the school about particular STEM activities planned for the future
  - liaison and conversations with brokerage personnel around accessing and organising a specific STEM activity.

BOX 11. Case-study perspectives: What are teachers' views on the impact of the brokerage service?

Schools experienced the following impacts as a result of engaging with the brokerage service:

- **access to STEM enhancement and enrichment activities**: as a result of the brokerage service, schools had accessed STEM enhancement and enrichment activities such as Lab in a Lorry and STEM Ambassadors. Schools had received initial advertisements about such opportunities which they had then pursued and arranged, usually via email and telephone conversations with the contract holders or directly with the providers.
- one teacher reported that STEMNET had negotiated a much longer period of access to Lab in the Lorry than would otherwise have been possible, resulting in more than two year groups accessing the provision: '*The kids absolutely loved it, fantastic, that was really successful'* (Head of Science, Case study 6).
- an example in one case-study school highlights a **school's journey of increasing involvement in STEM enhancement and enrichment** following an initial meeting with the brokerage service. The school had an initial meeting with the brokerage service to

learn about the service and the support on offer. Subsequent to this, the brokerage service supported the school to access a Smallpeice Trust engineering project and helped with funding the activity. The project involved a group of year 9s in a STEM day. This was followed by a smaller group of 4-6 of the pupils going on a residential weekend to undertake a range of engineering-related activities (e.g. designing boats and bridges). Subsequently, these pupils were involved in running an engineering project for a group of year 7 pupils in a series of after-school sessions based on the activities they themselves had experienced.

- **increased awareness of STEM enhancement and enrichment activities**: as a result of the brokerage service, schools received more information on activities and competitions in relation to STEM than they had in the past.

BOX 12. Case-study perspectives: How do teachers feel the brokerage service could be improved?

Some case-study schools had no direct experience of the STEMNET brokerage service, so it seems that **more work may be required to advertise this service to schools and ensure that schools are clear about the support available** through the service and how to access this. Schools would like to find out about what the brokerage service offers and how they could be supported by the service. There may also be a need for renewal of such input in schools that may have accessed one activity following brokerage contact but are not aware of the full range of other opportunities that they could access.

In several instances, when case-study schools were asked how STEMNET could better support their STEM enhancement and enrichment activities, teachers' requests were synonymous with the support provided through the brokerage service and they were not aware that such a service existed or the level of support that was available. In particular, **schools wanted support on working with STEM industry, information on funding streams that could be accessed to support STEM enrichment and free STEM provision and ideas of good and effective practice in STEM enhancement and enrichment, including examples from other schools.**

8. Pupils' engagement and satisfaction with STEM Ambassadors and STEM Clubs

This section explores the data from the two pupil surveys in relation to pupils' engagement and satisfaction with the STEM Ambassadors Programme and STEM Clubs. It also includes qualitative data from the school case studies.

8.1 Key findings

STEM Ambassadors

- The largest proportion of pupils surveyed, nearly half (47 per cent), had seen an Ambassador just once. 18 per cent had seen an Ambassador two to three times and 13 per cent more than ten times.
- The vast majority of pupils (92 per cent) had seen an Ambassador at their school. Less than one in ten (eight per cent) had seen an Ambassador within the workplace.
- The largest proportion of pupils (61 per cent) had seen an Ambassador give a talk, 39 per cent had seen an Ambassador when he/she had helped deliver a special STEM activity and 34 per cent had taken part in a practical activity with an Ambassador.
- Pupils were very positive about the activities that they had taken part in with Ambassadors with almost three-quarters (74 per cent) rating them as 'very good' or 'good' and over a third (37 per cent) rating them as 'very good'. Pupils rated the experience highly as they enjoyed the activity and found it 'fun'.
- Pupils who did not rate the experience highly said that the activity did not interest them or was boring.

STEM Clubs

- The largest proportions of pupils surveyed had been attending a STEM Club for about a year or for more than a year (36 per cent and 35 per cent respectively).
- Pupils had been involved in a wide variety of activities with large numbers of pupils involved in designing and making something (89 per cent), practical experiments and investigations (81 per cent) or working on a long-term project (70 per cent).
- A variety of individuals had helped with the STEM Club, with just under half of the pupils surveyed (49 per cent) reporting that people in STEM jobs helped with the club and over a fifth (22 per cent) responding that staff from universities/colleges helped with the club. However, 39 per cent of pupils reported that the club was solely run and delivered by school staff.
- Pupils were very positive about their STEM Club with a very high proportion, 94 per cent, rating their club as very good or good. Two-thirds (65 per cent) rated it as 'very good'.
- 81 per cent of pupils said that they would recommend their STEM Club to other young people.

8.2 Engagement and satisfaction with STEM Ambassadors Programme

In relation to how many times they had taken part in activities involving a STEM Ambassador in the last 12 months, **the largest proportion of pupils, nearly half (47 per cent), had seen a STEM Ambassador just once**. 18 per cent of pupils had taken part in activities with a STEM Ambassador two or three times, 13 per cent more than ten times, 10 per cent between four and six times and two per cent between seven and ten times. 12 per cent of pupils said that they had not taken part in activities involving a STEM Ambassador, although many of these remembered that they had as they went on to complete the survey.

In relation to where they had come into contact with a STEM Ambassador over the past 12 months, **the vast majority of pupils (92 per cent) had seen a STEM Ambassador at their school,** with a fifth having attended an event which STEM Ambassadors were helping with. Other places in which pupils had been in contact with STEM Ambassadors included: within the workplace (eight per cent of pupils); at a university or college and at a different school (both five per cent). Two pupils had seen a STEM Ambassador in other places which included through a video conference or at a computer space station.

In terms of the activities that they had been involved in with a STEM Ambassador over the last 12 months, **the largest proportion of pupils, 61 per cent, had heard a STEM Ambassador give a talk**. Thirty-nine per cent of pupils said that STEM Ambassador had helped to deliver a special STEM activity and 34 per cent of pupils had taken part in a practical activity with a STEM Ambassador. STEM Ambassadors were less likely to help out with regular lessons, with only 14 per cent of pupils having been involved with a STEM Ambassador in this context.

Twenty pupils provided some more specific examples of the activities that they had been involved in with STEM Ambassadors. These included, in order of popularity:

- working towards a CREST Award
- taking part in a debate
- undertaking a super-capacitor car activity
- building a football stadium model
- taking part in an automatic greenhouse activity
- taking part in the Greenpower challenge
- making a bridge
- making a car

- answering questions on space
- visiting Cosford air museum
- working on a Go4SET project.

The pupils surveyed were very positive in relation to their rating of the activities that they had taken part in with a STEM Ambassador. As Table 8.1 shows, **almost three-quarters of pupils (74 per cent) rated the activities that they had taken part in with a STEM Ambassador as 'very good' or 'good', with over a third (37 per cent) rating them as 'very good'.**

Table 8.1: Rating of activities with STEM Ambassadors

	N	%
Very good	58	37
Good	58	37
OK	29	19
Poor	6	4
Very poor	2	1
No response	2	1
Total =	**155**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who had taken part in activities with a STEM Ambassador.
A total of 155 respondents answered this question.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N = 176).

Pupils were then asked why they rated the experience in this way and were able to provide their own written response. **Regarding positive responses, the largest proportion of pupils (a quarter) said it was because they enjoyed the activity and it was 'fun'.** This was followed by 15 per cent of pupils who felt that the activity was interesting and 15 per cent who felt that they had learned new things and it was educational.

The next most common positive comments made by small numbers of pupils, between four and seven (in order of popularity), were that:

- the Ambassador provided support/help
- the Ambassador ran a practical which included pupil participation
- the Ambassador was friendly/pleasant
- the Ambassador was a good communicator
- the STEM Ambassador was helpful.

Two or three pupils said that the Ambassador provided good information, that the activity allowed pupils to be creative, that the activity was exciting, that the

activity showed pupils opportunities and that the activity was well organised. Other positive responses given by just by one pupil included: 'It helped me improve my grades/exam results', 'It encouraged me to pursue STEM careers', 'It included team working', 'I got to go on a trip', 'The activity was worthwhile', 'It was challenging', 'It was something different to regular school', 'It answered my questions', 'It involved the whole class', and 'It involved other schools'.

In relation to why they had provided less positive responses, the largest proportion of pupils, 12 per cent, commented that this was because the activity did not interest them or was boring. Four pupils said that they did not do much in the activity. Two pupils commented that it was not practical enough, that it was too difficult and that it was too long. Individual comments include: 'I have not been involved many times', 'It felt like a regular lesson', 'I was not in a group with my friends' and 'Some people did not take part'.

8.3 Engagement and satisfaction with STEM Clubs Programme

The largest proportions of pupils reported that they had been attending a STEM Club 'about a year' or 'more than a year' (36 per cent and 35 per cent respectively). 18 per cent of pupils had been attending the STEM Club for about two terms followed by seven per cent who had been attending for about a term and three per cent who had been attending for less than a term. When looking at impacts, it will be useful to remember that almost three-quarters of the pupil sample (71 per cent) had been attending the STEM Club for a reasonable length of time – almost, or over, a year.

Pupils had been involved in a wide variety of activities through attending their STEM Club. Large proportions of pupils had been involved in designing and making something (89 per cent) or practical experiments and investigations (81 per cent). Additionally, **70 per cent of pupils had been working on a long-term project.**

Other activities that pupils had been involved in included:

- taking part in a challenge (55 per cent of pupils)
- visiting an event (54 per cent of pupils)
- working on a project or idea from a club member (53 per cent of pupils)
- attending a lecture/talk or having someone visit the club (47 per cent of pupils)
- visiting a museum or activity centre (43 per cent of pupils)
- visiting a workplace (28 per cent)
- working towards the CREST Award (20 per cent)
- presenting STEM activities to primary pupils (19 per cent)

- working towards the STEM Leaders qualification (eight per cent).

Eight per cent of pupils had also been involved in other activities. These include, in order of popularity: a Lego league; trips away; LED masks; automated greenhouse; dissecting; presenting to other schools; chemical garden; investigating fingerprints; making circuits; creating an eco-system; Young Engineers award, Christmas lectures; cheese rolling; and a fashion show.

BOX 13. Case-study perspectives: What have STEM Clubs been doing?

- A typical club seemed to meet weekly, after school, for around an hour (e.g. *'The staple of the Science Club is running one hour after-school sessions on a Wednesday'* (Science teacher, Case study 7). Some clubs had an additional, preparatory session at lunchtime on club days.
- There was a clear (*'ninety-five per* cent') emphasis on 'fun stuff' and a commitment to flexibility in timing and focus. This was seen as positive for both club leaders and pupils. For example, one interviewee with teaching responsibilities commented: *'I've got limited time in the classroom and I've got so many people – whereas in the club you can do so much more …* [and] *make an activity longer or shorter, depending on how they are getting on with it'* (Biology teacher, Case study 1).
- In many schools club members were encouraged to set the agenda and identify areas of interest: *'They run the show themselves … they can discuss ideas, and then try and turn their ideas into practical activity'* (Head of Science, Case study 1). Both pupils and teachers saw benefits in taking a more self-directed approach to learning.
- Interviewees gave examples of one-off experiments, themed enquiries running over several weeks, and off-site activities, including 'science tourism', such as – in the case of one ASSEC – a visit to CERN.
- A few interviewees reported drawing on other STEMNET services in connection with their club; for example, getting Ambassadors to give 'expert' talks ahead of trips or act as judges in competitions.

Pupils reported that individuals who were in a job that involved science, technology, engineering or maths were the most likely people to help with the running of STEM Clubs, with half of the pupils (49 per cent) reporting this, while 39 per cent of pupils responded that it was solely staff from their school who ran the STEM Club. Around a fifth of pupils (22 per cent) responded that someone from a university or college helped with the STEM Club and 14 per cent reported that parents had helped with the STEM Club.

The pupils surveyed were extremely positive in relation to their rating of the STEM Club with 94 per cent rating their STEM Club as 'very good' or 'good' and 65 per cent rating it as 'very good'. When looking at pupils' responses by length of time that they had been attending the STEM Club**, it is interesting to note that pupils who had been attending the STEM Club for more than a year were more positive than those who had been attending for less than a year**. (Of those pupils who had attended more than a year: 71 per cent rated the club as 'very good', 23 per cent as 'good' and six

per cent as 'OK'. No pupils in this category rated the club as 'poor' or 'very poor'.)

Table 8.2: Pupils' rating of their STEM Club

	N	%
Very good	274	65
Good	123	29
OK	17	4
Poor	1	<1
Very poor	1	<1
No response	3	1
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Pupils were also very positive when asked if they would recommend the STEM Club to other young people with 81 per cent agreeing that they would and an additional 14 per cent saying that they would possibly recommend it.

Comparing the responses of pupils who had been attending the STEM Club less than a year or more than a year shows that pupils who had attended for more than a year were likely to be more positive, with 87 per cent of this category of pupils saying that they would recommend the STEM Club, compared to 81 per cent of all young people. In addition, pupils in years 10-11 were a little more likely than those in years 7-9 to recommend their STEM Club, with 88 per cent, as opposed to 82 per cent, agreeing that they would.

9. Key messages

The evidence gathered during the evaluation activities demonstrates that STEMNET's services are of a high quality, and that they are leading to a range of positive outcomes for both teachers and pupils. Notably, involvement in STEM Clubs and/or interactions with STEM Ambassadors is increasing pupils' interest in STEM, as well as developing their knowledge of the subjects, practical skills and generic transferable skills (e.g. team-working, problem-solving) which are of key importance to their future employability. There is also some evidence that involvement in STEM Clubs and interaction with STEM Ambassadors can increase attainment in STEM subjects and progression to STEM subjects. In relation to STEM Ambassadors, the evaluation suggests that more ongoing and sustained contact with STEM Ambassadors could lead to even greater impacts for pupils.

The evidence also suggests some issues to consider in the future, in particular relating to the place of mathematics within STEM. However, this is of relevance not only to STEMNET, but also to the wider community of organisations involved in STEM education.

The key messages arising from the evaluation are outlined in more detail below.

- **High levels of satisfaction have been reported** by teachers and pupils in relation to the STEM Ambassadors and STEM Clubs programmes and by teachers in relation to the STEM brokerage service.
- **STEMNET's services are resulting in positive impacts for both teachers and pupils**. For both STEM Ambassadors and STEM Clubs, pupil impacts are particularly seen in areas such as increased engagement and interest in STEM subjects and increased knowledge and understanding. STEM Clubs are also resulting in the development of pupils' practical skills as well as transferable skills, which are much needed by employers, such as team work, solving problems and communication skills.
- Although attainment in, and progression to, STEM subjects is not one of the main impacts identified through the survey data, **the small-scale case study data from schools suggests that STEMNET's services can have an impact on progression and attainment**. Participation in STEM Clubs and (more sustained) interactions with STEM Ambassadors can be seen to lead to improved attainment and increased progression to STEM subjects, as well as engendering more positive attitudes towards STEM subjects. It is also worth noting that other research has reported an association between increases in interest and motivation in subjects and increases in attainment and future study choices.
- As might be expected, **due to the fact that activities are sustained over a period of time, STEM Clubs are resulting in more positive impacts**

on both teachers and pupils than STEM Ambassadors. However, the findings from pupils in relation to the impacts of STEM Ambassador activities are impressive considering the fact that nearly half of the pupils surveyed had only seen a STEM Ambassador once. This suggests that more **ongoing and sustained contact with STEM Ambassadors would result in significant positive impacts on pupils**. Gathering and disseminating examples of good practice models from schools which have achieved ongoing and sustained contact with Ambassadors would be helpful. STEMNET is already exploring effective models of embedding STEM Ambassador activities within the curriculum with nine pilot schools.

- There is **still an emphasis on science** within STEM Clubs although some clubs do specifically focus on engineering. It is also important to note that, in comparison to the other STEM subjects, **the activities of STEM Clubs and STEM Ambassadors do not seem to be impacting very highly on maths** in relation to increased knowledge, interest and enjoyment and motivation to study maths further. It seems that STEM Clubs are less likely to focus activities on maths, highlight its importance, and make explicit reference to where maths is being used within, and to support, the other STEM subjects. Gathering and disseminating examples of successful activities focusing on maths would be useful.
- Related to the point above, data from the school case studies suggests that **links across the STEM departments are, in many schools, at their early stages and that a key barrier to joint working is teacher time.**

Appendix 1: Further details on the methodology

The telephone survey of 500 teachers explored their engagement and satisfaction with the range of STEMNET's services and programmes in relation to: STEM brokerage; STEM Ambassadors and STEM Clubs. It also explored their views on the impacts of STEM Ambassadors and STEM Clubs on both themselves and their pupils. The teachers who were approached to take part in the teacher survey were from schools which STEMNET Regional Directors, with the support of contract holders, had identified as being involved with STEMNET's programmes and services. A sample of 1978 teachers was provided from which the 500 interviews were achieved.

The paper survey of pupils who had been involved in activities with a STEM Ambassador was sent out to 21 schools, with ten schools returning completed questionnaires from 176 pupils. The schools that surveys were sent to were schools which STEMNET Regional Directors had identified as being involved with STEM Ambassadors. The survey explored the activities that pupils had undertaken with STEM Ambassadors, levels of satisfaction and the impacts that had been realised for pupils. A number of the questions on impacts separated out the different STEM subjects so that differences in impacts could be explored.

The paper survey of pupils attending a STEM Club was sent out to 47 schools, with 35 schools returning completed questionnaires from 419 pupils. The schools that surveys were sent to were schools which STEMNET Regional Directors had identified as running a STEM Club either through the After-School Science and Engineering Clubs (ASSECs) programme or otherwise. The survey explored the activities that pupils had undertaken within their STEM Club, levels of satisfaction and the impacts that had been realised for pupils. A number of the questions on impacts separated out the different STEM subjects so that differences in impacts could be explored.

Case-study visits or telephone interviews were also undertaken with 14 schools. All schools had been involved with STEM Ambassadors and/or run a STEM Club and some had also accessed brokerage support. Ten schools were visited and telephone interviews were conducted with teachers at the remaining four schools. Where telephone interviews were undertaken, these were with teachers and, in some cases, headteachers. Visits included interviews with teachers and, where appropriate, interviews/focus groups with pupils and, again, in some cases, headteachers were also consulted. One of the main aims of consultations was to explore in more depth the activities that schools had undertaken with STEM Ambassadors and within STEM Clubs

and the impacts that had emerged for teachers and pupils. The data from the case-study schools is included within the report in boxed examples which can be found throughout the report. In particular, they add more detail regarding the activities of STEM Clubs and STEM Ambassadors and the impacts that they are having on pupils and teachers.

During the same time period, STEMNET asked its Regional Directors to work with a small number of schools within their area to collect data on the impacts of STEM Clubs and STEM Ambassadors on pupils. NFER researchers supported Regional Directors in the analysis of this data and have presented the more robust data that has been provided by schools within this report. This data is presented in Section 6 of the main report and it explores the impacts that individual schools have reported in relation to: pupil attainment; pupil progression onto further STEM study and employment; and changes in pupils' attitudes to STEM.

Appendix 2: Background and characteristics of teacher and pupil survey respondents

This appendix provides information on the background and characteristics of the teachers and pupils who took part in the three surveys: the teacher survey; the pupil STEM Ambassadors survey; and the pupil STEM Clubs survey. It also provides some information on the involvement that the teachers surveyed had had with STEMNET.

1.1 Teacher survey

1.1.1 Background and characteristics of teachers surveyed

The **telephone survey of teachers included 500 teachers, of which 90 per cent were secondary teachers and ten per cent were primary teachers.**

Table 1.1: Schools' phase of teaching

	N	%
Primary	51	10
Secondary	449	90
Total =	**500**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Teacher Survey, 2010 (N=500).

The largest proportion of teachers surveyed had a responsibility for science (63 per cent) with 38 per cent of respondents teaching science and a quarter being the head of the science department. 17 per cent of respondents had a responsibility for technology, which included teachers of technology (eight per cent) and heads of technology (nine per cent). Eight per cent of respondents had a responsibility for maths, which included maths teachers (six per cent) and heads of maths departments (two per cent).

Table 1.2: Respondent's role in the school

	N	%
Teaching science	189	38
Head of science department	126	25
Member of senior leadership team	55	11
Head of technology department	46	9
Non-teaching role (e.g. Director of specialism)	41	8
Teaching technology	40	8
Teaching other subjects	32	6
Teaching mathematics	30	6
Head of faculty	17	3
Teaching engineering	12	2
Head of mathematics department	11	2
Head of engineering department	7	1
No response	5	1
N = 500		

More than one answer could be given so percentages may sum to more than 100.
A total of 495 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Only three per cent of respondents had a responsibility for engineering which perhaps reflects the fact that engineering tends to be more rarely offered by schools. (Two per cent of respondents were teachers of engineering and one per cent were heads of the engineering department.)

Six per cent of respondents were teaching other subjects, eight per cent had a non-teaching role, 11 per cent were a member of the senior leadership team and three per cent were head of faculty. Nearly two-thirds (63 per cent) of respondents held a specific responsibility for STEM such as STEM Coordinator or Director of STEM.

Table 1.3: Responsibility for STEM

	N	%
Yes	317	63
No	183	37
Total =	**500**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Teacher Survey, 2010 (N=500).

1.1.2 Teachers' involvement with STEMNET

Teachers were asked if they had engaged with the range of STEMNET's services. **Over a third (37 per cent) had personally engaged with the brokerage service**. An additional five per cent responded that their school had engaged with the service but that they had not been involved.

Table 1.4: Engagement with STEMNET's brokerage service

	N	%
Yes and I am involved	186	37
Yes, but not involved	25	5
No	279	56
Don't know	10	2
Total =	**500**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Teacher Survey, 2010 (N=500).

Of those teachers who had personally engaged with the brokerage service, just over three-quarters (76 per cent) had run enhancement and enrichment activities as a result.

Table 1.5: Delivery of enhancement and enrichment activities following engagement with STEMNET's brokerage service

	N	%
Yes	142	76
No	43	23
Don't know	1	1
Total =	**186**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who answered that they had personally engaged with the brokerage service.
A total of 186 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

A third of respondents had engaged with the STEM Ambassadors Programme with Ambassadors having visited their school. A further 16 per cent of teachers had discussed the programme but not yet taken part in it.

Table 1.6: Engagement with STEM Ambassadors Programme

	N	%
Yes - had Ambassadors in school	165	33
Yes - discussed it but nothing has taken place yet	80	16
No	252	50
Don't know	3	1
Total =	**500**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Teacher Survey, 2010 (N=500).

Over half of respondents (58 per cent) had a STEM Club in their school, with most of these (89 per cent) being directly involved in the club. Of the teachers who said that their school had a STEM Club which they were directly involved in, nearly three-quarters (70 per cent) were part of the ASSECs programme funded by DfE (previously DCSF). Of the STEM Clubs that were not part of the ASSECs programme, more than two-thirds (68 per cent) had received support from STEMNET in the running of the club.

Table 1.7: Engagement with STEM Clubs Programme

	N	%
Yes, and I am involved	254	51
Yes, but I am not involved	33	7
No	208	42
Don't know	5	1
Total =	**500**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Teacher Survey, 2010 (N=500).

1.2 Pupil survey

1.2.1 Background and characteristics of pupils participating in the STEM Ambassadors survey

176 pupils from ten schools completed the STEM Ambassadors survey. A higher proportion of the pupils who took part in the STEM Ambassadors survey were boys, 57 per cent, with 43 per cent being girls.

Table 1.8: Gender of pupils participating in STEM Ambassadors survey

Gender	N	%
Boy	101	57
Girl	74	42
No response	1	1
Total =	**176**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N=176).

The largest proportion of pupils was in year ten, with almost half of the pupils (48 per cent) being in this year group. Following this, similar proportions of pupils were in years 9 and 7 (18 per cent and 17 per cent respectively). The lowest proportions of pupils were in year 8 (nine per cent), year 11 (three per cent), and year 12 (three per cent). There was only one pupil in year 13.

Table 1.9: Year group of pupils participating in STEM Ambassadors survey

	N	%
Year 7	30	17
Year 8	15	9
Year 9	31	18
Year 10	84	48
Year 11	5	3
Year 12	5	3
Year 13	1	1
No response	5	3
Total =	**176**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N=176).

The vast majority of pupils were white (81 per cent), with five per cent being Indian or Pakistani, four per cent describing themselves as mixed race, two per cent being Black African or Black Caribbean, one per cent being Chinese, three per cent being other and three per cent preferring not to say.

Table 1.10: Ethnicity of pupils participating in STEM Ambassadors survey

	N	%
White	142	81
Mixed race	7	4
Indian	5	3
Other	6	3
Prefer not to say	6	3
Pakistani	3	2
Black Caribbean	1	1
Black African	2	1
Chinese	2	1
More than 1 box ticked	1	1
No response	1	1
Total =	**176**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N=176).

In terms of the STEM subjects they were currently studying, almost all of the pupils were studying science (94 per cent), with 89 per cent studying maths and 78 per cent studying design and technology. A small proportion was studying engineering (16 per cent).

Table 1.11: STEM subjects studied by pupils participating in STEM Ambassadors survey

	N	%
Science	165	94
Maths	156	89
Design and Technology	138	78
Engineering	28	16
No response	2	1
N = 176		

More than one answer could be given so percentages may sum to more than 100.
A total of 174 respondents answered at least one item in this question.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N=176).

In relation to the type of science being studied, the largest proportion of pupils was studying combined science (60 per cent). Around a third of pupils were studying physics, biology and chemistry (36 per cent, 34 per cent and 32 per cent respectively). Two per cent of pupils were studying other sciences and three per cent did not provide a response to this question.

Table 1.12: Type of science subjects studied by pupils participating in STEM Ambassadors survey

	N	%
Combined Science	99	60
Physics	60	36
Biology	56	34
Chemistry	52	32
Other	4	2
No response	5	3
N = 165		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered that they were studying science
A total of 160 respondents answered at least one item in this question.
Source: NFER Pupil Survey: STEM Ambassadors, 2010 (N=176).

1.2.2 Background and characteristics of pupils participating in the STEM Clubs survey

419 pupils from 35 schools completed the STEM Clubs survey, with an average of 12 pupils per school taking part. A higher proportion of the pupils who took part in the STEM Clubs survey were boys, 65 per cent, with 35 per cent being girls.

Table 1.13: Gender of pupils participating in STEM Clubs survey

	N	%
Boy	272	65
Girl	146	35
No response	1	0
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

In terms of year group, the largest proportion of pupils were in year 8 (38 per cent), followed by year 9 (27 per cent), and year 7 (23 per cent). As might be expected due to GCSE commitments, only a small proportion of pupils were in years 10 and 11 (ten per cent and one per cent respectively). The make-up of the STEM Clubs pupil sample in terms of year group contrasted to that of the STEM Ambassadors pupil survey, in which the largest proportion of pupils was in year 10 and less than ten per cent were in year 8.

Table 1.14: Year group of pupils participating in STEM Clubs survey

	N	%
Year 7	98	23
Year 8	161	38
Year 9	112	27
Year 10	43	10
Year 11	2	1
No response	3	1
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

The vast majority of pupils in the STEM Clubs survey were white (82 per cent), with five per cent being Indian, Pakistani or Bangladeshi, four per cent being mixed race, two per cent being Black African or Black Caribbean, one per cent being Chinese, three per cent being other and two per cent preferring not to say.

Table 1.15: Ethnicity of pupils participating in STEM Clubs survey

	N	%
White	345	82
Mixed race	15	4
Other	14	3
Indian	8	2
Pakistani	8	2
Prefer not to say	10	2
Black Caribbean	2	1
Black African	5	1
Bangladeshi	6	1
Chinese	3	1
More than 1 box ticked	2	1
No response	1	0
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

In terms of the STEM subjects currently being studied, almost all of the pupils were studying science, 92 per cent, with 83 per cent studying maths and 83 per cent studying design and technology. A much smaller proportion of pupils was studying engineering (30 per cent), but this is still an encouraging proportion. In relation to the type of science being studied, 49 per cent of pupils were studying combined sciences, 44 per cent were studying biology, 44 per cent were studying

physics and 44 per cent were studying chemistry. Six per cent of pupils were studying other science subjects.

Table 1.16: STEM subjects studied by pupils participating in STEM Clubs survey

	N	%
Science	384	92
Maths	346	83
Design and Technology	346	83
Engineering	125	30
No response	0	0
N = 419		

More than one answer could be given so percentages may sum to more than 100.
A total of 419 respondents answered at least one item in this question.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Table 1.17: Type of science subjects studied pupils participating in STEM Clubs survey

	N	%
Combined Science	207	49
Physics	185	44
Biology	183	44
Chemistry	185	44
Other	26	6
No response	0	0
N = 419		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered that they were studying science.
A total of 419 respondents answered at least one item in this question.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Appendix 3: Additional data tables from the three surveys

CHAPTER 3: IMPACTS OF STEM AMBASSADORS PROGRAMME ON PUPILS

Table 3.1: Impacts arising from contact with STEM Ambassadors

	Not at all	To a small extent	To some extent	To a great extent	Don't know	No response	Total
	%	%	%	%	%	%	%
Increased engagement and interest in STEM subjects	4	5	30	56	5	0	100
Increased knowledge and understanding of STEM subjects/concepts/topics	5	8	32	51	3	0	100
Increased awareness of the STEM employment and career options available	12	4	24	43	18	0	100
Increased awareness of the STEM study and options available to them	16	10	32	30	13	0	100
Increased skills e.g. In practical work	20	14	30	27	9	0	100
Increased motivation to study STEM subjects post-16 and in higher	10	5	26	31	27	0	100
Increased motivation to enter STEM employment/apprenticeships	13	6	28	26	27	0	100
Increased attainment in STEM subjects	13	7	24	12	44	0	100
Actual participation in STEM subjects post-16 or in STEM employment	12	5	21	13	48	0	100
Other	12	5	12	21	50	0	100
N = 165							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents gave at least one response to these questions.
Source: NFER Teacher Survey, 2010 (N=500).

CHAPTER 4: IMPACTS OF STEM CLUBS PROGRAMME ON PUPILS

Table 4.1: Impacts of pupils' participation in STEM Clubs

	Not at all	To a small extent	To some extent	To a great extent	Don't know	No response	Total
	%	%	%	%	%	%	%
Increased engagement and interest in STEM subjects	1	3	27	66	2	0	100
Increased knowledge and understanding of STEM subjects/concepts/topics	0	4	34	59	2	0	100
Increased skills e.g. In practical work	1	7	26	63	3	0	100
Increased awareness of the STEM study options available to them and what they	15	13	33	30	10	0	100
Increased awareness of the STEM employment and career options available to the	11	13	29	20	27	0	100
Increased motivation to study STEM subjects post-16 and in higher education	6	7	25	23	40	0	100
Increased attainment in STEM subjects	4	11	27	13	45	0	100
Increased motivation to enter STEM employment/apprenticeships	6	8	21	15	50	0	100
Actual participation in STEM subjects post-16 or in STEM employment/apprenticeship	5	2	13	9	72	0	100
Other	13	0	15	42	30	0	100
N = 230							

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the STEM Clubs Programme.
A total of 230 respondents gave at least one response to these questions.
Source: NFER Teacher Survey, 2010 (N=500).

CHAPTER 5: IMPACTS OF STEMNET'S SERVICES AND PROGRAMMES ON TEACHERS

Table 5.1: Extent to which impacts can be attributed to STEMNET's brokerage service

	N	%
1 = not at all	9	5
2	18	10
3	56	30
4	62	33
5 = entirely	27	15
Don't know	9	5
No response	5	3
Total =	**186**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the brokerage service.
A total of 181 respondents responded to this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 5.2: Extent to which impacts can be attributed to involvement in STEM Ambassadors Programme

	N	%
1 = not at all	5	3
2	16	10
3	51	31
4	59	36
5 = entirely	30	18
Don't know	2	1
No response	2	1
Total =	**165**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the STEM Ambassadors Programme.
A total of 163 respondents responded to this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 5.3: Extent to which impacts can be attributed to involvement in STEM Clubs Programme

	N	%
1 = not at all	2	1
2	7	3
3	60	26
4	103	45
5 = entirely	53	23
Don't know	3	1
No response	2	1
Total =	**230**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the STEM Clubs Programme.
A total of 228 respondents responded to this question.
Source: NFER Teacher Survey, 2010 (N=500).

CHAPTER 7: TEACHERS' ENGAGEMENT AND SATISFACTION WITH STEMNET'S SERVICES AND PROGRAMMES

STEM Ambassadors

Table 7.1: Reasons for engaging with the STEM Ambassadors Programme

	N	%
To enhance the curriculum	58	35
To inspire pupils and raise their aspirations	43	26
To provide pupils with a better understanding of the world of work	39	24
Why did you engage with the programme? - To encourage students to consider STEM-related careers	26	16
Why did you engage with the programme? - To help pupils understand better the STEM study and career options available to them	26	16
Why did you engage with the programme? - To help me relate what pupils are learning to real-life situations and work contexts	26	16
Why did you engage with the programme? - To motivate pupils to study STEM subjects further	24	15
Why did you engage with the programme? - Other	63	38
No response	0	0
N = 165		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all teacher respondents who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.2: How STEM Ambassadors have been used in school

	N	%
To be involved in specific activities e.g. STEM days	108	65
To support curriculum delivery in specific areas	74	45
To be involved in a STEM club	27	16
How have you used STEM Ambassadors within your school? – Other	18	11
No response	0	0
N = 165		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all teacher respondents who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.3: Number of visits by STEM Ambassadors a term

	N	%
0	3	2
1	86	52
2	26	16
3	10	6
4	4	2
5	7	4
6	2	1
7	3	2
8	3	2
10	6	4
11	1	1
12	4	2
15	1	1
24	1	1
50	1	1
No response	7	4
Total =	**165**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.4: Nature of contact with STEM Ambassadors

	Yes	No	No response	Total
	%	%	%	%
A) Used Ambassadors once for one-off activities	82	18	0	100
B) Built a relationship with one or more Ambassadors who come into the school repeatedly	41	59	0	100
C) Used an Ambassador to provide ongoing support with the same group of pupils for a period (e.g. supporting a club each week, or Diploma in Engineering)	28	72	0	100
N = 165				

A series of single response questions.
Due to rounding percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents gave at least one response to these questions.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.5: Plans to use STEM Ambassadors again

Are you planning to use STEM Ambassadors again?	N	%
Yes	140	85
Possibly	20	12
No	5	3
Total =	**165**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the STEM Ambassadors Programme.
A total of 165 respondents answered this question.
Source NFER Teacher Survey, 2010 (N=500).

After-School Science and Engineering Clubs (ASSECs)

Table 7.6: Subject focus of ASSECs

What type of club do you have? (i.e. what subject or subjects does the club focus on?)	N	%
Science	164	92
Engineering	113	63
Technology	111	62
Mathematics	86	48
No response	0	0
N = 179		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all teacher respondents who were running an ASSEC.
A total of 179 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.7: Target groups of ASSECs

Is it targeted at any specific group within those years?	N	%
No - open to all interested	82	46
Yes - those likely to progress onto STEM subjects	9	5
Yes - those who have potential to do well in one or more STEM subject, but are not achieving it	7	4
Yes – girls	2	1
Yes - those who are currently less engaged/interested in STEM lessons	2	1
Yes – other group	90	50
No response	0	0
N = 179		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all teacher respondents who were running an ASSEC.
A total of 179 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.8: Target groups of ASSECs – other group

	N	%
We target year 8	43	48
Gifted and talented	33	37
We target year 9	27	30
Key Stage 3	23	26
We target year 7	22	24
We target year 10	5	6
Key Stage 4	4	4
Primary school children	4	4
Those who have enthusiasm for one or more STEM subjects	3	3
Less able students	1	1
Boys	1	1
Girls	1	1
Post secondary	1	1
No response	2	2
N = 90		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered 'other group' in relation to the target group of their ASSEC.
A total of 88 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.9: ASSEC teachers undertaking Science Learning Centre training in relation to running a STEM Club

	N	%
Yes	116	65
No	62	35
Don't know	1	1
Total =	**179**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who were running an ASSEC.
A total of 179 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.10: ASSEC teachers' rating of usefulness of Science Learning Centre training in preparing them to run their ASSEC

	N	%
1 = not at all useful	1	1
2	5	4
3	13	11
4	32	28
5 = very useful	65	56
Total =	**116**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who answered that they had undertaken Science Learning Centre training in relation to running an ASSEC.
A total of 116 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.11: ASSEC teachers who have received support from STEMNET to run the club

Have you received any support from STEMNET (Regional Director or Contract Holder) to help you run the club (e.g. events to share practice, visits from STEMNET staff)?	N	%
Yes	126	70
No	49	27
Don't know	4	2
Total =	**179**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who were running an ASSEC.
A total of 179 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.12: ASSEC teachers' plans to continue running a STEM Club

Are you planning to keep running the Club after the funding ends?	N	%
Yes	160	89
Possibly	13	7
No	1	1
Don't know	5	3
Total =	**179**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who were running an ASSEC.
A total of 179 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Other STEM Clubs (non-ASSECs)

Table 7.13: Subject focus of other STEM Clubs (non-ASSECs)

	N	%
Science	44	86
Engineering	25	49
Technology	23	45
Mathematics	20	39
No response	0	0
N = 51		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all teacher respondents who were running other STEM Clubs (non-ASSECs).
A total of 51 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.14: Target year groups of other STEM Clubs (non-ASSECs)

	N	%
Year 7	28	55
Year 8	27	53
Year 9	19	37
Year 10	5	10
Year 11	2	4
Year 12	2	4
Year 13	1	2
Some groups are not targeted	1	2
No	8	16
No response	0	0
N = 51		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all teacher respondents who were running other STEM Clubs (non-ASSECs).
A total of 51 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.15: Pupil target groups of other STEM Clubs (non-ASSECs)

	N	%
Open to all interested	38	75
Gifted and talented, high achievers (e.g. in maths) and those willing to work hard	3	6
Those who have potential to do well in one or more STEM subject, but are not achieving it	2	4
Those likely to progress onto STEM subjects	2	4
Those who are currently less engaged/interested in STEM lessons	2	4
Girls	1	2
Pupils whose first language is not English	1	2
Environmental studies group	1	2
Pupils already taking part in STEM subjects	1	2
Years 5 and 6	1	2
Year 11	1	2
N = 51		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all teacher respondents who were running other STEM Clubs (non-ASSECs).
A total of 51 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.16: Other STEM Clubs (non-ASSECs) teachers' awareness of the STEM Clubs Network

	N	%
Yes	42	82
No	9	18
Total =	**51**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who were running other STEM Clubs (non-ASSECs).
A total of 51 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.17: Other STEM Clubs (non-ASSECs) teachers' plans to continue running a STEM Club

Will you continue to run your STEM Club in the future?	N	%
Yes	47	92
Possibly	4	8
Total =	**51**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who were running other STEM Clubs (non-ASSECs).
A total of 51 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Both ASSECs and other STEM Clubs teachers

Table 7.18: Usage of STEM Clubs website

The STEM Clubs website (www.stemclubs.net) offers resources, advice, examples of activities and support - have you used it?	N	%
Yes	170	74
No	54	23
Don't know	6	3
Total =	**230**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who were running ASSECs and other STEM Clubs.
A total of 230 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.19: What teachers have found useful about the website

	N	%
Ideas for activities and projects	49	50
Ability to share information and see what other schools are doing	32	33
Access to resources (general)	14	14
Contacts	7	7
Information on setting up a club	3	3
Nothing	3	3
Unable to comment	1	1
Other	4	4
N = 98		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered that they had found the STEM Clubs website 'useful' or 'very useful'.
A total of 98 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.20: Involvement of STEM Ambassadors in STEM Clubs

Have you involved STEM Ambassadors in your club?	N	%
Yes	50	22
No	179	78
Don't know	1	0
Total =	**230**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who were running ASSECs and other STEM Clubs.
A total of 230 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.21: Role of STEM Ambassadors in STEM Clubs

	N	%
Supporting staff to run the club by attending sessions	21	42
Supporting staff to run the club by leading sessions	16	32
Providing materials for use by the club	11	22
Running the club	10	20
Providing advice for staff (e.g. in relation to real-world applications of learning)	7	14
Arranging industry visits for club participants	6	12
Other	17	34
No response	0	0
N = 50		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered that they had used STEM Ambassadors in their STEM Club.
A total of 50 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.22: Role of STEM Ambassadors in STEM Clubs – 'other' responses

	N	%
Attending a particular day, project or event	3	18
Doing talks about their careers	2	12
Attending a science day	2	12
Judging competitions	2	12
Doing talks	2	12
STEM Challenge advice	1	6
Southbank University to support students	1	6
Smallpeice Trust	1	6
Related topics	1	6
Flying start challenge	1	6
Expertise (general)	1	6
No response	0	0
N = 17		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered 'other' in response to the question on the role of STEM Ambassadors in STEM Clubs.
A total of 17 respondents answered at least one item in this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.23: How often STEM Ambassadors support STEM Clubs

	N	%
Around once a term	12	24
Once a year or less	10	20
Every club session	9	18
Several times each half-term	7	14
Around once a half-term	5	10
Most club sessions	4	8
Don't know	3	6
Total =	**50**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who answered that they had used STEM Ambassadors in their STEM Club.
A total of 50 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.24: Regularity of STEM Ambassador involvement

	N	%
Regular involvement from same Ambassadors	29	58
Lots of one-off visits from different Ambassadors	21	42
Total =	**50**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who answered that they had used STEM Ambassadors in their STEM Club.
A total of 50 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.25: Effectiveness of STEM Ambassadors

	N	%
1 = not at all effective	1	2
2	1	2
3	5	10
4	18	36
5 = very effective	25	50
Total =	**50**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who answered that they had used STEM Ambassadors in their STEM Club.
A total of 50 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.26: Teachers' plans to use the brokerage service to access information, advice and support again

Are you planning to use the brokerage service to access information, advice and support again?	N	%
Yes	156	84
Possibly	23	12
No	6	3
Don't know	1	1
Total =	**186**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all teacher respondents who had engaged with the brokerage service.
A total of 186 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

Table 7.27: Reasons for not using the brokerage service again

	N	%
Doing and finding things myself	1	17
I receive a high volume of correspondence and its difficult to read through all the material I am sent.	1	17
Not aware of a direct contact point.	1	17
Not getting information - Ambassadors not coming back to me	1	17
Too expensive	1	17
We're too busy as we're preparing the school for a merger with another school.	1	17
Total =	**6**	**100**

Due to rounding, percentages may not sum to 100.
A filter question: all those who did not intend to use the brokerage service again.
A total of 6 respondents answered this question.
Source: NFER Teacher Survey, 2010 (N=500).

CHAPTER 8: PUPILS' ENGAGEMENT AND SATISFACTION WITH STEM AMBASSADORS AND STEM CLUBS

STEM Ambassadors

Table 8.1: Number of times pupils have participated in activities involving a STEM Ambassador

	N	%
Just once	82	47
2 or 3 times	31	18
4-6 times	17	10
7-10 times	3	2
More than 10 times	22	13
No activities	21	12
Total =	**176**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Ambassadors 2010 (N=176).

Table 8.2: Places where pupils have seen a STEM Ambassador

	N	%
Pupils' school	143	92
An event with STEM Ambassadors helping	31	20
STEM Ambassador's workplace	12	8
Different school	7	5
University or college	7	5
Other	3	2
No response	5	3
N = 155		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered that they had undertaken activities with a STEM Ambassador.
A total of 150 respondents answered at least one item in this question.
Source: NFER Pupil Survey: STEM Ambassadors 2010 (N=176).

Table 8.3: Places seen a STEM Ambassador – 'other' responses

Other	N
Computer space station	1
Video conference	1
No response	1
Total =	**3**

A filter question: all those who answered 'other' to the question on where they had seen a STEM Ambassador.
A total of 2 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Ambassadors 2010 (N=176).

Table 8.4: Activities participated in involving a STEM Ambassador

	N	%
Hearing STEM Ambassadors give a talk	94	61
STEM Ambassador help out delivering a special STEM activity	60	39
Practical lessons	52	34
Regular lessons	22	14
No response	7	5
N = 155		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered that they had undertaken activities with a STEM Ambassador.
A total of 148 respondents answered at least one item in this question.
Source: NFER Pupil Survey: STEM Ambassadors 2010 (N=176).

Table 8.5: Activities participated in involving a STEM Ambassador – type of activity

	N	%
CREST Awards	5	25
A debate	3	15
Super capacitor car activity	3	15
Building a football stadium model	2	10
Automatic greenhouse activity	1	1
Greenpower	1	5
Making a bridge	1	5
Making a car	1	5
Answered our questions on space	1	5
Science day	1	5
Cosford air museum	1	5
Go4SET Project	1	5
N = 20		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who answered a question regarding other activities that they had undertaken with STEM Ambassadors.
A total of 20 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Ambassadors 2010 (N=176).

Table 8.6: Pupils' reasons for rating the activities of STEM Ambassadors from 'very good' to 'very poor'

Why do you say that?	N	%
Enjoy it/fun	39	25
Interesting	23	15
Learned things/educational	24	15
Didn't interest me/ boring	18	12
Ambassador provided support/help	7	5
Practical/allowed participation	7	5
Ambassador was friendly/pleasant	6	4
Ambassador was a good communicator	5	3
Helpful	4	3
Didn't do much/only a few things	4	3
Ambassador provided good information	3	2
Allowed me to be creative	2	1
Exciting	2	1
Showed me opportunities (general)	2	1
Well organised	2	1
Too difficult	2	1
Wasn't practical enough	2	1
Too long	2	1
Mixed response (general)	2	1
Other relevant/ vague comment	2	1
Helps me to improve grades/exam results	1	1
Showed me/encouraged me to pursue STEM careers	1	1
Team working	1	1
Got to go on a trip	1	1
Worthwhile	1	1
Challenging	1	1
Something different to regular school	1	1
It involved the whole class	1	1
Involved other schools	1	1
It answered my questions	1	1
I haven't been involved many times	1	1
Felt like a regular lesson	1	1
I wasn't in a group with my friends	1	1
Some people didn't take part	1	1
Irrelevant/uncodeable	6	4
No response	23	15
N = 155		

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who had taken part in activities with STEM Ambassadors.
A total of 132 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Ambassadors 2010 (N=176).

STEM Clubs

Table 8.7: Length of time attending a STEM Club

	N	%
Less than one term	14	3
About one term	29	7
About two terms	75	18
About one year	151	36
More than one year	147	35
No response	3	1
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Table 8.8: Activities pupils have been involved in as part of their STEM Club

What the activity was	N	%
Designing and making something	374	89
Practical experiments and investigations	338	81
Working on a long-term project	292	70
Taking part in a challenge	229	55
Visiting an event	228	54
Working on a project or idea from a club member	221	53
Attending a lecture/talk or having someone visit the club	195	47
Visiting a museum or activity centre	181	43
Visit to a workplace	116	28
CREST Award	84	20
Presenting STEM activities to primary pupils	78	19
Working towards STEM Leaders qualification	35	8
Other	33	8
No response	0	0
N = 419		

More than one answer could be given so percentages may sum to more than 100.
A total of 419 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Table 8.9: Activities pupils have been involved in as part of their STEM club – 'other' responses

Other	N	%
Lego league	5	15
Trips away (general)	5	15
LED masks	2	6
Automated greenhouse	2	6
Dissecting	2	6
Presenting to other schools	1	3
Chemical garden	1	3
Investigating fingerprints	1	3
Made circuits	1	3
Creating an eco-system	1	3
Young engineer award	1	3
Christmas lectures	1	3
Cheese rolling	1	3
Fashion show	1	3
Irrelevant/uncodeable	2	6
No response	6	18
Total =	**33**	**100**

More than one answer could be given so percentages may sum to more than 100.
A filter question: all those who responded 'other' when asked about the activities that they had been involved in as part of their STEM Club.
A total of 33 respondents gave at least one response to this question.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Table 8.10: Individuals who have helped with the STEM Club

	N	%
Someone with a job that involves STEM	207	49
No adults	163	39
Someone from a university or college	90	22
A parent	57	14
Other	55	13
No response	0	0
N = 419		

More than one answer could be given so percentages may sum to more than 100.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Table 8.11: Would you recommend the STEM Club?

	N	%
Yes	339	81
Possibly	57	14
No	9	2
Don't know	4	1
No response	10	2
Total =	**419**	**100**

Due to rounding, percentages may not sum to 100.
Source: NFER Pupil Survey: STEM Clubs, 2010 (N=419).

Providing independent evidence to improve education and learning.

National Foundation for Educational Research
The Mere, Upton Park,
Slough, Berks SL1 2DQ

T: 01753 574123
F: 01753 691632
E: enquiries@nfer.ac.uk

www.nfer.ac.uk