How Science Works!

A project to develop skills relevant to the 'How Science Works' content of A-Level science subjects

Project report - May 2009

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Contents

How Science Works

Within A-level science-based curriculum areas, science has changed from a focus on what we know to how we know it. This, in turn, has implications for how students interpret science-based information and how they communicate it to others.

How Science Works identifies that science involves more than remembering a set of facts or figures; it requires students to think about where that information came from and how it was produced. Associating with the source of information enables students to engage more fully with a topic.

The How Science Work curriculum can be seen as a tool to help school-based students improve their scientific literacy in order that they can develop a greater understanding of the scientific process. In turn, this enables them to move on to become more effective researchers and scientists beyond their A-level study.

The Calderdale project

The Calderdale 'How Science Works' project has been supported via funding from Yorkshire Forward (the Regional Development Agency), The Independent/State School Partnership and the Excellence Hub (for Gifted and Talented Youth) and Aimhigher.

There were 100 places for Year 12 students in Calderdale who were engaged in Science A Levels. The project enabled students to apply their How Science Works skills and specifically focused on developing essential key skills, i.e.:

Communication
(e.g. contribute to debates about scientific claims, present orally and in written form)

ICT
(use of different sources to extract/retrieve/select appropriate information)

Working with others
(e.g. understanding collaborative skills)

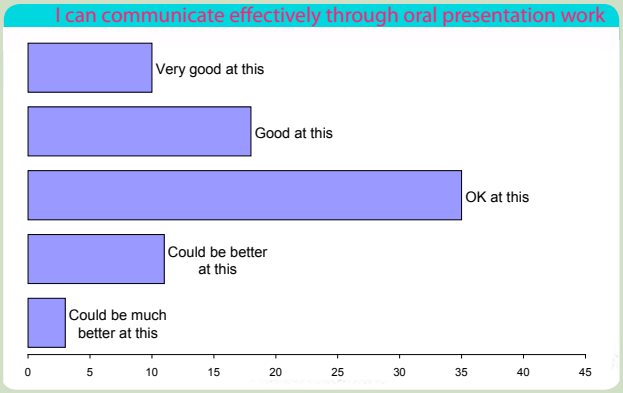
Improving own learning
(e.g. critical thinking, reflection and independent learning skills)

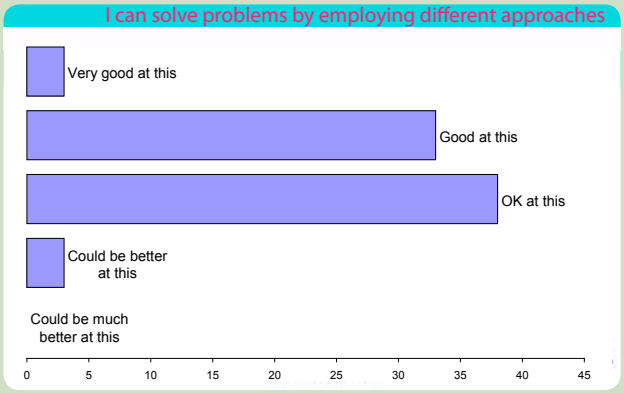
Problem solving
(working issues through, with others, and developing solutions)

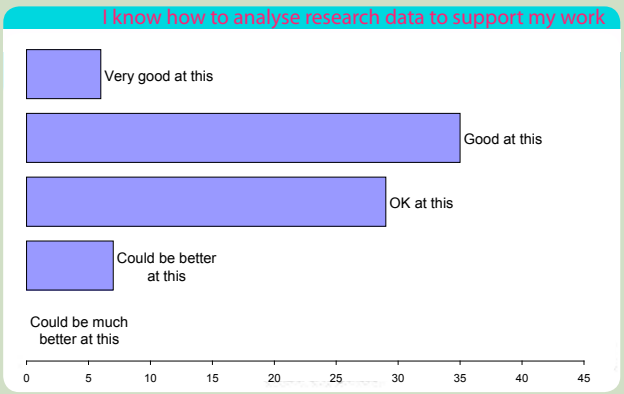
The content of the project consisted of a half-day workshop event at the Heath Training Centre in Halifax (which took the form of an interactive role-play activity); and a half-day event at the University of Leeds (where students were given a tour of science-labs and participated in lab-based seminar work. The content of the workshop and University visit was developed by the project training provider (Research Toolkit Limited) in collaboration with science teachers from participating schools (a twilight development session was held at Heath Training Centre in February 2009).

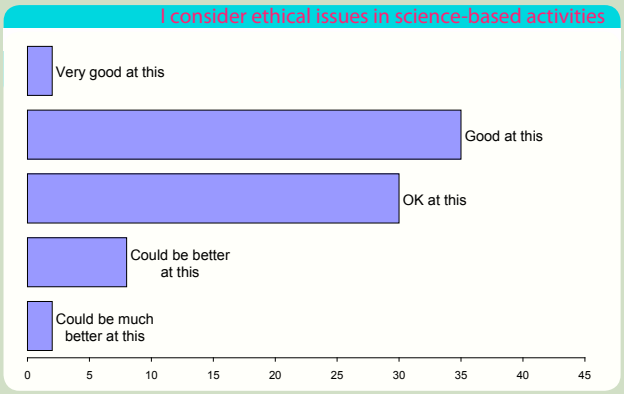
Prior to the half-day workshop an online survey was conducted with all potential workshop participants. This survey (the contents of which can be viewed as Appendix 1) enabled the project team to identify areas of strength and weakness in relation to the key skill areas identified above.

Following a review of the survey responses (see below for specific examples), workshop content was tailored to targeting the development of presentation skills, problem solving skills, researching skills and an appreciation of the ethical considerations in science-based activities.









The above examples show that the majority of participants felt they were 'ok' at presentations rather than being good at them; almost half were good' or 'very good' at problem solving and using research data to support work, the rest were 'ok' or 'could be better at this'; and less than half were 'good' at considering ethical issues in science-based activities.

Additional comments received from participants, via the online survey, acknowledged a development need in terms of presentation skills. These tended to indicate that more exposure to such activities would improve confidence and ability in relation to speaking to groups of people in a formal setting. Some participants also indicated that the application of scientific theories and concepts was difficult to achieve within their studies.

I need to become better at speaking in front of groups of people. I know what to say, but I need to practice to make sure I say it clearly and confidently.

I feel I am best at writing than I am at oral presentation work. I am a quite shy person when it comes to speaking out loud.

I sometimes can't make the links that relate what I learn in science to the outside, or real, world.

The How Science Works task

The core activity designed to enhance and develop the above core skills focused upon research/investigating the development of IVF treatment and preparing and presenting a 2 minute broadcast in the style of one from a selection of TV/radio programmes. These included: BBC Breakfast, GMTV, Radio Four's Today Programme, and The Wright Stuff.

Participants were required to work in teams (of usually 4 or 5) and to assign roles within the team to ensure the development and broadcast of their 'story'. Typical roles, defined by groups included: presenters, script-editors/story-developers, time-keepers, researchers, directors. A tutor pack, consisting of powerpoint slides, audio-visual programme excerpts, tutor notes, and student handouts was produced and distributed to participant schools upon completion of the workshop sessions.

Participant evaluation

Participants were asked to provide 'post-it' note feedback immediately following the workshop session. They were asked to provide feedback in relation to two areas: what had been the most valuable part of the session for them, and how they would apply what they had learnt.

For many, the most valuable content areas of the programme related to the development and refinement of presentation skill and technique. Co-ordinating, researching and presenting a 2-minute broadcast also focused participant attention on developing effective time and team-management approaches. Some also welcomed the opportunity to work with other students from different schools and subject groups.

What I'll use:
My new found confidence in presenting.

What I'll use:
Trying to pronounce words slowly and correctly in presentations.

What I'll use:
How to use the internet for effective data collection.

What I'll use:
Thinking and working under difficult and pressured circumstances.

What I liked:
The experience of working with others. Meeting new people. It'll go on my personal statement.

What I liked:
Doing a presentation of a show. It was fun and I was able to learn new things.

What I'll use:
Researching under pressure. How to process information quickly and effectively.

What I liked:
I liked that we started the activity fast and without hesitation. No long, tedious lectures!

Two focus group sessions were also held approximately 4 weeks following the workshop session. Participants at these sessions, who represented two of the schools involved in the project, were asked to reflect upon the workshop day and the skills developed as a result.

The role or task of the researcher in the group (who was charged with collecting data for the 'live' broadcast) was generally seen to have been one of the most challenging and pressured. Some groups had difficulty deciding who should undertake this role, and one researcher felt pressured by the requirement to quickly scan and synthesise information on the subject.

And seeing as no-one would go in my group, we had a debate for about 15 minutes of who were going to go, so I just went 'Fine, I'll go' and I had two minutes to get everything.

I didn't like being the research person because I couldn't find anything on Google and then the internet didn't work. And then I thought you could just print it all off but you had to make notes and I didn't know; I'm not a fast reader, so I wasn't getting all the material my team needed.

A number commented that meeting, and working, with participants from other schools was an important part of the event for some participants (although this may have been uncomfortable for some at first). There was, however, a recognition that this presented an opportunity to meet new people and develop networking, project management and team-working skills. This wasn't considered easy for some participants, and suggestions for future events included an 'ice-breaker' at the beginning of the session where participants could be encouraged to introduce themselves to their group.

Some people just sat there and were quiet and then you feel like you're talking too much and you sit down and like let them speak but then they don't (laughs).

We linked up with some other schools ... and we got to know a bit about them ... which is good 'cos it takes you out of your comfort zone.

As a warm-up activity, we should tell someone to stand up and tell us something about themselves and then get them into the mood and then get them into groups then after that.

In terms of the quiet members of our group, I thought that I had to be like the team leader and tell them like this is what you need to do, this is what you need to do and so get involved.

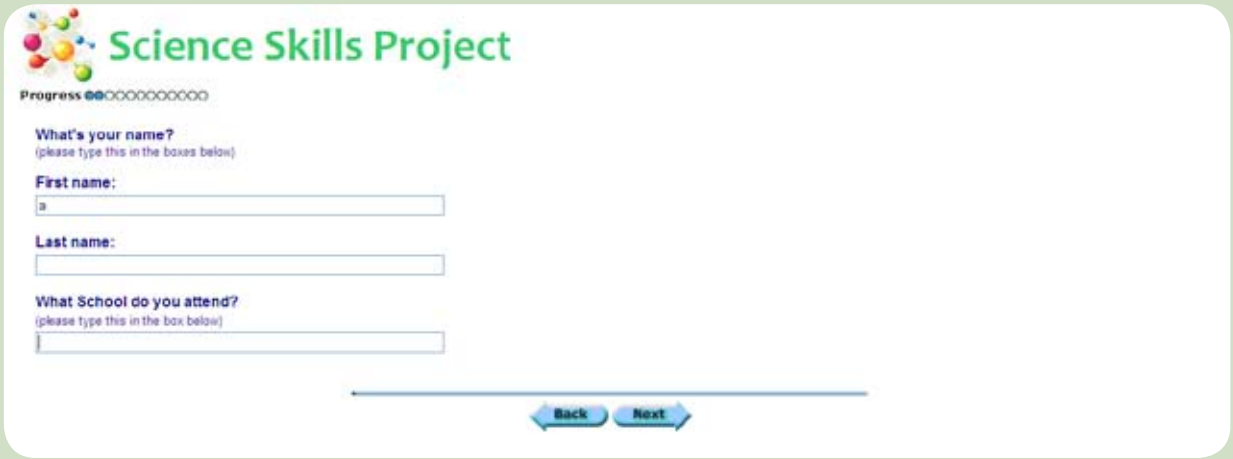
There was a general recognition by number of participants that the activities involved in the workshop assisted with the development of key social and academic skills - such as communicating ideas and issues, collecting data (or researching) in relation to these topics or issues, and working under pressure - which led to a focused appreciation of time management.

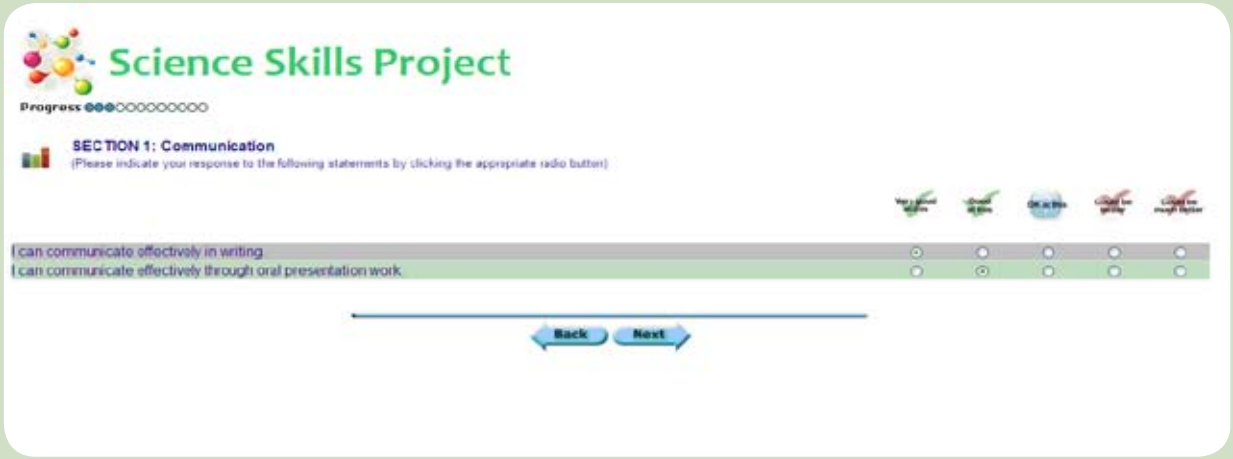
The whole event was a group activity where you could learn from each other ... you know, work together ... to build confidence and team working.

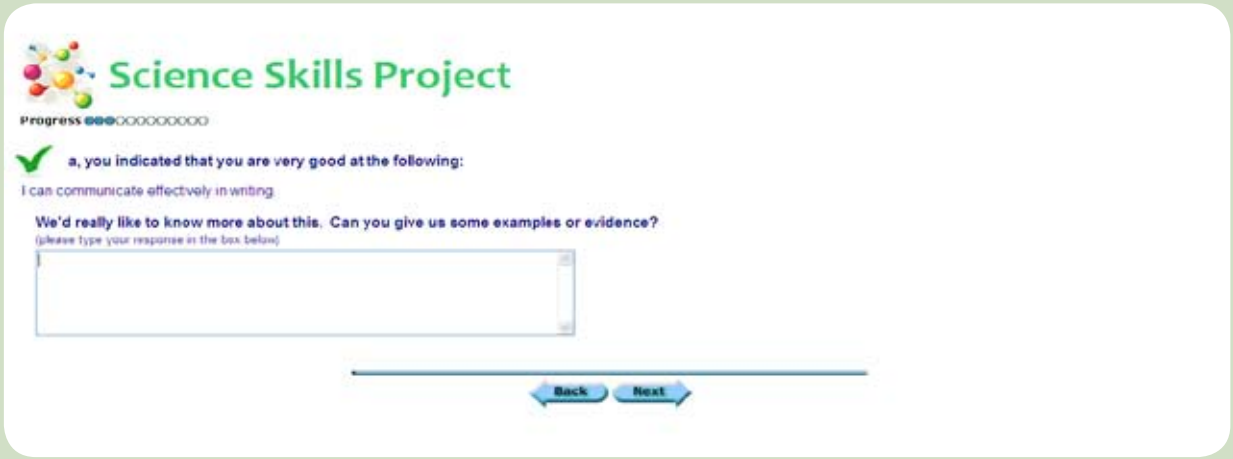
Appendix 1: Pre-workshop survey

How Science Works
Thank you participating in this exciting project which targets the development of skills relevant to the How Science Works elements of A Level Science specifications.
Before we can get started with workshop events designed to help improve your skills and abilities we need to ask you a few questions. This is not a test of you. This short survey has been designed to collect information from selected participants in order for us to develop workshops that satisfy your current learning needs.

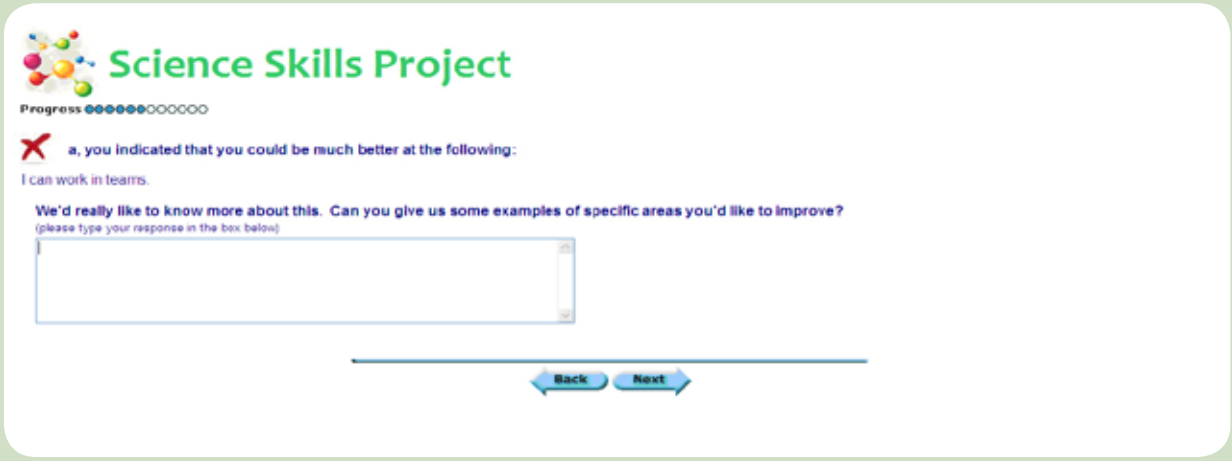
Please be as honest as possible in your responses as this will help with the development of the programme. There are 5 short sections, which should take around 5 minutes of your time to complete. The 'progress bar' in the top left-hand corner of the screen provides an indication of your progress through the questions.

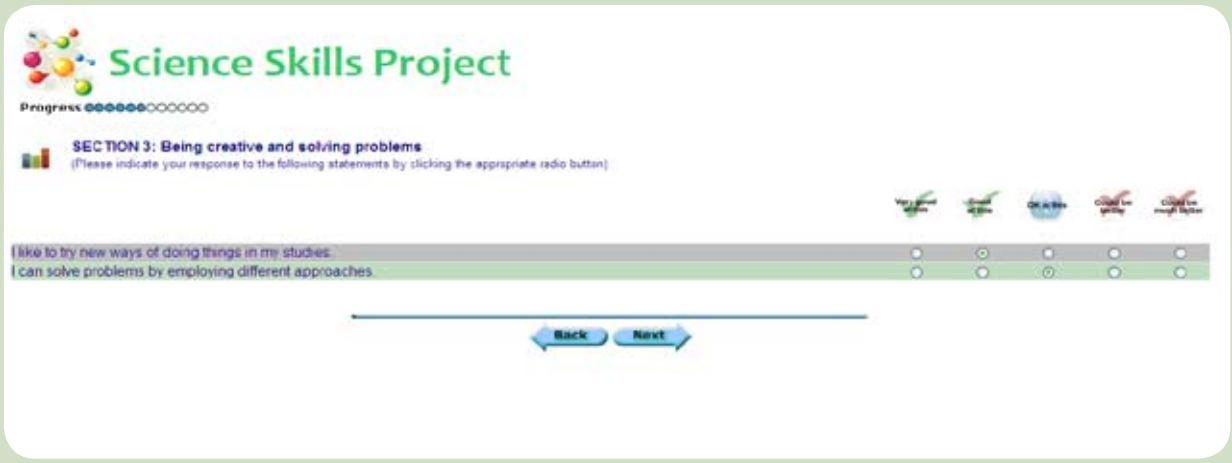



Science Skills Project
Progress
SECTION 1: Communication
(Please indicate your response to the following statements by clicking the appropriate radio button)
I can communicate effectively in writing
I can communicate effectively through oral presentation work
Back
Next

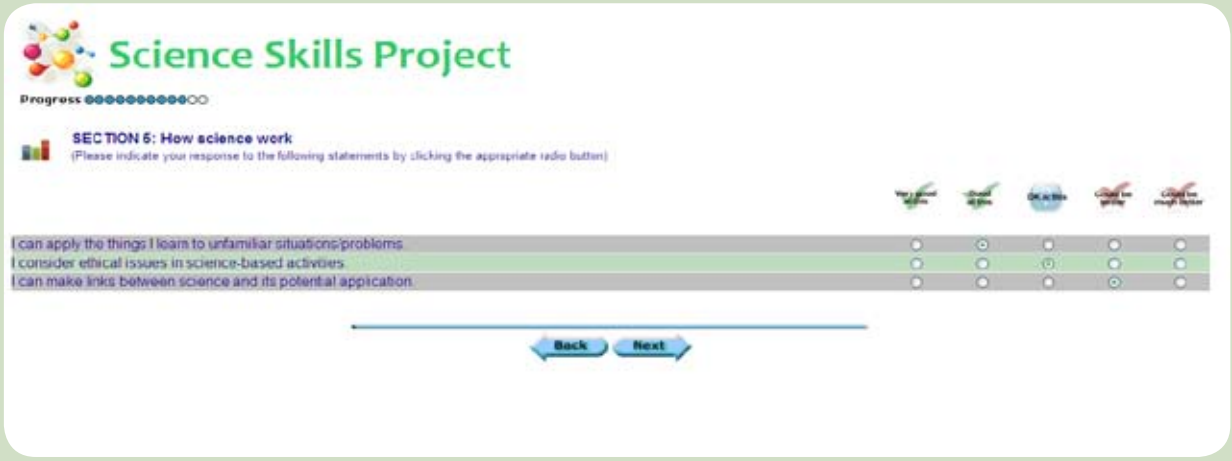

Science Skills Project
Progress
a, you indicated that you are very good at the following:
I can communicate effectively in writing
We'd really like to know more about this. Can you give us some examples or evidence?
(please type your response in the box below)
Back
Next


Science Skills Project
Progress
SECTION 2: Working with others
(Please indicate your response to the following statements by clicking the appropriate radio button)
I can work with other students
I can work in teams
Back
Next


Science Skills Project
Progress
a, you indicated that you could be much better at the following:
I can work in teams.
We'd really like to know more about this. Can you give us some examples of specific areas you'd like to improve?
(please type your response in the box below)
Back
Next


Science Skills Project
Progress
SECTION 3: Being creative and solving problems
(Please indicate your response to the following statements by clicking the appropriate radio button)
I like to try new ways of doing things in my studies
I can solve problems by employing different approaches
Back
Next


Science Skills Project
Progress
SECTION 4: Information skills
(Please indicate your response to the following statements by clicking the appropriate radio button)
I can analyse data (numbers) using computers
I know how to analyse research data to support my work
Back
Next


Science Skills Project
Progress
SECTION 5: How science work
(Please indicate your response to the following statements by clicking the appropriate radio button)
I can apply the things I learn to unfamiliar situations/problems
I consider ethical issues in science-based activities
I can make links between science and its potential application
Back
Next


Science Skills Project
Progress
That's everything, thank you a. Now click 'submit'.
Back
Submit