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ADAPT Program -- Accent on Developing Abstract Processes of Thought

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Module 4: Formal Thought

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Module 4 Formal Thought [Film]

Introduction

In Piaget's theory, concrete thought is characterized by serial ordering, simple classification, conservation logic and other operations applied to objects that a person is able to observe or manipulate directly. Formal thought includes these operations but goes beyond them to utilize other processes in situations where one does not deal with tangible objects. Formal processes often involve proportional reasoning, separation of variables, elimination of contradictions and class inclusion or exclusion operations.

In the film "Formal Thought" that you are about to see (1), you will observe Rita Peterson and Robert Karplus working with students between the ages of twelve and seventeen as they face four tasks. The young people's approaches are intended to illustrate the characteristics of concrete and formal thought described in Module 2 and to demonstrate that a group of high school students is likely to make use of both types of reasoning patterns. Though self-regulation is not emphasized in the film, you might look for situations in which a student finds that his procedure was not adequate and has the opportunity to use the new data for another attempt. Since this film was made in 1971, research with college students has produced similar results.

Objectives

To assist you in describing and/or identifying responses that indicate concrete thought and formal thought applied to simple Piagetian tasks.

Procedure

The staff will make available a film-showing schedule at the beginning of the workshop. "Formal Thought" lasts about thirty-five minutes but need not be seen in its entirety. Reading the film notes first will acquaint you with the four tasks that are used in the film.

After viewing the film, please go to the discussion center, where the workshop staff will meet with small groups of participants to help you exchange ideas, raise questions, and clarify your thoughts regarding Modules 1-4.

Film Notes

Proportional Reasoning (Ratio Puzzle)

In the first scene, JANET displays her command of proportional reasoning operations by determining a ratio of two measurements and then using this ratio to calculate the dimensions of an object that she cannot observe (2). In the second scene, PETER appears to approach this task in the concrete operational manner, but changes his procedure when asked to explain.

Separation of Variables (Flexible Rods)

In order to study the reasoning processes that one goes through in separating variables, Inhelder and Piaget performed a series of experiments with a simple device similar to that shown in the film (3). From front to back the rods are, in order, thin round steel, thin round brass, medium round brass, medium flattened aluminum, thick round brass, thick round wood. This "flexibility" apparatus permitted the adjustment of five variables (length, thickness, material, cross-section, weight) and required the experimental subjects to vary each factor independently if a complete solution was to be obtained. A complete description of the experiment appears in Chapter 3 of reference 3.

Combinatorial Logic (Chemical Mixtures)

Formal thought is characterized by the development of propositional logic. In turn, this logic depends upon the establishment of a combinatorial system that is manifested in a person's ability to link a set of associations or correspondences with each other in many possible ways. The "coloring liquids" problem shown in the film requires the student to combine a number of solutions (1=dilute sulfuric acid, 2=water, 3=hydrogen peroxide solution, 4=sodium thiosulfate solution, g=sodium iodide solution) to obtain the brown color of free iodine; the differences between the formal method which goes through the full range of possibilities each time and the concrete operational thinker's method of one-by-one combination which leaves many steps untouched are sharply illustrated here. This experiment is described in Chapter 7 of reference 3.

Application of Proportional Reasoning (Equal Arm Balance)

The last task shown in the film, balancing the beam, requires students to apply proportional reasoning and other elements of formal thought to a more difficult problem. The students we watch exhibit a variety of approaches. JOCELYN has an intuitive idea that increased distance compensates for increased weight, but she used the weight difference rather than the ratio to make a prediction. (Using differences rather than ratios in a situation like this is a characteristic of concrete operational thinkers.) ROBERT is able to handle a simple situation requiring the utilization of a 2:1 ratio, but he is unable to generalize the procedure to treat a more complicated application of proportional reasoning. Students who perform in this manner are often considered to be in transition from the concrete operational mode to the formal one. VLADIMIR clearly displays that he uses a formal thought process to arrive at the solution to the problem.

References:

(1) "Formal Thought" (16 mm film) available from Davidson Films, Inc., 3701 Buchanan Street, San Francisco, CA 94123 (Rental fee, $30.00).

(2) Elizabeth F. Karplus, Robert Karplus, and Warren Wollman, "Intellectual Development Beyond Elementary School IV: Ratio, the Influence of Cognitive Style," School Science and Mathematics, October 1974.

(3) Bärbel Inhelder and Jean Piaget, The Growth of Logical Thinking from Childhood to Adolescence, Basic Books, New York, 1958.