Inquiry Training Model
(The Suchman Inquiry Model)

Background

When children are young the world to them is full of questions to ask. Somewhere along the way, they get the idea that becoming an adult means leaving the world of questioning to enter the world of knowing the answers. Schools tend to encourage the movement from questions to answers since success becomes putting the right answer in the blank or marking the correct response. Questions in school tend to have one right answer and questions for which there are no answers are rare.

It has been stated that true wisdom might best be defined as knowing how little one knows in contrast to how much one knows. Therefore, if knowing how to learn is more important than knowing all the answers, then one must realize that good questions are more important than right answers. Teaching students to question and ask quality questions is more important than the correctness of the answers they can give.

Teaching science through inquiry requires that students ask questions and figure things out for themselves. It involves the attempt to answer questions and seek information. Inquiry can be conducted in a variety of ways: observing nature, predicting outcomes, manipulating variables, analyzing situations, and verifying assertions. It may involve discussing topics with others, reading, conducting field studies, surveys, and laboratory investigations, or all of these as one attempts to discover new knowledge and to figure things out.

The inquiry model, developed by Richard Suchman, is based on the premise that the intellectual strategies used by scientists to solve problems and inquire into the unknown can be taught to students. Using the natural curiosity of students, they can be trained and disciplined in the procedures of inquiry. The model was developed from analyzing the methods used in creative research personnel. The elements of their inquiry process were identified and these were built into an instructional model called inquiry training.

Inquiry training is designed to bring students directly into the scientific process through exercises that compress the scientific process into small periods of time. The training has resulted in an increased understanding of science, more creative thinking, and skills for obtaining and analyzing information as students establish facts, build concepts, and then generate and test explanations or

theories. The students are active learners involved in exploration, questioning, problem solving, inductive reasoning, invention, labeling, and discovery.

The inquiry process will help students:
1. approach future problems with confidence in their abilities to seek out the solution
2. to begin to consider success and failure as information rather than reward or punishment;
3. practice the process to develop the ability to sense the relevance of variables, make intuitive leaps, and put problems into forms with which they know how to work; and
4. improve their memory process because when they integrate material into their own cognitive structure, thus material is made more readily retrievable

The inquiry training method requires active participation in scientific inquiry and capitalizes on the student's natural curiosity. The general goals of inquiry training are to:
1. develop the intellectual discipline and skills necessary to raise questions and search out answers stemming from their natural curiosity;
2. acquire and process data logically' and
3. develop intellectual strategies that they can use to find out why things are as they are.

The Inquiry Training Model is based on Suchman's theory that:
1. students inquire naturally when they are puzzled;
2. they can become conscious of and learn to analyze their thinking strategies;
3. new strategies can be taught directly and added to the students' existing ones; and
4. cooperative inquiry enriches thinking and helps students to learn about the tentative, emergent nature of knowledge and to appreciate alternative explanations.

This model differs from other inquiry models in the way the data are presented. Students gather data in a simulated process through questioning rather than actual manipulation of data. Thus, the method is more process oriented as the primary goal is to improve students' ability to relate data to the inferences they have formed.

Inquiry training has five phases. The first phase is the student's confrontation with the puzzling situation. Phases two and three are the datea-0gathering operations of verification and experimentation. IN the data-gathering phases, the students ask a series of question that the teacher answers with a yes or no, and they conduct a series of experiments of the problem situation. In the fourth

phase, the students organize the information obtained during the data-gathering phases and try to explain the discrepancy. In the last phase, students analyze the problem-solving strategies they used during the inquiry.

The teacher's role is to construct the problem situation, to referee the inquiry procedures, to respond to students' inquiry probes with the necessary information, to help students establish a focus in their, and to facilitate discussion of the problem situation among the students.

Presentation of the model
A. Preparation for the Inquiry

1. Identify a problem requiring an explanation. In selecting the problem or event, these criteria need to be considered:

a. the event must pose a problem which requires a discoverable explanation, as opposed to teaching a fact, concept, or generalization. The problem must be genuinely interesting and stimulating to the learner.

b. the level of the problem must be approximately matched with the level of the learner.

c. the curiosity and motivation of the student are enhanced if the problem is prepared in a way which makes it appear discrepant.

d. the event focuses the student on a particular problem rather than on a set of problems in general.

2. In selecting the medium for presenting the problem/event, design experiences which will bring students into contact with a problem-evoking situation. Discrepant events, demonstrations, films, audio tapes, graphs, tables, problems and case studies can be used to start the inquiry process. It must be a puzzling situation to the students and conflict with the idea of reality.

The model can be presented in a variety of ways. To help the students improve their thinking skills, have them work in groups and follow the format on the worksheet.

B. Inquiry Training Lesson

Phase One: Confrontation with the Problem

a. Present the problem situation

b. Explain the inquiry procedures to the students.

i. They are to gather data through questions they ask of the teacher/ instructor who will be the main source of data.

ii. Each question must be asked as tentative hypothesis.

iii. The questions should obey two criteria: they must be answerable yes or no. (This places the responsibility for analyzing the problem on the students.) And the results

must be obtainable through observations rather than requiring an inference. The teacher may decide to add information or expand on the problem at any time; however, it is important that students experience some frustration as they question. Instead of asking students, "Is this what you mean?" it is better to say, "Can you repeat the question?" or "Can you state the question so I can answer it yes or no?" Avoid answering the questions for them. A teacher might say, "Yes, that is part of the answer, but why don't you consider this additional piece of information in light of what you have already discovered."

iv. Once called on, the student may ask as many questions as he/she wishes before yielding the floor to another student. Students must understand that they may ask question only when called upon.

v. Students should be encouraged to work together whenever possible. Encourage the students to call for a caucus when they need to talk to each other, but do not permit them to talk to each other during the questioning periods.

Phase Two: Data Gathering—Verification

a. Gather information about the event/problem to verify the nature of the objects and conditions.

b. Confirm the occurrence of the problem situation. The data should be recorded on the board or on data sheets kept by each student.

Phase Three: Data Gathering – Experimentation

a. Isolate relevant variables. Students introduce new elements into the situation to see if the even happens differently, changing things to see what will happen.

b. Students hypothesize a solution to the problem. When a student poses a theoretical question that seems to be an answer to the problem, the question is stated as a theory and written on the board. Now all data gathering is related directly to proving or disproving this theory. Students may caucus to discuss the information and nature of the problem and frame hypothetical questions which they will ask of the instructor. Depending on the nature of the problem, the students could be directed to other sources of information, activities, or to actual experimentation in the laboratory. They can also use a series of questions of the teacher to test the hypothesis.

c. Hypothesis are confirmed or revised.

       i. If the theory seems verified, then the class accepts
     the hypothesis as a solution and moves to the next
step.
       ii. If the hypothesis is not acceptable and is rejected
     by the class, then general data gathering begins
     again. Other hypothesis may be posed and tested
until a hypothesis has been accepted by the group.

Phase Four: Organizing, Formulating an Explanation

     a. Ask the students to explain the hypothesis that has been
accepted as a tentative solution to the problem and organize
the data to support the hypothesis. They should determine
how the hypothesis could be tested to see if the date can be
generalized to other situations.
     b. Have the students state their explanation so that the range of the
possibilities are noted.

Phase Five: Analysis of the Inquiry Process

     a. Ask the students to review the process they have just
used to arrive at acceptance of the hypothesis (their pattern
of inquiry). Which questions were the most effective?
Which direction of questioning was the most productive?
Which questions were not helpful? What type of information
was needed and not obtained?
     b. Discuss ways that they could have improved their inquiry.

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