Chapter 4

Self evaluation and next steps
Trying out various strategies

Many science teachers have a considerable grasp of numeracy skills. This sometimes makes it harder to understand the nature of the challenge that some pupils face when, for example, spotting trends in sets of data or rearranging a formula.

This section is about trying out some of the ideas in this iBook in new contexts and judging their effectiveness. Being aware of pupil responses is important as it can inform modifications to teaching and feedback to colleagues.

**ACTIVITY**

Identify an opportunity to try out a different approach to developing numeracy skills in forthcoming topics and activities.

Consider the context from the teaching sequence; reflect on the strengths and weaknesses of the students and how an alternative strategy may be of value.

Prepare your teaching input, utilising the new approach and using earlier pages from this iBook to help you.

**ACTIVITY**

Consider whether you are going to take a procedural approach or whether you are going to involve students in a discussion about which approach will work best.

A procedural approach is one in which you stipulate what the procedure is, and the challenge for students is to master that procedure. They learn the steps and how to apply them.

Alternatively, you may raise the question with the students as to how something can be approached. It may be that they have a preferred strategy, possibly one developed in other areas of the curriculum. The advantage of this approach is that it encourages students to develop a range of strategies and also the skill of deciding how to tackle something.

It also makes teaching more interactive and is likely to provide you with more of an insight into approaches that they feel comfortable with. However it needs a greater investment of time in the short term.

For example, if students are scaling the axes of a graph to show data from an experiment, you could ask them how they would go about doing it. Have strategies to hand, but be prepared to utilise their approaches if of merit.
ACTIVITY
What areas of mathematical skill do your students need to develop?

How do you know which skills your students need to develop?

Reflect on the written work relating to the use of maths in science produced by your students during the last year. What were the common errors? Were these errors those that you would expect? How did you try to resolve the issues? Were these approaches successful?

What do students think about their use of mathematical skills in science? How confident are they? Why is this? Do they know how to improve their mathematical skills in science?

Use the findings of your conversations and reflections to inform the activities you decide to try next.

ACTIVITY
It is important to gather evidence of the impact of the approach you have taken. As well as knowing how you approached the teaching, it will be important to gather evidence; this is likely to include a few examples of students' work and also student responses about the approach taken. This might be oral or written; it need not be extensive but is very likely to reveal how confident students feel with this approach.

Leading questions might include:

- How did this approach work for you?
- How confident do you feel about using it?
- Is it the kind of approach you’ve used previously?

Do you think you could use this again?
Science departments vary considerably in terms of the extent to which teaching strategies are discussed, shared and adopted. In some teams teaching approaches are left to individuals but an increasing number of departments are appreciating the value of exploring and evaluating various approaches.

**ACTIVITY**

Identify an opportunity to share your experiences of trying activities from this iBook with the rest of the science team.

If colleagues know that you are going to be sharing ideas about a particular approach they may be able to think through their own approaches and make a contribution to the discussion.

Plan your input by giving thought to sharing:

- Your reasons for wanting to develop a different approach
- The approach you took
- The success in terms of task completion by students
- The students’ responses to the approach, in terms of their attitude

Collaboratively you could consider the opportunities that have been presented to students previously and how these contribute to supporting progression in the development of their mathematical skills in science.

**ACTIVITY**

Share your experiences with the team. Make it clear why you are experimenting and how it worked. Be honest. Invite responses and be prepared to engage with different approaches.

Most colleagues will be prepared to consider your experiences and engage with the debate but some may feel defensive if they feel that their approach is (indirectly) being questioned.

Consider responses and decide how you will take this forward. It may be that your new approach is successful; it may be that you have gained other ideas from colleagues that you wish to try out.
Feeding back to the science team

**ACTIVITY**

Consider implications for departmental policy and practice.

It may be that the team wants to capture the ideas in a way that others can access; it may be that there are implications for schemes of learning and shared resources.

You might find it helpful to consider:

- When students are first taught the mathematical skills that you have been trying to develop;
- When the skills are first applied in a science lesson
- When students are given opportunities to practice their mathematical skills in science lessons
- Whether students are given sufficient opportunities to develop their mastery of mathematical skills in science
- Whether students know their areas for development and how to improve their mathematical skills
- How progression in the development of mathematical skills is mapped across the science curriculum and

How practice supports the expectations of the science GCSE and GCE specifications.
Schools vary significantly in terms of the extent to which departments share approaches to developing skills in common to those curricular areas. Where teaching strategies are shared, students develop mastery of the techniques involved more rapidly, reducing the number of errors seen and the amount of intervention needed to gain short-term improvements.

Teachers sometimes comment on the difficulty students face in using approaches from one curriculum area in another. It is not unreasonable for the crossover of skills to be supported by common teaching approaches and shared policies, including the explicit reference to approaches that students will have developed in mathematics lessons.

**ACTIVITY**

Working with a colleague in the Maths team, possibly the team leader, arrange a meeting and share with them your ideas, experiences and insights. Open up a dialogue - explain what you are working on, identify if there are possibilities for learning from each other and utilising common approaches so as to support students to maximise their learning.

**ACTIVITY**

Use the sample material you shared with the science team to explain the objective of your development work and find out how the Maths team have approached similar issues.

Establish:

- Whether it is seen as an issue
- Where in the curriculum it arises
- How it is approached
- What strategies are deployed
- What kind of task students are expected to undertake
- What the scope is for a shared approach

Provide feedback to the science team so that effective practice can be developed and shared widely across both teams.
ACTIVITY
Explore if there are other opportunities for shared approaches.

Common areas of interest may well include:

• Graphing data, including lines of best fit,
• Rearrangement of formulae
• Standard form
• Use of significant figures

The Mathematical requirements of GCSE and GCE courses may provide a useful focus for discussions – much of mathematics is delivered through context based scenarios – linking some of these scenarios to aspects of science will make it easier for students to bridge between the two subjects.
Taking action – suggested Next Steps

In the chapters you have read, you will have come across many possible activities – it is important to identify which activities you are going to complete and to think about how these will impact upon your students, their parents, colleagues, governors and other partners.

Reflect back over the suggested activities on the preceding pages of this and previous chapters. Identify a few actions that you might take – it is better to be successful in completing a small number of actions than to try to approach too many and fail to complete any.

The table below will help you to plan what you will do when. Remember, it is better to take a few actions and for them to have a positive impact, than to try to take a large number of actions and for the overall impact to be small.

<table>
<thead>
<tr>
<th>ACTION</th>
<th>IS THIS SHORT OR MEDIUM TERM ACTIVITY?</th>
<th>WHO WILL DO THIS?</th>
<th>WHEN WILL THE ACTION BE COMPLETED?</th>
<th>WHAT RESOURCES WILL BE NEEDED?</th>
<th>HOW WILL THE SUCCESS OF THIS ACTION BE MEASURED?</th>
<th>HOW WILL THE IMPACT OF THIS ACTION BE EVALUATED?</th>
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Try to link the outcomes of this iBook to your existing department improvement plan, to strengthen and support the identified actions in it and to provide evidence of the development that has taken place, either across the department, or as an individual.
Evaluation

Reflect on the actions you have selected to take forward on the previous page.

**REFLECT:**
For each action, you will have identified ways to monitor the impact on your students. As you engage in the actions, make sure that you gather the evidence you have indicated (and more if it is available), so that you can decide whether the action had a positive impact or not.

**REFLECT:**
When you have completed an action, ideally working with a colleague, review the evidence you have gathered to demonstrate the impact. If the action is having a positive effect on those to whom it was targeted continue it, perhaps involving a wider range of people; if there is little positive impact, consider why this might be (e.g. has something else had a major positive or negative impact which has affected the action you took?) and either adapt the action you are taking so as to increase the impact, or try something else instead.

**REFLECT:**
You may find it helpful to keep a log of the actions you take, the response of others affected by it and your own thoughts about the process you have engaged with.

**REFLECT:**
Try to use the outcomes of your actions to inform the future development planning within the department – share what you have found out more widely both within and beyond the science department.

This page will give you the opportunity to:

* Find out whether the actions we take work and have a positive impact on the intended groups of students.