

Teachers Guide: Organised Chaos

What is it like to work at a contemporary science research facility and what has it got to do with me?

Project Background

This resource is developed as part of an STFC funded project called Organised Chaos that brings together contemporary UK science and in-service teachers in a way that encourages them to inspire children to be the next generation of scientists. It aims to challenge public ideas about what scientists do.

The project collaborated with The Diamond Light Source Facility, which is a UK Research Facility, to which scientists from across the world visit and use the special lightbeam resource. These lightbeams enable data to be collected from a wide range of objects and artefacts that would otherwise not be possible using imaging techniques. For more information visit www.diamond.ac.uk.

Teaching Context

Working scientifically is a strong feature of the primary and secondary Science National Curriculum in England. Within these documents teachers are expected to reference to contemporary scientists and as such this resource will support the pupils by providing a real and contemporary context for learning, posed through key questions about what scientists do and how.

The emphasis of this resource is about learning about the scientific process and not the acceleration of electrons.

What scientists do?

Why scientists work in the way that they do?

Who else scientists work with?

Where scientists work?

How scientists challenge each other?

Resources

Microscope, digital camera/I pad, flower, crème egg, dressmaker pin, sugar grains, Data cards printed onto- 7 colours- one set per group, Peer review cards set per group and a prompt card.

Curriculum Model

The 7E learning cycle used as the framework to structure the concept development. The curriculum map provided can be adapted and should be used flexibly for different settings, lesson lengths etc. There are 7 lesson parts, each with a learning rationale which is clearly defined. An activity resource is provided and the link to real UK science in practice is exemplified.

Slide by slide learning intentions

Title slide (slide1) – Encourages curiosity from pupils around the topic by setting a big question.

Slide 2. **ENGAGE.** Pupils to realize that every scientist does not have access to all the equipment that they might require.

Pupils will understand that equipment that is very expensive is often in a few specialized places for booking a time slot. Scientists regularly select equipment based upon their investigation needs and bid to use the most relevant equipment, wherever it is in the world.

Pupils are probably familiar with microscopes and 2D Xrays. They are encouraged to consider: What would you use each for and why? What is the problem if you have a crème egg, a living organ or fragile flower?

Activity: If available use a real object and real pieces of scientific equipment. What could you find out by using a digital camera, a balance, or a microscope? What could you not find out about? Make the link to the Diamond Light Source Facility which uses very fast light to look at very high magnification, e.g. they can examine a pinhead-sized crystal.

Slide 3. **ELICIT.** Pupils to review evidence.

Activity: Print slide 3 as a laminated placemat per group of pupils. The images are from real and current scientific research at the Diamond Light Source Facility. Pupils are asked to use tokens/coins to place their votes once the teacher raises a question. Questions are suggested (Slide 4). It is expected that different groups will vote on different images and will collect points if they can justify their choice.

Slide 5. **EXPLORE.** Pupils to appreciate that scientists from across the world share data with each other.

Scientists do this through informal and formal methods and collaborate to test ideas and review findings to make more sense of their own conclusions. Scientists can spend as little as 24 hours at the Diamond Light Source Facility and will have huge amounts of data shared by many other scientists.

Activity: Group pupils into seven groups. Each group is given a colour (see the jigsaw). Each group is given an evidence set and then new groups gather to make sense of their findings and draw a conclusion. The conclusions are then compared across the class.

Useful relevant storybook: Seven Blind Mice by Ed Young.

As the pupils develop as scientists they will need to value other people's findings to draw better conclusions.

Slide 6. **EXTEND.** Pupils to be aware that engineers are essential support to scientific data collection.

The Diamond Light Source Facility employs engineers and technicians. The scientists might request that their samples be mounted in specific ways or that the light beam

meet a precise specification. Engineers adapt and refine equipment to make the time data gathering as useful as possible.

Slide 7 -9 **ELABORATE.** Pupils to reflect upon the function of peer review across the scientific community.

The use of the Diamond Light Source Facility is free! So, who decides who gets to use the expensive equipment and for how long? Those wishing to use the facility submit a persuasive text to a panel of peers. These peers will decide upon those submissions that take the greatest priority.

Activity: Pupil groups is given a set of contemporary scientists' profiles.

Slide 10 **EXPLAIN** Pupils to....

What is it like to work at a contemporary science research facility? Public perception and stereotypes of scientists continue to exist. Evidence for this can be seen if you google the top 20 images for scientists to find mad, bad, lonely experts who know lots of right answers.

Activity: Show the video: Diamond Light Source Facility scientists. Ask pupils to think in role by imagining they are a scientist that spends four weeks a year at specialized facilities. Pupils have a post card and are assigned one task.

They are asked to create a photo/picture board linked to their role based on:

If I were a scientist at the Diamond Light Source Facility:

- What my parents might think I do?
- What my friends might think I do?
- What my partner might think I do?
- What my neighbor might think I do?

Examples of these can be found on Google to demonstrate the concept.

Slide 11. **EVALUATE.** Pupils to revisit the starting question: What is it like to work at a contemporary science research facility and **what has it got to do with me?**

This plenary draws explicit reference to the seven ways promoted in the activity set that reflect the ways scientists work, e.g. collaboration, communication, creativity etc.

Activity: Ask pupils to look at the list of 7 keywords and then ask them to reveal number of fingers – how many of the keywords apply to them.

Learning review: Pupils will be able to consider the relevance of the learning experience to their own career progression into science and engineering and should enable teachers to reinforce that the skills they demonstrate would support them to be a scientist.

