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Facilitating Inductive Reasoning in the Elementary Classroom: A Novel Approach

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Introduction

Educational experiences often tend to leave children with the feeling that there is only one pathway to success. At an early age children are taught to perceive in a way consistent with an adult viewpoint. This is accomplished through repetitive conditioning during which children are taught that an adult, who possesses authority, perceives correctly(1). As a result, children begin to think in "acceptable" traditional modes and base their behavior on the standards and expectations of others.

If schools are to foster creative, inductive reasoning, children need opportunities to exercise these skills in a classroom setting. "They must have time to express themselves, not within a prescribed role, not as an expert, not in accordance with rules and conventions, but as a person with individual skills and talents."(2)

Puzzles

The footprint puzzles presented in this article (Figs. 1-3) have been constructed to provide children with information from which they can ask attendant questions. They have been designed primarily to be placed on an overhead projector and solved in a group task using a modification of the inquiry teaching strategy developed by Richard Suchman. They are not intended to be used in a specific subject or unit, but rather as a set of exercises which you can draw on as you involve children in their learning.

In order to provide students with a visual image which can be used to identify organisms from their track impressions in the footprint puzzles, the tracks have been enlarged to varying degrees. The magnifications on the drawing allow the students to depict the relative sizes of the tracks.

The track impressions were adapted from *A Field Guide to Animal Tracks*(3). Each picture represents the action which took place in the story, but does not mean to imply that the tracks would actually be retained in a natural setting. The activity would therefore not necessarily take place in mud or snow.

Following is a suggested procedure in using the footprint puzzles. You may modify the procedure to fit your teaching style and the abilities of the children.

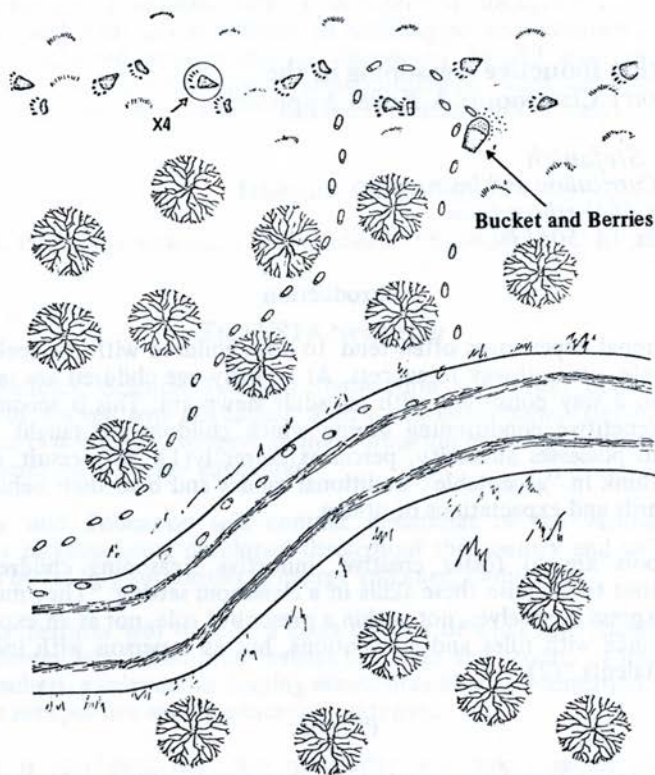


Fig. 1. Puzzle A.

A Suggested Procedure

1. Create the proper conditions: provide freedom and a responsive environment. In most classrooms I have found children to have sufficient experiences in observing animals to develop a plausible explanation of the events which can be inferred from the puzzle. When working with young or slower children, the teacher may wish to provide these activities with a unit on tracks. It is important that the children have sufficient background knowledge to be able to solve the problem.
2. Present the discrepant event. This involves simply placing the puzzle on the overhead projector or providing a copy of the puzzle to each student participating in the lesson.
3. Pupils are invited to ask questions and gather data concerning what happened. Ask them to phrase their questions so you can answer with a yes or no. Allow questions to flow spontaneously and don't become concerned over having a few students ask most of the questions. If this becomes a problem you may want to form subgroupings in later sessions.

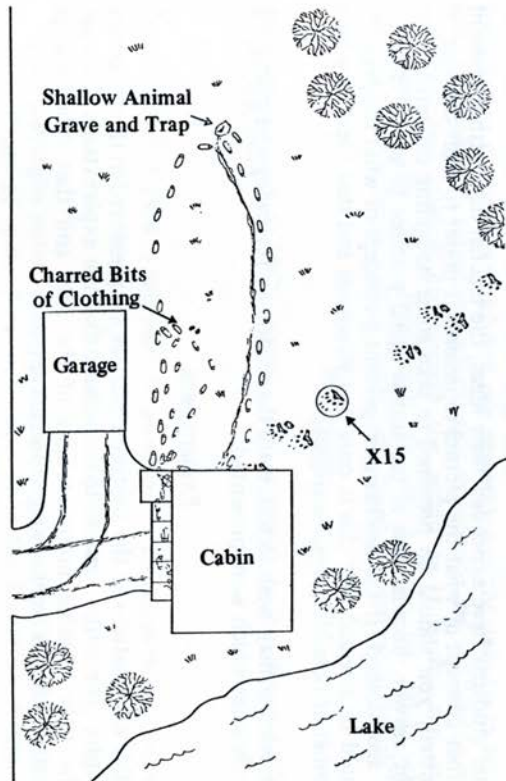


Fig. 3. Puzzle C.

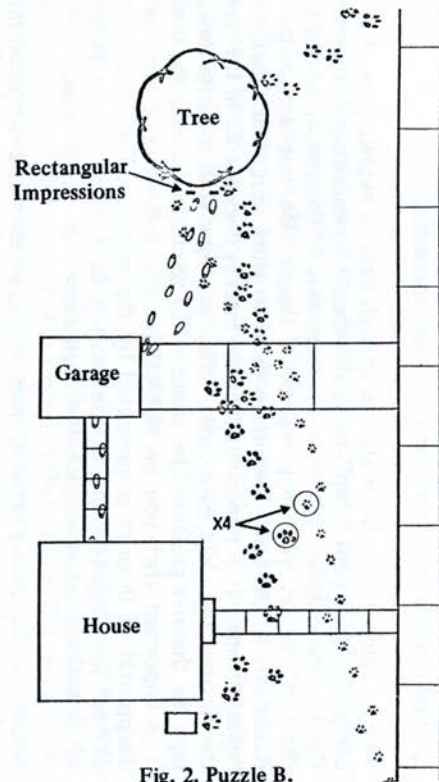


Fig. 2. Puzzle B.

4. Allow students to call for recess at any time. During a recess students should be allowed to exchange their ideas with each other. I have found limiting recesses to 1-2 minutes to be most successful.
5. When a student feels he or she has enough data to explain part of or the complete "discrepant event" he or she should be encouraged to present a theory. Don't answer yes or no to statements of theories, or to questions that try to get your approval of a theory. Do not summarize the statements of children. Encourage them to think out their theories in a logical manner. It is important that the teacher does not fill in the gaps of the theories the children present. Often you may wish to write down or tape the theories presented by students for discussion later in the session. It is important that you do not exhibit any indication of approval or disapproval of theories as presented by the students. This becomes very difficult for many teachers, as one tends to have certain mannerisms that subtly indicate to students whether their answers are good or bad.
6. Allow free oscillation between questioning, recesses and the presentation of theories. I have found management of the session to be most comfortable with a fairly structured setting during the questioning and theory portions of the session. During this time I try to maintain a high level of courtesy towards the student speaking so that all students can benefit from the questions and theories presented. Recesses are allowed only when requested and for limited times as suggested in step four.
7. After students have expended their ideas, the teacher may wish to present his/her concept of what the picture represents. I prefer to omit this step; if omitted, you should be prepared to take some badgering concerning the right answer, because this is the instructional practice to which children are accustomed. If the teacher does present a concept of what happened it should be stressed that this is only one viewpoint and that there may be a number of possible correct responses.
8. The teacher may wish to follow-up the session by reviewing and discussing the theories which were presented.

Explanations

Plausible explanations of the footprint puzzles are presented in the following paragraphs. The author wishes to emphasize that the explanations given are not the only possible interpretations of the data and that other logical explanations should be encouraged and accepted.

Puzzle A (Fig. 1)

A man walked into the woods from a slightly used dust road. He was picking berries and saw a black bear. The berry pail was dropped and the man ran back along the road. The bear was not affected by the antics of the man and rambled on in much the same fashion as at the beginning of the incident.

Puzzle B (Fig. 2)

A galloping cat passed in front of a dog who began to chase the cat. The cat turned in the driveway and they met face to face, then turned and ran up a

tree. The commotion attracted the homeowner who took a ladder, got the cat out of the tree, and took the cat into the garage.

Puzzle C (Fig 3)

A man had set a trap under the cabin and accidentally caught a skunk. The trap did not immediately kill the skunk and the man was sprayed, probably while killing the skunk. He then dragged the skunk over to the woods and buried it, along with the trap, in a shallow grave. The man then went behind the garage and called his son to bring him a new set of clothes. He burned the garments and then both he and his son returned to the house.

Summary

Depicted in this article are a series of three puzzles which have been found to work effectively with children. They should be used primarily as an introduction and motivator, not as an end in themselves. The possibilities can often be extended by allowing the students time to create their own puzzles which the class can solve.

Major advances in knowledge and understanding often occur when new observations and theories challenge "acceptable" traditional explanations of natural phenomena. The activities outlined in this paper encourage personal observation and inductive reasoning, both of which are essential for the formulation of theories which test our perception of the universe in which we live. Through such activities students gain experience and confidence in these processes and attempt to perceive the world as it is and not as their predecessors may have erroneously perceived it to be. Such activities demonstrate the limitations of "facts" and the elusive nature of "truth".

References

1. Moustakas, Clark E. 1967. *Creativity and conformity*. D. Van Nostrand Company, Inc., pp. 38-40.
2. *Ibid.*, p. 133.
3. Murie, Olaus J. 1954. *A field guide for animal tracks*. Houghton-Mifflin Company .

* * *

A Quick Camera Obscura

Take a Pringles potato chip can and a Planters potato chip can. Poke a hole in the bottom of each. Tape wax paper over the Planters can and slide it inside of the Pringles can (Fig. 1). This allows the camera to be focused.

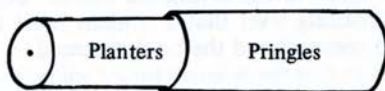


Fig. 1.

T. L. Demaree
Kansas Science Teachers Assn. Newsletter