Module 3: Planning

Presenter notes

This presentation is designed to support CPD leading to the development of a more effective policy within a school relating to the form and function of practical work in science. The particular focus of this module is how to decide how to present practical science activities to a class.

The module is designed to be delivered in 60 minutes, or longer if time allows. The materials are designed to be used flexibly and creatively. If you have not already done so, please refer to the introduction module; this gives the overall background to the project and puts this, and other materials, into context.

Materials needed

- A method of projecting the presentation
- Flip chart or other way of gathering and displaying group contributions
- Task 1 – A copy of the *Sorting Exercise Task 1* sheet for each pair of participants
- Task 2 – A copy of *Concept Cartoons Task 2* sheet for each triplet of participants (colour printed)
- Task 3 – apparatus for demonstrating a number of different activities to the participants. For more details, see notes for slide 5 below
- Task 4 – A copy of *Thinking About Challenge Task 4* sheet for each participant.

References

- *Good Practical Science*, The Gatsby Charitable Foundation (2017): www.gatsby.org.uk/GoodPracticalScience

Outcomes

The outcomes of this session are:

- Comparison of the role of demonstrations, group work and individual activity in science lessons
- Consideration of the ways of managing the level of challenge presented in a practical activity
- Agreement on principles for planning and implementing practical science activities with colleagues.

Slides

Slide 2 (3 minutes). Introduce the outcomes and briefly put in context of your school.

Slide 3 (10 minutes). This slide is intended to initiate thoughts about the ways in which we present practical science activities – as individual tasks, as group tasks or as demonstrations.

It may emerge that a particular activity could be presented in any of these ways, and there is space on the Venn diagram to record this. If this occurs, a useful discussion can ensure over the 'best' way, and how a teacher should decide which presentation to use. Can the discussion generate a list of criteria, or a flow chart to help decide on the 'best' approach to use?

You may decide that 15 examples of activities are too much and the discussion is getting repetitive, in which case reduce the number of activities to be discussed. Other activities can be found listed in the document *Typical Key Stage 3 practical activities* mentioned in the introduction module.

Slide 4 (10 minutes). Three photographs with 'speech balloons' are provided (depicting an individual activity, group activity and a demonstration). The purpose is to illustrate how one approach may suit some people or some situations, but not others.

The intention for this activity is to consider in more depth the ideas raised in the previous activity, and to identify strengths and weaknesses of different approaches. The group should be able to generate a list of tips on how to overcome some of the weaknesses inherent in each approach.

Slide 5 (12 minutes). Demonstrations can be very powerful learning experiences for pupils. In this task, the presenter will demonstrate a number of practical activities to the group, who should then discuss whether the activity is best presented as a demonstration. By the end of the task, participants should be able to clearly identify when demonstration is the most appropriate way to present an activity, by listing some criteria. They should also be able to generate a list of tips for making demonstrations more effective.

Suggested activities will depend on the resources and facilities available. Choose four or five activities, some of which clearly should be individual or group tasks, as well as some that are only effective as demonstrations.

Examples that we have used include:

1. Compressing different sealed syringes containing either air, water or sand (to represent gas, liquid and solid).
2. Connecting two syringes, partially full of air, with a short length of plastic pipe. Get the audience to explain a) why one plunger moves out when the other is pushed in; b) why one plunger moves in when the other is pushed out. Frequently, the explanations fail to mention equilibrium and external air pressure, so this activity can be used to help develop understanding of a complex set of ideas used to explain the phenomenon.

3. 'Density bottle' (see https://www.youtube.com/watch?v=-gKGWzvZleE, first minute only).
4. Homopolar motor (see https://en.wikipedia.org/wiki/Homopolar_motor#/media/File:Homopolar_Motor_Large_neutral.jpg).
5. Why does a candle go out when inside a jar? Invert a jar over a burning tea light and the tea light (candle) goes out. Why? Many suggestions will include that carbon dioxide, being heavier than air, extinguishes the flame. Respond with a POE activity (predict – observe – explain) by placing coins under the rim of the jar when it is placed over the burning candle. This can be extended, if time allows, by floating the burning candle on water and observing changes in water level as the jar is placed over the candle and the flame extinguished. Changes in volume inside the jar are not consistent with a balanced chemical equation for the combustion of candle wax. The purpose of this activity is to show that the use of demonstrations can be used to overcome misconceptions, providing the dialogue that accompanies the demonstration addresses the ideas of the participants and leads to a greater level of understanding!

Slide 6 (10 minutes). Students may not achieve the teachers' intended learning outcomes for a practical activity if the level of challenge is too great, or they are distracted by too many conflicting ideas. We suggest that teachers should be able to adapt the way in which activities are presented in order to take account of these challenges.

Put simply, do not use a complex practical procedure when utilising a practical activity to teach a difficult science concept, and vice versa. Better to master the procedure (or the concept) first. An example would be using a microscope to look at cell division. Setting up and making observations through a microscope is a challenging procedural activity for many 14 year-old pupils. If they need to master these practical techniques when learning about the behaviour of the nucleus during cell division, the level of challenge may be too great to achieve those learning intentions. Better to learn about the nucleus dividing through some other means first, so that they can anticipate what will be observed to help them become competent and confident microscope users.

The task asks participants to consider a number of different practical activities often observed in secondary teaching, in terms of procedural and conceptual challenge. The intended output from this activity is a list generated by the group of how task presentation can be adapted a) to focus on skills development and b) to focus on developing scientific understanding. Suggest ways of managing challenge within a task for a specific learning outcome.

Slide 7 (5 minutes). When discussing and recording a set of principles that have emerged from the session, you may wish to think about how to structure the group (individual, pairs, subject disciplines, 'pair and share', etc.).

Slide 8 (5 minutes). Now draw together the list of principles generated and get the whole group to reach consensus on the three statements that are top priority for inclusion in the policy, and which three should be held in reserve for inclusion.

Slide 9 (5 minutes). This is a plenary slide, and it is expected that subject leaders will need to spend some time on this task once the session has ended.

The outcomes from the purposes module (a list of principles from slide 8) will need to be combined with the outcomes from other modules and other sources when the final policy is drafted.

Thank participants for their ideas, contributions and active involvement. State what the next stage in developing an effective policy will be.