Session 7: Questions Lab

The reading for this session is closely aligned with the previous session (in fact, it comes from the same book.) A natural next step after considering skillful questions for you to ask, is considering how to stimulate student questions and (hopefully) student answers. The author suggests strategies for developing children's skills in asking productive questions, using surrounding objects to raise questions, and turning "difficult" questions from learners into starting points for inquiry.

5 Break up questions whose answers would be too complex into ones that concern relationships the children can find out about and understand.
6 Take children's questions seriously, as an expression of what interests them; even if the questions cannot be answered, don't discourage the asking.

5 Helping children raise questions – and answering them

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In my experience, many of the questions children ask spontaneously are not profitable starting points for science. The commonest questions I get asked in infant classrooms are along the lines, 'Is Mr Jelly your husband/father/brother?' I quote this not as a facetious example, but to make the point that questions from young children reflect an urge to make associations with their previous experience. Even when this associative process is triggered by interesting materials with great potential for scientific investigation, a child's curiosity often does not show itself as spontaneous questioning but rather as a statement of interests. 'Look it (snail) has little eyes on stalks'. In situations like this, teachers have to intervene in order to frame problems that children can investigate in a scientific way: 'Are they really eyes?' 'Can snails see?' 'How might we find out?' So in practice it is very often a *teacher*'s questioning, not a child's that initiates scientific activity. For this reason any consideration of handling children's questions in science must be closely related to the way in which a teacher handles her own questioning.

In Chapter 4 a series of different types of question were discussed. They were called *productive* because 'they stimulate productive activity' and were distinguished from unproductive questions, which do not lead to scientific activity but the recall of factual knowledge. Unproductive questions are those to which a child either knows the answer ('Where did you find it?') or, if he does not ('What's it called?'), he obtains it from secondary sources – the teacher or books. Such questions may be very useful for encouraging conversation or, with the development of reading skills in mind, for sending children to books to acquire information, but as starting points for scientific activity they are very limited and unproductive. The features of these two types of question are summarized in the table below.

Unproductive	*Productive*
Promote science as information	Promote science as a way of working
Answers derived from secondary sources by talking/reading	Answers derived from first-hand experience involving practical action with materials
Tend to emphasize answering as the achievement of a correct end product (the right answer)	Encourage awareness that varied answers may each be 'correct' in its own terms and view achievement as what is learnt in the process of arriving at an answer
Successful answering is most readily achieved by verbally fluent children who have confidence and facility with words	Successful answering is achievable by all children

Productive questions are the type we need to encourage in the classroom if we wish to promote science as a way of working, but experience shows that teachers ask far more unproductive questions than productive ones and, frequently find the framing of productive questions a difficult task. This is not at all surprising because most of us have acquired our formal education in bookish environments and have accordingly established questioning styles that tend to require factual answers. But it is important to make the effort to change the pattern of questioning, since productive questions are a very powerful tool for the teacher. They have considerable value when planning science work; they are extremely useful in those 'thinking on the feet' situations where we make an instantaneous response to something a child says or does, and importantly, they are the kind of question that children can profitably 'catch' if we wish them to find their own problems for investigation.

If we are to improve the range and quality of questioning in a classroom three things are required:

1 Improve our own ability to ask questions.
2 Establish a climate of curiosity and questioning that is conducive to question-asking by the children.
3 Develop strategies for handling children's spontaneous questions.

Improving teachers' own questioning skills

From the various types of productive question illustrated in Chapter 4 (see also Chapter 6), it is possible to see that there are

general frameworks which can be applied in a variety of situations:

'Which ________ is best for ______?'
'Who has the ____________?' (strongest hair, best sight, keenest hearing)
'Will it ____________ if we __________?' (swing more quickly if we make it longer)
'Do ____________ prefer ________?' (any animal/any food or condition)

The key to generating specific questions for particular situations is *practice*. With this in mind here are three activities for teachers to help improve questioning skills.

1 Try taping conversation when there is science work going on in the classroom. Later analyse the questions the teacher asks. Are they unproductive or productive? What is the proportion of each type? Of the productive questions what kind of child activity did each promote? This is a salutory experience for us all! The first analysis may well prove a little disheartening but, over time, it becomes very encouraging to note how questioning styles can alter.
2 Scrutinize the questions posed in primary science books. Are they unproductive or productive? If productive, what scientific experiences are they encouraging? Many teachers who have carried out this activity report an increased awareness of question types and an increased facility in generating their own productive questions.
3 Use odd moments to practise question-finding. Suppose, for example, you are waiting in a car park (a useful situation, since all schools will have one). What is its potential for science? What productive questions could you ask about it to stimulate children's scientific activity? Make a list of attention-focusing questions (see Chapter 4, p. 37). Try to go beyond the obvious properties such as colour/shape/size/kind/age and include questions involving patterns and relationships. For example:

Which of the cars are rusting?
Which parts of a car rust?
Which parts have no rust?
Do all cars rust in the same place?
Is there any connection between the amount of rust and the age of a car?
What attention-focusing questions might you ask about car tyres, windows or lights?

Try also to identify problem-posing questions (see Chapter 4, p. 39), such as which colour is the best safety colour for a car?' Can you think of others? What productive questions are appropriate for a study of the buildings around the car park?

It's also useful to apply question-finding practice to normal classroom events. Think, for example, of the water play area of an infant classroom. The children will have observational experience of things that float and things that sink. How might their work be extended to involve fair-testing experience? What questions could they be asked? 'Who can make the best boat?' is one that can promote interesting discussion and activity. Can you think of another?

Establishing a classroom climate conducive to children's question-asking

If questioning styles are not taught, a teacher's verbal questioning will probably be the most important factor in establishing a climate conducive to question-asking by children. But it is not the only factor and so it is useful to consider ways by which curiosity might be aroused and how such curiosity can be linked to particular questioning frameworks. As a first step we need to get children's interest stimulated and this means giving them direct contact with materials. It also means that we need to think carefully about the nature of the materials that make children curious. Materials brought in spontaneously by the children have a built-in curiosity factor and need no further discussion; but what of materials selected by teachers? These can usefully be considered in two categories: those with immediate appeal and those that are commonplace when seen through childs' eyes, but which can evoke curiosity if teacher tactics present them in a new and challenging light. The first kind present fewest problems because we know that certain properties such as colour, shape and movement can, in themselves, trigger curiosity. Indeed we constantly capitalize on these facts when we introduce materials into the classroom. But if we remember that children's response is shaped largely by what they guess to be the expectations their teacher has for them, then in many classes materials will promote activities of the kind summarized in Fig. 5.1.

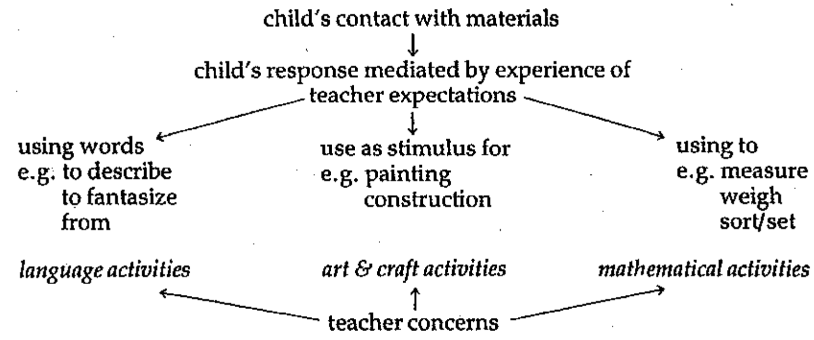

Fig. 5.1

Not surprisingly, therefore, a child's response tends to show itself as an application of the known (procedures and techniques), rather than in a concern for the unknown and an associated generation of questions. For this reason it is helpful to concentrate consciously on building up what we might call the questioning dimension in childrens' expectations of how teacher would like them to respond. This dimension can be developed when they associate with a teacher's productive questioning style. It can also be strengthened by teacher-promoted activities which reinforce the style; activities that bring children into contact with materials linked to appropriate questions, and activities that provide opportunities for children to frame their own productive questions. Increased contact with appropriate questions can be achieved in a variety of ways. For example:

1 By making sure that displays and collections have associated enquiry questions for the children to read, ponder and perhaps explore incidentally to the main work of the class.
2 By introducing a problem corner or a 'question of the week' activity where materials and associated questions are on offer to the children as a stimulus to thought and action which might be incorporated into classwork.
3 By making 'questions to investigate' lists that can be linked to popular information books.
4 By ensuring that in any teacher-made science work cards there is a question framed to encourage children to see their work as enquiry-based and which also provides a useful heading for any resultant work displayed in the classroom.

Opportunities for children to frame productive questions include activities such as:

1 Using regular class time (such as news time or equivalent) to encourage children to talk about something interesting they have observed, and to tell others of the questions it prompts.
2 Encouraging children to supply 'questions of the week' (as in the activity described above).
3 Establishing procedures by which children, having completed a piece of work, are encouraged to list further questions about it. For example, individually when completing a work card or collectively when discussing work on display.

With techniques such as these it is often surprising how much the quality of children's questioning improves over a period of time. However, it should be stated that, initially, most children find it a very difficult task and tend to ask only unproductive questions. They will need lots of encouragement and quite clearly too much emphasis on question-asking too soon can be counter-productive and may result in a 'not another question' dismissal rather than the excitement and enthusiasm we wish to develop.

Curiously, materials that are very 'ordinary' in childrens' eyes often generate more sustained question-asking than materials with obvious child appeal. Perhaps this is because a child's particular involvement with things with immediate appeal is sufficient satisfaction in itself and further scrutiny becomes an intrusive and unwanted distraction. Whatever the reason, it is worth considering how commonplace things can be used to promote question-generating situations. For example:

1 By using collections of everyday things as a focus for linking materials with teacher-framed questions. A collection of kitchen utensils, say, has little immediate appeal but associated with appropriate questions it can provide challenging involvement. If for example the tools are sorted by function many enquiry questions can follow. In time, children can be encouraged to organize their own collections of 'ordinary' things and supply questions for others to investigate.
2 By selecting materials for practical investigation that do unexpected things. As for example, the effect of dropping a plasticine ball on polystyrene when investigating bouncing balls, Anomolous happenings are very good question stimulators.
3 By using magnifiers and microscopes to extend children's observation so that they will see exciting detail in familiar things.
4 By considering the extent to which the conventional aesthetic approach to display can be broadened to include materials which may not be visually pleasing but which justify inclusion in display themes because of their potential for enquiry work. For example, a display centred on the theme of the sea is made richer educationally by the inclusion of some tatty, ugly shoreline debris if the material is linked to challenging questions.

Teacher tactics of the kind described do, undoubtedly, improve the climate of enquiry in a classroom and, as a consequence, lead to more spontaneous questioning by children.

Handling children's spontaneous questions

Spontaneous questions from children come in various forms and carry a variety of meanings. Consider for example the following questions. How would you respond to each?

1 What is a baby tiger called?
2 What makes it rain?
3 Why can you see yourself in a window?
4 Why is the hamster ill?
5 If I mix these (paints), what colour will I get?
6 If God made the world, who made God?
7 How long do cows live?
8 How does a computer work?
9 When will the tadpoles be frogs?
10 Are there people in outer space?

Clearly the nature of each question shapes our response to it. Even assuming we wanted to give children the correct answers, we could not do so in all cases. Question 6 has no answer, but we can of course respond to it. Question 10 is similar; it has no certain answer but we could provide a conjectural one based on some relevant evidence. All the other questions do have answers, but this does not mean that each answer is similar in kind, nor does it mean that all answers are known to the teacher, nor are all answers equally accessible to children.

When we analyse what we do everyday as part of our stock in-trade, namely respond to children's questions, we encounter a highly complex situation. Not only do questions vary in kind, requiring answers that differ in kind, but children also have different reasons for asking a question. The question may mean 'I want a direct answer', it might mean 'I've asked the question to show you I'm interested but I'm not after a literal answer.' Or, it could mean, 'I've asked the question because I want your attention – the answer is not important.' Given all these variables how then should we handle the questions raised spontaneously in science work? The comment of one teacher is pertinent here:

'The children's questions worry me. I can deal with the child who just wants attention, but because I've no science background I take other questions at face value and get bothered when I don't know the answer. I don't mind saying I don't know, though I don't want to do it too often. I've tried the "let's find out together" approach, but its not easy and can be very frustrating.'

Many teachers will identify with these remarks and what follows is a suggested strategy for those in a similar position. Its not the only strategy possible, nor is it completely fail safe, but it has helped a large number of teachers deal with difficult questions. By difficult questions I mean those that require complex information and/or explanation for a full answer. The approach does not apply to simple informational questions such as 1, 7 and 9 on the list above because these are easy to handle, either by telling or by reference to books, or expertise, in ways familiar to the children in other subject areas. Nor is it relevant to spontaneous questions of the productive kind discussed earlier, because these can be answered by doing. Essentially it is a strategy for handling complex questions and in particular those of the 'why' kind that are the most frequent of all spontaneous questions. They are difficult questions because they carry an apparent request for a full explanation which may not be known to the teacher and, in any case, is likely to be conceptionally beyond a child's understanding.

The strategy recommended is one that turns the question to practical action with a 'let's see what we can do to understand more' approach. The teaching skill involved is the ability to 'turn' the question. Consider, for example, a situation in which children are exploring the properties of fabrics. They have dropped water on different types and become fascinated by the fact that water stays 'like a little ball' on felt. They tilt the felt, rolling the ball around, and someone asks 'Why is it like a ball?'. How might the question be turned by applying the 'doing more to understand' approach? We need to analyse the situation quickly and use what I call a 'variables scan'. The explanation must relate to something 'going on' between the water and the felt surface so causing the ball. That being so, ideas for childrens activities will come if we consider ways in which the situation could be varied to better understand the making of the ball. We could explore surfaces keeping the drop the same, and explore drops keeping the surface the same. These thoughts can prompt

others that bring ideas nearer to what children might do. For example:

1 Focusing on the surface, keeping the drop the same:
   What is special about the felt that helps make the ball?
   Which fabrics are good 'ball-makers'?
   Which are poor?
   What have the good ball-making fabrics in common?
   What surfaces are good ball-makers?
   What properties do these share with the good ball-making fabrics?
   Can we turn the felt into a poor ball-maker?

2 Focusing on the water drop, keeping the surface the same:
   Are all fluids good ball-makers?
   Can we turn the water into a poor ball-maker?

Notice how the 'variables scan' results in the development of productive questions that can be explored by the children. The original question has been turned to practical activity and children exploring along these lines will certainly enlarge their understanding of what is involved in the phenomenon. They will not arrive at a detailed explanation but may be led towards simple generalization of their experience, such as 'A ball will form when . . .' or 'It will not form when . . .'.

Some teachers see the strategy as one of diversion (which it is) and are uneasy that the original question remains unanswered, but does this matter? The question has promoted worthwhile scientific enquiry and we must remember that its meaning for the child may well have been 'I'm asking it to communicate my interest'. For such children interest has certainly been developed and children who may have initiated the question as a request for explanation in practice, are normally satisfied by the work their question generates.

The strategy can be summarized as follows:

Analyse the question
↓
Consider if it can be 'turned' to practical activity (with its 'real' materials or by simulating them)
↓
Carry out a 'variables scan' and identify productive questions
↓
Use questions to promote activity
↓
Consider simple generalization children might make *from experience*

It is not a blueprint for handling *all* difficult questions, but it does provide a framework that helps us to cope with many of them. Its use becomes easier with practice. Try using it to respond to question 3 on page 53 (a comparatively simple application) and to the question, 'Why do aeroplanes stay up?' which is a more complex application. The task may be difficult initially, indeed several aspects of the analysis and use of questions put forward in this chapter may prove likewise. But the effective handling of questions is vital in any science programme.

Summary of main points

Children learn their question-asking habits from teachers. If children are to be encouraged to raise questions that lead to investigation, this is one more reason (added to those given in Chapter 4) for teachers making the effort to ask more productive questions and fewer unproductive ones. Some specific ways in which teachers can practise and improve question skills have been suggested.

The atmosphere in the classroom must also be conducive to encouraging children to ask questions. Some ways of showing that questions are welcome are by adding questions to displays and collections, introducing a problem corner in the classroom, creating lists of 'questions to investigate', making sure any work cards or sheets are framed in terms of investigable questions. Regular discussion of questions is also important. Children, like teachers, do not find it easy at first to change the emphasis in their questioning from unproductive to productive. Novel materials are not necessarily the best stimulus; often more familiar ones help children raise questions, especially with a lead from the teacher to the kind of productive questions that can be asked.

Once children begin to ask questions they will ask ones of all kinds; some will be difficult for teachers to handle, but it is important to find a way of doing this which does not make the child wish (s)he had not asked. A strategy has been described for analysing children's questions so that unproductive ones can be used productively.

Guidelines for encouraging children's questioning

1 Provide a wide range of materials for children to respond to.
2 Practise and improve your questioning style so that it provides an example for the children.
3 Provide a climate of enquiry for children to work in.

4 Encourage children to form and to discuss their own questions.
5 Respond positively to children's spontaneous questions.
6 Turn children's unproductive questions into productive ones that promote investigation of real materials.