BA CREST AWARDS- CELEBRATING CREATIVITY IN SCIENCE AND TECHNOLOGY

Sharmila Banerjee

British Association for the Advancement of Science
165, Queen's Gate, London SW7 5HE, UK

ABSTRACT
BA CREST Awards-Celebrating CREativity in Science and technology aims to develop curiosity in young people aged 11-19 to carry out authentic project work in science and technology. Through a mentoring system, the scheme builds links between schools and industry or higher education. It enables students of all abilities to explore relevant scientific or technological problems and promotes work-related learning. By recognising and accrediting student's achievements, BA CREST Awards help young people realise their potential and develop motivation and confidence, encouraging them to pursue careers in science, engineering and technology.

INDEX TERMS
Young people carrying out and communicating project work in science and technology

INTRODUCTION

'Science is boring, lacks relevance and is full of known certainties'. This is the attitude, and one of the many reasons why young people are turning their back on science and technology in the UK. This view is highlighted by the Robert's review (2002) and *Connecting Science* report (2005). The science curriculum in UK schools primarily reinforces these ideas and one of the main issues is the demanding delivery of an extensive 'science content' curriculum as illustrated by the *Report on Science Education from 14-19* (House of Lords Select committee on Science and Technology 2002). This has left many students disengaged from science and technology as it offers little room for authentic practical work. A rigorous assessment regime focusing on young people's knowledge and understanding of science, has given rise to reduced opportunities within the science curriculum to experience the 'nature of science' and the scope for creativity and 'testing against uncertainties' as well as appreciating the societal context of science and technology. A student review of the science curriculum in 2003 (Cerini,B.. Murray,I.& Reiss,M. 2003) showed that students want more discussion and practical work in class and to focus on the social impact of science and technology. Successful ways of stimulating and engaging students in science and technology have been demonstrated by bringing students together with scientists and engineers in research departments to carry out projects (Collins 2004)

This paper outlines how the BA CREST award scheme aims to address the above issues by giving young people opportunities to develop their scientific curiosity as well as problem solving, practical and communication skills for use in the 'real world' Since the development of CREST awards in the early 80's over 250,000 young people in the UK have participated in the scheme. In 2003-2004 the BA CREST award scheme underwent a review to ensure that the science communication process and ideas were current and relevant to educational initiatives such as GCSE coursework, work experience and cutting edge science and that opportunity were provided for young people to communicate their work to a wider audience.

BA CREST AWARDS objectives

- To develop cutting edge/relevant science and technology project ideas, to stimulate young people to undertake project work in science and technology
- To provide opportunities for young people to meet and gain work experience with practising scientists and engineers on research projects
- To engage teachers in facilitating and supporting BA CREST awards within their schools.
- To increase the number of partnerships in the education community to endorse, promote and support BA CREST awards across the UK
- To encourage young people to exhibit and communicate their project works in regional and national science and engineering fairs.

Target audience

- Students between the ages of 11-19
- Primary and secondary science and technology teachers
- Education community (SETPOINTS, Local Education Authorities, Science Learning centres, Department for Education and skills, science institutes, universities, science centres)

THE SCIENCE COMMUNCIATION PROCESS

The BA CREST award scheme is designed to inspire and engage young people in undertaking science and technology project work and is carried out in the following ways:

- as part of an enrichment club which takes place out of curriculum time, for example, in the lunch hour or after school
- as a special activity day or activity week, for example, National Science week
- as part of curriculum time during the science or technology lesson, for example related to GCSE Design and Technology course work
- as part of work-experience placement, for example Nuffield Bursary scheme

BA CREST awards operate at 3 levels, bronze, silver and gold. At each level the student can carry out project work in any area of science and technology. The aim of the award scheme is for students to communicate the development of their project from inception to conclusion using a variety of media, text, illustrations, graphs, diagrams and IT. On completion of their project, young people submit a short written report and complete profiles (logbooks) which guide them through the scientific process. For example, students need to explain what they did and why, have presented data in an appropriate way, drawn logical conclusions, understand how their work fits in with wider background knowledge and research and demonstrate the wider application of their project work. The written report accompanied by the profile, govern the accreditation criteria with a number of hours also recommended at each level.

Often project work by young people is generated by their own interests or via the science and technology courses they are studying and in some cases industry/ university placements. At bronze level a number of projects are carried out during a science club or activity week. Many schools and local Science, Technology, Engineering, Maths (STEM) delivers will run events such as CREST in a day whereby whole year groups, for example one hundred Year 9 students aged 13, will participate in a circus of investigations and challenges to achieve their bronze award. At silver level students may for example submit their GCSE Design and Technology coursework for CREST accreditation

Table 1. *BA CREST award levels and recommended hours needed to complete project work*

BA CREST Award Level	Recommended hours to complete project work
Bronze Award	10 hours of project work. Typically for ages 11-14
Silver Award	40 hours of project work. Typically for students aged 14-16. Links with industry encouraged
Gold Award	100 hours of project work. Typically for students aged 16+. Students linked with mentor from industry or higher education. Can accredit students on link schemes such as Nuffield Bursary placements and Engineering Education scheme (EES) project work.

As illustrated in Table 1, students at gold level often carry out their projects with a mentor on a link scheme placement. The Nuffield Bursary scheme aimed at young people aged 17-19 offers students a six week placement in their summer vacation at a university/ industrial research department. On the placement students will have at least 5 consultations with a mentor to discuss the project.

To inspire students to participate in project work in science and technology the 'BA CREST project ideas' web-based resource was launched in 2004 (www.the-ba.net/crest). The project ideas span all areas of science, engineering and technology and are grouped into 10 themes: Fashion, Sport, Life at the Edge, Environment, Entertainment, Food, Health and Hygiene, Transport, Detective work and Space. Open-ended questions such as 'Have you ever wandered what skateboards are made from and how designs have changed over the years?' are used as prompts to engage and inspire students to investigate. To support teachers in facilitating project work with their students, all the on line project ideas are signposted to show links to curricular and have passed heath and safety checks. Case study examples are given within the resource to illustrate the pathways taken for a project at different levels from bronze to gold. Over 250 project ideas have been generated in collaboration with scientists from the Research Councils UK, to reflect not only the interests of young people but also current priorities and innovation in the different science and technology research fields in the UK.

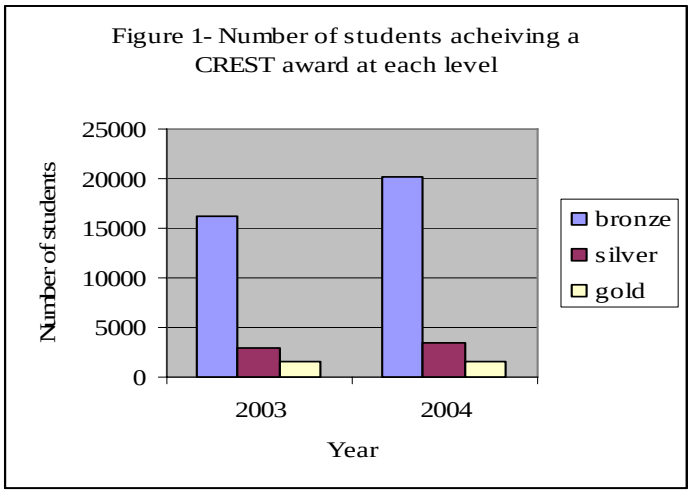
An integral component of the BA CREST award scheme is for students to identify the commercial and social value of their projects and to communicate their findings. Once a project and profile is completed, an external assessor is invited to carry out the accreditation process. Projects are assessed under the following categories: i) achievement of objectives, ii) scientific/technological process, iii) creativity and iv) communication skills. In categories such as 'creativity' students are given recognition for using a novel idea for a project, overcoming obstacles to carry out their project and showing entrepreneurship. Students are encouraged to submit their projects for CREST regional events. At these events, students have the opportunity to display their work and demonstrate their communication skills to a number of target audiences from their peers to practising scientists, and at the same time compete for prizes. Outstanding projects are selected for the prestigious national BA CREST Science Fair.

BA CREST is promoted in schools through 13 regional managers based in a SETPOINT (Science and Engineering Technology Point which acts as the local deliverer of science, engineering, technology and maths enrichment activities). The regional managers work in partnership with the BA in providing support and In-service training to teachers to facilitate CREST within schools, such as, finding mentors for students and carrying out the assessment and accreditation of projects. There are well-established links between the BA and other

STEM enrichment programmes. For example, the Engineering Education scheme offers residential courses to young people to carry out authentic problem-solving project work in engineering and the Nuffield Bursary scheme which focuses primarily in scientific research and project work. Many students gain BA CREST gold awards through participation in these programmes. A key feature of the BA CREST awards scheme is that it can be used as an accreditation process for activity that takes place through other Science, Technology, Engineering and Maths (STEM) enrichment schemes. This means that other schemes can offer a value-added dimension by offering BA CREST

EVALUATION

The impact of the BA CREST award scheme has been measured using an on-line database which captures the breakdown of students participating in the scheme in terms of, CREST level, school type, project discipline and gender. Teachers register their students and associated projects via their local CREST SETPOINT deliverer. The SETPOINT is responsible for keeping up to date records on the CREST database of all the students and projects carried out in their local area. In 2003 the number of youngsters receiving BA CREST awards equalled 20,781. In 2004 this number increased to 25,334 CREST awards showing an 18 % increase in the number of young people participating in the award scheme. In 2004 the number of girls achieving BA CREST awards was approximately 53% compared to 52% of boys. There are approximately 1008 active CREST schools representing an equal split between independent and state schools. The number of schools participating in BA CREST awards has increased by 250 schools from 2003. Figure 1 illustrates the breakdown of the number of awards achieved at each level for bronze, silver and gold in 2003 compared to 2004.



A key success has been a significant increase in the number of students achieving bronze awards from 2003 to 2004 representing a percentage increase of 18%. Silver awards show a percentage increase of 26% and gold a percentage increase of 9% from 2003 to 2004.

The number of projects carried out in 2004 was approximately 3500. A significant proportion of these projects were carried out on work placements in the areas of Design and Technology (785 projects) where by young people worked in teams of five with an engineer to Biology (393 projects) which involved a placement in a university research department.

In 2003, students were able to exhibit and communicate their project work at 9 regional fairs representing approximately 900 students participating across the UK. In 2004 this increased to 11 regional fairs across the UK representing the participation of approximately 1100

students. At the BA CREST Science Fair National Final (2004) questionnaires were administered to students on the BA CREST award scheme. 65 out of 82 responses received by students highlighted that by participating in the BA CREST award scheme increased their interest in studying science/technology at university. When asked what the best aspect of doing their project was, students commented on the '*opportunity to investigate in- depth science in a commercial* lab' or '*seeing the project used in reality'*. The main reasons that students wanted to exhibit their work at the science fair was expressed by comments such as *'presenting the report gave purpose to my project'* and ' *meeting like minded people and seeing what others have achieved'*.

The number of partnerships the BA worked with in promoting CREST awards increased from 13 regional partners to 23 across the UK in 2004.These additional providers have been trained to deliver the scheme in their local area. This has allowed for better impact and support into schools across the UK. In-service training for teachers were also provided through workshops at the Association for science Education conference (Jan 2004), The National Advisors and Inspectors conference (July 2004) and the BA Festival of science (September 2004) reaching approximately 400 new teachers. Feedback from teacher workshops showed that teacher's recognised the benefits and relevance for their student's participating in the CREST award scheme. After attending a workshop, teachers felt more confident about facilitating student – led project work back in their schools as the workshops had helped them to address some of the barriers that had prevented them doing this type of work, such as, time management of open-ended investigations, resources and ideas for this type of work and support in terms of mentors.

DISCUSSION

The BA CREST award scheme has strategically focused on engaging young people in science and engineering by increasing opportunities and removing barriers for this type of work to take place. The significant increase in the SETPOINT partnerships with the BA has allowed for a wider reach in terms of providing support to both teachers, to build their confidence in facilitating student led project work and for young people by enhancing opportunities to work with scientists and engineers.

The BA CREST 'project ideas' web-based resource and recent media stories inspired many of the projects that exhibited at the regional and national fairs in 2004. For example, a team of students from Wales investigated the properties of 'chocolate'; their mission was to produce a chocolate that would not melt in extreme heat so that soldiers in Iraq would be able to eat their favourite snack. The project ideas resource will continue to be updated and more ideas added through the on-going collaboration with the Research Councils UK. The significant number of Design and Technology projects generated in 2004 can be associated with the re-design of the BA CREST Silver Technology profile in 2004 which compliments the GCSE Design and Technology course, and has given an incentive for students to submit their coursework for CREST accreditation and to communicate their work at regional finals. In a recent school's inspectorate OFSTED report (2004) it was highlighted that schools focusing on investigative science such as BA CREST, showed that it '*benefited both the pupil's interest and performance'* and this is also highlighted in a comprehensive study of the CREST scheme (Woolnough and McIntyre 1996).

Engaging young people with real scientists and engineers is an important aspect of the BA CREST scheme. In 2005 the BA CREST award scheme will continue to work closely with SETPOINTS and Research Councils to sign up scientists and engineers as mentors for the scheme. A recommendation will be to collaborate with the Researcher's in Residence (RiR)

scheme which has over 2500 PhD students in biosciences and co-ordinated by Sheffield Hallam University. This will allow for RiR scientists who have partnerships with schools to be trained to facilitate students carrying out CREST projects. Training material and templates are currently being developed for a pilot to be carried out at AstraZeneca, Alderly Park, in 2006 for students on two week work experience placements. The aim is for scientists at AstraZeneca to help young people to carry out science or technology project work on these placements and achieve bronze or silver CREST awards. The pilot will then be rolled out to other science and technology industrial work experience placements to encourage more relevant, purposeful and stimulating science and engineering opportunities for young people experiencing the world of work.

CONCLUSION

BA CREST fulfils its aims for young people by encouraging them to follow their excitement and interests in a field of science and technology. The BA CREST award scheme is a framework for recognising the achievement of young people carrying out project work in science and technology whether it is through a science club or work placement. By providing young people with opportunities to be inspired and work with mentors in both science and industry, the relevance and social implications of research are appreciated. The differentiated levels of the award scheme enable youngsters of all abilities to experience positive achievement in science and technology and cover many of the required key skills in the process. The quality of the work produced by young people in the scheme is of a consistently high standard. The public celebration of their work at regional and national events has been shown to be an important aspect of the process in their decision for undertaking project work in science and technology. The success of the BA CREST scheme is due to the local delivery and on-going support of the scheme by other STEM deliverers and partnerships with industry and the Research Councils.

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