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Chapter 1: Piaget's Theory and College Teaching

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The influence that Piaget's theory has had on the understanding of cognitive development is incalculable. One can look at the establishment of the Jean Piaget Society, the publication of literally hundreds of books that deal with Piagetian theory, and the dominance in professional journals of articles related to Piagetian theory as some indication of the immense impact that this theory has had on the study of the child's acquisition of knowledge.

In the last decade, the force of Piaget's theory has spilled over into other areas, most notably education. Such books as _Thinking Goes to School: Piaget's Theory into Practice_ (Furth and Wachs, 1974); _Discovering Piaget: A Guide for Teachers_ (Gorman, 1972); and _Piaget for Teachers_ (Furth, 1970) suggest that Piaget has something important and practical to say to the educational community. The fact that Piaget-based programs have mushroomed and educators have begun to use Piaget's theory to help teach specific and troublesome content areas [_A Study of Concrete and Formal Operations in School Mathematics: A Piagetian Viewpoint_ Collis, 1975; and _How Children Learn Mathematics: Teaching Implications of Piaget's Work_ Copeland, 1970] indicates that educators from a variety of levels and disciplines have begun to examine Piaget's theory. It is, however, only very recently that college and university professors have looked toward Piagetian theory for relevant and practical suggestions about how to maximize college student learning.

There are some good reasons for the tardiness of the college community in examining Piagetian theory. Initially the writings of Piaget focused on the age period from 11 to 16 as the final stage of cognitive development. It was believed that the child during this period was able to abstract from concrete experiences and to theorize about the total possibilities or alternatives that could be explored in any situation. It has, however, become clear that the transition to abstract or formal thought is not usually completed by the college years. Several studies indicate that as many as 50 percent of our college freshmen are not capable, much less facile with formal operational thought processes (Tomlinson-Keasey, 1972; Wason, 1968; Lovell, 1961; Karplus, 1974). Further, the evidence that the acquisition of formal operational thought processes continues throughout the adult years continues to mount (Tomlinson-Keasey, 1972; Piaget, 1972). One can speculate on the basis of the above that instruction during the college years might well serve to maximize this final stage of cognitive development.

Before one can consider maximizing intellectual growth, however, it is necessary to chart the course of cognitive development. Hence, a brief sojourn into the stages of intellectual development as outlined by Piaget is necessary. A stage of intellectual development refers to a period when a person's activities and reasoning are characterized by certain common features. The last two--concrete operations and formal operations--are particularly interesting to college educators.

An infant begins to know the world by touching and feeling things. He has no words or symbols to make those things meaningful. The main way information is obtained is by interacting in a very physical way with the environment. For these reasons this period is called the sensory motor stage. As the child begins to acquire language, around age two, objects that have been experienced in the sensory motor stage of development are named. With the ability to name or label objects, the child enters the stage of intuitive or pre-operational thought. After a child has attached symbolic meanings to objects, he is able to move into the concrete-operational stage. Such a child is no longer limited to dealing with objects in a perceptual or physical way. The many symbols which are referents for objects can now be manipulated in a logical way. Thus, it is possible to form a class of animals, for example, which is composed of dogs, cats, dinosaurs, birds, etc. Further, any particular class might be composed of several subclasses. If a child was limited in his operational ability to sensory motor or pre-operational kinds of thought, then he could only react to a dog as one object, a dog. If, however, symbols are available, and those symbols mean something, then those symbols can be transformed so that the object, dog, can become an animal, a mammal, a Cocker Spaniel, and Prince simultaneously. The abilities gained in concrete operations allow the child to begin transforming information logically.

The stage of formal thought which begins somewhere between 11 and 16 years of age allows the child to abstract even further from concrete experience. In the concrete stage the child could simultaneously put an object in multiple kinds of categories. Moving from these concrete kinds of labels, the child in the stage of formal thought can now reason about objects which cannot be seen or experienced concretely, such as the principle of inertia. The most dramatic change from concrete to formal operations is evidenced in a shift from focusing on the realities of the world to a consideration of the total possibilities that might exist in the world. In fact, once formal operations are attained, the actualities of the world are secondary in a person's thought processes to the range of possibilities that might exist. For this reason, thought is much more flexible. An example of this is the adolescent in the university who has experienced a democratic political system his whole life. That experience constitutes his concrete understanding of a political system. However, when he reaches the formal operational stage, he is no longer limited in his thinking about political systems to the consideration of a democratic state. Hence, he can consider and in some cases embrace political idealizations that he has never experienced. He might become a Maoist or talk about the advantages of a socialistic state or a totalitarian state, or even an anarchistic state. In this example, the child's concrete experience places limits on his ability to think about the total possibilities. However, when he is able to deal formally with all of the possibilities his thinking about politics may change radically. Another example is the development of moral or religious attitudes. A child whose religious experience has been an affiliation with the Catholic faith, might, when she goes to college, suddenly be struck by the plethora of possibilities other than the Catholic religion. Hence, she might study Buddhism or Judaism, or a variety of other approaches to moral and religious questions. Occasionally this kind of revolution in thinking troubles parents and teachers, yet it constitutes one kind of hallmark that the child is beginning to move from concrete experiences to a consideration of the total possibilities.

To summarize then, the characteristic differences between the concrete operational and formal operational periods are the individual's ability to consider the total possibilities in a problem. In time the possibilities begin to transcend the actual. In addition, the individual is capable of and indeed prefers propositional logic to the earlier reliance on the empirical information available. In some sense, the individual substitutes postulates for his earlier reliance on symbols and objects. Finally, the individual can recognize and interpret functional relationships.

Most university professors have encountered students whose academic work seems to suggest that they are relying heavily on concrete operational thought patterns. Trying to teach students using such thought patterns to be analytical, logical, and critical constitutes a major and exciting challenge to college professors. The ADAPT program is one attempt to meet that challenge.

Before instituting a program based on Piagetian theory, one must have some indication of how a student progresses from concrete operations to formal operations. The mechanism suggested by Piaget is called self-regulation. Self-regulation occurs when a student is engaged in learning. When experiences and encounters confirm ideas or beliefs that have been held in the past, then these ideas and beliefs are stabilized. But when experiences tend to disconfirm a student's ideas, these ideas must be reorganized to deal with the conflict. Such conflict is an impetus for growth and change and leads to a new, more highly differentiated and stable set of ideas. The regulation that occurs is the constant monitoring that a student does of his own ideas and the new ideas that are being presented.

This, then, is the process whereby a student grows. Information that does not fit with the way a student is dealing with the world and serves as a disconfirming case for the categories and principles used, forces him to gradually change and adapt to the new information. Obviously, however, students and adults never have categories or ways of organizing the world that are completely satisfactory. In every instance new information, or information that doesn't fit a student's concepts or an adult's concepts, can serve as an impetus for further growth. It follows that it is possible for a person to be in a stage of formal thought in relation to one content area and still be in a concrete operational stage in another area. Those areas in which a student would most likely be concrete operational would be the areas of least experience. The expectation is that students approaching the content of economics for the first time, for example, would have a very global and undifferentiated set of concepts about economics.

Likewise, it should be clear that the stage of formal thought is really an adult mode of processing information. One continues to develop formal thought patterns throughout his lifetime in terms of deepening his understandings, broadening the domains of his experiences, and adding new intellectual fields or content areas to his experience. Finally, it follows that the quality of the abstractions that one forms in a particular area are to some extent dependent on the kind of conceptual or concrete information that is present.

Having considered, theoretically, the stages of intellectual development and the process by which development occurs, we can proceed to the implications that these principles have for college teaching practices. The first rather obvious point is that one must begin with material which is meaningful to the student. This often means beginning at a fairly elementary level. When new ideas and experiences are presented in a way that is partially consonant with the student's past experiences, the possibilities for growth are maximized, as is the likelihood that these experiences will be incorporated into a new and stable set of concepts about the specific content area.

A second implication of Piaget's theory focuses on the self-regulation that takes place in the student. The clear point of a self-regulatory model is that the learner must be considered in all phases of planning and instruction. This puts an enormous burden on college instructors who genuinely want to present material that students can use. The learning cycle is one way of dealing with this problem and has served as a model in the ADAPT program for how to encourage students' participation. The actual courses in the ADAPT curriculum all begin with an exploration phase in which students are required to observe a behavior or phenomena and collect data about that phenomena. Following such exploration the data are organized and are used to form hypotheses, to provide a basis for introducing concepts which are important to the field, and to provide a basis for generalization to other topics. With the background provided by exploratory activities, students are prepared to deal with some of the theories and empirical findings related to a phenomena.

Of course the learning cycle doesn't always progress smoothly from one point to another. What happens, for example, when exploratory activities do not lead to the conclusions or concepts that are envisioned by the professor? When do you intervene in what might seem to be aimless exploration and start imposing your own classification system on the student? The points of intervention and the timing of intervention seem to be a delicate matter.

Translating Piagetian theory into the exploration, invention, and discovery phases of the learning cycle (Karplus, 1974) creates other problems. Exploration takes time and whereas the topic, revolution, might have consumed two lectures before, you cannot explore and then discover revolution so quickly. It seems probable, then, that exploratory activities will mean that some content is sacrificed. Whether students will have suffered from this reduction in content remains to be seen. Studies indicating that students tested on a lecture one week later recalled only 17 percent of the lecture's content (FIPSE, 1975) suggest that the amount of material covered is not necessarily correlated with the amount a student learns. If an approach like the learning cycle can engage students in thoughtful acquisition of knowledge, the loss of some content might seem less critical.

In summary, the most sophisticated thought patterns are not fully developed in college students. Further, if Piaget is correct, the way to develop these processes is to begin with concrete experience and proceed to more and more sophisticated abstractions. A final ingredient that should maximize student learning is allowing the student's own thought processes to guide the search for knowledge. While these principles defy direct translation into specific classroom experiences, they can serve as a basis for a multitude of classroom activities. More importantly, they can form an approach to college instruction whose aim is a student with an integrated fund of knowledge that can be logically transformed into the advances of tomorrow.

BIBLIOGRAPHY

Copeland, Richard W. How children learn Mathematics: Teaching Implications of Piaget's Work (Macmillan, New York 1970).

Collis, K.F. A Study of Concrete and Formal Operations in School Mathematics: A Piagetian Viewpoint. Australian Council for Educational Research, 1975.

Fund for the Improvement of Postsecondary Education, Program Information and Application Procedures, Department of Health, Education and Welfare, Document PMB No. 85-R-0287, p. 11, 1975.

Furth, H.G. and Wachs, H. Thinking goes to School: Piaget's Theory in Practice (Oxford University Press, New York, 1974).

Furth, H.G. Piaget for Teachers (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1969).

Gorman, R.M. Discovering Piaget: A Guide for Teachers (Charles E. Merrill, Columbus, Ohio, 1972).

Karplus, R. Science Curriculum Improvement Study: Teachers Handbook. Lawrence Hall of Science, Berkeley, California, 1974.

Lovell, K.A. "A follow-up study of Inhelder and Piaget's growth of logical thinking." British Journal of Psychology, 52, 143 (1961).

Piaget, J. "Intellectual Evolution from adolescence to adulthood." Human Development, 15, (1972).

Tomlinson-Keasey, C. "Formal operations in females aged 11 to 54 years of age." Development Psychology, 6, 364 (1972).

Wason, P.C. "Reason about a rule." Quarterly Journal of Experimental Psychology, 20, 273 (1968).