



THE UNIVERSITY
of LIVERPOOL

CREST awards evaluation

Impact study

An evaluation sponsored by AstraZeneca

Dr Laura Grant

University of Liverpool
Science Communication Unit

Acknowledgements

Thanks go to the following for their help and advice on this project:

AstraZeneca

The British Association for the Advancement of Science

The London Benchmarking Group

Research Councils UK

SETPOINTs

SETNET

Contents

Executive summary	04
1 Science education context	08
1.1 Background	08
1.2 The evidence	09
1.3 Attitudes to science among young people	11
2 The CREST programme.....	12
2.1 What is CREST?	12
2.2 The uptake of CREST	13
3 Methodology	14
3.1 Data collection instruments	14
3.2 Sample	14
4 Findings	17
4.1 Recognition of CREST sponsors	17
4.2 CREST involvement	18
4.3 Pre-existing attitudes	19
4.4 How is CREST used in schools?	23
4.4.1 Year groups	23
4.4.2 Time spent on awards?	24
4.4.3 Where did students complete their projects?	25
4.4.4 Did students work alone or in groups?	25
4.5 CREST resources	26
4.6 Impressions of CREST	27
4.6.1 The best and worst parts of CREST	27
4.6.2 Students' impressions of CREST	29
4.6.3 Teachers' impressions of CREST	31
4.7 Regional and national fairs	31
4.8 CREST impacts	32
4.8.1 Knowledge and skills	32
4.8.2 Attitudes and aspirations	35
4.8.3 Aspirations to SET in HE	37
4.8.4 Careers in SET	39
4.8.5 Impact on course choices	42
4.8.6 Relationship between pre-existing attitudes and impacts	43
4.9 Teachers' perspectives on CREST impacts	44
4.10 Findings from teachers' focus group	46
4.11 Findings from mentors' focus group	47
5 Conclusion	49
6 References	51
7 Appendix	53
Student Questionnaire	53
Teacher Questionnaire	61

Executive summary

It is widely recognised that fewer young people are choosing to study science subjects (and especially physical sciences) at school and university¹. A supply of qualified scientists and engineers is key to the economic competitiveness of the UK. To address this problem, a large range of Science, Engineering and Technology (SET) initiatives have been funded by Government and other bodies to stimulate young people's interest and promote careers. However, there appears to be little or no change in the uptake of SET subjects. The current study aimed to evaluate the impact of one such initiative, the British Association for the Advancement of Science (the BA) CREST Awards, on participants (CREST stands for CREativity in Science and Technology). Few previous studies have been conducted with this level of depth, and the research aimed to identify the programme's impacts as well as immediate outcomes for the young people and others involved.

A separate part of the same review process made strategic and operational recommendations for the scheme's development; however these are not presented here. This document presents the findings of the CREST impact study.

Background

CREST is aimed at 11-19 year-olds and is the only UK-wide scheme to accredit SET projects. Young people conduct their own creative problem solving through mini research projects and awards are made at three levels: Bronze, Silver and Gold. At the Gold and Silver levels scientists and engineers from industry and academia normally mentor the projects. Regional fairs and a national final showcase some of the young people's work. Between 2000 and 2006 the number of awards sold has fluctuated between 20,781 and 28,172. 1104 schools participated in CREST during 2005 (this represents around 15% of the ~7000 secondary schools in the UK).

Evaluation methodology

The impact study was designed to incorporate the opinions of students, teachers and mentors. The research questions explored how the scheme is used, participants' impressions of the scheme and, most importantly, the impacts of CREST. Impacts were explored in three domains: knowledge and skills, attitudes and aspirations, and intended behaviour.

¹ HM Treasury (2006); ABPI (2005); Roberts (2002)

The evaluation had three parts:

- Student and teacher questionnaire survey (including pilot phase).
- Focus groups with teachers and mentors.
- Interviews with key stakeholders, including the BA and CREST delivers.

This report considers the findings from the student and teacher questionnaire surveys and the teacher and mentor focus groups. 512 young people who had participated in CREST in the 2005-06 academic year were surveyed using questionnaires; 103 were completed at the CREST national final in February 2006 and 409 were completed in a postal survey that involved 19 schools from across the UK. The survey also included 62 teachers who completed questionnaires with open items.

Impressions of CREST

Students and teachers in the survey rated CREST highly and said that it was a worthwhile experience.

Impacts: knowledge and skills

Students improved several areas of learning from CREST and participation led them to develop a range of skills. The messages and skills differed between award levels.

- Students at all levels felt they had developed organisational and practical science skills and gained a clearer idea of 'what it's like to work in SET' and 'how SET fits in with society'.
- At all levels students improved their knowledge in the area of science, engineering or technology that was directly related to their investigation.
- At Bronze, the main message was 'SET can be fun' and students developed teamworking skills.
- At Silver there was also an emphasis on fun, but students also felt they had built their skills in IT, presentations and problem-solving.
- At Gold students developed their problem-solving and report-writing abilities and many said they had learned that they 'want a career in SET'.
- Some students said they had learned that 'SET can be hard work'.
- On average, students at Bronze and Silver improved two areas of learning and four or five skills while Gold award students improved three areas of learning and six skills.

Impacts: attitudes and aspirations

There were a number of positive impacts on students' attitudes towards SET, their aspirations for further study and SET careers.

- A considerable proportion of students said they were more interested in science as a result of their involvement with CREST (50% Bronze, 50% Silver, 61% Gold).
- Some students said that CREST had made them more interested in science at University or in Higher Education (33% Bronze, 35% Silver, 43% Gold).
- Many students also said that CREST had made them more interested in a career in science (30% Bronze, 33% Silver, 46% Gold).
- The increased interest in SET was more marked for science than for engineering or technology.
- Mentors identified the strong impact on decision-making at Gold level.

Impacts: intended behaviour

Some students said that they had chosen or would choose more SET options (e.g. GCSEs or A levels) as a result of their involvement in CREST (16% Bronze, 16% Silver, 18% Gold). However, a small proportion of Bronze and Silver students (5% and 2% respectively) said that they had chosen or would choose fewer SET options after participating in CREST. This is perhaps unsurprising, given that many students said CREST had taught them more about the nature of scientific work: inevitably some students may learn that such a subject is not appropriate to their individual interests or aptitudes.

Impact on teachers

Teachers described several benefits of CREST for students.

Those mentioned most often included the fact that the scheme gives students a 'broader experience of science' and that it 'stimulates interest and motivates' students.

When asked about the impacts of the scheme on them, many teachers cited the benefits to students as a positive impact. Some also said that the scheme had informed their teaching and that they enjoyed the opportunity to work more closely and in a different way with the participating students.

Impact on schools

CREST was seen to have a number of benefits to schools, including increased interest and motivation from students in SET. For many schools publicity from success in the awards had raised the profile of the school locally. Some teachers said that CREST raised the profile of SET subjects and their department, for example by presenting certificates during assembly. A few teachers gave specific examples of CREST prize money being used to establish further SET activities in the school, and several teachers felt CREST led to greater uptake and attainment in SET subjects.

Conclusion

These findings indicate that CREST has a strong positive impact on students. Data suggest that students gain knowledge and develop a number of skills. Attitudes towards SET and aspirations for SET careers are also significantly improved. Importantly, involvement in the scheme appears to encourage students to continue with the study of SET subjects. There are also benefits for teachers and schools that participate in the scheme.

1 Science education context

1.1 Background

In 1988, the Education Act² placed mathematics and science at the heart of the National Curriculum signalling the importance of a knowledge-based economy for the UK. This was further reinforced by the OECD finding linking the level of advanced level qualifications in a population to the competitiveness of a nation³. The 1998 Competitiveness White Paper was followed by a Treasury led paper on the supply of scientists and engineers⁴. These papers drew the following conclusions:

- While overall numbers of young people progressing to higher education have increased over the last decade the proportion of young people progressing into the physical and chemical sciences is decreasing.
- Many Universities have either closed departments or reviewed their provision in chemistry and physics.
- The quality of undergraduates from established UK universities remains high but the level of active problem solving and investigative science skills is declining. This is reflected in the practical capabilities of researchers in academia and industry.
- The 'entitlement for all' to study sciences to 16 has produced a very broad based curriculum that has had little or no impact upon progression post-16. Measurably lower skills in the teaching force have compounded further the practical investigative skills decline.

Following the publication of the ten year science and innovation investment framework in 2004,⁵ the recent DTI Next Steps⁶ report described a number of measures to increase participation and attainment in SET subjects. These included making science a priority in schools and increasing recruitment and retention of science teachers.

² HMSO (1988)

³ OECD (1996)

⁴ HMSO (1998)

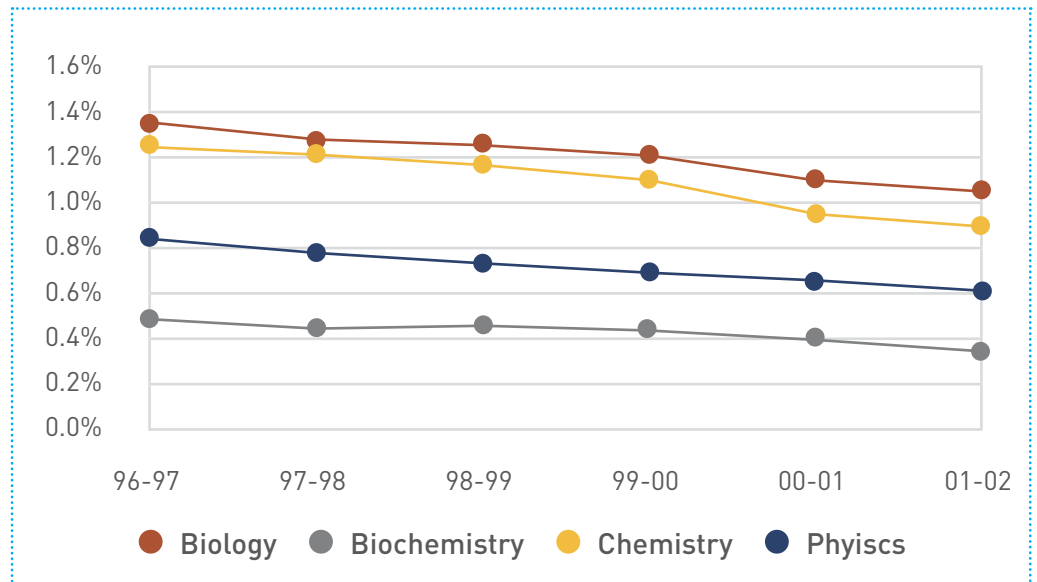
⁵ HM Treasury (2004)

⁶ HM Treasury (2006)

1.2 The evidence

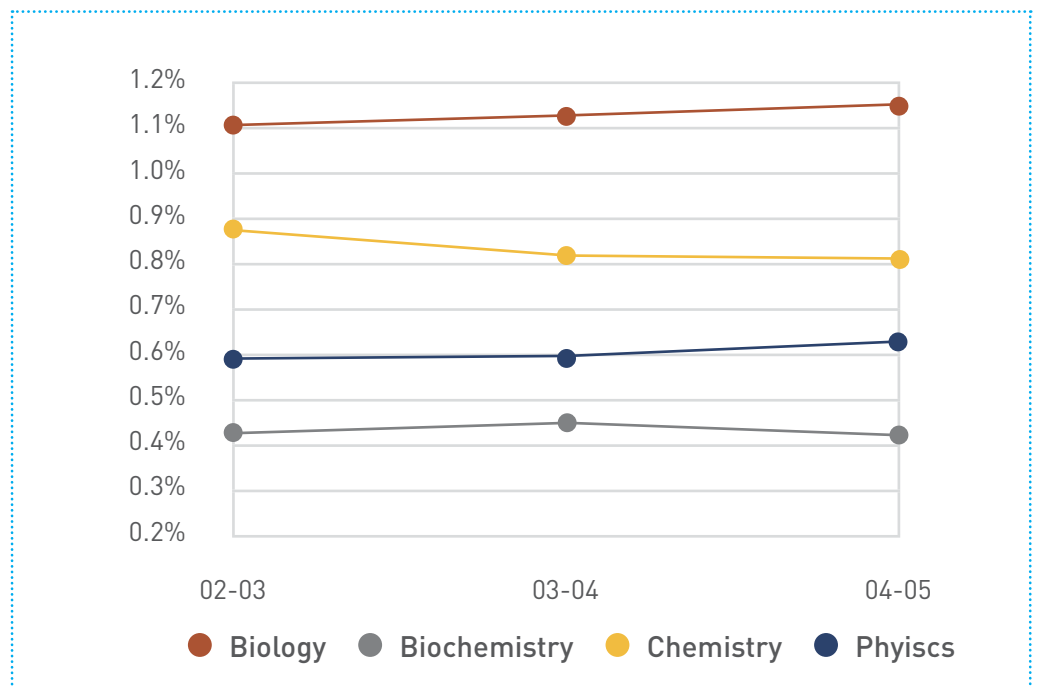
Data from the Higher Education Statistics Agency (HESA) show that the proportions of full-time undergraduates on science courses have fallen considerably in the last decade.

Figure 1.1 Proportion of full time HE students 1996 - 2002



To take one example, the number of full-time Chemistry undergraduates fell from over 22,500 in 1996/7 to just 19,000 in 2001/2. In the same period, the total number of undergraduates had risen by 300,000.

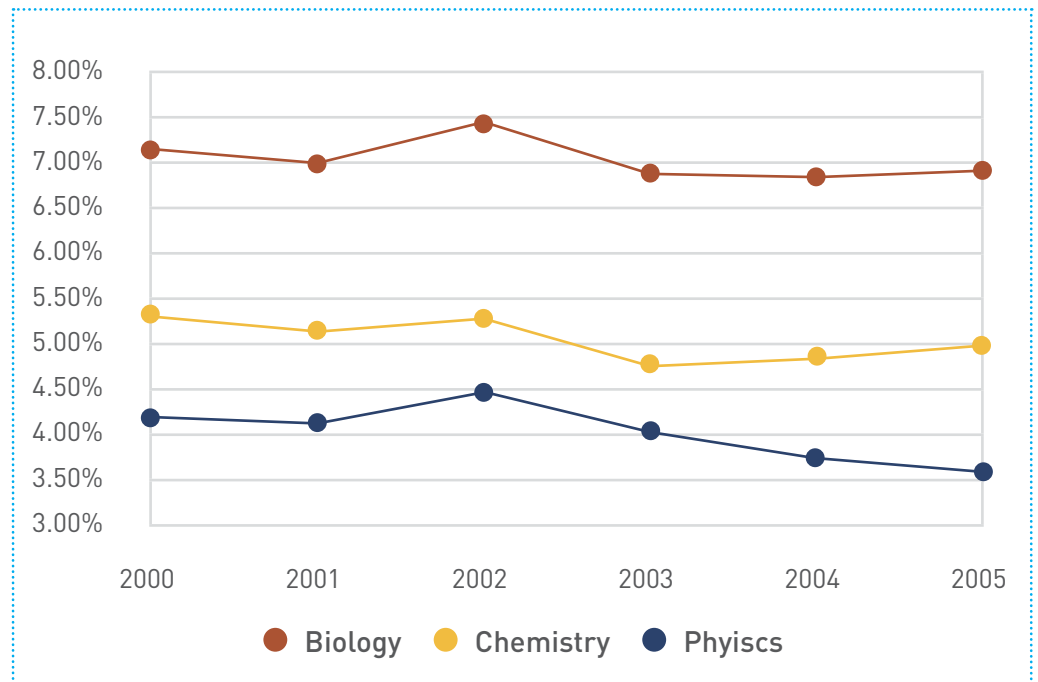
Figure 1.2 Proportion of full-time HE students 2002 - 2005



Changes in the way in which data are coded means it is not possible to compare data for 2002/3 onwards with previous figures. Trends over the last three years appear more positive for physics, where numbers increased by 2,000 over the period. However, the number of chemistry students is still in decline; undergraduate numbers dropped by 500 during the period.

These trends are also reflected in the A Level choices that students are making, as shown in the graph below:

Figure 1.3 Proportion of full time HE students 2000 - 2005



While the proportion of students taking A Level biology appears to be relatively stable, there has been a decline in the proportions of candidates taking chemistry and physics. The numbers taking chemistry dropped by 2,000, from 40,800 to 38,800, while the total number of candidates rose by 10,000 in the same period.

The next section considers some of the reasons for this decline.

1.3 Attitudes to science among young people

There is a difference in young people's opinions of science in the real world, and 'school science'. While science generally is perceived as interesting and relevant, science in schools is perceived as boring⁷. Science education research has clearly indicated that attitudes towards school science decline from the point of entry into secondary education⁸ and over the course of secondary education. In the UK, this decline in interest is largely believed to start at age 11, although some research suggests it could be taking place before this⁹.

The House of Commons Select Committee for Science and Technology Third Report on Science Education from 14-19¹⁰ describes school students' declining interest in science post-14:

"It is clear that the major problems lie at Key Stage 4... Many students lose any feelings of enthusiasm that they once had for science. All too often they study science because they have to but neither enjoy nor engage with the subject. And they develop a negative image of science which may last for life"

The specific issues identified by the report within Key Stage 4 (ages 14-16) science are: perceived irrelevance, failure to engage in debate, repetitiveness, limited options, problems with practical and fieldwork, coursework, and the use of ICT. Research has also documented the negative shift in attitudes towards science as students progress through the educational system¹¹.

There are a number of ways in which these negative trends can and are being addressed. The curriculum can be changed, or activities to enrich the curriculum provided. In fact, both approaches are underway. The next section looks at the development of a strategic approach to enriching school science, this is the approach that is relevant to the CREST awards scheme.

⁷ Ebenezer & Zoller (1993); Sundberg *et al* (1994)

⁸ Young & Kellogg (1993); House of Commons (2002); Osborne *et al* (2003)

⁹ Hadden & Johnstone (1983); Pell & Jarvis (2001)

¹⁰ House of Commons Select (2002)

¹¹ See for example, Osborne *et al* (2003); Reid & Skryabina (2002); Williams *et al* (2003)

2 The CREST programme

2.1 What is CREST?

CREST is a UK-wide science accreditation scheme. The programme was initially developed in the mid-80s and has been managed by the British Association for the Advancement of Science (the BA) for the last five years. Through CREST, young people aged 11+ explore the real nature of science and engineering by doing their own creative problem solving through mini research projects. At the higher levels, practicing scientists and engineers from industry and academia mentor the projects and the young people. The name 'CREST' stands for 'CREativity in Science and Technology'.

CREST projects are accredited and awards are made at three levels – Bronze, Silver and Gold. At each level the student undertakes project work. Detailed profiles guide students through work of an appropriate level with a number of hours also recommended in each instance (Bronze 10 hours, Silver 40 and Gold 100). The levels are progressive but can be awarded separately at any stage.

Regional fairs are held all over the UK to allow young people to present their work and celebrate their achievement. In addition, each year the CREST National Science Fair is held in London which brings together the best projects from the regional fairs at each level as well as some projects developed through other means.

The CREST programme specifically aims to:

- Promote positive attitudes towards science and scientists.
- Provide skills for students in practical science, problem solving and communication skills.
- Raise awareness of the choice and availability of careers in science – particularly at the Gold level.

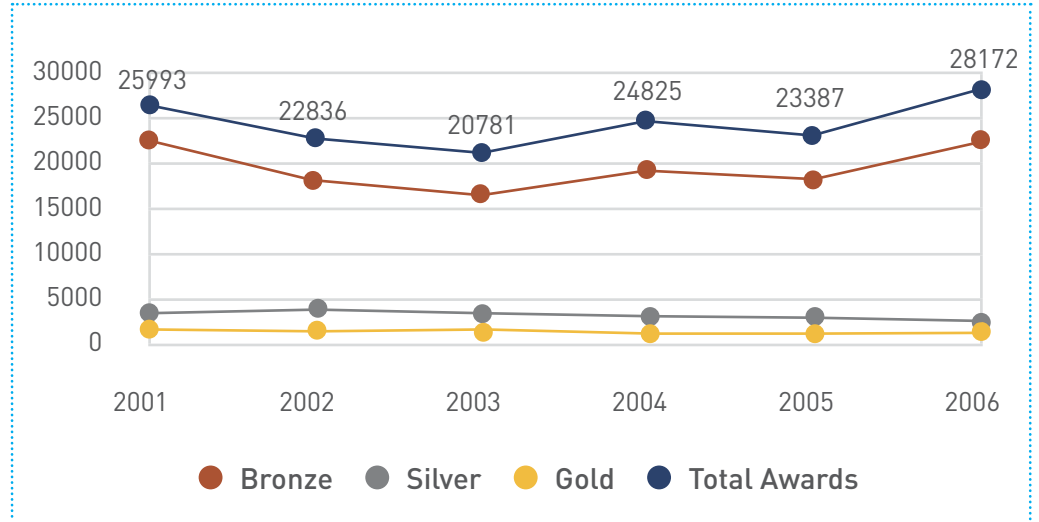
And as a side product of these activities to:

- Enhance the skills of those who facilitate the scheme i.e. mentors (communication) and teachers (science teaching).
- Raise awareness of the choice and availability of science careers at the Silver and Bronze levels and encourage Gold level students to choose science courses for study in higher education.

2.2 The uptake of CREST

Over 28,000 young people achieved CREST awards in 2006. Most of these were Bronze awards. The total sales and sales of each type of award are presented in Figure 2.1 below:

Figure 2.1 CREST award sales 2001 - 2006



3 Methodology

The impact study was designed to include the opinions of students, teachers and mentors. The research questions addressed three main areas: how the scheme is used, participants' impressions of the scheme and most importantly, the impact of CREST. Impacts were explored in three domains: knowledge and skills, attitudes and aspirations, and intended behaviour. The methods were straightforward and allowed a large amount of information about the scheme to be collected and analysed.

3.1 Data collection instruments

A questionnaire survey with $n > 500$ was used to canvass the opinions of young people that had participated in CREST during the 2005/6 academic year. A pilot questionnaire consisting of open items was used to develop a series of rating and categorical scales for data collection from the final sample. The questionnaires were distributed to all students that attended the CREST national final in London, and by post to nineteen schools that were recruited into the survey by the BA.

Questionnaires were also used to survey over 60 teachers at the national final and by post. In addition, a teacher focus group was convened which involved science teachers that had a range of levels of involvement with CREST. A focus group was also conducted with scientists who act as mentors at Gold level.

A copy of the student and teacher questionnaires is provided in the Appendix.

3.2 Sample

A total of 528 questionnaires were completed at the CREST national final in February 2006 and in a postal survey that involved 19 schools from across the UK. The sample was cleaned to remove students that said they had not been involved in the scheme and 512 respondents remained. The teacher sample included 62 teachers that completed questionnaires at the national final and as part of the postal survey. Sample sizes were as follows:

Figure 3.1 Sample sizes

Sample	National final	Postal survey	Total sample
Student sample	103	409	512
Teacher sample	38	24	62

Student sample demographics are included in the tables below:

Figure 3.2 Student sample year groups

Year group	National final	Postal survey	Total sample
7 or P7	5%	21%	18%
8 or S1	3%	8%	6%
9 or S2	6%	17%	15%
10 or S3	20%	30%	29%
11 or S4	5%	8%	7%
12 or S5	10%	12%	12%
13 or S6	47%	4%	13%
1st year undergraduate	2%	0%	0% (2 students)

The profile of year groups for the two samples differs. Compared to students who completed the questionnaires in the postal survey, Years 7, 9 and 10 students were under-represented at the national final and Year 13 students were over-represented. This is not unexpected however; a similar proportion of students who had completed the Bronze, Silver and Gold awards were present at the final, whereas nationally a larger proportion of Bronze awards are completed by younger students than Silver and Gold by older students.

Figure 3.3 Sample gender

Gender	National final	Postal survey	Total sample
Male	52%	39%	42%
Female	48%	60%	58%

Females are over-represented in the postal sample, probably because several girls' schools returned a large number of questionnaires.

Figure 3.4 Sample ethnic groups

Ethnic group	National final	Postal survey	Total sample
White	84%	92%	91%
Asian or Asian British	7%	4%	4%
Black or Black British	1%	1%	1%
Mixed	3%	1%	1%
Chinese	5%	1%	2%
Other	0%	1%	1%

White students are over-represented in the postal survey. Asian, Mixed and Chinese students were over-represented at the national final.

Figure 3.5 Disability

Disability (declared)	Total sample
Non-disabled	98%
Dyslexia or dyspraxia	1%
Other impairment	1%

A large majority of students were non-disabled.

4 Findings

4.1 Recognition of CREST sponsors

CREST is sponsored by AstraZeneca and Research Councils UK (RCUK), and managed by the BA who give in-kind support. AstraZeneca provides the largest amount of funding for the programme. Local sponsorship for the regional events is also obtained from a number of other organisations. The BA and sponsors' logos are included in CREST promotional materials and on the award certificates. Students were asked whether they recognised any of the CREST sponsors. Some did and the results are presented in Figure 3.6 below.

Figure 4.1 CREST sponsors - students

Sponsor	National final	Postal survey	Total
The BA	9	61	70
AstraZeneca	49	15	66
Sentinus	-	46	46
RCUK	12	15	27
Rolls Royce	4	20	24
SETPOINT	-	15	15
Others	10	35	45

Figure 4.2 CREST sponsors - teachers

Sponsor	Total
AstraZeneca	28
The BA	7
RCUK	3
Rolls Royce	3
The Wellcome Trust	3
Others	18

It appears that AstraZeneca had the highest profile at the national final, while the BA, Sentinus and Rolls Royce had a good presence in the regions. Some students also mentioned their local SETPOINT, whichever that happened to be. Teachers were most likely to mention AstraZeneca, possibly because they have sponsored the scheme for longer than RCUK. Some teachers added the BA, although they are not 'sponsors' in the same sense as AstraZeneca and RCUK.

4.2 CREST involvement

Respondents had different levels of involvement with the scheme. These are summarised below:

Figure 4.3 Involvement with CREST

CREST involvement	National final	Postal survey	Total sample
Bronze	36%	82%	73%
Silver	22%	20%	21%
Gold	44%	6%	16%
Attended regional final	91%	34%	45%
Attended national final	100%	5%	22%

As expected, the distribution of students who had completed awards at the three levels and attended the regional and national fairs differed considerably between the two samples. 103 students in the sample completed the questionnaires at the national final in London. The proportion of students in the postal survey who had attended the national final appears high; this is likely to reflect the bias that is often present in surveys conducted by post: teachers who are very engaged in the scheme are more likely to have attended the national final and are probably more likely to make the effort to distribute the questionnaires to their students.

4.3 Pre-existing attitudes

In order to explore attitudinal change it was important to measure pre-existing attitudes towards SET. The pilot study included an open questionnaire item which asked students what they thought about SET before they took part in CREST. Their responses showed that individuals distinguished between science, engineering and technology, so the item was split for the quantitative survey.

Students were asked about their interest in science, engineering and technology before they took part in CREST. Results are presented below, disaggregated by sample.

Figure 4.4 Pre-existing attitudes towards science

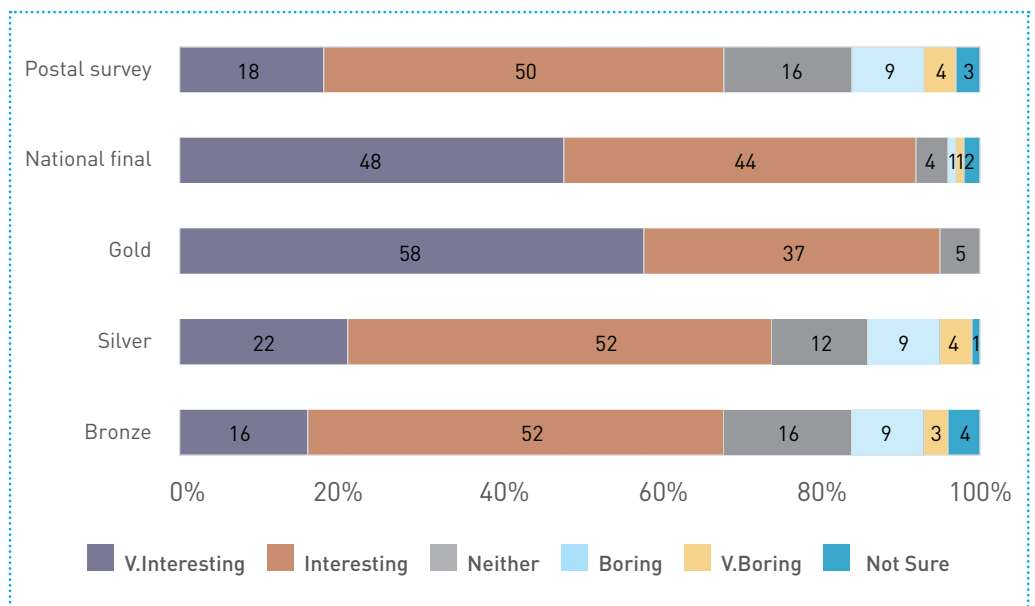


Figure 4.5 Pre-existing attitudes towards engineering

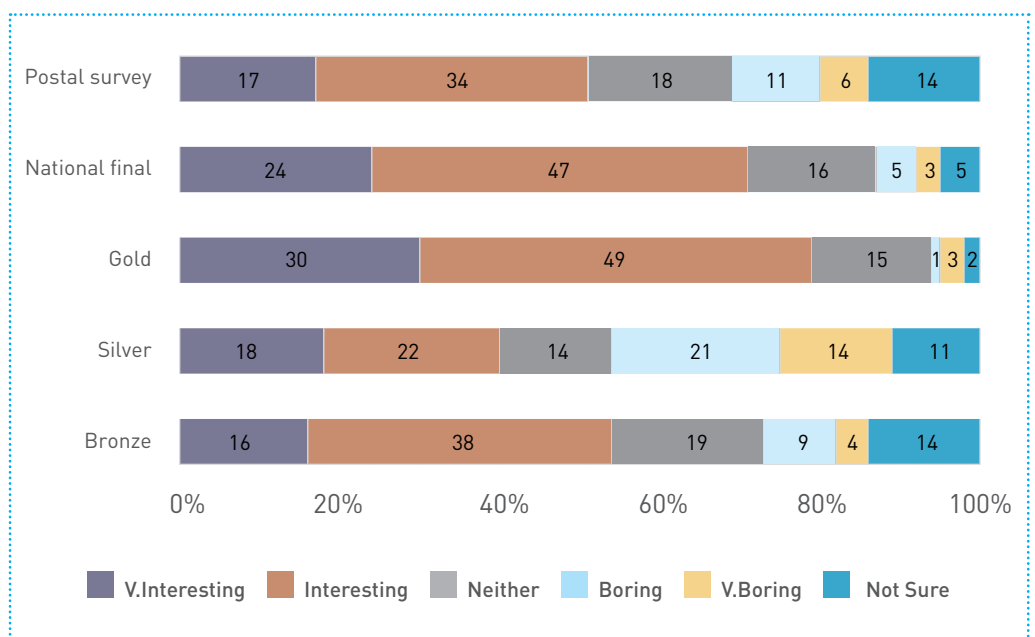
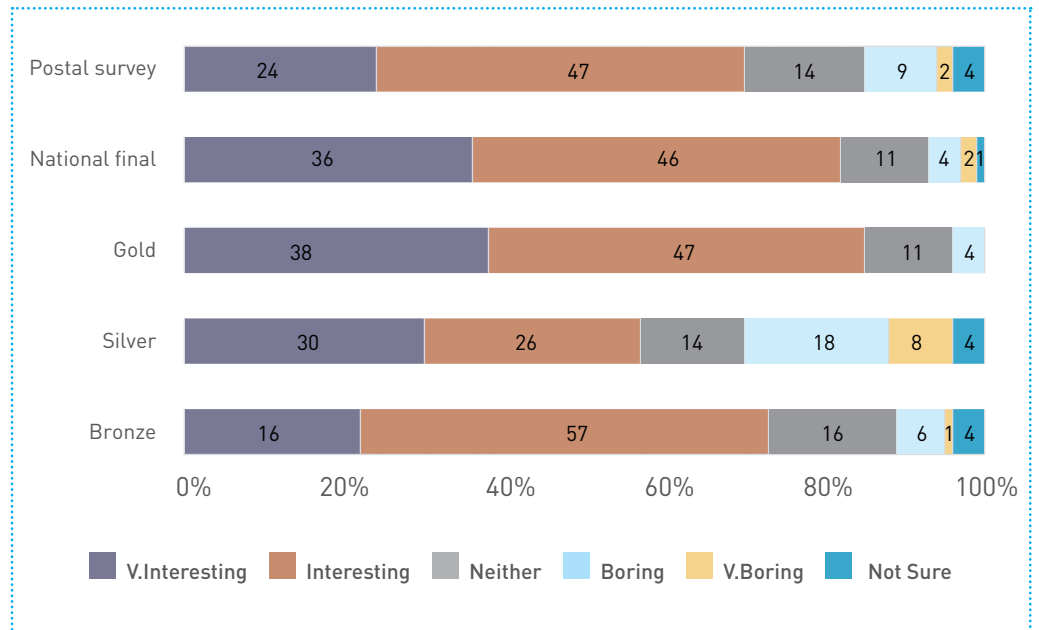


Figure 4.6 Pre-existing attitudes towards technology



It is interesting to note the differences in opinions of science, engineering and technology, and the difference between the two samples. More students in both samples are interested in science and technology than engineering. Students who attended the national final appeared to have, on average, a greater pre-existing interest in SET than those who responded in the postal survey. Similarly, students that completed the Gold award had a stronger pre-existing interest than those that completed Silver or Bronze, although many of the Gold award students were in the national final sample.

Figure 4.7 Pre-existing attitudes towards science careers

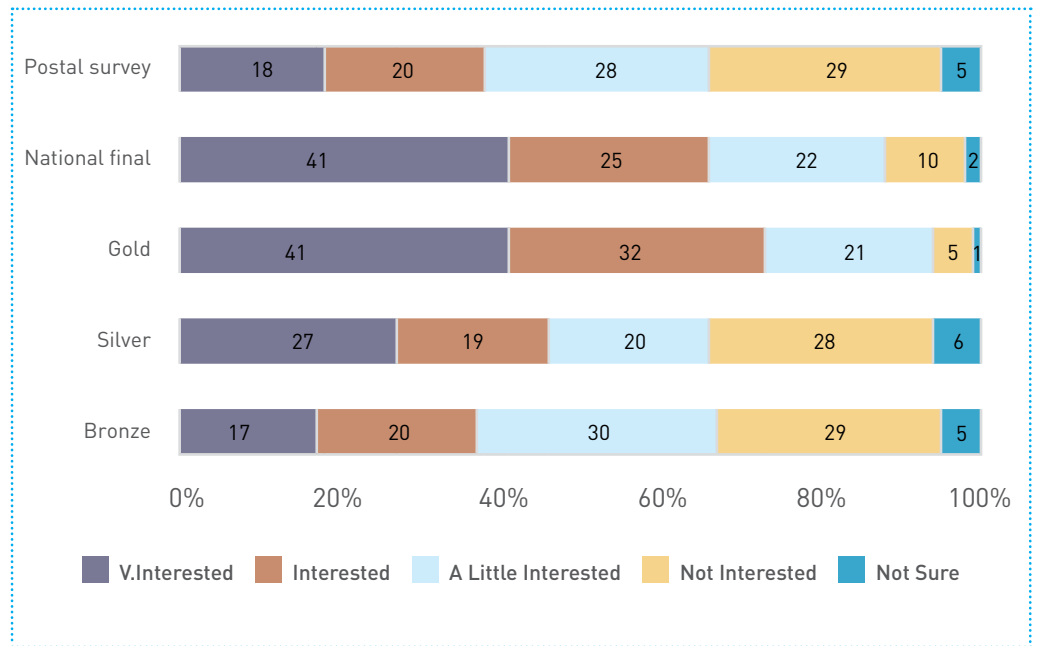


Figure 4.8 Pre-existing attitudes towards engineering careers

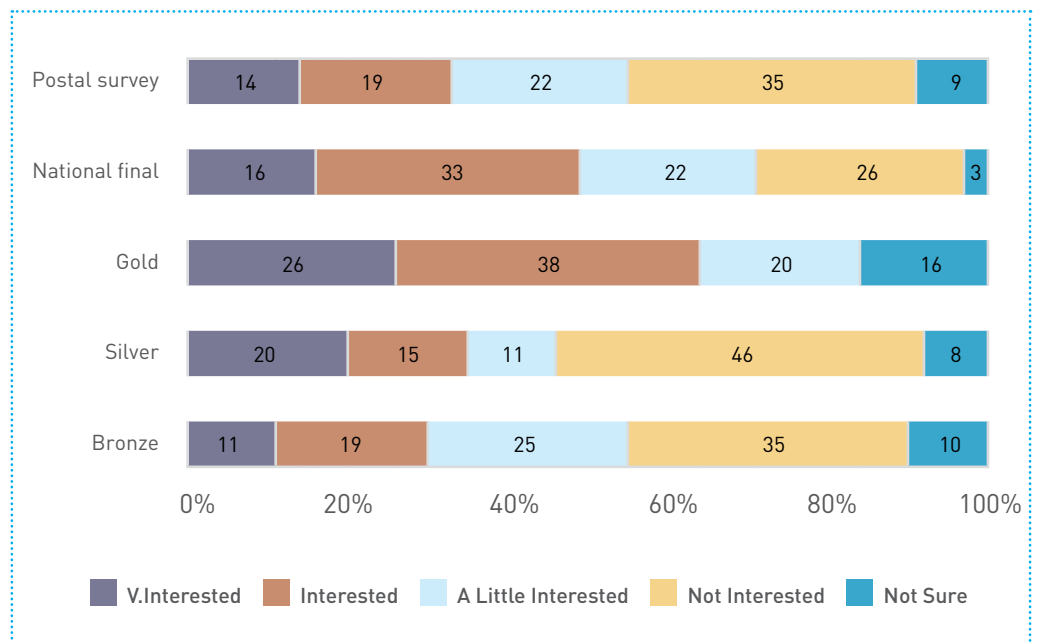
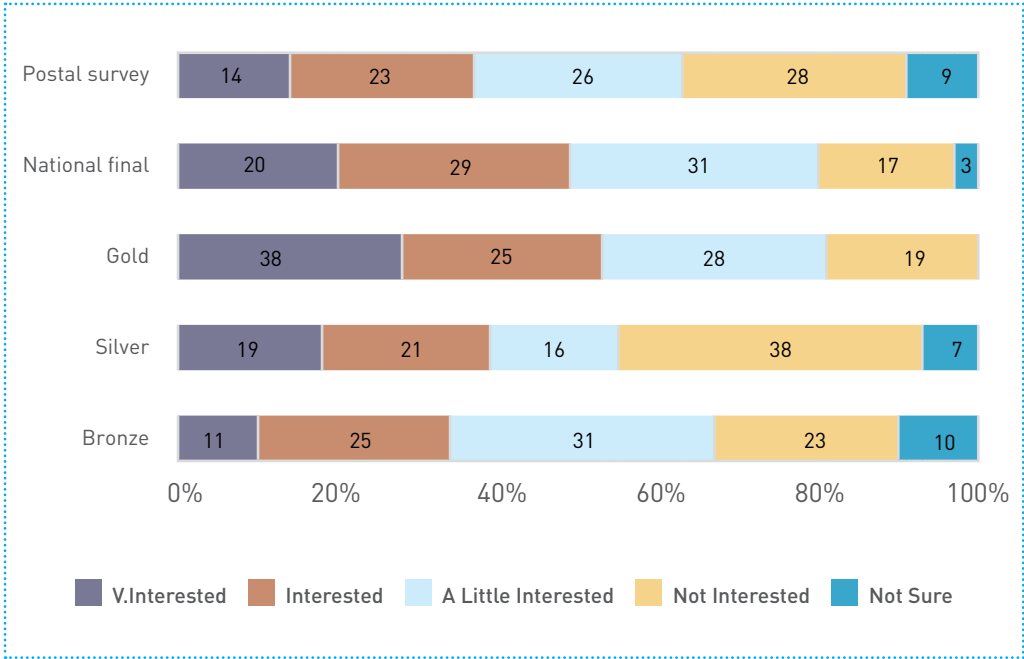


Figure 4.9 Pre-existing attitudes towards technology careers



Unsurprisingly, the proportions interested in careers in SET are lower than the proportions interested in SET generally. Again more young people appear to be interested in science careers than careers in engineering and technology.

4.4 How is CREST used in schools?

4.4.1 Year groups

Students were asked a number of questions about the way they had achieved their CREST awards, including how long the awards had taken them to complete and what year group they were in when they received the award. Guidelines from the BA are as follows:

Bronze

10 hours of project work
Typically for ages 11-14

Silver

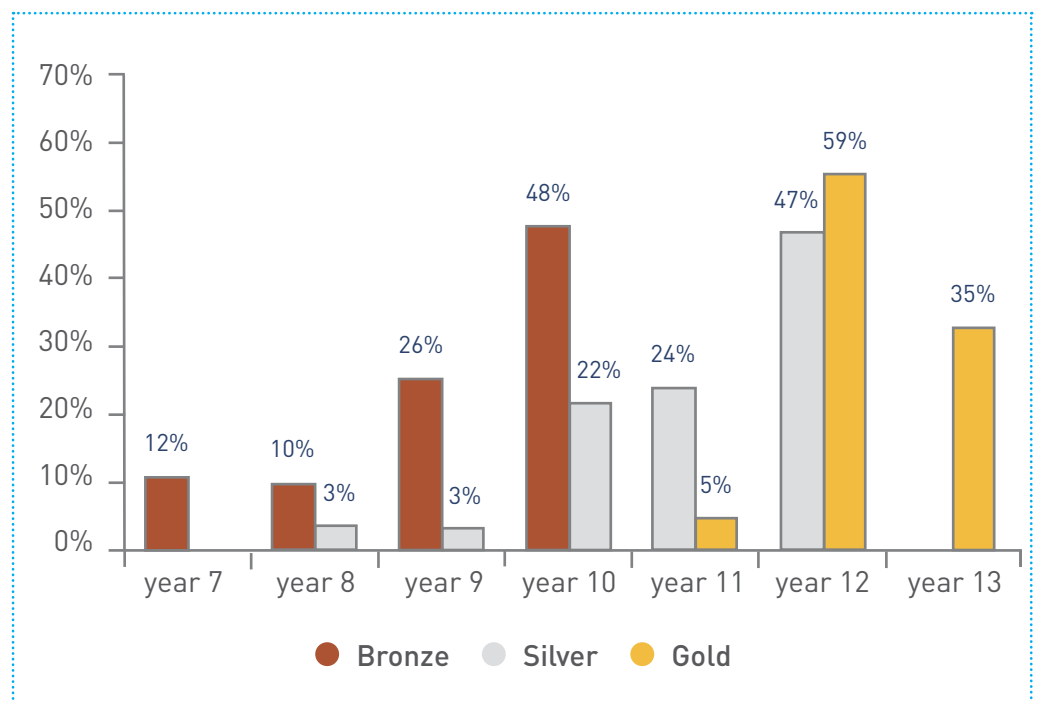
40 hours of project work
Typically for students aged 14-16
Links with industry encouraged

Gold

100 hours of project work
Typically for students aged 16+
Students linked with mentor from industry or higher education
Can accredit Nuffield Bursary placements and Engineering Education Scheme (EES) project work

The related results from the survey are shown in Figures 4.10 and 4.11 below.

Figure 4.10 Year group in which students completed CREST awards



The graph shows that there is some overlap in when students complete the awards. Years 10 and 12 are popular times, probably because students do not have major examinations in these years. It is interesting that the largest proportion of both Bronze and Silver awards are completed at the upper ends of the recommended age ranges.

4.4.2 Time spent on awards

Figure 4.11 shows how long students spent completing the awards at different levels.

Figure 4.11 Time spent on the different level awards

Award	Time range (hours)	Percentage of students
Bronze	Less than 5 hours	6%
	5-15 hours	77%
	More than 15 hours	17%
Silver	Less than 20 hours	19%
	20-60 hours	55%
	More than 60 hours	25%
Gold	Less than 70 hours	15%
	70-150 hours	49%
	More than 150 hours	36%

Students were asked how long it had taken them to complete each of the awards. From the results, it is not clear how students have estimated the total number of hours; for example some students said their Gold projects has taken 400 hours – the equivalent of more than 10 weeks full-time work. It could be that students included all the hours that, for example, a detector was running, or all the hours that they were away on a field trip, rather than just the hours they spent working on the project.

A significant proportion of students at Silver and Gold level are spending either more or less than the recommended time on their projects. At Bronze level, most students (77%) appear to be completing their awards within 5 hours of the recommended time (10 hours). The data suggest that there is a greater variation in the duration of projects at the higher levels.

4.4.3 Where did students complete their projects?

Students were asked where they completed their projects. Multiple choice options were developed following the questionnaire pilot and consultation with the BA and CREST sponsors. The results are presented in Figure 4.12 below:

Figure 4.12 Where did students complete their CREST awards?

Award	In class	At home	Science club	DT club	Nuffield Bursary	Young Enterprise	Engineering Education Scheme	Other
Bronze	72%	28%	10%	3%	-	1%	1%	13%
Silver	40%	26%	22%	5%	-	24%	-	6%
Gold	16%	11%	-	2%	32%	-	40%	8%

These results give an interesting insight into how CREST is delivered. It is clear that most Bronze awards are completed in class with students doing further work at home. Many of the 'other' responses came from groups of students who had completed their awards at another activity – 21 students at a Robotics day and 7 at Anfield football ground in Liverpool. Silver awards were the most likely CREST awards to be completed at a science club or linked to the Young Enterprise scheme. A large proportion of Gold awards were completed through the Nuffield Bursary or Engineering Education Scheme.

4.4.4 Did students work alone or in groups?

One of the survey items aimed to discover whether students worked alone or in groups for the awards at different levels. Results are presented in Figure 3.13 below.

Figure 4.13 Did students work alone or in groups?

Award	Alone	Pair	Group of 3-5	Group of 5-10	Group of more than 10
Bronze	34%	21%	41%	1%	1%
Silver	43%	16%	17%	10%	13%
Gold	47%	7%	44%	1%	-

Students appeared to be most likely to complete the awards alone or in groups of 3-5. Groups of more than five were most common for the Silver awards.

4.5 CREST resources

Students were asked which resources they used to help them with their CREST project. The results are presented in Figure 4.14 below.

Figure 4.14 Resources that students used for CREST

Award	Percentage of students who used the resource						
	CREST website	Other website	Books	Teacher	Parent or guardian	Mentor	Other
Bronze	13%	66%	78%	96%	47%	31%	13%
Silver	24%	64%	66%	97%	54%	30%	16%
Gold	35%	77%	71%	89%	60%	76%	12%

Students were most likely to use websites, books and teachers to help them with their projects. The proportion of students who used the CREST website increased with the level of the awards, but only one in three Gold award students used it suggesting that this resource is under-used. As expected, Gold award students were much more likely to use a mentor than students at other levels.

Students were asked to rate the helpfulness of each resource they used on a four point scale: 'very helpful', 'helpful', 'a little helpful' or 'not helpful'. Figure 3.15 below shows the percentage of students who felt each resource was 'helpful' or 'very helpful'.

Figure 4.15 Resources that students used for CREST

Award	Percentage of students who thought resources were helpful					
	CREST website	Other website	Books	Teacher	Parent or guardian	Mentor
Helpful or very helpful	52%	77%	78%	86%	44%	69%

As well as being the resource students were most likely to use during CREST, the largest proportion of students rated teachers as helpful in completing their projects. These findings underline the important role of teachers in the scheme. A few teachers were even named and thanked by students in later sections of the questionnaire:

"It was great fun! My technology teacher was fabulous!" (Year 10 female)

Websites, books and mentors were also rated as helpful by respondents.

4.6 Impressions of CREST

4.6.1 The best and worst parts of CREST

Students were asked to describe the 'best thing' and 'worst thing' about CREST. Responses were in multiple-choice format; the list of options was developed following the pilot survey. Students were asked to select one or two items from the list. Results are presented in Figures 4.16 and 4.17 below, disaggregated by award level.

Figure 4.16 Students' favourite aspects of CREST

Aspect	Bronze		Silver		Gold	
	n	%	n	%	n	%
Learning new skills	145	26%	35	21%	59	39%
Doing the investigation	136	24%	21	13%	27	18%
Working in a group	97	7%	34	21%	22	14%
Freedom to choose the experiment	7	13%	36	22%	17	11%
Receiving the certificate	72	13%	28	17%	14	9%
Working alone	18	3%	4	2%	6	4%
Something else	23	4%	5	3%	7	5%

For all levels the most popular aspects were learning new skills, doing the investigation and working in groups. More detailed feedback on the skills students felt they developed is available in section 4.8.1. Freedom to choose the experiment was also a popular aspect, especially at Silver.

Figure 4.17 Students' least favourite aspects of CREST

Aspect	Bronze		Silver		Gold	
	n	%	n	%	n	%
Writing the report	96	22%	17	13%	16	16%
Hard work	75	17%	24	18%	16	16%
No choice in experiment	71	16%	3	2%	8	8%
Disagreements in group	51	11%	18	14%	5	5%
Stressful	43	10%	28	21%	12	2%
Giving up time	39	9%	27	20%	15	15%
Presentation	26	6%	27	20%	15	15%
Travel	12	3%	1	1%	3	3%
Something else	31	7%	5	4%	12	12%

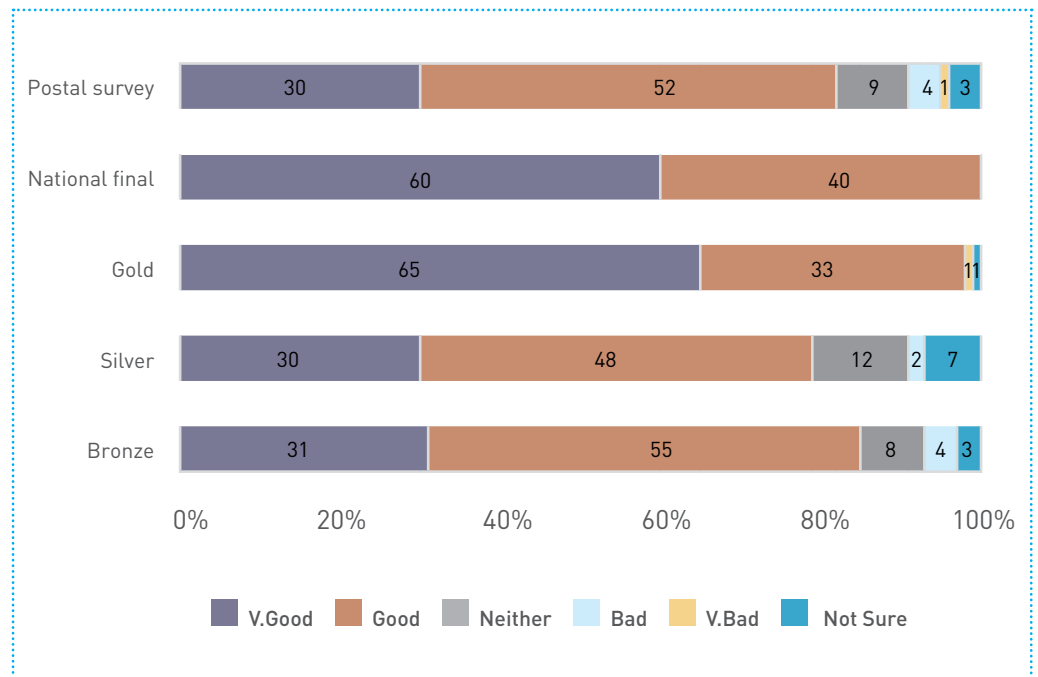
Most students found the hard work and report writing the least enjoyable aspects of the project. It is interesting to note that students who did the Silver awards found it stressful, and didn't like giving up time. A few commented in the 'other' responses that the project had clashed with examinations and revision, so this may explain why giving up extra time was stressful for some students at that stage. Students who completed the Bronze award appeared to be the most displeased if they were unable to choose their own experiment.

It is also interesting to note that in total students reported more positive than negative aspects of the programme.

4.6.2 Students' impressions of CREST

The questionnaires asked students about their impressions of different elements of the CREST scheme and about their overall impressions of the scheme. This section presents these results. Students' overall impressions of the CREST scheme were disaggregated by the highest level of award they had completed and whether they completed their surveys at the national final. Results are presented in Figure 4.18 below:

Figure 4.18 Students' overall impressions of CREST



Students had a very positive opinion of the CREST scheme, with a large majority rating it 'good' or 'very good' (100% in the case of the national final). These results are especially encouraging for an intervention such as CREST because often it is not the students who choose to take part in the scheme.

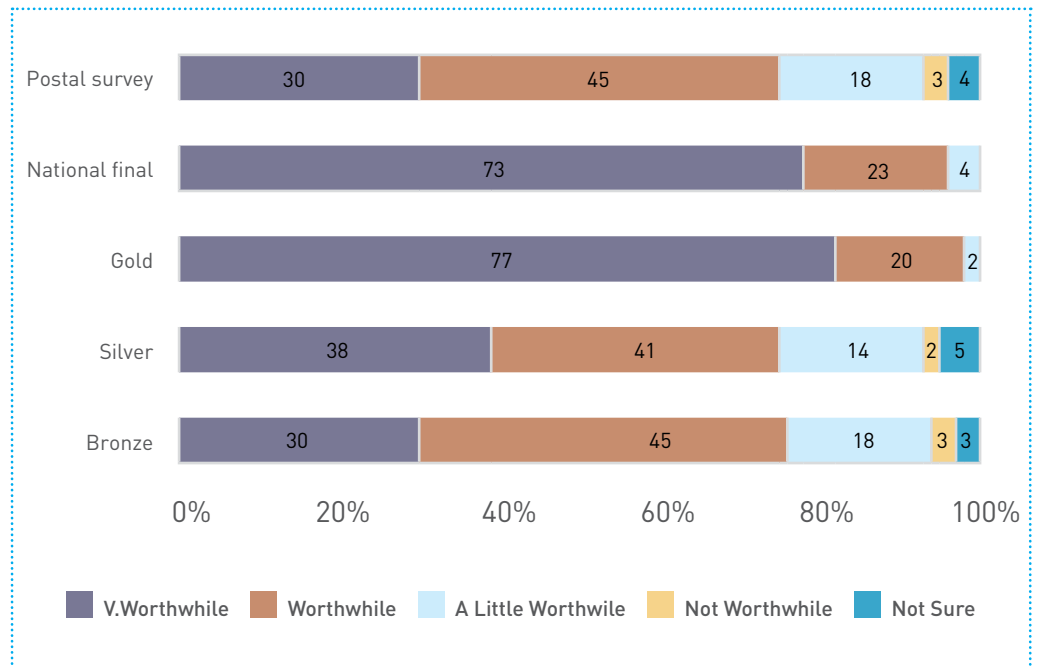
"I thoroughly enjoyed creating the game and CREST has given me a great opportunity" (Year 10 female, Bronze award)

"Crest and the robotics day was a great experience and has really made me think" (Year 9 female, Bronze award)

"It's pure class!" (Year 11 male, Silver award)

Students were also asked how worthwhile they felt that their involvement in CREST had been. Results are presented in Figure 4.19 below.

Figure 4.19 Students' opinions of whether CREST was worthwhile



A large majority of students agreed that CREST was a worthwhile experience. Students who attended the national final were more likely to respond that CREST was 'very worthwhile'. Only twelve students out of the entire sample of 512 (3%) felt that CREST was not worthwhile. These results indicate that students value the CREST experience, especially at Gold level and at the national final.

"It's the most worthwhile thing I think I have ever done! Thank you!"
 (Year 13 female, Gold award, National final)

"Doing a project really opens your eyes to what technology can achieve"
 (Year 9 male, Silver award)

4.6.3 Teachers' impressions of CREST

Teachers were also asked about their impressions of the CREST scheme. On the whole they rated it highly. Comments included:

"A good scheme that rewards students and allows them to further develop their interest in science" (Science teacher)

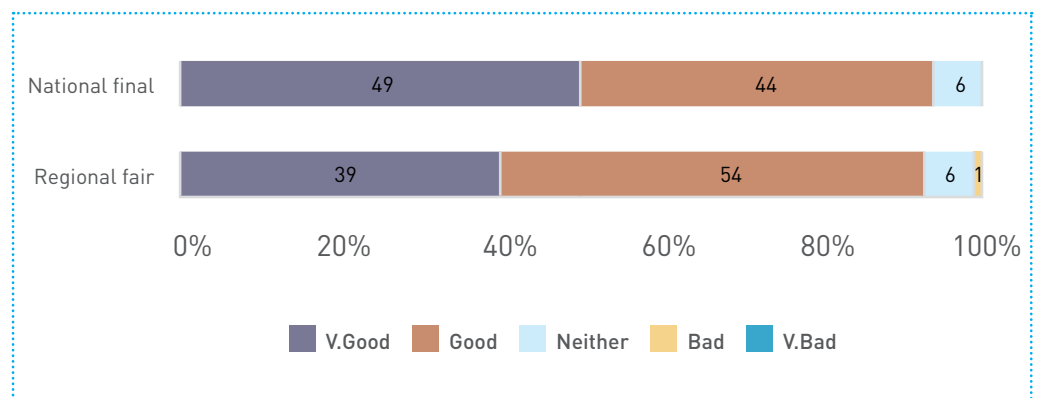
"Has a positive impact & generates interest in science research. Ownership & the competitive element make it more relevant to pupils" (Biology teacher)

"A very valuable scheme which is recognised by a growing amount of employers and institutions" (DT teacher)

4.7 Regional and national fairs

Nearly half of the students in the sample (46%) had attended the regional fair, and around one in four (23%) attended the national final. These numbers are inflated because a fifth of the questionnaires were completed at the national final. Only ten students who completed questionnaires in the postal survey had attended the national fair. Figure 4.20 shows students' responses to the questionnaire items related to the regional and national fairs.

Figure 4.20 Students' impressions of the regional fair (n=232) and the national final (n=114)



Students rated the regional and national fairs very highly. An overwhelming majority (93%) rated the regional fairs as 'good' or 'very good' and a similar proportion (93%) said the same for the national fair, although fewer had attended the national fair.

Comments on the regional fair included:

"It was a very fun day and we all had a good time" (Year 7 female)

"I saw other projects which opened my mind to other things" (Year 9 male)

"A chance to see real science development and talk to real scientists & different areas" (Year 12 female)

Comments on the national fair included:

"I enjoyed talking to the judges and there were lots of activities to do"
(Year 8 female)

"The venue was great and the projects were very good" (Year 9 male)

"It was good to show others what we had achieved" (Year 13 male)

Only a small minority of students made negative comments about either their regional fair or the national final. Of these the most frequent regarded waiting around, not being able to sit down or not feeling there were enough activities to keep them entertained.

4.8 CREST impacts

4.8.1 Knowledge and skills

Students were asked a number of questions related to the impact of CREST. The first two addressed learning, both in terms of key messages and the development of skills. Student questionnaires included multiple choice options, which were developed during the survey's pilot stage. Where possible balanced options were given to avoid leading the respondents. Results are given below, in Figures 4.21 and 4.22.

Figure 4.21 What did you learn from CREST?

Message	Bronze		Silver		Gold	
	n	%	n	%	n	%
SET can be fun	187	24%	40	21%	43	15%
SET related to the investigation	120	15%	25	13%	59	21%
SET can be hard work	117	15%	30	15%	40	14%
What it's like to work in SET	114	15%	23	2%	45	16%
How SET fits in with society	97	13%	26	13%	43	15%
I want a career with SET	43	6%	21	11%	45	16%
I don't want a career in SET	55	7%	17	9%	2	1%
I learned nothing	16	2%	12	6%	0	0%
I learned something else	26	3%	1	1%	4	1%
Average No. of Messages	2.3		2.0		3.4	

A major learning outcome for all levels appeared to be 'SET can be fun'. Students also gained knowledge specific to their investigations, for example 'how birds feed'. It was interesting that a significant proportion felt their involvement had taught them more about 'how SET fits in with society'. The proportion of students that had learned about careers increased from Bronze to Silver to Gold.

The number of boxes that each student ticked was also recorded. It appears that most Bronze and Silver students felt they had learned two items from the list and those who had taken part at Gold level had learned three or four.

Some more subtle impacts were indicated by students' responses to the 'I learned something else' item. One Bronze level student said she had learned that 'girls can be involved in engineering', while a Gold level student had learned 'how companies work'.

Figure 4.22 What skills did you develop from CREST?

Skill	Bronze		Silver		Gold	
	n	%	n	%	n	%
Teamwork	187	13%	49	11%	39	8%
Organisation	177	13%	47	11%	62	12%
Research skills	148	11%	48	11%	51	10%
Creativity	139	10%	43	10%	37	7%
Practical science skills	137	10%	23	5%	42	8%
Presentation skills	124	9%	47	11%	56	11%
IT skills	121	9%	41	10%	33	7%
Problem-solving	115	8%	42	10%	63	13%
Confidence	115	8%	39	9%	52	10%
Report-writing	86	6%	30	7%	56	11%
CV/UCAS form	13	1%	13	3%	7	1%
No skills	18	1%	5	1%	0	0%
Something else	8	1%	1	0%	1	0%
Average number of skills	4.2		4.7		6.1	

It is clear from these results that students felt they had developed a range of skills from their involvement in CREST. Teamwork and organisation were top of the list for Bronze and Silver level students, while Gold students felt that they had developed their problem-solving abilities. Again, the average number of skills gained was calculated and students who achieved Gold CREST ticked more boxes than those at the Bronze and Silver levels.

4.8.2 Attitudes and aspirations

The questionnaire survey also probed whether CREST had changed students' attitudes towards SET, their aspirations to SET in higher education (HE) and SET careers. The results are presented in this section. Firstly, Figures 4.23 to 4.25 present the results on SET attitudes.

Figure 4.23 Opinion about science

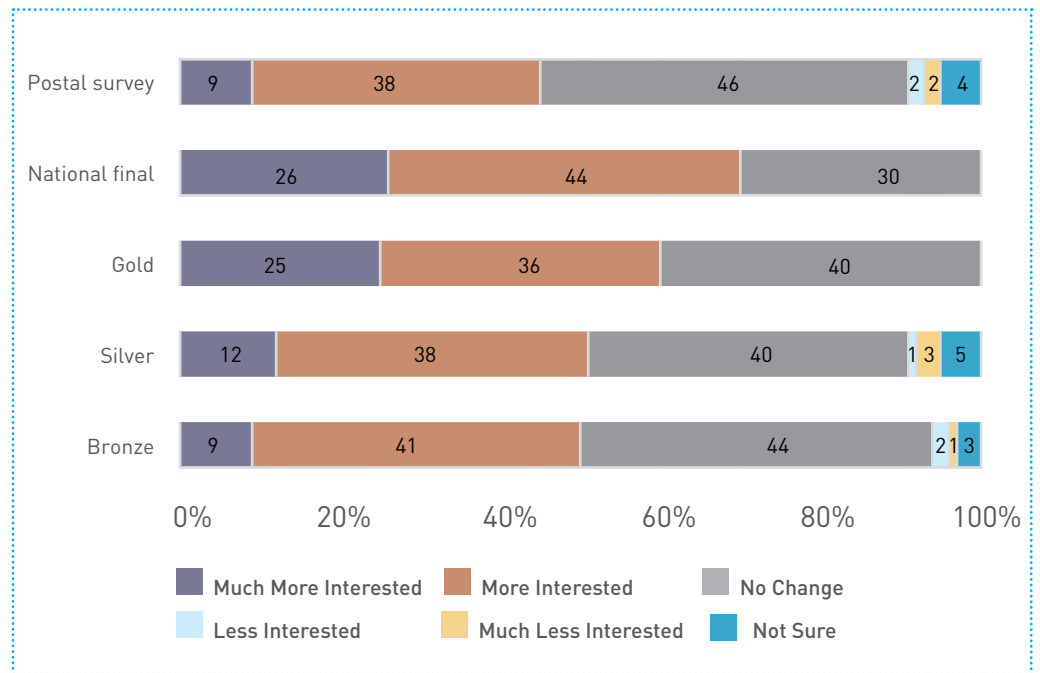


Figure 4.24 Opinion about engineering

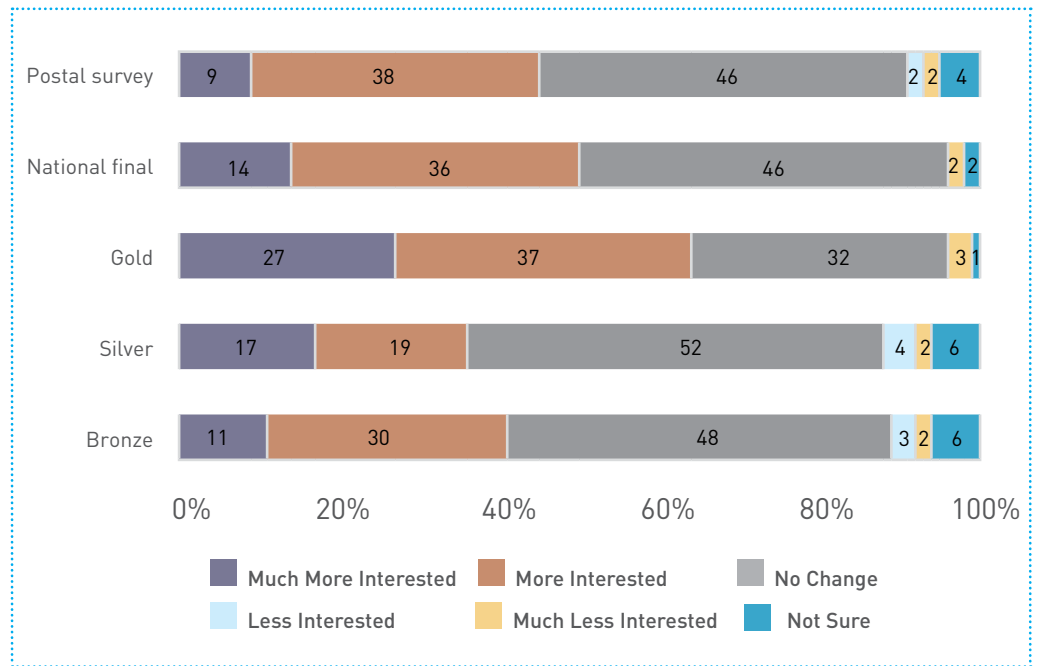
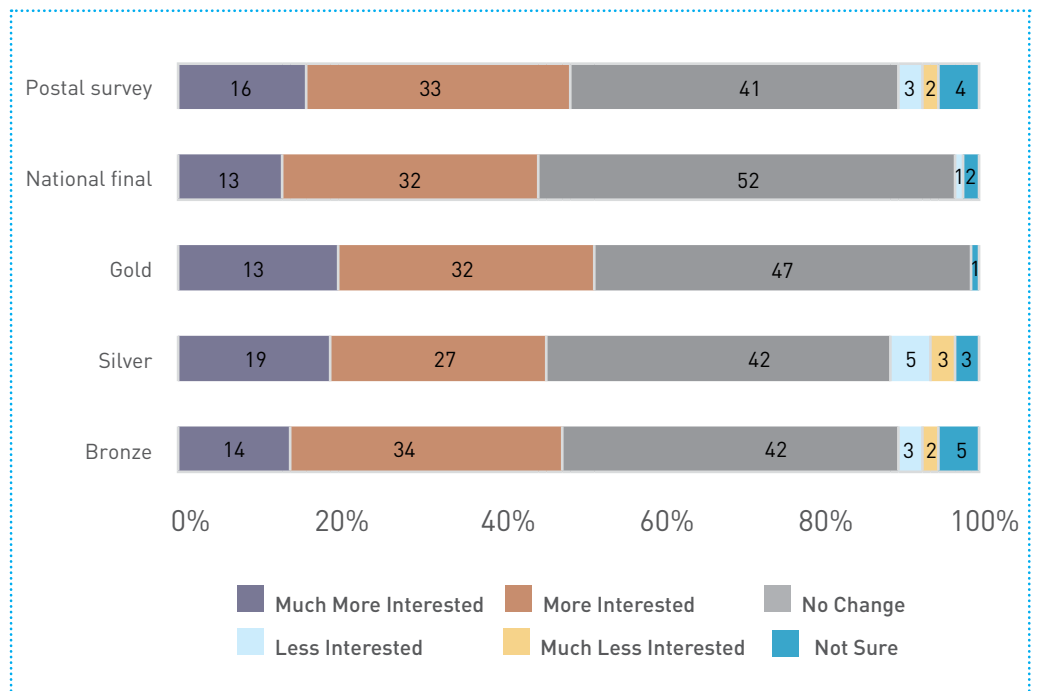


Figure 4.25 Opinion about technology



Over half of the students surveyed (52%) said that they were more interested in science as a result of the scheme. Slightly fewer said they were more interested in engineering or technology as a result of their involvement (43% and 49% respectively). The national final appears to have had the strongest impact on attitudes towards science, while the Gold award has a stronger impact on engineering and technology. Additional student comments included the following:

“We were given an actual engineering problem which we had to solve making us realise the relevance of engineering in society”
 (Year 13 female, Gold award)

“I learned that you could have fun and do hard work at the same time”
 (Year 10 male, Bronze award)

“Because before I wasn’t that interested but I am now very interested”
 (Year 10 male, Bronze award)

4.8.3 Aspirations to SET in HE

The questionnaire asked whether involvement in CREST had changed how students felt about SET in higher education. Figure 4.26 shows the results.

Figure 4.26 Aspirations to science in HE

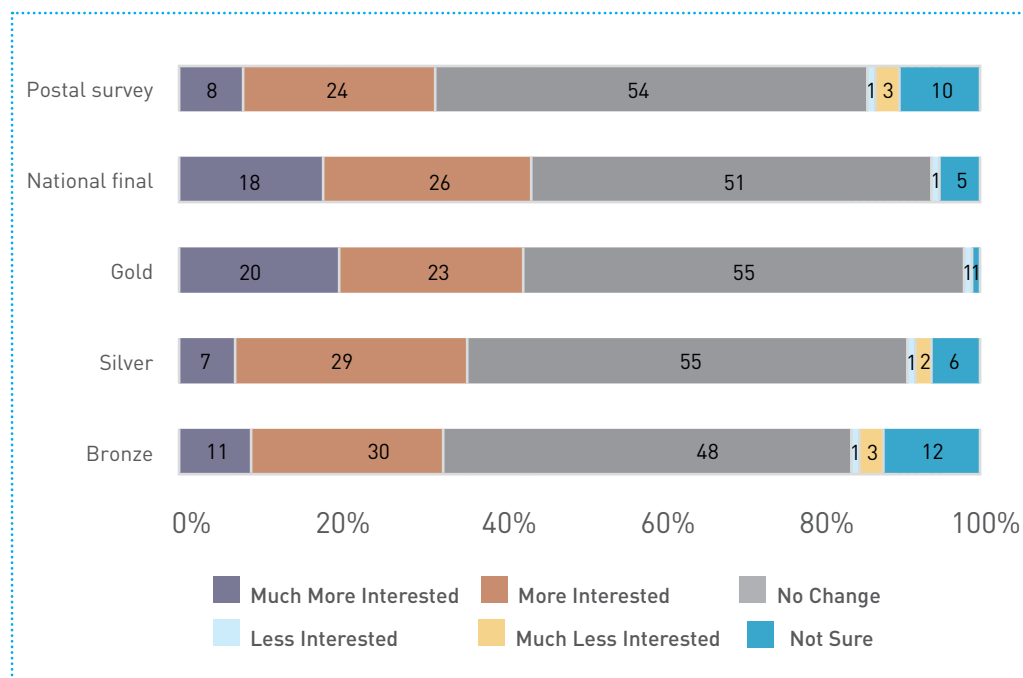


Figure 4.27 Aspirations to engineering in HE

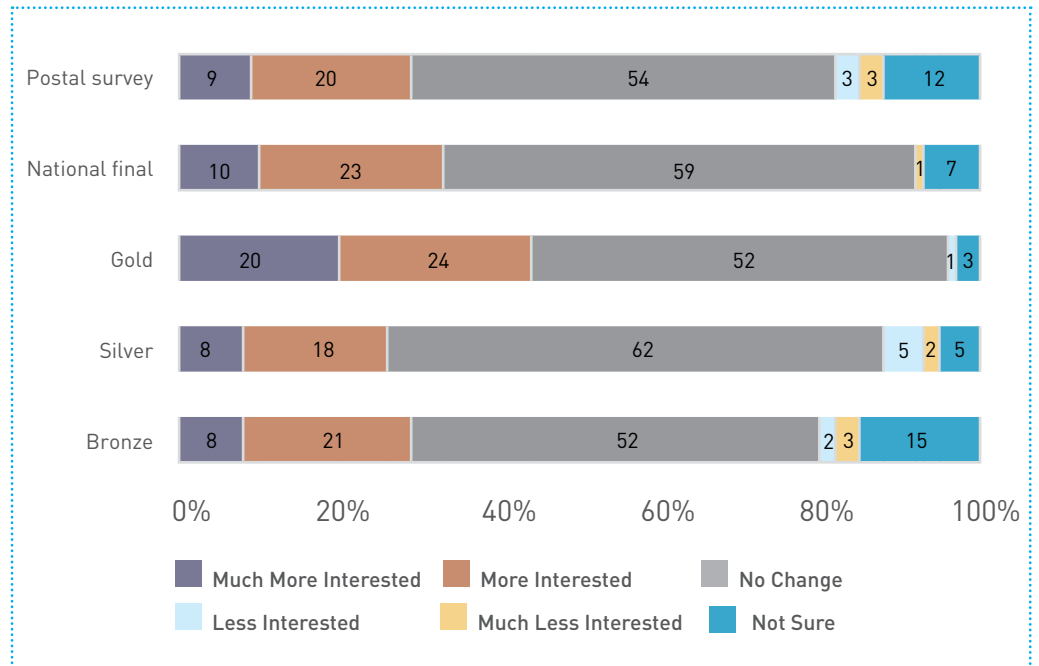
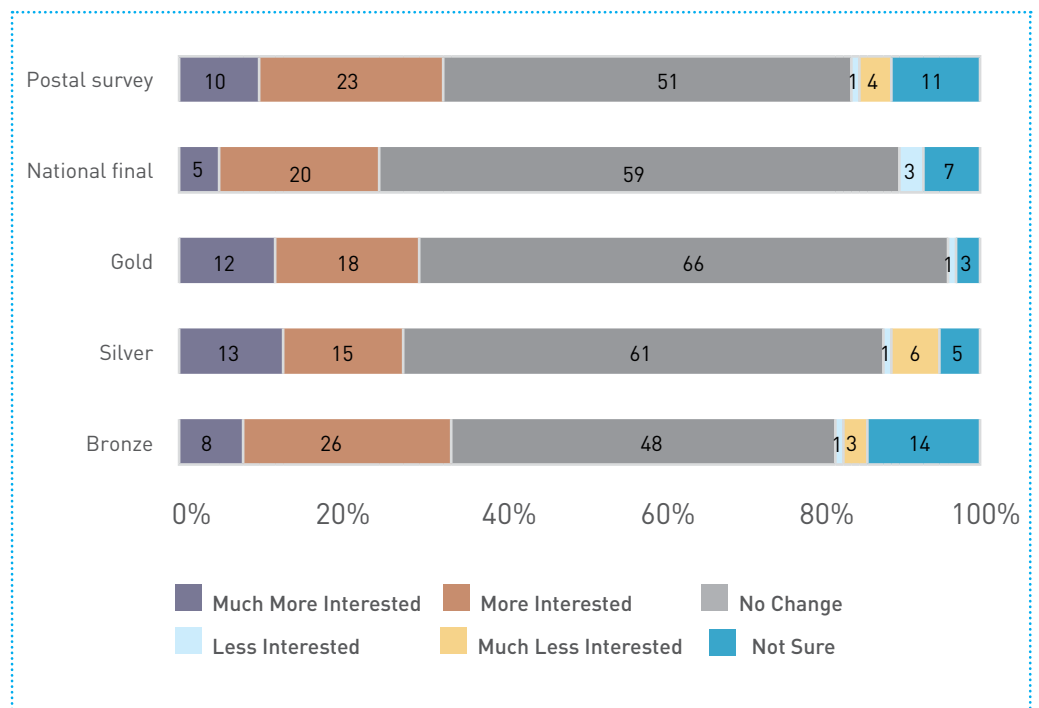


Figure 4.28 Aspirations to technology in HE



A third (35%) said that as a result of CREST, they were more interested or much more interested in science in HE and slightly smaller proportions said they were more interested or much more interested in engineering or technology as HE options (30% and 32% respectively). Students' comments included:

"I would like to do something like civil engineering so it gave me an insight"
 (Year 10 female, Bronze award)

"I want to go to uni to see how I can relate science to my environment"
 (Year 11 female, Silver award, National final)

"I was already interested" (Year 7 female, Bronze award)

4.8.4 Careers in SET

The next question asked whether CREST had changed the way respondents felt about a future career in SET. Results are given in figures 4.29 to 4.31 below.

Figure 4.29 Students' opinions of science careers

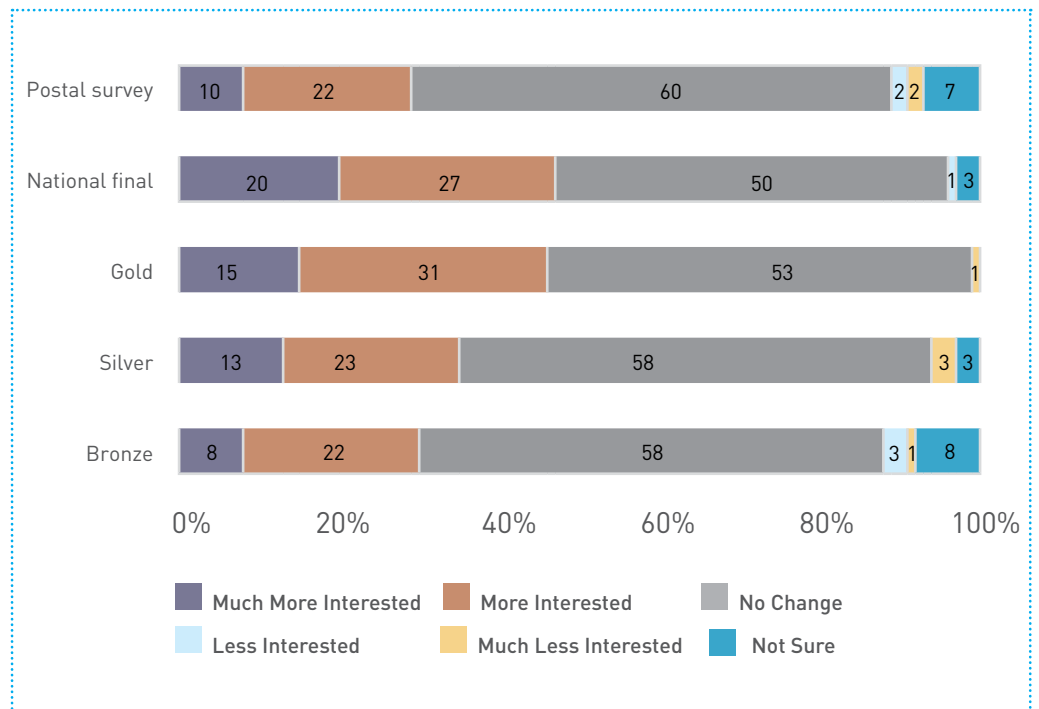


Figure 4.30 Students' opinions of engineering careers

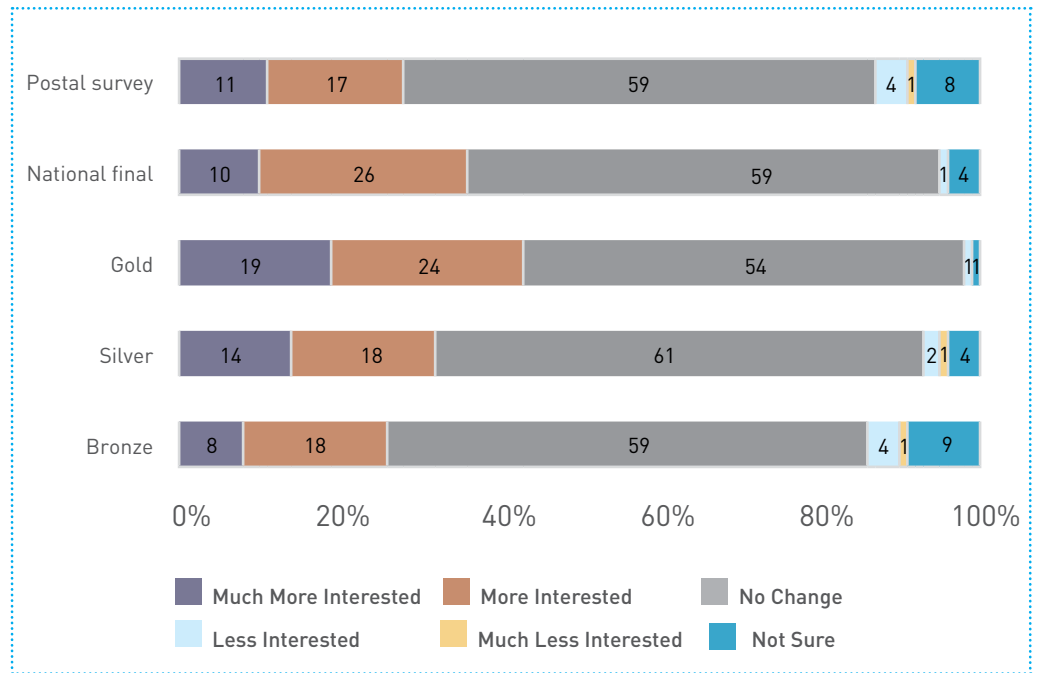
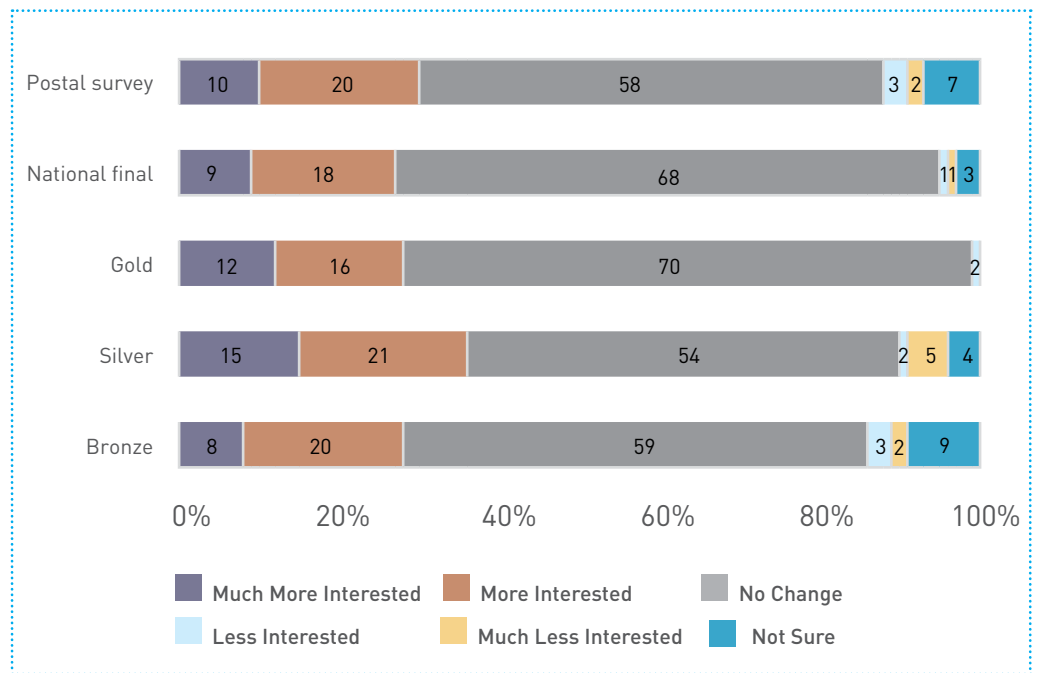


Figure 4.31 Students' opinions of technology careers



Again, interest in science careers was improved more strongly than for careers in engineering and technology. A third (33%) of respondents said they were more interested or much more interested in a scientific career compared with 29% for engineering and 29% for technology.

“I always liked science but this has made me realise how many careers include SET” (S3/Year 10 female, Bronze award)

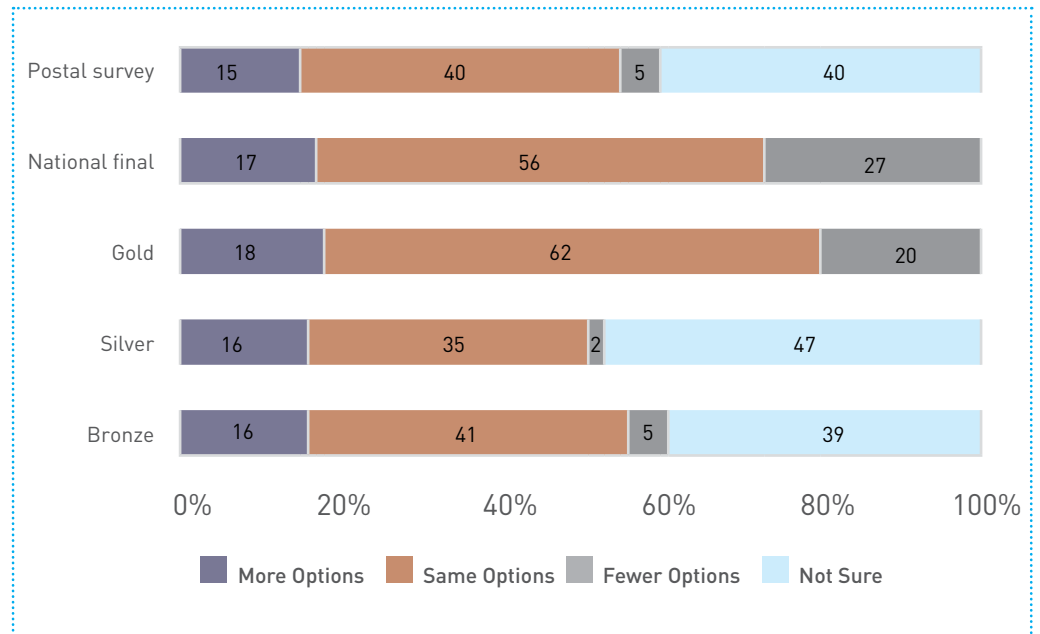
“I enjoy science and I was always looking for a career in it anyway”
(Year 9 male, Bronze award)

“I found out what it would be like to be a researcher”
(Year 13 male, Gold award, national final)

4.8.5 Impact on course choices

Students were asked whether their involvement in CREST had changed the number or type of SET options that they had chosen or were likely to choose. Results are presented in Figure 4.32 below.

Figure 4.32 Impact on SET options



One in eight students in the sample (16%) said that they had chosen or would choose more SET options as a result of participation in CREST. However, a small proportion (3%) said they would choose fewer options as a result of the scheme. This may be linked to the finding that CREST shows students what a career in SET can be like, and this has the potential to influence decisions in both directions depending on the individual. It is also apparent that students who completed the Gold award are clearer about their options than those at Bronze and Silver. Respondents' comments included:

“Technology was just fun, now I’m doing it for GCSE”
(Year 10 male, Bronze award)

“I think it made a big change in my choice of A Levels for college I am planning to study tech but Crest made me more enthusiastic about my choice”
(Year 11 female, Silver award)

“I have already chosen my subjects before the scheme”
(Year 12 female, Gold award)

4.8.6 Relationship between pre-existing attitudes and impacts

The relationship between students' pre-existing interest in SET and the impacts of CREST was explored. Results are presented in Figure 4.33 below.

Figure 4.33 Relationship between pre-existing attitudes and CREST impacts

More interested in... %	Pre-existing attitude				Total	p
	+	0	-	Not Sure		
Science	43	5	2	1	51	0.00
Engineering	35	5	1	2	43	0.00
Technology	43	3	1	1	48	0.00
A career in science	23	6	2	1	32	0.00
A career in engineering	20	6	3	0	29	0.00
A career in technology	20	7	2	1	30	0.00
Chose more SET options	14	1	1	0	16	0.00

NB + indicates responses 'very interesting' and 'interesting' for SET, and 'very interested' or 'interested' for SET careers. 0 indicates 'neither' for SET, and 'a little interested' for SET careers. - indicates 'very boring' and 'boring' for SET, and 'not interested' for SET careers.

Kendall's tau b test was applied to the five-point response data set to explore links between reported impacts and pre-existing attitudes towards SET. The data indicate that respondents with a pre-existing interest in science, engineering and technology were significantly more likely to report that CREST had increased their interest in SET. The findings for SET careers were similar. The pre-existing interest in science item was cross tabulated with the responses to the question about SET options to give the data in the final row of the table. All of the correlations were statistically significant at the 99% confidence interval.

Although it appears that students with a pre-existing interest in science are more likely to become more interested as a result of CREST, the data also show that some students that were ambivalent beforehand have also experienced a positive impact, as have some that were previously disinterested. The effect is slightly more marked for SET careers.

4.9 Teachers' perspectives on CREST impacts

Teachers were asked to reflect on the impact that CREST had on their students, themselves and their schools. Because the questions were open-form, category analysis was performed, where themes arising from the responses were grouped. The results are summarised in Figures 4.34 to 4.35 below:

Figure 4.34 Category analysis for teachers' perceptions of impact on students

Category	Number of responses
Stimulates interest and/or motivation	23
Gives a broader experience of science	20
Rewarding for students	6
Builds confidence	5
Develops transferable skills	4
Others	5

Teachers identified stimulating students' interest/motivation and giving students a broader context for their science as the main impacts of CREST. Comments included:

"Allows them to become confident, articulate students with ownership of their understanding"

(Biology teacher)

"Raises awareness that learning extends beyond the classroom"

(Science teacher)

"Creates enthusiasm, independent learning, greater interest in science"

(Science teacher)

Figure 4.35 Category analysis for impact of CREST on teachers

Category	Number of responses
Benefits to the students	33
Better informed teaching	11
Opportunity to work closely with students	7
Others	2

The majority of responses to this item of the questionnaire described the positive impact of CREST on students. Eleven teachers commented on the ways in which involvement in the scheme informs their teaching, for example through awareness of other schemes and resources, or by keeping up-to-date with the latest information on SET or SET careers. Some teachers also enjoyed the opportunity to work more closely with enthusiastic students. Comments included:

“It has made me realise how many other schools are involved in events like this and I never realised how many positive effects it would have on pupils’ views of science” (DT teacher)

“Real pride in students’ achievement – students have taught me!”
(Biology teacher)

“Keeps you up to date with current science as students like their projects to be up to date/relevant to them. Rewarding experience getting to work with interested young scientist - helps to see how they learn”
(Chemistry teacher)

Figure 4.36 Category analysis for impact of CREST on the school, and other impacts

Category	Number of responses
Benefit to students	18
Raises profile of SET within school	16
Raises profile of school	14
No impact reported	11
Better informed teaching	8
Increased SET uptake and attainment	5
Prize money/opportunities	4
Others	7

Teachers were asked to comment on the impact of CREST in their school and on any other impacts. The responses to the two questions fell into the same categories so they are grouped together here. The largest proportion of respondents cited the benefits to students (e.g. increased motivation) as a positive impact on the school. Many also mentioned the role of CREST in raising the profile of SET within the school (e.g. by presenting certificates during assembly) and in raising the profile of the school locally (e.g. through positive press coverage). The notion that involvement in CREST can help inform teaching was raised as a school-level impact and some teachers felt CREST boosted uptake and/or achievement in SET subjects. A few teachers gave examples of prize money or opportunities from CREST directly leading to further enrichment activities being established in school. Some teachers felt that there was no impact on the school or that they were too new to the scheme to comment. Responses to these questions included the following:

“Have previously (years ago) won it at Bronze level – money from this still supports scientist of the year award in yrs 7-10” (Physics teacher)

“Raised school profile within local area” (Science teacher)

“Impacts on the well being of students. Creates equal access for all to participate and be successful” (DT teacher)

“The head is very impressed that the girls are achieving high CREST awards” (Mathematics teacher)

4.10 Findings from teachers’ focus group

Six teachers took part in a focus group during July 2006. They had a range of levels of involvement with CREST. All but one had been involved at some time, two regularly participated in the scheme and the others took part sporadically. The views of this group were understandably more mixed than those from teachers that completed the questionnaires – the teachers for the questionnaire sample were either motivated enough to return the forms in the postal survey or were attending the national final.

Participants did not seem initially enthused about CREST and they used some of the discussion to air complaints about the scheme’s delivery in their area. However, as the conversation moved on to impacts, teachers reflected on the benefits of the scheme to students. One teacher ran Bronze CREST with all of Year 8 and said it was ‘one of the things they enjoyed most about science’. At Silver it was felt that CREST could provide focus for work in science clubs. Many of the impacts reported in the questionnaires were picked up by the teachers during the discussion. The advantages in motivating students and stimulating their interest were reiterated, as was the benefit of spending time with students that were keen on SET. Teachers felt the main reward for them was seeing the students gain confidence and skills through their involvement. The teachers agreed that using CREST awards to accredit achievement at an enrichment event worked very well.

There were a number of reasons why teachers lost motivation with CREST. An important one was the difficulty in finding experiments that were both exciting and achievable. Teachers new to the scheme described difficulties in grasping exactly what a student would need to do to achieve an award. The regional and national fairs were seen as a valuable aspect of the scheme, however there was some anxiety on the part of teachers should their students' work not match the standard of other schools at the event.

Identifying mentors for Gold awards was seen as a major challenge, and the discussion allowed those teachers that had been successful in this to share what had worked well, notably working with the Researchers in Residence scheme or the SETPOINT: most teachers in the group were not aware of these initiatives. All of the teachers felt that further communication about the benefits of the scheme and the opportunity to share experiences would be helpful.

4.11 Findings from mentors' focus group

A focus group was convened with scientists that mentor CREST Gold/Nuffield Bursary students. Unfortunately only three scientists were able to attend, although the findings are interesting nonetheless. All of the scientists worked at the same HEI but in different departments or research groups. The mentors had each worked with between 3 and 10 students in the past.

The main benefits of mentoring were seen to be the fresh perspective that mentees bring to the science. The mentors talked about being 'challenged' to explain their science in an accessible way and felt this was useful in clarifying their own ideas. Mentoring a student is also a useful way to gather data and occasionally students had contributed to publications. These benefits do not come for free however and mentors described some of the challenges, mainly the logistics of organising the placements.

The impacts on students were discussed at length. After the first placement schools had contacted the scientists each year to arrange further placements, meaning each mentor worked with a single school. It was agreed that this was a sign that the schools greatly valued the mentoring work, however there was some regret that further mentors from the HEI could not be recruited so that more schools could participate.

A number of impacts on students were discussed. Many of the skills that students reported developing in the questionnaire survey were listed by the mentors, including problem-solving and research skills, as well as report-writing and learning to keep a good lab book! However, the most interesting impacts were on students' decision-making. One mentor reported that all three students they had mentored over the last three years had intended to study medicine at the start of the placement. By the end of the placement all three had decided to study an alternative scientific subject. It was added that none of these new choices were directly related to the work of the placement research group; however there was a definite impact on decision-making. Another of the mentors described a previous mentee who, after completing their degree, is now employed as part of the research group, working on similar projects to their earlier Gold CREST award. The mentors agreed that careers information and advice related to scientific careers is woefully inadequate and that CREST provides a rare opportunity for students to gain a real insight into what it's like to work as a scientist. This, naturally, has a strong impact on their decision-making.

Although only a few mentors were involved in the study and the evidence is somewhat anecdotal, these findings support the data from the questionnaire survey and show an important role for CREST, especially at Gold level, in informing decision-making for future scientists.

5 Conclusion

These findings show that CREST appears to have a strong positive impact on students. Students at all levels felt they had improved their practical science skills and gained a clearer idea of 'what it's like to work in SET' and 'how SET fits in with society'. Attitudes towards SET and aspirations for SET careers are also significantly increased, slightly more so for science than for engineering and technology. Importantly involvement in the scheme appears to encourage students to continue with the study of SET subjects. Findings from teachers and mentors support the impacts measured for students. It also appears that the scheme has a positive benefit on teachers and indeed schools involved.

Few impact studies with this much depth exist so benchmarking is difficult. CREST appears to have a similar impact in terms of enjoyment and promoting interest in science as an interactive science lecture such as the recent Institute of Physics schools and colleges lecture, *Our Planet – Our Future*¹². 79% of participants rated the lecture as 'good' or 'very good' compared to 86% for CREST; 51% said they were more interested in science as a result of the lecture, compared to 52% for CREST. It should be noted when making these comparisons that the lecture was evaluated immediately after the presentation, whereas postal survey respondents may have completed their CREST awards several months previously. However, what is unique about the CREST scheme is the range of impacts it has. An interactive lecture, for example, can hardly hope to develop students' practical science and transferable skills or give them a sense of what it is like to be a career scientist working in a research lab. CREST delivers these impacts through a programme that is highly enjoyable and rewarding for a large majority of the young people involved.

There are a number of aspects of the CREST scheme that are fundamental to its success. Firstly, the fact that the content of the awards is student-led allows participants to, as one teacher put it: develop 'ownership of their understanding'. In an educational climate that is increasingly dominated by examinations and assessment it is no surprise that students respond so well to this approach. Another benefit of the scheme is its flexibility and way in which the awards at different levels cater for (or, more likely, have evolved to fit) the needs and interests of the students in their target groups. At Bronze level the emphasis is on fun, teamwork and transferable skills. This works well at KS3 where much research has indicated that students' attitudes towards science have already begun their decline¹³. At the other end of the spectrum Gold awards allow the most able students and potential future scientists to conduct some real research, giving them an accurate basis on which to make their important choices about university and careers. In addition, these students develop practical science and research skills that industries often find lacking in recent science graduates¹⁴.

¹² Bultitude & Grant (2006)

¹³ See for example, Spall (2005); Jarvis & Pell (2002)

¹⁴ ABPI (2005)

Silver awards provide a useful bridge between Bronze and Gold, maintaining continuity with the scheme. They are also a way of accrediting outstanding work that has been entered at the Bronze level. Because they are aimed at students in KS4 Silver awards can be used as an alternative means of accrediting work for students who may have good practical skills but tend to underperform in examinations. The recognition of CREST by educational institutions and employers gives the awards a useful 'currency'.

In summary, this impact study has found CREST to be a unique and valuable scheme that would benefit from greater promotion to allow more students to participate. The scheme has positive impacts on knowledge and skills, attitudes and aspirations, and decision-making for those involved and serves to raise the profile of SET in participating schools. Schemes such as CREST have a vital role to play in reversing the declining interest in SET subjects, inspiring future scientists and engineers and therefore contributing to future economic competitiveness.

6 References

- Association for the British Pharmaceutical Industry (2005)
Sustaining the skills pipeline in the pharmaceutical and biopharmaceutical industries
Available at <http://www.abpi.org.uk/Details.asp?ProductID=285>
- Bultitude K & Grant L (2006)
Our Planet – Our Future final report
Available at www.uwe.ac.uk/fas/graphicsscience/projects/talks/opof.htm
- Ebenezer JV & Zoller U (1993)
Grade 10 students' perceptions of and attitudes toward science teaching and school science
Journal of Research in Science Teaching 30, 175-186
- Hadden RA & Johnstone AH (1983)
Secondary school pupils' attitudes towards science: the year of erosion
European Journal of Science Education 5, 309-318
- HMSO (1988)
Education Reform Act 1988
Her Majesty's Stationery Office
- HMSO (1998)
Our Competitive Future - Building the Knowledge Driven Economy
Her Majesty's Stationery Office
- HM Treasury (2004)
Science and innovation investment framework 2004-2014
Her Majesty's Stationery Office
- HM Treasury (2006)
Science and innovation investment framework 2004-2014:next steps
Her Majesty's Stationery Office
- House of Commons (2002)
Science Education from 14 to 19
Select Committee on Science and Technology Third Report
Her Majesty's Stationery Office
- Jarvis T & Pell A (2002)
Effect of the Challenger Experience on Elementary children's attitudes towards science
Journal of Research in Science Teaching 39 (10), 979-1000

Organisation for Economic Co-operation and Development (1996)
The Knowledge-Based Economy
Available at <http://www.oecd.org/dataoecd/51/8/1913021.pdf>

Osborne J, Simon S & Collins S (2003)
Attitudes towards science: a review of the literature and its implications
International Journal of Science Education 25(9) 1049-1079

Pell T & Jarvis T (2001)
Developing attitude to science scales for use with children of ages from five to eleven years
International Journal of Science Education 23, 847-862

Reid N & Skryabina EA (2002)
Attitudes towards physics
Research in Science & Technological Education 20 (1) 67-81

Roberts (2002)
The supply of people with science, technology, engineering and mathematics skills
Her Majesty's Stationery Office

Spall K (2005)
Students' perceptions of physics and biology
PhD thesis, University of Liverpool

Sundberg MD, Dini ML & Li E (1994)
Decreasing course content improves student comprehension of science and attitudes towards science in freshman biology
Journal of Research in Science Teaching 31, 679-693

Williams C, Stanistreet M, Spall K, Boyes E & Dickson D (2003)
Why aren't secondary students interested in physics?
Physics Education 38 (4), 324-329

Young BJ & Kellogg T (1983)
Science attitudes and preparation of preservice elementary teachers
Science Education 7, 279-291

Students - What do you think about CREST?

The CREST organisers are doing a survey to find out what students think about the CREST awards scheme. Please take a few moments to answer the following questions about CREST. Your answers will help the organisers improve the scheme, so please be as honest as you can.

Section A: this section is about you...

1. Your school
2. Your age
3. Your year group
4. Your gender

5. Please tick the boxes next to your ethnic group and origin:

Ethnic Group:

- White
- Mixed
- Asian or Asian British
- Black or Black British
- Other

Ethnic Origin:

- British
- Irish
- Other White Background
- White and Black Caribbean
- White and Black African
- White and Asian
- Other Mixed Background
- Indian
- Pakistani
- Bangladeshi
- Other Asian Background
- Caribbean
- African
- Other Black Background
- Chinese
- Other Ethnic Group

6. Do you consider yourself to have a disability? (Y/N)
7. If so, please specify the nature of the disability:
8. Are you registered disabled? (Y/N)

9. **Before** you took part in CREST, how did you feel about science, engineering and technology (SET)?

	Very Interesting	Interesting	Neither	Boring	Very Boring	Not sure
Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. **Before** you took part in CREST, how did you feel about a career in science, engineering or technology?

	Very Interested	Interested	A little interested	Not interested	Not sure
Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section B: this section is about your involvement in CREST...

11. Which of the following CREST awards have you **completed/will you complete**?

Bronze	Silver	Gold	None
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**** For questions 11 to 14, just fill in the answers for the awards relating to you ****

12. Roughly **how long** (in hours) would you say each project took?

Bronze hours Silver hours Gold hours

13. What **year group** were you in when you completed each of the projects?

Bronze hours Silver hours Gold hours

14. **Where** did you complete the awards? (tick more than one if appropriate)

	In class	At home	Science club	DT club	Nuffield Scheme	Young Enterprise	Engineering Education Scheme	Other (please state)
Bronze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. Please tick whether you worked **alone or in a group**

	Alone	Pair	Group of 3-5	Group of 5-10	Group of 10 or more	Other (please state)
Bronze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. Which **resources** did you use, and how helpful were they? (tick the last box if you didn't use them)

	Very helpful	Helpful	A little helpful	Not helpful	Did not use
CREST website	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other website	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Books	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teacher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Parent/Guardian	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mentor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other Resource (please state)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

.....

17. Please tell us what you thought of the **regional fair** held in your area
(tick the last box if you didn't go)

Very Good

Good

Neither

Bad

Very Bad

Did not attend

Please tell us why you think this:

.....

18. Please tell us what you thought of the **national fair** held in London
(tick the last box if you didn't go)

Very Good

Good

Neither

Bad

Very Bad

Did not attend

Please tell us why you think this:

.....

19. Can you name any of the CREST **sponsors**? If so please write them below:

Section C: this section is about what you think of CREST...

20. What was the **best thing** about the CREST award? Tick one or two boxes.

- | | |
|---|--|
| <input type="checkbox"/> Freedom to choose the experiment | <input type="checkbox"/> Working in a group |
| <input type="checkbox"/> Receiving the certificate | <input type="checkbox"/> Something else (please state) |
| <input type="checkbox"/> Doing the experiment/investigation | <input type="checkbox"/> Working on my own |
| <input type="checkbox"/> Learning new skills | |

21. What was the **worst thing** about the CREST award? Tick one or two boxes.

- | | |
|--|--|
| <input type="checkbox"/> Giving up my own time | <input type="checkbox"/> Giving a presentation |
| <input type="checkbox"/> It was hard work | <input type="checkbox"/> Disagreements in my group |
| <input type="checkbox"/> Writing the report | <input type="checkbox"/> Travel |
| <input type="checkbox"/> Stress | <input type="checkbox"/> Something else (please state) |
| <input type="checkbox"/> Having the experiment chosen for me | |

22. What is your **overall impression** of CREST?

- | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Very Good | Good | Neither | Bad | Very Bad | Not Sure |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

23. Was CREST a **worthwhile experience** for you?

- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Very Worthwhile | Worthwhile | A Little Worthwhile | Not Worthwhile | Not Sure |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

24. What, if anything, do you feel you have **learned** from CREST? Please tick as many boxes as you like.

- | | |
|---|---|
| <input type="checkbox"/> Science, engineering and technology (SET) relating to my investigation | <input type="checkbox"/> What it is like to work in SET |
| <input type="checkbox"/> SET can be fun | <input type="checkbox"/> How SET fits in with the world/society |
| <input type="checkbox"/> SET can be hard work | <input type="checkbox"/> I have not learned anything |
| <input type="checkbox"/> That I want a career in SET | <input type="checkbox"/> I have learned something else
(please state)
..... |
| <input type="checkbox"/> That I don't want a career in SET | |

25. Has CREST helped you develop any of the following **skills**? Please tick as many boxes as you like.

- | | |
|--|---|
| <input type="checkbox"/> Problem Solving | <input type="checkbox"/> Research skills |
| <input type="checkbox"/> Organisation and planning | <input type="checkbox"/> Practical science skills |
| <input type="checkbox"/> Confidence | <input type="checkbox"/> IT skills |
| <input type="checkbox"/> Teamwork | <input type="checkbox"/> Presentation skills |
| <input type="checkbox"/> Creativity | <input type="checkbox"/> I didn't develop any skills |
| <input type="checkbox"/> Report-writing | <input type="checkbox"/> Something else (please state)
..... |
| <input type="checkbox"/> CV, UCAS form etc. | |

26. Did CREST change the way you **feel** about science, engineering or technology (SET)?

	Much more interested	More interested	No change	Less interested	Much less interested	Not sure
Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tell us why you think this:

.....

27. Did CREST change your opinion on **higher education/University** courses in SET?

	Much more interested	More interested	No change	Less interested	Much less interested	Not sure
Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tell us why you think this:

.....

28. Did CREST change your opinion on a **future career** in science, engineering and technology?

	Much more interested	More interested	No change	Less interested	Much less interested	Not sure
Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tell us why you think this:

.....

29. Has your involvement in CREST affected the number of school **SET options** (e.g. GCSEs or A levels) you chose, or are likely to choose in the future?

Chose/would choose
more SET options

Chose/would choose
the same options

Chose/would choose
fewer SET options

Not Sure

If so, please describe how:
.....

30. Are there any **other ways** in which CREST has had an impact on you? If so, what are they?

31. Do you have any ideas about how we could **improve** the CREST scheme?

32. Do you have **any other comments** about CREST? If so, please write them in the box below.

THANK YOU

Teachers - What do you think about CREST?

The CREST organisers are conducting a survey to find out what teachers and students think about the CREST awards scheme.

Please take a few moments to answer the following questions about CREST. Your answers will help the organisers improve the scheme, so please be as honest as you can! The responses will be treated anonymously and confidentially.

Section A: this section is about you...

1. Your school
2. Your position in the school
3. Subject taught
4. How long (in years) have you been involved with CREST?

5. Who co-ordinates CREST in your area?

6. How did you get involved in CREST?

7. Can you name any of the CREST sponsors? (Without checking!)

8. Which of the following CREST awards do students complete?

Bronze

Silver

Gold

None

**** For questions 8 to 11, just fill in the answers for the relevant awards ****

9. Each year, approximately **how many** students complete awards at each of the following levels?

Bronze Students

Silver..... Students

Gold..... Students

10. What **year groups** usually complete each of the levels?

Bronze Students

Silver..... Students

Gold..... Students

11. **Where** do students complete the awards (e.g. in class, science club, work experience, Nuffield scheme etc)?

	In class	At home	Science club	DT club	Nuffield Scheme	Young Enterprise	Engineering Education Scheme	Other (please state)
Bronze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Do students work **alone** or in **groups** (e.g. alone, pairs, class, year group)?

	Alone	Pair	Group of 3-5	Group of 5-10	Group of 10 or more	Other (please state)
Bronze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section B This section is about your opinions of the CREST scheme...

13. What **motivates** you to take part in CREST?

14. What would you say the main **barriers** to teachers taking part in the scheme are?

15. Which **resources** did you use, and how helpful were they?
(tick the last box if you didn't use them)

	Very helpful	Helpful	A little helpful	Not helpful	Did not use
Local CREST adviser	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CREST website	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other website	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Books	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mentor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other Resource (please state)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

.....

16. Please tell us what you thought of the **regional fair** held in your area
(tick the last box if you didn't go)

Very Good	Good	Neither	Bad	Very Bad	Did not attend
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tell us why you think this:
.....

17. Please tell us what you thought of the **national fair** held in London
(tick the last box if you didn't go)

Very Good	Good	Neither	Bad	Very Bad	Did not attend
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please tell us why you think this:
.....

18. Is the **support** you receive from your local CREST advisor appropriate?
Why or why not?

19. Do you use **mentors** for CREST? If so, who organises this?
Please comment on how well it works.

20. What is your overall **opinion of the CREST scheme?**

Very Good	Good	Neither	Bad	Very Bad	Did not attend
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section C This section is about the impact of CREST...

21. What impact, if any, do you feel that the scheme has on **your students**? Why?

22. Has the scheme had an impact on **you**? If so, in what way?

23. Has the scheme had an impact on **your school**? If so, in what way?

Section D This section is about the future of CREST...

25. Which aspects of the scheme do you think are **good, and should be retained**?

-
-
-

26. Which aspects of the scheme do you think **should be improved**?

-
-
-

27. Do you have any other ideas about how CREST could be **improved** in the future?



28. Do you have **any other comments** about CREST? If so, please write them in the box below:

