

psychologists, educators, and others. Naturally, the perspective from which the investigators approach their work affects their perceptions and conclusions. Although the study of cognition has a long history, the last two decades have witnessed a revived interest in intellectual activities, especially in cognitive psychology.

In the receptive milieu created by these trends, the writing of two men have received particular attention. Jean Piaget, a Swiss genetic epistemologist, studied the cognitive development of children for more than half a century, mostly through observations of small numbers of children in natural and controlled conditions. Piaget has inferred from his observations of behavioral content that intelligence develops in the individual by invariant functions acting upon changing structures.

More recently, David Ausubel, an educational psychologist, has explored extensively the role of cognition in learning. His work has culminated in a cognitive theory of meaningful learning which he calls assimilation theory. This theory postulates that new information is linked to relevant pre-existing aspects of cognitive structure with both the newly acquired information and the pre-existing structure being modified in the process. Based on his model, he describes the cognitive process of subsumption with its underlying principles of progressive differentiation and integrative reconciliation. He sets his theory within the context of school learning and explores at length the types of meaningful reception learning which he believes form the core of the classroom experience.

Although interest in Piaget's work has been the greater of the two, both theories have generated considerable empirical investigation with mixed results. Recently a body of research has begun to accumulate which combines the two theories to generate unified, testable hypotheses. (Lawton, 1977a; Lawton, 1977b; Swadener & Lawton, 1977; Lawton & Fowell, 1978; Lawton & Wanska, 1978; Lawton & Wanska, 1979; Lawton & Ershler, Note 1). This body of related research seems to indicate that properly designed and implemented advance organizers result in enhanced learning, retention, and transfer and in accelerated cognitive development in children in the preoperational and concrete operational subperiods.

Theoretical Comparison and Contrast

Are the theories of Piaget and Ausubel basically compatible or do they differ on too many major issues for their ideas to be used in conjunction with one another? Answering this question is complicated by the fact that while Ausubel comments liberally about Piaget in his book *Educational Psychology: A Cognitive View*, there are no sources of Piaget's response to Ausubel's thinking. Therefore, Ausubel's perspective will be adopted in this discussion.

Ausubel primarily accepts Piaget's stage-dependent theory of cognitive development. In responding to critics of Piaget's work, he states, "Actually, developmental stages imply nothing more than identifiable sequential phases in an orderly progression of development that are qualitatively discriminable from adjacent phases and generally characteristic of most members of a broadly defined age range" (Ausubel et. al., p. 225). In his consideration of school learning, however, Ausubel eschews Piaget's complex arrangement of periods, subperiods, stages, and substages. Instead, he stipulates three general stages in children's cognitive development differing most significantly along the concrete-abstract dimension: the pre-school child can generally understand concepts only if their criterial attributes can be related to multiple exemplars of the concept before relating it to cognitive structure; the elementary school child

COMPARATIVE EVALUATION OF THE COGNITIVE THEORIES OF PIAGET AND AUSUBEL

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Cognition, the act or faculty of knowing, has been the object of investigation since ancient times. Two areas of cognition in particular, cognitive development and cognitive processes, have been studied extensively by biologists,

can understand the meaning of a concept by relating the criterial attributes directly to cognitive structure with the aid of concrete-empirical examples of those attributes; and the secondary student can understand and manipulate abstract ideas and relationships among them directly, without the benefit of concrete props (p. 206).

Although Ausubel basically accepts Piaget's theory as valid, he does take exception to some of Piaget's formulations when specifically applied to education. The points of difference he lists include: Piaget is concerned solely with the development of thoughts as opposed to comprehension; by identifying the operations of thought with the operations of logic, Piaget confuses a special tool of thought with the actual operations of thought in problem solving situations; Piaget attributes to thought the quality of implicit action in contrast to the widely accepted view of thinking as a reorganization of elements in cognitive structure to meet the requirements of a situation; Piaget places prime emphasis on endogenous motivation, largely ignoring education's role of stimulating the development of new motivations from existing potentialities; Piaget discounts education's role in promoting cognitive development, placing instead great emphasis on spontaneous or incidental experience; Piaget denies the role of education in accelerating cognitive development or in facilitating transfer from one stage to another; and Piaget believes the function of language is communicative, attributing to it no operative role in thought (p. 231).

The third issue raised by Ausubel, that Piaget conceives of thought as action in opposition to thought as reorganization of cognitive structure, represents a basic difference between the two men. Piaget emphasizes the processes of thought while Ausubel focuses more on the manipulation of content. Ausubel says the belief that "it is feasible to teach general cognitive operations isolated from actual subject-matter content not only makes excessive demands on children, but is also artificial in terms of particularized contents which such skills necessarily assume in each discipline" (p. 231). Shulman (1970), in discussing the relation of psychology to mathematics education, describes Ausubel's stance strongly: "He remains a militant advocate of the importance of mastering well-organized bodies of subject-matter knowledge as the most important goal of education" (Shulman, 1970, p. 36). In a paper proposing assimilation theory as an alternative to Piagetian psychology, Novak (1977) explores this same dichotomy by saying, "The key issue . . . is whether children develop general 'cognitive structure' or 'cognitive operations' to make sense out of experience, or, if instead, they acquire a hierarchically organized framework of specific concepts, each of which or some combination permits them to make sense of an experience . . ." (p. 455). Novak (1977) would support the latter position.

Another point of difference identified by Ausubel is that Piaget believes the most important form of motivation to be endogenous, or originating within the individual, which in turn, suggests discovery learning as the most effective type of education. While Piaget favors discovery learning for all children, Ausubel suggests that meaningful reception learning is most appropriate for children in upper elementary and secondary school who have acquired a basic conceptual store. Ausubel explains that the nature of the abstract stage of cognitive functions permits individuals to learn most new concepts and propositions directly, grasping verbally or symbolically stated relationships between previously learned abstractions. Exemplars or props are used for illustrative purposes only.

While the difference in emphasis on discovery versus reception learning by these two men is clear, their translation of the implications of formal operations for instruction is less

oppositional. In particular, the function of language emerges as an issue. Although Ausubel implies that Piaget posits that language has no operative or process role in thought, he is being overly simplistic in his interpretation. Piaget does stress that during the sensory motor period of development "representational thought does not begin with and result from the incorporation of verbal signs from the social environment" (Flavell, 1963, p. 155). Rather, symbolic representation leads to the acquisition of language. However, in contrasting his proposed active method against receptive methods, Piaget himself emphasizes that the activity need not always involve physical manipulation of objects. For older children "the most authentic research activity may take place in the spheres of reflection, of the most advanced abstractions, and of verbal manipulations (provided they are spontaneous and not imposed on the child at the risk of remaining partially uncomprehended)" (Piaget, 1970, p. 68).

Related to the emphasis on discovery learning, Ausubel states that Piaget stresses spontaneous or incidental experience over formal education in promoting cognitive development. Ausubel somewhat resolves the conflict by stipulating two types of readiness occurring within the individual: specific and general. General readiness reflects a cumulative product of genic effects, incidental experience, and learning in which subject-matter learning affects cognitive capacities in a general way. Specific or subject-matter readiness, in contrast, is based on acquiring prerequisites for particular learning. "Experience or learning *any* subject-matter produces general as well as specific *developmental* changes in cognitive capacity in addition to specific changes in subject-matter readiness" (Ausubel et al., p. 249).

Piaget also categorizes cognitive achievement along a general-specific continuum, particularly for the adolescent, albeit in a more structured manner than does Ausubel. Most general is the group-lattice structure of formal thought; most specific are task linked concepts emerging from work with Piagetian experiments. Formal operational schemata are intermediate in generality and can be applied across a range of problems (Flavell, 1963, p. 222). Therefore, a general cognitive structure indeed emerges for Piaget, but its formation is augmented by specific task-concepts of subject-area content.

Having distinguished between two levels of cognitive development, Ausubel continues by suggesting that appropriate school experiences can accelerate more general development, particularly that of transition from one level of operations to another. While Piaget concedes that some acceleration, albeit necessarily limited in extent, is certainly possible. Ausubel emphasizes the role of training and education. He is especially interested in the transition from concrete to abstract thinking. The general training procedure he describes takes place in anticipation of the next higher developmental period after the current stage is fairly well consolidated. To move from concrete to formal operations he suggests "gradually withdrawing the concrete-empirical props as the prior stage becomes consolidated—that is, by withdrawing the props well in advance of the actual attainment of abstract cognitive functioning" (p. 249-250). He concludes, "On theoretical grounds there is no reason why *only* incidental (spontaneous, undirected, unexplained) experience (despite Piaget's insistence to the contrary) must effect the gradual cumulative change in intellectual capacity that makes transition to a higher stage possible" (p. 248).

Again, despite Ausubel's insistence to the contrary, Piaget suggests a similar instructional approach. Because of the importance to Piaget of the key concept of gradual transformation of overt action into mental operations, Piaget

indicates that the teacher should assist this process by encouraging the student to work with progressively less direct support from the external givens (Flavell, 1963, p. 368). Ultimately, the external actions can take place internally and in complete autonomy from the environment.

Finally, in considering the concrete and abstract periods of cognitive development as well as the transition between them, Ausubel makes some distinctions between Piaget's thinking and his own that seem to differ more in emphasis than in substance. Without explicitly using Piaget's term *decalage*, Ausubel iterates that the movement from concrete to abstract functioning must occur separately in each discipline. He does hypothesize, however, that the general overall stage of development is transferable to the new discipline. This is due to "the existence of a larger body or 'critical mass' of stable abstractions in cognitive structure and of sufficient transactional terms for relating them to each other, as well as considerable experience in comprehending and manipulating abstract ideas without the benefit of concrete props in other disciplines" (Ausubel et. al., p. 206). Therefore, while the individual who has achieved formal thought must move anew through concrete to abstract reasoning in each new discipline, the process is greatly accelerated.

Furthermore, he identifies a different critical feature as the quality distinguishing between concrete and formal operations. For Piaget, this feature is that the more advanced child "is able to deal internally with ideas about ideas or to perform 'second order operations'" (p. 237). Ausubel modifies this view considerably by stating, "It is rather the preadolescent's and adolescent's ability verbally to manipulate relationships between ideas in the absence of recently prior or concurrently available concrete-empirical proofs that is the distinctive attribute of formal operations" (p. 237). He supports this premise by maintaining that concrete operational children can draw correct inferences from hypothetical premises involving abstract relations.

Ausubel recognizes a general similarity between Piaget's formulation of the assimilation process and his own assimilation theory. This similarity stems from the provision in Piaget's view of assimilation for the absorption of new into existing schemata which is generally analogous to subsumption. Ausubel quickly adds, however, that "not only does Piaget fail to go beyond this general statement of assimilation and describe explicitly how assimilation occurs, he also conceives of assimilation solely in terms of developmental progressions rather than in terms of a contemporaneous learning process" (p. 231).

Difficulties stemming from two different definitions of the same word—assimilation—exemplifies how confusing terminology overshadows some of the interrelatedness which actually does exist between the two theories. For instance, the two types of subsumptive learning, derivative and correlative, are roughly akin to assimilation and accommodation although the relation Ausubel identifies is between assimilation and subsumption. More formally, Ausubel's assimilation theory of meaningful learning involving progressive differentiation and integrative reconciliation appears to be analogous to adaptation with its complementary processes of assimilation and accommodation.

IMPLICATIONS

The explication and comparison of the theories of Jean Piaget and David Ausubel indicate that the two cognitive theories are compatible and perhaps even complementary. From this assumption, pedagogic implications emerge particularly for the use of advance organizers in instruction.

Although the discoveries and technology of today's world are engendering an ever-accelerating movement towards tomorrow's reality, the bulk of the learning in the schools continues to be that of meaningful verbal materials. In fact, because of burgeoning knowledge, the amount of materials learned has increased exponentially. How to facilitate learning, retention, and transfer of meaningful verbal materials is a prime concern of education. Appropriately designed and implemented advance organizers appear to be one means to this end.

Moreover, Piaget posits that cognitive ability varies qualitatively with the developmental stage, suggesting that different types of instruction are more appropriate than others at specific developmental points. That carefully designed advance organizers have been proven to be facilitative in preoperational and concrete operational children is consistent with this position. The weight of the research evidence in support of these points gives credence to systematically using advance organizers in the classroom. (See Searls, Note 2, for specific guidelines.)

However, the scope of the research combining the two theoretical bases has been limited largely to work with young children and some serious methodological problems have been evident. Additional work needs to be undertaken with children of different age groups.

Reference Notes

1. Lawton, J. T., and Ershler, J. *Effects of formal and informal pre-school programs on logical concept learning and development: An interim report*. Paper presented at annual meeting of the American Educational Research Association, Boston, April 1980.
2. Searls, E. *Using advance organizers in the classroom*. Paper presented at the American Reading Conference, Sarasota, December 1980.

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