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Author(s)	Leong, Amy
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THE USE OF QUESTIONING IN THE DEVELOPMENT OF CHILDREN'S THINKING IN ELEMENTARY SCIENCE LESSONS

AMY LEONG

"Always the beautiful answer who asks a more beautiful question."

e.e. cummings

The Role of Teacher Questioning in the Classroom

Recent developments in the fields of technology and science have ushered in a broad spectrum of new knowledge, and led subsequently to the rapid obsolescence of a major portion of this knowledge. Many things learned in the way of specifics for permanent retention by a child in today's primary science classroom will probably be out-of-date before he reaches the end of his secondary school career. There is, therefore, an urgent need to help the child develop his critical thinking faculties so that he can learn how to learn on his own.

An examination of the various recent elementary science curricula will show that, despite their diversity, they share the common underlying feature of encouraging the use of an inquiry approach. Teaching and learning science by the inquiry approach involves proper questioning which leads to the use of scientific processes for finding answers. It has been said that the asking of questions is one of the basic ways by which the teacher stimulates student thinking and learning. Dewey in his book, *How We Think,* put forth the view that the art of questioning is "the art of guiding learning", for in the skilful use of learning, we have "the guide to clear and vivid ideas, and the quick spur to imagination, the stimulus to thought, the incentive to action". Karplus and Thier, the developers of Science Curriculum Improvement Studies

(SCIS), urged that question-making in the classroom should be a process demanding careful reflection and analysis, instead of the free and spontaneous type typical of most daily questioning exchanges.

How Do Children Think?

Many regard children as miniature adults. In fact, children differ considerably from adults in their perceptual abilities, language comprehension, and thought patterns. Young children tend to ask questions such as "Why don't we see two things with our two eyes?" Through such questions, the child reveals to us the relationships in his world. If the teacher can duplicate this state of perception – at least, components of this style – he may gain an invaluable aid in facilitating the child's learning. Clearly logic and learning are not innate in the child. Instead they evolve gradually and their development can be enhanced by using stimulating questions to direct the child's attention to the significance of their learning experiences. Hence it is very important for a teacher to assess, as accurately as possible, the level of a child's development and design questions accordingly.

What Questions Do We Ask?

If questions can help unlock others' feelings, thoughts or actions, consciousness of the questioner's intent gives substance and shape to these keys. Many of the questions we ask in the classroom seem to get bogged down in the "knowledge" category – the necessity to learn facts. We should not conclude too hastily that our present plight be remedied by bringing in the "how" and the "why" questions. Memory questions should not be discarded because some facts are necessary in themselves; others serve as stepping stones for building concepts and larger generalizations. Hunkins, in his book entitled *Involving Students in Questioning,* suggests that questions be developed at the lowest level of Bloom's taxonomy with succeeding higher-order questions posed to students after they have accumulated a sufficient number of facts. This implies orderliness and logical progression. For example, in a lesson on "Magnets" for a Primary Four class, the teacher may plan his questions in the hierarchy as shown below:

(a) What are magnets made of? (Factual)

(b) Which of the following substances are attracted to a magnet: iron, nail, pencil, wooden ruler, pins, and paper clip? (Factual)

(c) Which parts of the magnet have the strongest power of attraction? (Factual)
Name the parts. (Factual)

(d) What will happen if two magnets are brought together with opposite poles facing each other? (Prediction)

(e) Suppose you are given two substances X and Y. One is a magnet, while the other is a piece of iron. How do you find out which is the magnet? (Hypothesizing)

Ineffective Questions and Questioning Techniques

It is rather difficult to judge the effectiveness or ineffectiveness of questions on their face value alone. Nonetheless, in the course of my interaction with pupils, I have found the following types of questions and questioning techniques generally ineffective and I suggest that the teacher should avoid using them, whenever possible:

1 QUESTIONS WHICH ELICIT ONLY "YES" OR "NO" RESPONSES

As teachers we are seldom interested in simply a positive or negative response. Most of the time we follow up with another question like "Why do you think so?" or "How come?" Questions which elicit only "Yes" or "No" responses are therefore a waste of time and provide invitations to chance guessing. It is easy to identify and hence avoid asking such questions for they begin with a "helping verb" or "auxiliary verb" like is, are, was, were, do, does, could, should, would, might, shall, will, has, had, have.

2 AMBIGUOUS QUESTIONS

Sometimes children are baffled by questions like "What can you tell me about light?" They are not sure what the questioner expects. They remain silent until the questioner himself is aware of how broad the question is, and offers a more specific question instead.

3 STATEMENTS WHICH BEGIN AS DECLARATIVES AND TURN INTO INTERROGATIVES

These include questions like "Yesterday we learned that there are three states of matter; these are ... what?" These questions are unfair because they throw the students off guard by initially lulling them into passivity and then suddenly calling on them for action.

4 "EVERYTHING IS EXCELLENT"

When we accept any and every response without comments or requests for clarification, it reflects the lack of discernment on our part. Students will soon lose interest and begin to wonder about the significance of the questions.

5 THE *RIGHT* ANSWER

A complete reverse to the previous situation mentioned is when we accept none but "the one, and only one, *right* answer". It encourages students to learn by rote what the teacher tells them in class and regurgitate it when asked to do so. In addition to this, it may result in students perceiving things in a very narrow way and may stifle their development for critical thinking.

6 SPEEDING

This technique involves a rapid-fire kind of approach. It does not allow adequate time for the pupils to stop and think the question over before answering it.

Suggestions for Improving the Skill of Questioning

1 Ask questions that are simple, concise, and as direct as possible.

Poor example: How many of you can tell me something about the poles of a magnet?

Better example: What happens when unlike poles of two magnets are brought together?

2 Direct the question to the whole class instead of designating any particular child to answer even before the question is asked. Some studies have shown that teachers tend to direct their questions to pupils within the "inverted T" in the classroom plan shown in Figure 1. Hence it is important to make a conscious effort to involve those pupils not within the "inverted T" as well. One way to do this is to make a mark against the pupil's name on the class plan, whenever he is asked a question.

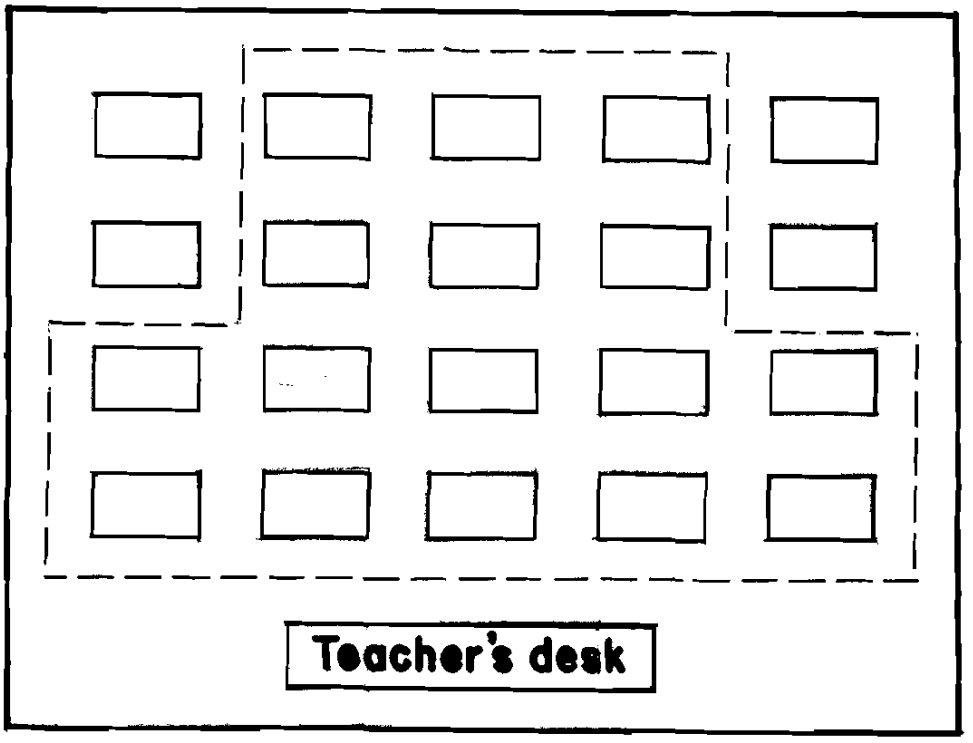

Figure 1

3 Allow for wait time so that the pupils will have adequate time to think about the question.

4 Ask questions that encourage children to use critical thinking processes. Design questions that lead pupils to:

(a) ILLUSTRATE

Example: Name three systems that you see around you.

(b) INFER

Example: A glass of ice-cold water is left on the table. A little while later, water droplets appear on the outside of the glass. Where does the water come from? Why do you think so?

(c) PREDICT

Example: What would happen if some iron nails are left in a dish of water for a few days?

(d) HYPOTHESIZE

Example: What do you think has caused a piece of bread to turn mouldy after it has been left on the table for a few days?

(e) INTERPRET

Example: What does the flat portion of the temperature-time graph tell you about the temperature of the boiling water during that interval of time?

Conclusion

In conclusion, it must be emphasized that the use of questions in the classroom should be a conscious development of the thought processes which will lead to understanding. Neil Postman and Charles Weingartner in *Teaching as a Subversive Activity* emphasized the importance of such awareness. They recommend that questions should increase the will of the learner as well as his learning capacity, and develop a "sense of joy in learning". The most important purpose of classroom questioning is probably two-fold: to promote thinking and to request *(not demand)* the sharing of thoughts. What is extremely powerful and yet also precarious about questioning is that one can hope for just about any sort of shared response, but there is no guarantee that the desired answer will be given. So, whether questions become bypasses leading to ignorance or throughways to real understanding depends on teachers getting the message across before too many of our pupils lose their curiosity and enthusiasm for learning.

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