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A Review of Epistemic Curiosity and Behavior*

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EPISTEMIC curiosity is usually stirred up by a thought-provoking experience which contradicts expectations and leaves the student perplexed. The discovery methods of learning are aimed at fostering understanding (18, p. 9). It is logical that understanding will tend to eliminate conceptual conflict and will reward the student by alleviating tension associated with anxiety over missing information. Understood information is both more readily retained and transferable than hazy information (15, p. 32). Berlyne (3) corroborates this statement by indicating that learning motivated by curiosity can give rise not only to particularly rapid and lasting acquisition of knowledge, but also to knowledge in which ideas are fruitfully pieced together into coherent structures.

Epistemic behavior is divided into the three categories of epistemic observation (empiricism), consultation (authoritarianism), and directed thinking (rationalism or intuitionism). Directed thinking, proceeding by the selection of sequential symbolic steps, acts as a guide to observation and consultation and is used in conjunction with them. The function of epistemic behavior is to equip the subject with knowledge. All these responses may be tied in with perceptual curiosity. If the knowledge becomes a lasting part of the subject's repertoire of stored knowledge and if this residue and the satisfaction and technique of obtaining it are of value to him for obtaining knowledge from his environment in the future, then the function is in the realm of epistemic behavior.

Epistemic behavior is generally initiated by a specific dissatisfaction. The knowledge needed to resolve conflict must be directly related to the original dissonance. If the gain is to be rewarding, it must resolve the initial conflict in accordance with the psychological function of information. Extrinsically, knowledge is prized for the contribution it makes toward the attainment of a practical goal. Intrinsically, knowledge is satisfying in itself and for its power to reduce conflict.

Curiosity arousal was found by Paradowski (13, p. 50) to increase significantly both intentional learning and incidental learning. Both intelligence and extended curiosity were singled out as the responsible characteristics necessary for retention by Berlyne (2, p. 132).

Structure and Direction of Thinking

Berlyne holds that the following three motivational factors are characteristic of directive thinking in a situation involving curiosity (3):

1. *Activation* in thinking appears to involve the degree, concentration, and force as related to persistence in thought and ability to ward off distraction and discouragement.

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2. *Direction* in thinking encompasses the selection among alternative kinds of symbolic material at different levels.

3. *Reinforcement* usually means the achievement of a symbolic sequence or pattern regarded by the thinker as sufficient for his needs. It appears to be analogous to goal attainment in motor activity. In thinking, the attainment may take the form of confirmation when a thought pattern resolves cognitive conflict.

"The ultimate objective of a directed thought process is the construction of a solution chain" (4, p. 299), leading from the initial problem situation to a represented terminal situation, and capable of relieving the epistemic curiosity that actuated this thinking in the first place. If the extrinsic motivation is strong enough, the subject may activate an overt behavior chain and put into practical use the sequence of steps leading to the solution.

A solution chain is analogous to the branches of a tree, each node representing a choice-point for a decision leading to the solution. If the problem is difficult, the choice-points will appear to be more equal in strength, and more conflict will be present. At this choice-point, a hierarchy branching out from this node must be considered. The elements comprising the alternatives are made up of sub-hierarchies of the next level and a selection must be made from among these alternatives. If a solution has been reached, then there remain only a number of alternate specific transformational chains to be viewed for appraisal and ultimately applied to the learning of new knowledge (10, p. 206).

The ability of a person to solve a problem depends on his previous success with easy training items. A thorough training free of frustrations is the best preparation. Of course, the more difficult a task, the more satisfaction one finds in its successful accomplishment. Such a task becomes a challenge well met. Simultaneously, the anticipated frustration generated by the difficulty works toward the rejection of the task. Careful weighing of these two interrelating factors swings the acceptance or rejection of the problem. Other factors bearing on the case include whether the problem is worth thinking about and whether the problem is either hopelessly beyond the capacity of the subject or only beyond his present knowledge. If thinking fails to solve the problem, the subject may revert to other means of epistemic behavior such as observation or consultation.

Implications of Recent Research

Much recent research in the area of curiosity has been performed in the U.S.S.R. It is apparent that Morzova (11), a Russian psychologist, has verified the need for arousal of epistemic curiosity in order to motivate epistemic behavior by conceptual conflict. This was through studies done in 1955 on literature which "interested" schoolchildren. The books most in demand were indicated by Morzova to be those that tended to raise questions, offered chances to guess answers, and required thought on the part of the child. Conversely, most of the rejected books were simply purveyors of information.

Another experiment conducted in Russia by Zankov (19) allowed children to examine an object (a plant specimen) under a microscope while listening to a lecture instead of only listening. The learning results of this experiment strongly resembled discovery learning.

Berlyne comments that new discovery techniques (4, p. 264) rely heavily on stimulating independent discovery of facts and development of individual judgment. Accordingly, he does not view the student as either passive or absorbed, but rather as one whose curiosity has to be cultivated so that he will discover knowledge through his own activities. Thus stimulated, he will consequently have the exhilaration of possessing new knowledge.

Suchman (17, p. 26) equated discovery methods with inquiry methods and presented to a class a film which demonstrated a surprising physical phenomenon:

> A brass ball that was just small enough to slip through a brass ring was heated and then set on the ring without being able to pass through it; an empty varnish can, having been

heated and then allowed to cool, collapsed because condensation of moisture reduced the internal pressure. The children were then invited to ask the teacher questions that could be answered "yes" or "no." At first, the questions concerned properties of the objects and events that they had seen on the film, but, as the questioning proceeded, each child was encouraged to think of possible explanations and of experiments by which the validity of each explanation could be tested. He asked the teacher whether a particular outcome would occur if the experiment described was carried out.

Inquiry skills were observed to improve significantly over the 15-week experimental period.

Contradicting expectations stir up epistemic curiosity by an experience that leaves the subject perplexed. Questions elicit answers that reduce the resulting conceptual conflict progressively, and differential reinforcement evidently guides the subject toward the most fruitful strategies of interrogation.

Bruner (6, p. 100) comments that it is at about the age of 11 years that subjects can grasp the importance of adopting a strategy of narrowing the field of questions in order to arrive at an answer by sorting things into categories and then arranging the categories into hierarchies. At the age of six, the child simply asks a series of questions to test an independent hypothesis, with each question bearing no relation to the previous question. This Bruner (6, p. 88) terms hypothesis scanning. Restraint is evident in about 50 percent of the questions by the age of eight.

Inquiry for everyone begins with a discovery curiosity about an environment (8, p. 40). The ordering of questions and the key words contained in the questions are of prime significance.

Arnstine (1, p. 602) has analyzed conditions fostering curiosity in the classroom with conclusions that recommend the relaxation of classroom pressures typified by schedules and goals. He recommended more leisure time, together with the availability of investigative situations that would, unknowingly to the subject, result in unexpected outcomes.

Carll (7, p. 62) recommended an atmosphere where children's natural curiosity would lead them to make sense of things, which Schulte (16, p. 304) asserts is the difference between education and training. For example, he suggests letting them move around the room freely and purposefully in pursuit of learning for their own satisfaction. Mulhern (12, p. 17) found that students of these intrinsically motivated schools are more apt to deal successfully with the unanticipated problems of life after their formal schooling has ended.

Boraas made two interesting observations:

1. Initiative can be developed only through practice on the part of pupils. Teachers must begin by letting them think for themselves and by allowing them to initiate projects.

2. Pupils must begin by practicing those forms of initiative which they naturally incline towards and like—for example, curiosity, wonder, and questioning (5, p. 94).

Curiosity as motivation is particularly suitable to independent and individual study since all students are not curious about the same things at the same time (1, p. 601).

Day's (9, p. 43) investigation into the role of curiosity in school achievement reiterates that the present education system has failed to develop interest in complexity. Achievement in the classroom requires intelligent behavior but little or no interest in expanding one's knowledge into areas peripherally or indirectly connected with the curriculum.

Peterson and Lowery (14, p. 347) found first-grade children to be characterized by continuous and intense exploratory behavior when permitted. They often respond to puzzle-solving situations by rearranging items. Other first-grade children exhibit less continuous and less intense exploratory behavior. They frequently respond to novel or unfamiliar objects by manipulating them, but they fail to rearrange or modify the items. A few first-grade children are conspicuously lacking in exploratory behavior. They approach unfamiliar objects, look, and leave. In the company of more curious peers, they appear disinterested and prefer to talk, sit quietly, or leave the environment.

As a basis for this study, curiosity was considered to be composed of various exploratory behaviors such as approaching, looking, listening, smelling, tasting, touching, manipulating, and questioning. Each exploratory behavior suggested that the child desired to know or gather information simply for the sake of knowing. Of these three graded attitudes, the first is obviously more representative of scientific curiosity.

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