Engaging Schools and Young People

the handbook

BBSRC
20 Years of Pioneering
Great British Bioscience
# Contents

This booklet has been designed to provide practical advice and tips for undertaking effective Science, Technology, Engineering and Maths (STEM) engagement with young people, schools and educators. The booklet covers activities designed specifically for young people and accompanies the BBSRC handbooks; Exhibitions and media training, Public engagement training and Media training.

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Why engage with young people?
The future of science and our world relies on the next generation. Engaging young people with your science can achieve far reaching impacts and improve scientific literacy in the long term. BBSRC is committed to “enthuse and inspire young people about science; empowering them as future citizens to participate in public dialogue about science, and to pursue science-based careers”.

Informal learning experiences are associated with raised interest in science – most students who did practical workshops in science centres and who visited a hands-on exhibition reported an increased interest in science afterwards.13

89% of students who did practical workshops...

74% of students who visited a hands-on exhibition...

...reported increased interest in science

From the Wellcome Trust infographic ‘Evidence for informal science learning’; www.wellcome.ac.uk/informallearning

“Education is the most powerful weapon which you can use to change the world.”

Nelson Mandela
Who is your audience?
Young people age 4-19 and educators (e.g. teachers, youth workers, scout leaders) or parents who are involved in their learning. There are many ways to reach your audience and your approach may well influence the make-up of the audience. Science festivals attract a broad cross-section of the public and you are likely to interact with children spanning a broad age range and their parents. Visits to schools are often with a focused group of pupils, likely of the same age and similar abilities.

Before planning your activity find out as much as you can about the children you will be communicating your research to.
What is your aim?
Are you going to be carrying out Public Engagement? Science communication? Science Education? If you can identify your aim you will be able to work out what sort of activity you will be engaged in. It might be one, two or a mix of these activities.

**Public engagement...**

...involves dialogue, *interaction* and *participation*, drawing in researchers and non-academics. It is as much, or more, about *listening* to the views and values of others as it is about offering your view.

Public engagement includes public dialogue, two-way discussions around an area of research or an issue with the aim of informing research direction, policies or strategy. It also includes public attitude studies and consultation - extractive opinion gathering to help understand public views, values and attitudes around an area of research. Finally, public engagement may take the form of collaborative partnerships where researchers and non-academics work together to develop a shared understanding and design and implement a research programme.

If you are doing public engagement you will want to ensure you get good feedback and involvement of the young people.

**Science Communication...**

...is primarily a one way communication process although there may be some, limited, opportunities for discussion; it aims to *inform*, *enthuse* and *inspire*. Science communication might involve disseminating the outcomes, outputs and processes of research to raise awareness or promote understanding.

It also includes engaging young people, with the dual aims of inspiring the next generation of practicing scientists and equipping the young people of today with the tools and knowledge to aid them in future debates around science and technology.

If you are doing science communication you will want to ensure you have a clear message.
Science Education...

...aims to achieve increased understanding through a learning activity. Learning can take place in formal (classrooms) and informal (science centres, country shows) learning environments.

If you are doing science education you will want to ensure that you are providing the correct and appropriate information for students. Find out from teachers what they require, find out the age and abilities of the students, take a look at the curriculum. You will also want to ensure you are providing something that the teachers can’t provide to enrich the curriculum.

If you are doing science education you will want to ensure you have a learning objective and a way to ensure learning takes place.

To enable learning use open questions:

- Attracting attention: What happens when…? What do you see? What have you noticed?
- Inspiring people to observe and measure: How much? What size?
- Suggesting comparisons: What is the difference between…? Which is the most…?
- Urging people to experiment: How do you arrive at…? Can you find a way to…?
- Stimulating thought: What has happened? What can we do? Can you explain…?
- Encouraging a critical approach: What do you think of…? Do you agree…? In your opinion…?
It’s quite likely, and desirable, that you have more than one of these approaches in your activities. If you’re unsure about whether you’re setting out to do public engagement, science communication or science education, ask yourself these questions:

**What is your aim?**

- Are you hoping to have a meaningful conversation with non-experts and use this conversation to help you think about your research?  
  - YES  
  - NO

- Are you hoping to primarily change the understanding, behaviour, views or values of non-experts about your research?  
  - YES  
  - NO

- Are you hoping young people will learn and understand the underlying science used in your research sufficiently to be assessed on their knowledge?  
  - YES  
  - NO

Public Engagement  
Science Communication  
Science Education
How do you reach your audience?
There are many ways to reach your audience. Friends and colleagues with children or school contacts can often be an easy route into schools or you may have children yourself. Universities have outreach departments with good local schools contacts and the local contract holders for the STEM ambassador scheme maintain databases of schools wanting visiting scientists. There are also a multitude of educational and social groups catering for children who will benefit from your contribution. Some of these are listed below.

**Science, Technology, Engineering and Maths (STEM) ambassadors**
www.stemnet.org.uk/ambassadors

**Farm and Countryside Education (FACE)**
www.face-online.org.uk

**National Federation of Young Farmers’ Clubs**
www.nfyfc.org.uk/

**Scouts**
http://scouts.org.uk

**Girlguiding**
www.girlguiding.org.uk
What support can you receive?
You are not on your own when it comes to engaging young people. There are a number of professionals whose job it is to support your school engagement activities and they can provide advice, guidance, logistical help, contacts and even funding to enable your activities to succeed.

We also fund about 20 researchers around the country, the School Regional Champions (SRCs), to enable and encourage researchers to engage with young people. All the SRCs have significant experience in science communication and public engagement and are able to provide support and advice for other researchers.

Institutes and universities have their own outreach and communications staff that will be able to provide support or point you in the direction of other members of staff or organisations that can help you. The National Coordinating Centre for Public Engagement (NCCPE) runs an ambassador scheme for anyone enthusiastic about public engagement [www.publicengagement.ac.uk/how-we-help/ambassadors-scheme](http://www.publicengagement.ac.uk/how-we-help/ambassadors-scheme). The NCCPE ambassadors share their expertise and enthusiasm for public engagement nationally and can support public engagement in their organisations.

BBSRC recommend that anyone who is carrying out engagement activities with young people signs up to the STEM ambassador scheme run by STEMNET [www.stemnet.org.uk/ambassadors](http://www.stemnet.org.uk/ambassadors). STEMNET provide training for their ambassadors, coordinate contact with schools and have resources and online networking.

### Other organisations

- Association for Science Education (ASE) [www.ase.org.uk/home/](http://www.ase.org.uk/home/)
- British Science Association (BSA) [www.britishscienceassociation.org/](http://www.britishscienceassociation.org/)
- Society of Biology [www.societyofbiology.org](http://www.societyofbiology.org)
Where and when?
You can engage young people at a school, in your organisation, at a science event, at a music festival or even online. Where you engage young people will influence when you should do it. If you are working with teachers and intend to visit a school you will need to pay particular attention to the school timetable. Pupils are at school for roughly 39 weeks a year and during this time teachers have to deliver the curriculum, organise exams, find time for revision sessions and fit in a school sports day. This only leaves a few windows when going into school will be possible. Avoid planning activities just before exams or the first week of the year. Teachers are usually keen to get pupils settled and focused during these times. The school day is shorter than a normal working day and like the school year it is a busy time with a rigid schedule. The day will start and finish early and each lesson will often be shorter than an hour. There is rarely chance to extend your activity beyond the length of a lesson and you cannot be late because the teacher will start without you.

If you are organising an event at your institute pay the same attention to the school year and length of day, taking into consideration the time it will take for pupils to travel from school and back in time for the end of the school day.

Science festivals, country shows and other public events will be organised at set times of year. They may cater to school groups coming during the school day and the general public at weekends, in the holidays or in the evening. A list of popular events is below:

- Big Bang Fair National
- Big Bang Fairs regional
- British Science Festival
- Royal Society summer exhibition
- Science festivals (Cheltenham, Edinburgh, Cambridge, London, Manchester, Midlothian, Norwich)

Are you taking part in an online engagement?

The advantage of this is you can take part wherever you like. These events may take place at a set time or may give you the flexibility to contribute when it is convenient to you e.g. I’m a Scientist Get Me Out of Here ([http://imascientist.org.uk/](http://imascientist.org.uk/)) has specified dates in the academic year when they run their events.
Organising an event for young people
Events range in size from short visits by a couple of students to large national events for thousands of students. The size of the event will reflect the amount of planning required.

One of the first things to establish before starting the planning for an event is do you have the facilities, finance and support that you will need to put on a successful event?

If you are confident you can put on the event you should consider the needs young people have.

Can young people come to your event? Is it an activity organised with the school and do they have transport for the pupils or is it an event held outside normal school hours in a public space?

If you are organising an event the availability and cost of transport can be a hindrance to the ability of schools to come to you. Will you have funds to enable the young people to attend?

If you are organising an event outside school how accessible is it? Is it a weekend event in a city centre with ample public transport or is it an evening event in a rural setting?

Consider access to and around your venue for visitors with disabilities. Do you have appropriate toilet facilities for young people or those with disabilities?

How will you know if your event was a success? The most effective evaluations are incorporated into event planning at the beginning.

Below is a handy checklist of things to consider if hosting an event for young people. It is not an extensive guide and doesn’t cover everything you might need for a large event.

☐ Finance
☐ Venue
☐ Event timetable
☐ Marketing & Publicity
☐ Insurance
☐ Event materials
☐ Risk assessment
☐ Evaluation
☐ Photography permissions
☐ Internal communications
☐ Briefing helpers and schools
Organising a visit to a school
The key to getting many aspects of your visit right is good clear communication with your contact at the school. Make sure you have contact details for the teacher and the school. Teachers are unlikely to answer phone calls or emails while they are teaching so you should also have a contact for the main office.

Check the location of the school and if possible go there in advance of the visit. Is there parking or good transport links? When will you need to be there? Will you need time to set-up in advance?

Before planning the activity find out who the activity is with, where it is and when it is.

Depending on what you plan to do with the school, what resources will you need? Are you just giving a presentation? Will there be a laptop and a projector for you? What resources can the school provide?

**Other questions you should ask:**

- How many students will be attending the activity and what age will they be?
- What is the range of special needs in the class? Will any of the students have a special needs assistant with them?
- How many male and female students will there be at the activity?
- Have the students been told anything about the activity to prepare them beforehand? If yes, what information have they already been told?
- Will there be any other adults, apart from the teacher, in the room with you when you’re doing your activity e.g. teaching assistants?
- What have the students learnt recently that may link in with your activity? Is your activity pitched at the right level?

Teachers are responsible for risk assessing any practical activities in schools so it’s crucial you keep them informed of the activity you are planning, including details of any props you are hoping to bring with you on the day and any potential risks with the activity.

You should not be on your own in the classroom; a teacher should be with you at all times.

You are not responsible for the behaviour and control of the students and the teacher should take responsibility for the actions of the pupils in the classroom.
Suitable activities
The activities you plan will be largely dependent on the event you are taking part in. There are a number of tried and tested formats used in science engagement.

The most straightforward and easiest to prepare for is a meet the scientist event. These usually involve a question and answer session where young people have the opportunity to find out directly from you about your research, career, likes and interests. They are simple but effective ways for young people to get an insight into what scientists do and what they are like.

**Other formats**
- Presentations
- School assembly
- Demonstrations
- School lesson
- Workshops
- Event stand
- Field excursion
- Guided tour
- Interactive exhibition
- Games
Enriching the curriculum
Interacting with scientists offers the opportunity for young people to get experiences above and beyond the school curriculum. You should plan activities that complement the curriculum but still add that something extra to make it a special experience. The most important part of this is; you. It will be your research and career that provide something a teacher can’t.

There are also some other areas of learning where schools and teachers will welcome support.

Many schools and particularly primary schools will be limited in the hands-on and practical science experiences they can provide students. Experimentation is central to scientific research and is one of the core principles of the BBSRC strategy for engaging young people. Educators recognise the importance of a practical science education and young people are often very keen to get involved in hands-on activities.

Most young people don’t have access to teachers or parents with an in-depth knowledge of science careers. Providing an insight about life as a researcher and the journey you have taken to become a scientist can enable children to decide if a STEM career is for them.
Science education involves students learning a large vocabulary of new and technical words. This can be very challenging and literacy activities that help students understand the spellings and meanings of technical terms will be very helpful.

Mathematical competency is essential for undertaking science; and maths is an area where many young people lack confidence or skills. Teachers are required to include numeracy in their teaching so designing activities that include calculations will be highly beneficial.
Introduce young people to instruments or materials used in research. These may be current or historical objects. Even the simplest of **scientific equipment** can prove fascinating to children, from lab coats and gloves to petri dishes. You may have access to **historical documents** or objects that will help you explain your work. Ensure rare and valuable items are properly protected from handling or damage and that it will be safe for instruments, materials or objects to be on display or touched.
Health and Safety
For any activities you carry out with young people you should consider the Health and Safety implications and the need to carry out a risk assessment. If you are going to be carrying out practical activities and demonstrations it is important to follow Health and Safety legislation and guidance. CLEAPSS www.cleapss.org.uk/ provides Health and Safety support to schools and education organisations in England, Wales and Northern Ireland.

The Scottish Schools Education Research Centre (SSERC) www.sserc.org.uk provide training, advice and guidance on Health and Safety in Scotland. CLEAPSS has reciprocal arrangements with SSERC.

There are also publications and reports on science education Health and Safety available from the Association for Science Education (ASE) www.ase.org.uk/resources/health-and-safety-resources
Working with children
You are required by law both to protect children and young people from harm and under the Criminal Justice and Court Services Act to declare if you are disqualified from working with children. If you are volunteering on a regular basis, unsupervised you may be required to undertake a Disclosure and Barring Service (DBS) check. These are free for unpaid volunteers.

**Behaviour** - Whilst it is important to ensure that young people are at ease when taking part in activities, avoid being over familiar such as fooling around or making fun of young people.

**Contact** - There should be no need to touch a young person, however, not all scenarios can be foreseen and it is therefore recommended that if unavoidable any contact is kept to a minimum.

**Disclosure** - Adults have a duty to report any child protection or welfare concerns. It is highly unlikely that young people will disclose any information to you that gives rise to concern for their physical or emotional safety or well-being. If this does occur, report it to the teacher, the responsible adult accompanying them, a designated member of staff in your organisation and/or the local social care office. Do not do anything that may jeopardise a police investigation, such as asking a child leading questions or attempting to investigate the allegations of abuse. Do not promise confidentiality to the child as you may need to report your concerns for their safe being. For further information consult the guidance provided by your organisation on child protection.
Best practice guidelines
The following are guidelines for best practice when planning and carrying out activities with schools and young people on behalf of BBSRC.

1. Present a positive image of science, the BBSRC and RCUK.

2. Enable opportunities for discussion and listen to the views and opinions of young people.

3. Enable exploration of underlying concepts and issues, rather than information provision.

4. Take account of the aspirations, concerns and needs of young people.

5. Take into consideration the diversity of young people and aim to cater for a broad range of abilities and levels of understanding to ensure accessibility.

6. Develop and deliver events with interactivity, ensuring displays or presentations, if used, form only part of the event.

7. Deliver activities that target hard-to-reach groups, such as ethnic minorities, inner city communities or those with special needs.

8. Carry out risk assessments prior to all activities.

9. Use BBSRC branding in promotional materials, activity resources and presentations.

10. Provide activities free of charge.

11. Focus activities on science and research and not on promotion of higher education or particular institutions.

12. If based in a Higher Education Institution, ensure there is coordination with the institutions’ outreach programme.

13. Follow your institutions policies and guidance on delivering engagement activities.

14. Ensure events and activities are covered by adequate insurance.

15. Obtain appropriate permissions for recording images of young people.

16. Evaluate activities or contribute to evaluated events.
Top tips
Top tips for going into school

• Find out the timetable for the school day including lunch time. School days vary and lessons timings are rarely flexible.

• **Always** be on time. Allow plenty of time for any travel, parking or meetings running over. Get a map and directions.

• Get clear agreement on what you will do, what the teacher wants and discuss how activities will be carried out.

• Don’t dress too smart or too scruffy.

Top tips for talking with children

• Think about who you’re talking to and what they might want to know. How old are they? Find out what they already know.

• Use plain English (about not approximately; wrong *not* erroneous etc.)

• Be honest. If you don’t know don’t pretend you do. If something goes wrong in a demonstration discuss why that might be. You can’t know everything and it’s OK to be wrong. Scientific discovery is about investigating the things we don’t know the answers to and sometimes experiments don’t work.

• Talk about what you do, what it is like being a researcher, what you are working on. They will probably be more interested in you than your research.

• Use a level of language that children can easily understand and avoid the use of jargon.

• Use brief, concrete and amusing explanations that are clear and easy for children to understand and ask further questions about.

• Use analogies that children can relate to.

• Explain what you mean in a variety of ways, using different words to help children understand.

• Where possible offer praise and encourage children to talk by asking questions and listening to their views and ideas.

• Avoid the use of inappropriate language such as swearing.

• Avoid asking intimate questions and bear in mind there may be a range of issues that children are uncomfortable talking about. Even topics such as household income and dietary habits could be too ‘personal’ and it is recommended that you use common sense and change the topic if a child appears reluctant to engage with a certain topic.

• Don’t try too hard to be cool or funny. Be enthusiastic!
• Relax and be yourself.
• Don’t be patronising or condescending. Be clear.
• Don’t be grumpy, argumentative or confrontational.

Top tips for presentations, workshops or activities

1. Capture the attention of your audience. You could set them a puzzle, present them with a mystery object or carry out a surprising demonstration and ask for their initial thoughts e.g. what happens if we grow plants upside down?

2. Find out about your audience/elicitation/active listening

3. Ask students to come up with questions at the start of a session that they would like answered by the end. This gets them thinking and can serve as your elicitation to establish what the students don’t yet know about the subject.

4. You can also pose questions about your activity at the start of a session.

5. Some ‘How’ and ‘Why’ questions should be saved for the later stages of a session, as they may require more complex answers that require you to explain a concept that the children don’t yet understand.

6. Use questions as titles throughout sessions.

Asking questions

• Ask about the way an instrument works, for instance: How does a microscope work?

• Ask children to draw or comment on a diagram, for example: A diagram of a plant.

• Ask for explanations of phenomena, for example: Why do plants flower in the spring?

• Ask children to describe the likely outcomes of an experiment, for example: What happens when seeds are germinated in the fridge?

7. Talk for no more than 10 minutes at a time, punctuated with 20 minutes for a physical and practical activity.

8. Don’t try to do too much. Prepare extra materials and activities in case you have time but also be prepared to drop activities and adjust your plans. If an activity is going well, don’t stop and move on to your next activity just because you want to squeeze them all into your available time.
9. Make a list the equipment you will need.
10. Choose equipment that is easy to operate, reusable, solid and safe;
11. Practice and test equipment, demonstrations and exhibits. Make sure they work and people know how to use them properly.
12. Have spare equipment in case anything goes wrong.
13. Create activities that test a scientific question.
14. Ensure everyone can get hands-on.
15. Have a variety of activities so everyone can take part.
16. Review the outcomes of the activities and refer back to the questions posed at the start of the session.

**Top tips for events**

1. Take a look at the venue noting:
   a. how much space you have
   b. how noisy is it
   c. is the light sufficient
   d. where the electrical sockets are
   e. where you can get drinking water
   f. where you can store equipment and valuables
   g. if you have the required chairs, tables or poster boards etc
2. Aim for a maximum of 15 participants for 1 educator
3. Memorise the days programme.
4. Prepare a brief introduction, some key facts and anecdotes you can remember easily when talking to your audience.
5. Get to know the people you are delivering the event with and agree roles.

If this is your first time presenting science you might like to have a look at this publication to give you some pointers: [www.bbsrc.ac.uk/documents/presenting-science-pdf/](http://www.bbsrc.ac.uk/documents/presenting-science-pdf/)

After you’ve been to a school or run an event with children you’ll find that you develop an idea of the language to use and that talking to people becomes much easier.
Training and Further reading
Training

• **BBSRC public engagement training**
  www.bbsrc.ac.uk/funding/awardholders/public-engagement-training.aspx

• **BBSRC media training**
  www.bbsrc.ac.uk/funding/awardholders/media-training.aspx

• **STEM ambassadors**
  www.stemnet.org.uk/ambassadors/

• **Society of Biology**
  https://www.societyofbiology.org/careers-and-cpd/training

• **Biochemical society**
  www.biochemistry.org/Conferences/Courses.aspx

• **NCCPE**
  www.publicengagement.ac.uk/how/training

Further reading

**BBSRC**

• Exhibitions and media training
  www.bbsrc.ac.uk/documents/presenting-science-pdf/

• Public engagement training

• Media training
  www.bbsrc.ac.uk/documents/1407-media-guide-pdf/

**RCUK**

• Benefits of Public Engagement
  www.rcuk.ac.uk/documents/scisoc/RCUKBenefitsofPE-pdf/

• Concordat for engaging the public with research
  www.rcuk.ac.uk/pe/Concordat/

• Dialogue with the public: Practical guidelines
  www.rcuk.ac.uk/Publications/archive/DialoguewithPublic/

• Manifesto for public engagement
• RCUK Engaging Young People with Cutting Edge Research A guide for researchers and teachers
  www.rcuk.ac.uk/documents/scisoc/SchoolsPolicy-pdf/

• RCUK Resources for schools
  www.rcuk.ac.uk/documents/scisoc/InformationforSchoolsWeb-pdf

Vitae

• The engaging researcher booklet
  www.vitae.ac.uk/images/vitae-publications/the-engaging-researcher-booklet.jpg/view

STEM education and public engagement

• Many Experts, Many Audiences: Public Engagement with Science and Informal Science Education

• Wellcome trust exploring young peoples views
  www.wellcome.ac.uk/About-us/Publications/Reports/Education/WTVM0527_35.htm

• Delivering Effective STEM Public Engagement

• Embedding Public Engagement in the Curriculum: A Framework for the Assessment of Student Learning from Public Engagement
  www.publicengagement.ac.uk/sites/default/files/publication/assessing_student_learning_from_pe.pdf

• LESSONS IN LEARNING Primary schools, universities and museums
  www.ucl.ac.uk/museums/learning-resources/higher-education/lessons-in-learning.pdf

Evaluation

• Does it work? Better evaluation: better STEM

• RCUK Evaluation: Practical Guidelines
  www.rcuk.ac.uk/Publications/policy/Evaluation/