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Piaget: Implications for Teaching

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The educational implications of Piaget's theory are closely tied to his concept of intelligence as the dynamic and emerging ability to adapt to the environment with ever-increasing competence (Piaget, 1963). By what processes does the individual gain this proficiency, and how may the teaching-learning situation be designed to maximize human potential? A brief review of Piaget's basic assumptions will provide some insight into the processes of cognitive growth (Piaget and Inhelder, 1969, Piaget, 1963), and examples drawn from research and personal experience will illustrate applications of this theory to educational practice.

Theoretical Assumptions

Piaget believes that four factors serve as propellants to mental development. Each is vital, as it is the interaction of these components that results in cognitive growth. First, maturation of both nervous and endocrine systems provides physical capabilities. Second, experience involving action on the part of the learner aids in the discovery of the properties of objects and in the development of organizational skills. Third, social interaction offers opportunities for the observation of a wide variety of behaviors, for direct instruction, and for feedback concerning the individual's performance. Finally, Piaget believes that within each person there is an internal self-regulation mechanism that responds to environmental stimulation by constantly fitting new experiences into existing cognitive structures (assimilation) and revising these structures to fit the new data (accommodation). Piaget refers to these cognitive structures as schemas. A balance, or equilibrium, between assimilation and accommodation maximizes cognitive functioning.

Piaget has identified a series of stages in the process of cognitive development. These stages must occur in a particular sequence, since each stage incorporates and restructures the previous one and refines the individual's ability to perceive and understand. While suggested ages for each stage are indicated, intelligence and/or environment may cause variations. Certain patterns of behavior are characteristic of the way an individual will interpret and use the environment at each of these stages.

While Piaget's research has generated many suggested implications for teaching, five issues have been selected for discussion. These are stage-based teaching, uniqueness of individual learning, conceptual development prior to language, experience involving action, and necessity of social interaction.

Stage-based Teaching

Several questions arise with reference to the use of Piaget's developmental stages in teaching. What implications may be drawn from the general characteristics of each stage? Can or should a child's progression through those stages be accelerated? Does a unitary period of formal operations actually exist?

During the sensori-motor stage, from birth to about two years, the child uses his senses and emerging motor skills to explore the environment. Verbal interaction, an object-rich setting, and the freedom to explore are of paramount importance at this time. During the preoperational stage, from about two to seven years, the child is "perceptually bound;" he is unable to reason logically concerning concepts that are discrepant from visual clues. His thinking is hampered by such factors as egocentrism (seeing things only from his own point of view), centering (focusing on only one attribute at a time), and inability to follow transformations and perform reversals. Being confronted with the opinions of others and being actively involved with objects and processes will help this child to build the cognitive structures necessary for logical thought.

As the child moves into the concrete operational stage, from about seven to eleven years, he is able to use this logic to analyze relationships and structure his environment into meaningful categories. It is crucial for the child to have many interactions with concrete materials during this entire period, since the ability to think abstractly is built on these understandings. Finally, during adolescence the individual may pass into the period of formal operations and develop the ability to manipulate concepts abstractly through the use of propositions and hypotheses. The teacher should realize, however, that from 25 to 75 percent of all adolescents and adults have not achieved formal operations, and many concrete interactions are needed for comprehension (Good, et al., 1979).

What problems may arise from a mismatch between the level of the learner and that of the material? Kirkland (1978) observed that in beginning reading the preoperational child's centering may make her unable to consider parts and wholes in words at the same time. The child may regularly confuse "was" and "saw" despite extensive drill. The child who cannot follow transformations may not be able to sound out words. The individual sounds of *c*, *a*, and *t* may not be recognized as "cat" even when she "says it fast." Some research studies have indicated that there is a high positive correlation between the ability to conserve and beginning reading achievement.

Another attempt to match level to learner was the

University of Nebraska's ADAPT program (Accent on Developing Abstract Processes of Thought). Since many college students cannot perform formal operations, ADAPT was designed to provide concrete experiences in math, science, and the humanities. After the freshman year, these students scored significantly higher than controls on a variety of measures (Tomlinson-Keasey and Eisert, 1978).

Can a child's progress through the stages be accelerated? Piaget contends that for optimal comprehension, these changes should result from numerous experiences over a long period of time. Two reviews of research illustrate both the possibilities and the problems in acceleration attempts.

In an effort to determine what can be accelerated, fifteen training studies were classified in three types: learning a specific Piagetian task, learning to perform a specific mental operation, and moving a student from the concrete to the formal stage (DeCarcer, et al., 1978). Conclusions were: (1) that an individual can learn a specific task or operation but often with limited retention and transfer and (2) that apparent shifts from concrete to formal operations may result from interim experiences unrelated to training and/or from test-wiseness if the same instrument was used for both pre- and post-testing.

Evans (1975) analyzed the teaching methods used in training studies. He categorized the approaches as verbal rule (direct verbal instruction), cognitive conflict (getting children to question their own perceptions), and task analysis (pretraining on subskills of a task). Use of verbal rule and cognitive conflict can result in the acquisition of conservation, but transfer may be limited. The relative success of task analysis seems to depend on the levels and interactions of subskills already possessed by the learner.

Educators may draw several implications from the findings of these studies. Rather than concentrating on the learning of specific Piagetian tasks and operations, the classroom milieu should be structured to encourage constant thinking on the part of students. Verbal rule, cognitive conflict, and task analysis all may be used in a wide variety of settings to increase the incidence of transfer. Better comprehension at a given stage may be a more appropriate goal than forced acceleration to the next cognitive level. Piaget feels that such piecemeal acceleration often results in distorted or incomplete conceptual development that may hamper future thinking.

While Piaget's first three stages appear to be universal, serious concerns have been expressed with reference to the period of formal operations. Berzonsky (1978), after an extensive review of research, suggested that formal operational thinking is not a

unitary quality that can be applied to all areas of thinking. Abstract thinking appears to be linked only to those content areas in which an individual has had extensive training. Based on the work of Guilford and others, Berzonsky suggested a branch model. After concrete operations, an individual may acquire abstract thinking in behavioral, symbolic, semantic, and/or figural content areas depending on experience. The quality and type of educational opportunities during adolescence thus becomes crucial, since both the development and direction of formal operations depend on these experiences.

Uniqueness of Individual Learning

If a science lesson is presented to six students, each of them will have a different learning experience. Why is every learning unique? How does an individual's repertoire of schemas structure the learning for him? What is meant by high level and low level learning?

Each person's cognitive schemas are constantly being revised through the assimilation of new information and the refinement of mental structures to make fullest use of this input. Therefore, no two individuals can ever be at the same level of readiness for a given experience.

The particular schemas that an individual has developed and their levels of functioning will structure the learning situation in several ways: (1) what is noticed (we perceive selectively in terms of such factors as past experience, interest, level of difficulty, and novelty), (2) whether we fit in the new information accurately or distort it (the child learns that "es" is used to form plurals and says "mouses"), and (3) how much increase in competence results from the encounter (at an adequate readiness level, material is correctly incorporated into the schema thereby increasing the capabilities of that cognitive structure).

While Piaget contends that the child will restructure everything that he experiences in terms of his current cognitive schemas, Gagné feels that meaningful structure can come from the environment (Strauss, 1972). Gagné advocates curricula based on sequential hierarchies. The views of Piaget and Gagné may or may not be in conflict depending on the particular situation. Gagné's prerequisite experiences may provide the necessary input for Piaget's schema accommodation thus rendering one learner ready for the experience. However, because of a difference in schema development, another learner may perceive these same prerequisites as boring, too hard, or unrelated to his needs and withdraw from the learning situation.

Intellectual growth occurs only when the learner is doing thinking that is high level in relation to his own stage of development (Furth and Wachs, 1975). A given activity may be high level for one child and low level for another. A level that is too high may produce frustration, distortion, or rote learning; one that is too low can result in disinterest and boredom. When a task is presented, it is the child who makes the final determination as to whether it will be a high or low level task; she performs in terms of her own level. For instance, if she is asked to learn about geological land forms, she may understand the concepts and apply them to other instances (high level), or she may memorize without comprehension (low level). "Whether or not instruction is 'individualized,' learning is!" (Wadsworth, 1978, p. 183)

Piaget believes that the child first internalizes concepts from his interactions with the environment and later develops the language to label and describe these understandings. He further contends that language actually may confuse comprehension. Many early childhood panics are based on a child's misunderstandings of things that are said. Another example is that of the student who becomes hopelessly lost after reading a stated problem in math because he can't conceptualize the relationships among numbers presented. Empirical support for the development of concepts prior to linguistic experience is found in several studies relating to deaf children (Evans, 1975).

Is language, then, of no value in the development of concepts? Piaget found that seriation may be improved by verbal training while conservation is not. By contrast, Bruner and others have found in many studies that the use of language facilitates conceptual development.

What implications for teaching may be drawn from the relationship between concept development and language acquisition? First, in all areas of learning, much concrete experience must precede abstract verbalizations. Second, task-oriented testing situations should be used so that the child's understanding will not be confused with his verbal ability. When I was teaching seventh grade, I was alarmed to note the high positive correlation between grades in reading and in social studies over a seven year period. Verbal loading in both teaching and testing could account for this finding. A third implication is that much learning can be accomplished without extensive use of oral language. When Furth and his colleagues established their model School for Thinking, most of the thinking games included in the curriculum did not involve the use of oral language (Furth and Wachs, 1975).

While these implications relate to all children, they are particularly crucial in the development of

children who, for various reasons, are language disabled. The teacher should remember that use of language is not the same as concept development, and verbal explanations are not adequate substitutes for experience.

Experience Involving Action

If learning were viewed merely as an increase in knowledge, active participation on the part of the learner would not be so vital. However, if one accepts Piaget's concept that each learning involves a restructuring of the student's cognitive schemas, learner involvement becomes mandatory. How does direct experience aid in cognitive development? What criteria may be used in the selection of appropriate learning activities? When may activities not prove profitable?

In discussing the importance of experimentation in cognitive development, Wadsworth (1978) makes several important points. Most ideas are not completely wrong; they are merely incomplete. When the child makes an incorrect response and the teacher simply tells her the right answer, the child may discard all the reasoning connected to that wrong answer. What the teacher should do to promote thinking and cognitive growth is to help the child to analyze the problem again, keep the correct elements of her reasoning, and fill in the necessary details to correct the error. For example, when deciding whether an object will float or sink, heaviness is not totally wrong as a determinant; it is just not the only variable. When considering experience from this point of view, wrong answers can be as important as right ones.

Furth and Wachs (1975) suggested the following rationale for selecting worthwhile activities. (1) Let each child's success be measured in terms of bettering his own performance. Motivation is hard to maintain in the face of repeated failure. (2) Structure for individualization, not for convergence. Avoid activities that are so structured that there is only one correct way to respond. (3) Provide activities that are challenging, but not overwhelming. (4) Arrange for most of the students' time to be focused on activities, not on the teacher. (5) Provide individual activities to be accomplished in the company of peers. While individual effort is necessary for cognitive growth, peer interaction provides encouragement and assistance. (6) Become a thinking person yourself so that you can model these qualities to your students.

Will the use of activities guarantee cognitive development? Learning may not take place if such activities are not geared to the ability level of the learner. Good (1979) found that college students capable of abstract thought learned science concepts more read-

ily if concrete objects were used. However, students still in the the concrete stage failed to comprehend these ideas despite the use of models. Activities also may be too simple; Inskip (1972) cautioned against the overuse of manipulation after the students were capable of abstract reasoning.

Necessity of Social Interaction

Piaget viewed social interaction as one of the major forces in cognitive development. How do relations with others facilitate learning and mental growth?

Peer interaction can be of great value for several reasons. First, students are apt to attach special significance to activities deemed important to their peers. Second, peers can serve as models and/or instructors for skills yet to be acquired. Third, since peers are likely to be near the same cognitive level as the learner, their explanations may be more understandable than those of the teacher. Fourth, when students at varying cognitive stages discuss problems, the less advanced students may gain insights and correct inaccuracies in their thinking.

The more advanced students also profit from such exchanges. In trying to explain a concept to others, these students must think through their own reasonings. In answering questions from the group, ideas may be more clearly differentiated or expanded.

The effectiveness of group processes in facilitating learning has received empirical support. In one study, children at different stages of development shared their often contradictory views to problem situations. After these exchanges, many of the preoperational children advanced to the concrete operational stage of thinking (Strauss, 1972). In another study, students were placed in small classes and exposed to many group experiences. In addition to scoring significantly higher than controls in logical and abstract reasoning, these students showed marked gains in personality skills and social interactions (Tomlinson-Keasey and Eisert, 1978).

Summary of Implications

- Consider the stage characteristics of the student's thought processes in planning learning activities.
- Use a wide variety of experiences rather than drill on specific tasks to maximize cognitive development.
- Don't assume that reaching adolescence or adulthood guarantees the ability to perform formal operations.

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- Remember that each person structures each learning situation in terms of his own schemas; therefore, no two persons will derive the same meaning or benefit from a given experience.
- Individualize learning experiences so that each student is working at a level that is high enough to be challenging and realistic enough to prevent excessive frustration.
- Provide experience necessary for the development of concepts prior to the use of these concepts in language.
- Consider learning an active restructuring of thought rather than an increase in content.
- Make full use of wrong answers by helping the student to analyze his thinking in order to retain the correct elements and revise the miscomprehensions.
- Evaluate each student in terms of improving her own performance.
- Avoid overuse of materials that are so highly structured that creative thought is discouraged.
- Use social interaction in learning experiences to promote increases in both interest and comprehension.
- Piaget's view on the role of a teacher can best be summed up in his own words. "What is desired is that the teacher cease being a lecturer satisfied with transmitting ready-made solutions; his role should rather be that of a mentor stimulating initiative and research" (Good, 1979, p. 430).

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