DOCUMENT RESUME

ED 033 820 RE 001 878

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TITLE Reading as Cognitive Functioning.
Pub Date May 69
Note 26p.; Paper presented at the International Reading Association conference, Kansas City, Mo., April 30-May 3, 1969.

EDRS Price EDRS Price MF-$0.25 HC-$1.40
Descriptors *Cognitive Development, *Cognitive Processes, *Concept Formation, Critical Reading, *Critical Thinking, Developmental Psychology, Reading Ability, *Reading Development

Abstract

Theories and practices concerned with cognitive functioning and development and its possible relationship to reading and reading instruction are reviewed. The nature of the strategies involved in reading and thinking are similar. Increase in task complexity for reading most likely involves cognitive functioning that ranges in complexity similar to the stages Piaget and others have described. Like concept attainment, reading requires of the reader problem-solving ability that is logical and mobile. Reading cannot be regarded as a passive process; like thought, it requires action, and it cannot be directed by passive teaching. The basis of reading is rooted in action within a developmental interactionist theory of cognitive development. A bibliography is included. (WB)

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READING AS COGNITIVE FUNCTIONING

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For many years authorities have contended that reading is an intellectual process akin to thinking. Much speculation has been done about the concepts and cognitive skills used in this process. Huey said that when reading was done for the attainment of the reader's purposes, it became excellent practice in the higher thought processes. The feeling for values and the choosing of the relevant requires, he said, a mental discipline that is "...golden practice in the training of judgment." (15, pp. 363-364) He went on to say that "real reading" whereby the reader actively and sympathically follows the ins and outs of an author's intentions, his fidelity to truth, his accuracy and method, "...cannot but train the mind to modes of functioning that are similar to his." (15, p. 365) By so doing it "acquaints one with the more effective ways of thinking, and develops them in the reader...". (15, p. 365)

Apparently not all of the variability of attainment in reading is attributable to conditions within the learner. Some of it results from differences existing among authors as reflected in their thinking and their writing. Both conditions, author and reader differences, are encompassed by a host of variables which affect success in comprehension and concept learning. If, as Bacon said, writing maketh the accurate man, then the degree to which authors observe the disciplines of accuracy permits an imitation by readers that should be cognitively productive. It would be dangerous to assume, however, that reading the classics resulted in automatic acquisition of cognitive skill by-products.

The admonishing of many scholars about the proper business of schools, and particularly the teaching of reading, has until only recently been negated largely by teaching practices that produce non-thinking parrots and word callers. Many so-called authorities in reading have been writing glowing accounts of the need for efficient reading and the use of higher mental processes and at the same time attaching their names to reading instruction materials that cultivate passive mastery. Recent advances in the understanding of concept attainment and the maturation of thought processes have great promise and may offset such compromising.

Reading is a mental process—a dynamic, active process and it can be taught that way. Teaching strategies that can elevate cognitive effectiveness are being developed. As a result we need no longer wait for the superior children to discover the strategies of thinking by slowly

and painstakingly examining the writing of scholars to determine their modes of functioning and in the meantime see the less able either drop out or become semi-literate robots.

Language and Thought

The role of language in cognitive development is undoubtedly significant. It is largely because of language and symbolization that most forms of cognitive functioning become possible. In this regard, however, Piaget has been quite clear about the relationship between language and intellectual operations.

The source of intellectual operations or cognitive functioning resides in the sensorimotor period in which the intellectual instruments consist of percepts and movements. (25, Chapter 3) Even though objects and events are experienced only in their perceptual immediacy, elementary forms of conservation and operative reversibility are to be found. For instance, recognition of the permanency of objects represents a first invariant. Thus the changes that occur in intellectual operations when language is acquired show that language is not fully accountable for the transformations.

The beginning of representation and of representative schematization or symbolic functioning in general appears at about the same time as language. Symbolic or imaginative play is a source of personal cognitive and affective representation that is contemporaneous with the appearance of language but is independent of it. By the end of the sensorimotor

period, thought with its roots in action, has permitted a child to overcome initial perceptive and motor egocentrisms. He can attain practical aims by activity that yields success cognitively speaking and pleasure affectively speaking. Deferred imitation, or imitation that occurs in the absence of a model, and mental imagery, or the sonorous imagery of a voice represent two other possible links between sensorimotor behavior and representative behavior.

Sinclair-de-Zwart, a linguist on Piaget's staff, uses an apt illustration to distinguish between symbols as signals and as signs. The former leads to what is signified much as the part leads to the whole. In addition they are usually personal. Signs, on the other hand, are distinct signifiers that are arbitrary and can form systems. For instance, a child pushing a shell along the edge of a box and saying "meow" illustrates signals as signifiers. The shell has a resemblance with the object (cat) and the word "meow" is a signifier. (28)

Such acts of practical intelligence accompanied by words (language) are thus a part of a much larger process constituting intellectual operations. Even though language is necessarily interpersonal and a system of arbitrary signs that frees the individual from the immediate, it is a particular form of symbolic functioning. Sensorimotor schemata seem to be of importance not only from the beginning of intellectual operation but continue to develop and structure thought up to the constitution of formal logic. "It is permissible to conclude," writes Piaget, "that thought precedes language and that language confines itself to profoundly transforming

thought by helping it attain its forms of equilibrium by means of a more advanced schematization and a more mobile abstraction." (25, pp. 91-92)

While it appears to be true that language and the like make possible most of the complex forms of cognitive functioning, it is not the source of all coordinations. School learning and reading instruction cannot overlook such truths. Many operations are basically coordinations among actions before they are transposed into language and the operations of thought. Children can classify collections of objects or seriate objects before they can do so linguistically.

> The question is also whether language is sufficient in and of itself to give rise to these (formal)* operations ex nihilo, or whether, on the contrary, its role is limited to allowing the fulfillment of structuring which originates from the systems of concrete operations and, therefore, from the well-springs of action itself. (25, p. 95)

Undoubtedly language permits symbolic condensation and social regulation and the integration of actions into simultaneous systems, but also it is linked with actions in continuous reciprocity. Sinclair-de-Zwart, after summarizing her studies on linguistic development and research on deaf and blind children, said results confirmed Piaget's views that "...language is not the source of logic, but is on the contrary structured by logic." (28, p. 325)

Cognitive Development

Cognitive development is a continuous construction of intellectual operations that evolve toward a subtle and mobile systemization essentially

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* My insert.

directed toward equilibrium. Intellectual operations, or the organization forms of mental activity, are rooted in action and are always a part of a system of operations or structured wholes. At all levels of development there are constant functions common.

> ...action presupposes a precipitating factor: a physiological, affective, or intellectual need. (In the latter case, the need appears in the guise of a question or a problem.) ...In addition to the constant functions, there are the variable structures. (25, pp. 4-5)

The constant functions assure transition from one period of development to another and the variable structures provide the organizational forms of mental activity, intellectually as well as affectively.

The developing child acquires complex sets of learnings based on discrimination, perception, transposition and generalization. In so doing he acquires concepts and a set of appropriate behaviors. Concepts and processes enable a child, according to his capacities, to cope with his environment, to organize his mental activities along two dimensions—intrapersonal and interpersonal (social), and to form attitudes that are emotional and intellectual.

The stages of intellectual development as described by Jean Piaget provide a schematic description of developmental cognitive changes that occur through time. His stages are open-ended enough to allow for the fact that children show different levels of ability, knowledge, and skills as a function of the rate and quality of the learning experiences they encounter.

The first two years of life are described as the sensorimotor period. The infant, using the inherent reflexes of his biological endowment, interacts with his environment. The interplay of internal and external conditions through stimulation and response characterizes the normal development of infants. Gradually from the maze of undifferentiated, unreflective, and unspecified experiences the child attains rudimentary knowledge. To accomplish this, he, as Sigel says, "...establishes a differentiation of himself from objects; he localizes himself in space; he establishes a beginning awareness of cause and effect, of time and space." (27, p. 215) By the time most children are eight to twelve months old they have shown intention or goal-directed activity. Purpose, or the intentionality of purpose, now begins to influence their interactions. This is a big stride intellectually as awareness of "means-end relationships" helps the child to cope with the physical and social complexities of his world. By the end of this stage the child is well on the way to dealing with his environment symbolically and conceptually. He can already invent solutions in his mind rather than acting them out by trial and error.

It is apparent, then, that in the first two years of life children live in a world, albeit a concrete world, and in a series of situations. The interaction that is going on between a child and his physical and social world permits him to separate himself from his environment as well as to realize that the environment has certain properties of space, location, permanence, and causality. Increasingly, he is able to operate symbolically by classes or groups. He can tell that a dog, Silver, is a

member of the dog family but cannot deal with the category animal.

The next five years of life Piaget describes as the preoperational phase. In this phase language plays an increasingly important role as the child acquires concepts through a complex set of processes. To attain concepts he has to become increasingly sensitive to objects in his concrete world. He has to learn not only that they exist but, also, that they have many characteristics and attributes. In addition he sees that diverse items can be organized into classes or categories (Silver, collie, dog, animal, vertebrate) and that language can facilitate as well as direct the process.

At the sensorimotor period, a giant intellectual stride noted was the influence of intention or purpose, the sensing of means-end relationships. At the operational stage an equally significant stride is made as the sensory-motor infant becomes, through symbolic functioning, a manipulator of representations. The act of symbolic functioning is the result of the generalized capacity to differentiate between signifiers—symbols which stand for something, and significates—the objects. This representational intelligence through its possession of symbolic functioning sets the stage for the upper limits of cognition and the manipulation of reality.

At this stage, though, conceptualization is dominated by the world of preconcepts. The potency of physical attributes to a large degree determines the concepts formed. Piaget calls this the pre-concept period

because children grasp first-level concepts primarily. They can grasp the fact that peaches and pears are food but cannot distinguish between different pears. Or, they can recognize that certain very different things belong together: Daddy's watch, Daddy's chair, Daddy's hat.

In the four to seven years of age phase, increased symbolic functioning is possible. Signs—linguistic signs—are acquired from the social surroundings and are socially shared. Words are the commonest signs of our codified and socially shared linguistic system.

The private signifiers or symbols as well as the early use of linguistic signs provide the focus for Piaget's saying that children are egocentric. They lack generally the ability to take the role of another person and to treat their own thought processes as the object of thought. Over and over again Piaget indicates that it is in the context of social interaction as a member of a learning group that a child, forced to take cognizance of the ideas of others and forced to become increasingly cognizant about his own thoughts, their reliability and validity, emerges as a sociocentric objective scholar.

In addition to grasping the function of images and signs as signifiers, the child learns to use them as anticipative mediators of future actions. Starting with imitative images which serve as anticipative schema, the child begins to direct future action. He begins to evoke acts and deeds in thought, as opposed to actually carrying them out in reality. This ability to anticipate, to look ahead, to conjecture, to

speculate leads to the ability to hypothesize, to deal with variants and covariants, and to test logically. In the life of a learner this ability signifies advance of the utmost importance. It is the pattern of inquiry which George Kneller defines as, "...to analyze the problem and to consider ways of dealing with it—that is, to set up hypotheses." (22, p. 42) Now the learner is becoming more reflective and less impulsive. He is beginning to want proof, to suspend judgment, to think of information as tentative and relative. Now, rather than seizing on the first idea that occurs to him, he pauses (suspends judgment) to note whether or not there are better ways or other alternatives.

Another cognitive advance that occurs at this stage is the ability to use numbers, not only to order things in terms of quantity, but also to see that relationships can exist on a numerical basis. A system such as the number system has properties too—formal properties that are agreed upon by mathematicians. The child who can produce a sum deals with an abstraction based upon formal properties of mathematics. Interestingly enough Piaget makes it quite clear that the understanding of numbers does not begin by learning numerals.

The latter part of the preoperational stage finds children making judgments largely on the basis of partial and immediate perceptions and/or on the basis of objective similarity. They judge by the way things look and usually in terms of just one of a number of relevant dimensions. Even so, three fundamental operations can be determined. They can think in terms of classes. When presented with a group of circles or squares

they can classify the items on the basis of roundness. They can think in terms of relationships; i.e., Mr. Jones is the father of Ralph, Mr. Jones is bigger than Ralph, and Ralph is the oldest of three children. They can think in terms of quantity or by handling number concepts.

In the concrete operations period the thought of the seven to eleven age group is more like that of the adult in that they think more in logical terms. Operations is used by Piaget to refer to mental acts or imminent acts of an internalized nature and taking place in the mind. These mental acts represent a process of interaction and development whereby new syntheses are formed by discovery. Attributes are noted, objects are classified, and categories determined. These syntheses are real in the sense that they not only have a location in time and space but also that they take place in the minds of human beings. In the process of cognitive growth through discovery and synthesis the individual is merely the neural medium in the resynthesis of cultural elements.

Three significant operations described by Piaget are reversibility as in arithmetic (2 + 3 = 5 or 5 - 3 = 2), classification or the organization of objects into classes (desk, chair, table = furniture), and seriation or arranging ideas along a spectrum of increasing values (2, 4, 8, 16, 32). In brief at this stage the child is able to treat objects as alike (desk-chair) (furniture) even though different, to note that they can be in more than one class, that some classes can be subordinate to others, and to count one item as first and another as second.

In addition the child has to understand the concept of conservation. In other words, he has to see that certain properties of objects such as quantity can remain invariant even in the face of certain changes. For instance, two circles with a diameter of six inches remain alike even though one is cut into quarters and the other is cut into thirds. Cutting the circles doesn't alter the amount or quantity of the circle.

To arrange items in a series along a continuum a child must grasp the principle of transitivity. He must understand such ordering whereby he recognizes that if A is larger than B, and B is larger than C, then A is larger than C.

In this concrete operations stage, even though the child's thinking may be logical and systematic, his thoughts are limited to the direct experiences he has had. When he has no direct experience, he tends to reason by analogy to something he has experienced. In this regard, the crucial element may be verbal ability, as well as physical activity and social interactions with verbal ability, acting as a support to help a child overcome the influence of his visual perceptions. While training designed to increase the appropriate vocabulary may facilitate the development of logical thinking and help resolve the perceptual-cognitive conflict, it is "equilibration" or self-regulation that takes on greatest significance. To permit a child "...to learn an appropriate answer without making certain that he can retrace his steps, or arrive at the same result in another way, is to encourage the erection of a verbal superstructure that may crumble under even minimal cognitive stress." (1, p. 132)

The fourth stage or that of formal operations is the time when abstract thinking develops. The child enters this stage at about the beginning of adolescence. Now he begins to grasp the ability to deal with the possible without reference to the actual. Now he begins to grasp the complexity of human knowledge by learning how to construct theories and make logical deductions about their consequences without the need for empirical evidence. As J. McV. Hunt puts it, "...instead of observation directing thought ... the adolescent's thought directs his observing." (17, p. 355) In all this, language, or representational thought, plays an important role, but Piaget is of the opinion that ability to use language to express logic is an outcome of activity, and that attempts to improve a child's logic by teaching him in the use of language is apt not to be very successful.

It seems then that language development as a part of maturation or all round mental capacity influences much of the child's progress, from thought that is predominantly perceptual and intuitive to thought that is more conceptual and logical. A child's verbal accommodation to a learning experience is helpful but it will produce lasting effects only if, through further self-regulation, generalization to other tasks has resulted. It is not enough just to have had an experience, even verbally, unless it affects a child's way of organizing his experiences.

Finally, as Piaget has declared, the key factors in the transition from one level of thought to the next involve maturation, social interaction, physical activity, and, most important, the process of equilibration or self-regulation.

Children's cognitive actions and interactions, intellectually and affectively, as described by Piaget, suggest that reading ability to the degree that it is cognitive in nature represents similar potential. It remains for us to account for the reading-thinking processes in as definitive and astute a manner as he did. Reading tasks structured carefully both syntactically and semantically may reveal the "how" of the reading-thinking act and the "why" of different strategies for attainment and assimilation. Developmental stages may be determined and reading materials prepared to foster growth in subtle and mobile skill acquisition and functioning.

Piaget's theory of cognitive development advanced over the past half-century reflects an empiricist-idealist base and has only recently met with wide acceptance in the United States. He starts from the central postualte that action (motor) is adaptive and is the source from which mental operations emerge. Intelligence is viewed as an adaptation, an organizing activity whereby there occurs a progressive balancing of increasing complex forms under the impact of experience. His work in cognitive development and critical thinking now represents a major influence upon basic research in psychology and education.

Concept Learning

Concept attainment is now generally considered a part of the psychology of learning and the development of cognitive processes. (12, p. 37) Attention is focused on the logical form of concepts with studies of concept attainment generally based on inductive methods and

the strategies used. (6, p. 37) Strategies differ from person to person, from discipline to discipline and from one level of sophistication to another. While many concepts are acquired by discovery learning through discrimination, abstraction, differentiation, hypothesis generation and testing, and generalization, many more are acquired through school learning and/or reading. In the latter, the concepts are learned by means of criterial attributes presented and the relating of them to established ideas. (2) Thus the acquisition of concepts can be accomplished inductively by concept formation or deductively by concept assimilation. Even so, there is a considerable likelihood that the learner must use much of the same processes of concept formation even when appropriate contexts are presented as in concept assimilation.

At the Wisconsin Research and Development Center for Cognitive Learning, (20) Concept is treated as a superordinate category of which all concepts are instances and differentiated from other products of learning such as facts, principles, and problem-solving skills. A concept is referred to as having four characteristics--definability, structure, psychological meaningfulness, and utility. Four bases of defining concepts are identified in terms of perceptible defining properties, semantically, operationally, and logical or numerical relationships or axioms. Structure is determined by the form in which the concepts are experienced. Psychological meaningfulness refers to the phenomenological or idiosyncratic nature of concepts and the internal representations held by an individual. Utility is related to the use of a concept which is

determined primarily by how well an individual has formed a concept.

Bruner in his Study of Thinking (6) defined strategies as regularities in decision-making and indicated that they provided the basis for making inferences about the mental processes involved in concept learning. He identified four strategies under the selection paradigm and two in the reception paradigm. Under the former he defined the strategies as 1) simultaneous scanning, 2) successive scanning, 3) conservative focusing, 4) focus gambling. Under the latter he labeled them as 1) wholist and 2) partist. Byers' study done at the Wisconsin Center (7) designated the strategies used as one of three variants of a conservative focusing strategy or as one of two variants of a focus gambling strategy.

Byers found that practice modified the probability with which subjects used various strategies. Use of conservative focusing strategies increased while use of others decreased. Attempts at instruction in the use of strategies (21, p. 32) showed that subjects were readily taught the conservative focusing strategy and did better than those not taught. On the other hand they could not be taught to use focus gambling strategies consistently and tended toward use of conservative focusing strategies.

Concepts are utilized when reading. The meanings of previously learned concepts and propositions are perceived and dealt with and the acquisition of new concepts is facilitated. The cognitive processes of concept attainment and concept assimilation are used most likely both in simple and more complex varieties of reading.

In addition it may be noted that insofar as the central role of cognitive variables are concerned the distinction between formation and utilization on the one hand, and problem solving on the other, becomes less definitive. (16) (18) (19) This is true of concepts acquired by discovery as well as by meaningful reception learning. It is true of simple as well as complex problem solving.

Reading is a form of problem solving in much the same way as is concept development. All three—concept attainment, problem solving, reading—are active cognitive processes of seeking relationship to, differentiating from, and reconciling with, existing ideas and the processes therefor overlap in many ways. Some of the principal ways are hypothesis-generating and testing, abstracting and generalizing. The efficient reader reads with a purpose, abstracts information, tests its value, and then accepts or rejects.

Singer, after reviewing the literature on conceptualization and reading behavior, and in an examination of the variance in the sub-strata theory of reading, said that the formation and use of concepts needed to be accounted for as it entered into the development and dynamics of general reading ability. (29) (30) Similarly, Kress, using a battery of clinical tests of concept formation and comparing "achieving readers" and "non-readers" concluded that capacity for conceptualization was specifically related to reading achievement. (23)

As is already stated, to read requires a reader to employ the concepts he has acquired and provides opportunity to attain new concepts

and remodel old ones. The act of acquiring concepts being so much like that of problem solving and in turn like reading, the analysis of concept acquisition can in turn be suggestive about ways of analyzing the reading-thinking act.

Critical Thinking and Teaching Strategies

Even though Huey (15) (in 1913) stated the case for critical reading in a professional text on the teaching of reading his account did not have the impact on thinking about reading as did Edward L. Thorndike's "Reading as Reasoning" report. (35) He concluded in 1917 that

> ...understanding a paragrapn is like solving a problem in mathematics. It consists in selecting the right elements of the situation and putting them together in the right relations, and also with the right amount of weight or influence or force for each. ...all under the influence of the right mental set or purpose or demand. (35, p. 329)

More recently Ennis (9) (10) has said that critical reading is the use of critical thinking in the act of reading. Russell maintained a similar position and defined critical thinking as a three factor ability. He included an attitudinal factor of questioning and suspending judgment, a functional factor of logical inquiry and problem solving, and a judgmental factor in terms of some norm or concensus. (26)

A significant study by Taba (34) was concerned with teaching strategies and thought processes. Her multidimensional analysis of classroom transactions in terms of measureable changes in levels of thinking had several advantages. Results showed that children can learn to make inferences, to generalize, and to make logical assumptions if

they receive systematic instruction. The enormous influence of teacher behavior on the thinking of students was most impressive.

The Productive Thinking program of Covington and Crutchfield showed that instructed children were more willing and able to make use of the cognitive skills and strategies common to both creative problem solving and to discerning reflective reading. They developed a general problem solving program of 16 self-contained problem solving episodes. Creative problem solving strategies were taught as well as a number of thinking strategies. (8)

A comprehensive study done at Ohio State University had as the major purpose to determine whether or not children in the elementary grades could be taught to read critically. This required the development of an extensive operational definition of critical reading and the identification of specific skills. It also required the development of an observation instrument for classroom use. Bloom's (5) approach to ways of ordering knowledge influenced the development of a classification system for teacher's verbal behavior and Guilford's (14) structure of the intellect proved useful in determining the separate types of thinking of the pupils. Twelve teaching units were developed and a test labeled the Ohio State University Critical Reading Test. (35) Results indicated that teaching critical reading is feasible to children of both sexes and that achievement is influenced by intelligence, general reading ability, and personality, and that teaching skill, especially the ability to ask questions and interpret pupil responses was a key factor. (36) In this latter

respect it is interesting to note that Gallagher showed how the questions a teacher asks determined the kind of thinking the student did. (3)

Ennis in a project on critical thinking set as his goal to contribute to knowledge about what critical reading is and about when it can be taught. The report covering the first phase dealt with deductive logic in adolescents. He defined logic as that part of critical thinking which deals with whether a conclusion follows necessarily from the premises that are offered in support of it. Of the types of logic that exist he studied two: conditional logic and class logic. In general he concluded that progress in mastering class logic and conditional logic could be made although instructional time required varied. (9) (10)

Suchman has been experimenting with the teaching of strategies and tactics of scientific inquiry to children and devised a method known as inquiry training. He states that inquiry is "the pursuit of meaning" and his major emphasis appears to be on the means by which knowledge is acquired. While the training increased the number of valid questions asked, he found no significant differences between two groups. (32) (33)

A longitudinal study to learn the nature and direction of changes from freshman to senior year in critical thinking ability, in attitudes of stereotypes and dogmatism, and in traditional value orientation was done at Michigan State University. There were marked changes in critical thinking ability, attitudes, and values from the freshman year to the senior year with the changes in critical thinking of greatest magnitude occurring during the freshman year. (24) It might be concluded that

students come to college with the hope that centers of higher learning are also centers that foster and require critical thinking. However, by the end of the freshman year they have discovered apparently that conformity and intellectual bondage win the higher grades and please the professors.

Berlyne concentrated on directed thinking and defines its function as "to convey us to solution of problems." (4, p. 19) In so doing directed thinking involves both epistemic behavior and symbolic behavior. Such thinking is launched by a "felt difficulty," a problem, a question, a conflict, uncertainty or disequilibrium and is in turn motivated thereby. The native propensity of the mind to ask "why" from age three on and its compelling force are still far from understood psychologically or physiologically but there seems to be little doubt about the potency of the desire for equilibrium in the function of learning and thinking and their responsibility for adaptive change.

Strategies of thinking, of problem solving, of concept attainment must be learned and therefor can be taught. Similarly, strategies for effective reading-thinking must be learned and can be taught. It is significant and directive to note that a basic operational mechanism in problem solving and in concept formation is a problem, or a question or a mental set, and that a question well asked can be half the answer. Similarly it is the purpose of a reader that determines not only his rate of reading but also the nature and depth of his achievement. At the same time the most essential pedagogical skill is the teacher's resourcefulness in the art of questioning. As Piaget has said, "It is so hard not to

talk too much when questioning." The unequivocal role of "the question" in learning as well as in the directing of learning is a point that has not been sufficiently appreciated. Undoubtedly there can be no learning without a problem and it is in this regard that the studies reviewed here are highly suggestive.

Conclusion

Sam A. Fleming, writing in the Phi Kappa Phi Journal on the "Specter of Ignorance " said, "Dedication and clear thinking are our need

> Dedication and clear thinking are our need today. It is ironical that in this period of so much learning ... a specter of ignorance should hang over us ... that there should be irresolution about many of the true values which are fundamental to our way of life. (11, p. 12)

Much the same might be said about what is reading and how to teach reading. Universal agreement can be obtained supporting the conclusion that comprehension is the invariant condition of reading. Almost universal agreement can be obtained regarding the conclusion that reading is a process akin to thinking. Some few agree that if the first two premises are true then reading should be taught as a thinking process. (31)

This review of theories and practices concerned with cognitive functioning and development and its possible relationship with reading per se and with the teaching of reading may prove helpful if it will stimulate research that will define ways and means to more effective reading. Specific thought processes involved in reading for various purposes and with varied materials should be identified.

There seems little doubt about the nature of the strategies involved in reading-thinking acts. Increase in task complexity most likely requires cognitive functioning that ranges in complexity from stage to stage of maturity similar to the stages Piaget and others have declared. Like related intellectual tasks such as concept attainment, reading requires of the reader problem solving ability that is logical and mobile. Undoubtedly, too, achievement is influenced by a reader's intellectual potential, his attitudes and values, his intrapersonal and interpersonal dimensions, and the teaching and testing to which he is exposed. Even though at the college level a renewed attempt at critical thinking is made by college freshmen, pedagogical demands do not foster similar changes across the four years.

Children deal with means-ends relationships as early as the sensorimotor period. They learn to deal with variables selectively and to act reflectively in the pre-operational period. They make decisions on logical terms through immanent acts of an internalized nature. This they do by discovery and synthesis as they resolve perceptual-cognitive conflicts of the operational period. Finally at the logical stage they can construct theories and make sound deductions without the need for empirical evidence. And in all this, language (oral or written), or representational thought plays a highly significant role.

If reading is akin to thinking and represents a means of generating predictive systems and if sicence is a search for relationships then the science of critical reading requires that such actions be central. We

cannot be satisfied with passive reading accomplished through passive processes and directed by passive teaching and least of all at the college level. We must require that reading be a thinking act and teach it that way. If thought has its roots in action then reading does too within a developmental interactionist theory of cognitive activity.

Bibliography

1. Almy, Millie, Edward Chittenden and Paula Miller. Young Children's Thinking. New York: Teachers College, Columbia University, 1966.

2. Ausubel, David P. Educational Psychology, A Cognitive View. New York: Holt, Rinehart & Winston, Inc., 1968.

3. Berlyne, D. E. "Condition of Prequestion and Retention of Meaningful Material," Journal of Educational Psychology, vol. 57, No. 3 (1966), pp. 128-132.

4. Berlyne, D. E. Structure and Direction in Thinking. New York: John Wiley & Sons, Inc., 1966.

5. Bloom, Benjamin, et al. Taxonomy of Educational Objectives Handbook 1: Cognitive Domain. New York: David McKay Co., Inc., 1956.

6. Bruner, Jerome S., Jacqueline J. Goodnow, and George A. Austin. A Study of Thinking. New York: John Wiley & Sons, Inc., 1956.

7. Byers, J. L. Strategies and Learning Set in Concept Attainment. Unpublished doctoral dissertation, Madison: University of Wisconsin, 1961.

8. Covington, Martin V. "Training for Creative Understanding in Reading: Some Experimental Evidence," Russell G. Stauffer (Ed.) Reading and the Cognitive Processes, Highlights of the 1966 Pre-Convention Institutes. Newark, Delaware: International Reading Association, 1967, pp. 13-22.

9. Ennis, Robert. "A Concept of Critical Thinking," Harvard Educational Review, vol. 32, No. 1 (Winter 1962), pp. 81-111.

10. Ennis, Robert. "Critical Thinking Readiness in Grades 1 - 12," Cooperative Research Project No. 1680. Ithaca, N.Y.: Cornell University, April 1962.

11. Fleming, Sam M. "The Specter of Ignorance," Phi Kappa Phi Journal, (Winter 1969), pp. 9-16.

12. Gagne, Robert M. Conditions of Learning. New York: Holt, Rinehart, & Winston, Inc., 1965.

13. Gallagher, James J. Teaching the Gifted Child. Boston: Allyn & Bacon, Inc., 1964.

14. Guilford, J. P. "Intellectual Factors in Productive Thinking," Mary Jane Ashner and Charles E. Bish (Eds.) Productive Thinking in Education. National EducationaAssociation, 1965.

15. Huey, Edmund Burke. The Psychology and Pedagogy of Reading. New York: Macmillan Co., 1913.

16. Hunt, Earl B. Concept Learning: An Information Processing Problem. New York: John Wiley & Sons, Inc., 1962.

17. Hunt, J. McV. Intelligence and Experience. New York: Ronald Press, 1961.

18. Kendler, Howard H. and Tracy S. Kendler. "Vertical and Horizontal Processes in Problem Solving," Psychological Review, vol. 69, (1962), pp. 1-16.

19. Kendler, Tracy S. "Learning Development and Thinking," E. Harris (Ed.) Fundamentals of Psychology: The Psychology of Thinking. Annals of the New York Academy of Science, vol. 90 (1960), pp. 52-56.

20. Klausmeier, Herbert J., et al. Strategies and Cognitive Processes in Concept Learning. Final Report, Project No. 2850, Contract O.E. 5-10-143. Washington, D.C.: Bureau of Research, Office of Education, U. S. Department of Health, Education and Welfare, 1968.

21. Klausmeier, Herbert J., Chester W. Harris and W. Wiersma. Strategies of Learning and Efficiency of Concept Attainment by Individuals and Groups. Cooperative Research Project No. 1442. Madison: University of Wisconsin, 1964.

22. Kneller, George F. Logic and Language of Education. New York: John Wiley & Sons, Inc,, 1966.

23. Kress, Roy A. An Investigation of the Relationship Between Concept Formation and Achievement in Reading. Unpublished doctoral dissertation, Philadelphia: Temple University, 1955.

24. Lehmann, Irvin J. and Paul L. Dressel. Critical Thinking Attitudes Values in Higher Education. Office of Education, U. S. Department of Health, Education and Welfare. Cooperative Research Project No. 590. East Lansing, Michigan: Michigan State University, 1962.

25. Piaget, Jean. Six Psychological Studies. David Elkind (Ed.) New York: Random House, 1967.

26. Russell, David H. Children Learn to Read. Boston: Ginn & Co., 1961.

27. Sigel, Irving E. "The Attainment of Concepts," Review of Child Development Research, Martin L. and Lois Wladis Hoffman (Eds.) New York: Russell Sage Foundation, 1964. pp. 209-248.

28. Sinclair-de-Zwart, Hermina. "Developmental Psycholinguistics," Studies in Cognitive Development: Essays in Honor of Jean Piaget, David Elkind and John H. Flavell (Eds.) New York: Oxford University Press, 1969, pp. 315-336.

29. Singer, Harry. Conceptual Ability in the Substrata Theory of Reading. Unpublished doctoral dissertation, Berkeley: University of California, 1960.

30. Singer, Harry. "Substrata-Factor Theory of Reading: Theoretical Design for Teaching Reading," J. A. Figurel (Ed.) Challenge and Experiment in Reading: Proceedings of the Seventh Annual Conference of the International Reading Association. New York: Scholastic Magazines, 1962, pp. 226-232.

31. Stauffer, Russell G. Directing Reading Maturity as a Cognitive Process. New York: Harper and Row, Publishers, 1969.

32. Suchman, J. Richard. "Inquiry Training in the Elementary School," Science Teacher, vol. 27 (1960), pp. 42-47.

33. Suchman, J. Richard. "A Model for the Analysis of Inquiry," Analyses of Concept Learning, Herbert J. Klausmeier and Chester W. Harris, (Eds.) New York: Academic Press, Inc., 1966.

34. Taba, Hilda, Samuel Levine and Freeman F. Elzey. Thinking in Elementary School Children. U. S. Office of Education. Cooperative Research Project No. 1574. San Francisco: San Francisco State College, April 1964.

35. Thorndike, Edward L. "Reading as Reasoning: A Study of Mistakes in Paragraph Reading," Journal of Educational Psychology, vol. 8, (June 1917), pp. 323-332.

36. Wolfe, Willavene, Charlotte S. Huck and Martha L. King. Critical Reading Ability of Elementary School Children. Office of Education, U.S. Department of Health, Education and Welfare, Project No. 5-1040, Contract No. OE-4-10-187. Columbus, Ohio: Ohio State University, 1967.

37. Wolfe, Willavene, Charlotte Huck, Martha King, and Bernice D. Ellinger. The Ohio State University Test of Critical Reading Ability. To be published by The Ohio State University Press, Columbus, Ohio.