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ABSTRACT

Many elementary classroom teachers must overcome the following problems in order to teach science effectively: (1) a lack of background in scientific concepts and general information; (2) a scarcity of science equipment and supplies on hand or insufficient funds to purchase them; (3) little basic knowledge of the skills, processes and attitudes that differentiate science as a body of knowledge from science as a way of finding out things. This paper suggests a teaching technique for overcoming these problems. A commonplace topic is chosen (such as footwear), and using student suggestions, a number of possible activities are compiled. A flow chart is provided outlining many suggested student activities relating to footwear. The "science" occurs in the methods devised by the children to investigate their suggestions. Small groups of children thoroughly plan how they will carry out their investigation, discuss their proposal with the teacher, and then collect their data. Results are presented to the class by a variety of means such as transparencies, the blackboard, and charts, and a class discussion and analysis should follow. Often these discussions lead to the need for a formal lesson presented by the teacher, and suggest new interesting topics and avenues of investigation to the students. (JR)

DEVISING YOUR OWN INVESTIGATIONS USING COMMON CLASSROOM AND HOUSEHOLD MATERIALS

The regular Elementary classroom teacher in the majority of Ontario schools must overcome many of the following problems in order to teach Science effectively:

A Lack of Background in scientific concepts and general information.

A Scarcity of Science Equipment and supplies on hand or insufficient funds to purchase them.

Little or No Basic Knowledge of the Skills, Processes and Attitudes that differentiate "Science" as a "Body of Knowledge" from "Sciencing" as a way of finding out things.

The task of trying to be expert in a large number of subject areas and the emphasis upon Mathematics and Language Arts often means that Science will be neglected or forgotten.

As a result, when Science is taught, it is too often:

Literature Type Lessons consisting of secondhand experiences gained largely from textbooks, encyclopedias, filmstrips, movies, cook's tours, television programs, lectures, quizzes or blackboard outlines and diagrams.

Nature Study rather than a balance of elements of Physics, Chemistry, Biology and Earth Science.

Playing of the Game - What's On the Teacher's Mind as a substitute for logical or critical thinking. When teachers do all the planning, organizing and evaluating, they and not the students are usually the ones who are "learning how to learn".

Fragmented and Compartmentalized instead of integrated with other subject areas where natural connections occur, often resulting in problems with courses of study and timetabling.

The preamble to P1,J1 Interim Revision Science, the guidelines from the Ontario Ministry of Education, states that:

(a) "... every child learns best when real things ... are at hand.
"... younger children think better when they are handling real materials.

(b) "... the interests of individual children and groups of children should determine their activities ..."
"... to some extent each individual child will have his own program.

(c) "... the experiences of the young child as he attempts to find things out are often more important than what he discovers."

(d) "The investigation would broaden out freely according to the interests of the children."

(e) "A program designed to encourage free enquiry need not be disorganized."

Paper presented at the 21st Annual Convention of the National Science Teachers Association held in Detroit, April 2, 1973.

Here is just one possible method that has proven useful in overcoming many of the aforementioned problems and enabled teachers to meet the objectives outlined above.

The topic selected as a vehicle is Footwear.

Why Study Footwear?

1. Shoes are safe, common, everyday objects found right at your feet.
2. The pupils can easily obtain a good supply of shoes.
3. Shoes possess a wide variety of characteristics (variables).
4. There is very little material written about the scientific aspects of shoes at a child's level.
5. Children and teachers have very few preconceived ideas about the topic so there is a greater chance to be creative.

What Other Topics Could be Substituted?

Almost anything from minnows to matchboxes could be used in place of shoes. Bottles, bulbs, buttons, boats, bones, potatoes, papers, cloths, cereals, strings and toys have all been found to work very well.

Some Suggested Steps

Step 1 Brainstorming

Brainstorming should be done first by the teacher to make a flow chart and then with the pupils to develop a list. Its purpose is to compile a number of possible activities that could be of interest to the pupils.

(a) Begin by asking the pupils to suggest activities that they could do using real shoes to find out more about shoes. Stress that the pupils' suggestions must be things to do and that these activities must be suited to investigation largely within the school area. Record their suggestions on the blackboard, overhead projector, chart paper so that they may be kept for future reference. The pupils' suggestions could include things associated with geography, history, math, art, literature or music, etc. The Science occurs in the method devised by the children to investigate their suggestions.

(b) Have the pupils examine as wide a variety of types of footwear as can be conveniently assembled; i.e., all sizes and types of slippers, boots, rubbers, sandals, skates, snowshoes, etc. Other objects associated with the topic such as pictures of people wearing shoes, shoe repair tools, etc., could also be included in the display. When the children have looked at these things and handled them, ask for more suggestions and add these to the list.

(c) The final step in the brainstorming occurs when the teacher adds suggestions from her planning that the pupils overlooked.

Step 2 Forming Groups

Refer to the list of suggestions developed in part one and allow the pupils to select the particular activity that they would like to investigate. Some activities may not be selected. Some pupils may wish to investigate an activity all by themselves. A group of two students would probably be an ideal size. Some groups willing to participate in an activity may be too large, thereby necessitating some pupils to select a second choice. Large groups could be broken up into smaller groups each trying the same investigation if there is sufficient equipment.

The names of the pupils involved with a particular activity could be recorded beside the appropriate activity right on the list. This will aid the teacher in keeping track of who is or has done what.

Step 3 Pupil Planning

When groups have been established, each group could then make the following decisions about the activity that they had selected.

(a) What will we need?
(b) Where can we obtain the materials?
(c) How will we use the materials?
(d) What will each person do?
(e) How will we record the information?
(f) How will we display what we have found out?

The wise teacher will wish to discuss each group's plans with the members of that group. This could be done with one group at a time while the remainder of the class is at work in other subject areas. At this stage, the teacher may wish to guide the pupils by asking such questions as:

(a) Do you have enough trials to rule out chance?
(b) Should you take an average?
(c) Do you have a control for purposes of comparison?
(d) Is only one variable being changed at a time?

and other scientific method aspects that would not normally occur to children. Alternatives regarding safety and practicality may also need to be recommended.

Step 4 Carrying Out the Investigation

The pupils should now be ready to carry out their investigation working largely on their own. The teacher will be needed to answer many questions and give assistance when an activity gets bogged down. Many activities will require numerous modifications as much learning occurs through trial and error. The atmosphere in the classroom will include noice, mess and movement. The teacher may find a signal of some sort of value in recapturing the pupils' attention should this interruption become necessary. As the pupils work, they would be encouraged to collect their data on rough paper. The activity then should not be considered complete until the data has been used to reach some discussion or form some answers to the problems under investigation.

Step 5 Displaying the Results

This step is designed to provide the pupils with an opportunity to translate their rough work into a finished product. To do this, the pupils should be free to choose from a wide variety of media and recording techniques the type that they feel is the most appropriate; i.e., graphs, charts, paragraph work, diagrams, tape recordings, overhead projector transparencies, painted pictures, murals and so on. In any case, the emphasis in recording should be on communicating. The final result would, therefore, be large, brief, colourful and more accurate than the rough work. It should be displayed in some manner so that everyone in the class can see it. The display need last only until there is something new to replace it.

Step 6 Capitalizing on the Results

This aspect is perhaps the one that is most important and the most often neglected. The teacher may wish to select for peer group evaluation, through discussion, the work displayed by a particular group of pupils. The work selected might be of value to the entire class because it contains an important concept. A good example of pupils' work could be used to reinforce a technique or skill previously taught. Discussion could be used to correct an error or to reward someone who has made significant progress.

In criticizing each other's work, the pupils could be encouraged to make such positive statements as: The thing I liked best is ... or If I had done it I would have .... The pupils could talk about neatness, use of colours, spelling, special organization, grammar, accuracy of conclusions, the degree of being scientific and so on.

During the activity portion, the display and the discussion, the observant teacher may recognize a need to teach a formal lesson. He may have identified deficiencies in science skills, math operations, recording techniques, language and so on. These might be taught only to small groups of pupils or to the class as a whole.

Many teachers may wish to use the experiences of the pupils as the base for the creative writing of stories and poems. Songs based on the theme might be sought out and sung. Chart and graph displays could be used to teach interpolation and extrapolation. Predictions could be varified by experiments. Graphs and charts could be shown to other pupils to see if they can identify what the data tells.

Step 7 Adding to the List

When a group of pupils have completed their initial investigation, they are ready to move on to another activity. During their investigation, they may have become aware of more possibilities for other activities. These new suggestions should be added to the original list. New groups of pupils will form as new interests are selected. The activities added to the list may begin to spread further and further out from the original topic; i.e., the treads of shoes may lead to an interest in tracks, and tracks to animal's feet or tires and so on.

The teacher may wish to terminate the process when he feels that the activities are becoming too diversified for efficient handling or if the topic fails to stimulate the pupils' interest.

GOOD LUCK!

A FLOW CHART EXAMPLE