A Constructivist Perspective for Teaching Thinking

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Piaget's theory of developmental stages and Werner's orthogenetic principle suggest the need for students to recognize and resolve discrepancies.

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Educators, psychologists, philosophers, and anthropologists are writing profusely about thinking (Maxwell, 1983). Even though thinking is "essential to our nature as human beings" (Lockhead, 1983, xiii), there seems to be a rediscovery of the significance of this function. Is that not ironic? Even more perplexing is the emphasis educators are now putting on thinking skills. Hasn't the perfection of thinking *always* been the whole purpose of education?

This surge of interest stems from a complex set of factors, such as dissatisfaction with children's thinking skills, declining test scores at every level and a shift from social concerns (How good do our students feel?) to a cognitive perspective (How well do our students think?). Whether we understand all the sources of this revitalized interest in teaching thinking is less important than the real ch llenge—how to develop programs to develop mature, incisive thought.

I propose a perspective for developing an educational program to enhance children's thinking. It provides a conception of thinking and identifies factors that influence its development. A discussion of constructivism follows, leading to a recommendation for use of inquiry teaching strategies. Finally, I will relate the entire discussion to the educational and social milieu.

Thinking is a term we often use but rarely define precisely. Definitions of the verb *to think* range across a broad array of mental functions from reflection, meditation, and cogitation (suggesting passive reception) to mental actions such as conceptualization and problem solving (implying an active approach). For the purposes of this discussion, thinking is regarded as an active process involving a number of denotable mental operations such as induction, deduction, reasoning, sequencing, classification, and definition of relationships. Each of these processes can function separately or in combination to meet environmental demands such as problem finding and problem solving.

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Factors Influencing Thinking

Thinking does not just emerge and function, but develops under the influence of three conditions relevant for education: students' developmental levels, their social-emotional status, and their cultural milieu (including the school as well as the broader society).

Developmental level considerations. Piaget (1950) showed that the child is an active construing creature inherently predisposed to thinking activities. The child by nature is able to assimilate knowledge from experience and to organize this knowledge through a variety of mental operations. The aspects of experience the child will attend to and the ways he or she will organize it will be limited, however, by the child's developmental level. For example, Grennon (pp. 11–16 in this issue) describes a boy named Jeff. In his work with bar graphs, Jeff treats each bar separately. "For Jeff, the graph is not an array which compares results among questions; it is instead a series of discrete questions with separate answers." Jeff's immature developmental level prevented him from viewing the graph as a comparative instrument.

Piaget (1950) theorized that thinking competence evolves through stages and suggests that certain competencies and skills emerge at each stage. Children at the concrete operational stage, for example, have more difficulty dealing with logical deductive reasoning than those at a formal stage. To illustrate this point, consider the question—Which weighs more, a pound of feathers or a pound of lead? A preschool child is unlikely to answer that both weigh the same; young children focus on the *content* of the pound and overlook the importance of the constancy of the *unit*. Older children, however, are likely to observe that the pound as a unit is the factor, and the contents of any one pound are irrelevant.

Werner's orthogenetic principle (Werner, 1957 and 1978) cuts across Piaget's stages and describes processes that characterize all development. According to Werner, development is regulated by

> an orthogenetic principle which states that wherever development occurs it proceeds from a state of relative globality and lack of differentiation, articulation, and hierarchic integration. This principle has the status of a heuristic definition (Werner, 1978, pp. 108–109).

Development, then, involves such processes as differentiation, integration, re-integration, and de-differentiation of experience, moving horizontally and vertically in a complex organization of patterns. This is a general principle including *all* of development, including thinking.

Of course, in the process of learning about an event, it is important to disassemble hierarchies and re-classify. Such a process would require de-differentiation and/or re-integration, followed by revised articulation and/ or reintegration. The development of thinking, then, employs both horizontal processes (differentiating groups) and vertical ones (structuring hierarchies).

An example of the orthogenetic principle can be observed in the child's development of classification skills (Sigel, 1953). Imagine a very young child with objects representing different types of animals (zoo animals, farm animals, and so on). If asked to organize the objects, the young child will create a large collection, not separating them in any way. With increasing growth the child may divide the group into sets, such as two-legged animals, animals you eat, and so forth, exemplifying differentiation. Re-integration is possible if animals are reorganized into other sets. Hierarchies can be formed, too—for example, zoo animals, farm animals. Later, as super- and subordinate categories become more complex, extensive vertical categorization can be produced; for example, one may note that all animals represent living things.

The orthogenetic principle is not limited to children's classifications. The same ordering of information applies, say, when an adult comes to a new city. To a newly arrived person, the city may appear as one global mass. But over time the individual differentiates the city into its relevant parts, which may be broken down even further into, say, neighborhoods. In time the city is again perceived as an integrated unit, but its elements are arranged in hierarchies and appreciated as components of the whole. This process of differentiation, de-differentiation, re-integration, and movement toward creating hierarchies is intrinsic, I believe, to all development.

Piaget's notions of stages and Werner's orthogenetic principle complement each other. Piaget describes the logical operations children use at different levels of development. The orthogenetic principle describes the processes the children use in organizing knowledge. For example, in the classification example, from a Piagetian perspective, children might be grouping items in an array on the basis of a single or multiple attribute, thus evidencing different levels of logical thought. Whichever logical strategy children use, they are still differentiating attributes and integrating them. These latter processes are reflections of the orthogenetic principle. Thus, working with a Piagetian stage model and Werner's orthogenetic principle, the teacher can identify two sets of complementary processes, each contributing to children's thinking and problem-solving skills.

Personal-social influences. How we think, what we think about, and how we carry out our thoughts are in part dependent on what kinds of persons we are, our attitudes and feelings about our competence, and whether we are willing to take risks, be flexible, and so on.

All these characteristics affect the thought process, facilitating or inhibiting its effectiveness. Thinking skills depend on these factors. For example, I presented a group of young children with a group of three-dimensional miniatures of farm and zoo animals. I asked the children to separate the assortment of objects into those animals they liked and those they feared. I then asked them to classify the items in the liked and feared groups into smaller groups. Most children had no trouble creating subsets of animals in the *liked* group, but they tended to leave the *feared* group as an undifferentiated whole. By asking the children to separate the benign from the threatening, I was asking them to articulate their emotional reactions. Since they created subsets for the benign but not the threatening group, the competence of the children to create groupings was not in question; rather, a negative emotional response blocked their performance in the feared part of the task.

Let us not just think of emotions as having a negative impact on cognitive performance; they can have positive effects as well. Such factors as interest, curiosity, and enthusiasm can influence the quality of thought positively, while text anxiety, fear of failure, and negative attitudes toward the task can have adverse effects on the quality of thought.

Cultural factors. Although it is true that humans, by their very biological similarity, can employ a wide array of thinking skills, the use of these skills will vary as a function of cultural milieu. For example, in Western thought, it is common to think in terms of causal connections, of discovering relationships among discrete events, and of placing value on analytic and synthetic activities. These processes, however, may necessarily be employed in non-Western cultures. Cause-effect, for example, is conceptualized to some Eastern cultures as it is among Westerners. Even the notion of an objective reality is not accepted by all cultures.

Comparable differences can be found within our own society. How creationists and evolutionists interpret geological data and draw conclusions about the origin of the human species, for example, is a function not of differential abilities, but of divergent beliefs.

Constructivist Perspective and Distancing Strategies

In view of the influences of developmental level, social-emotional states, and surrounding culture, how are we to think about teaching thinking? How do we go about it? We can begin by recognizing three components as critical to the teaching of thinking: concepts of the child, of the context, and of teaching strategies.

The child as a constructor of knowledge. The constructivist's fundamental assumption about the child is that knowledge is an end product. The child's mind naturally and actively perceives and constructs relationships about surrounding objects, events, and people; in so doing, new knowledge is integrated with previous experience, forming an ever-increasing knowledge base (Coppel and others, 1984).

Discrepancy as context. Cognitively, the child develops by recognizing and resolving discrepancies, that is, inconsistencies between what is expected and what actually occurs in the environment (Copple and others, 1984; Sigel and Cocking, 1977). These incongruities usually generate tension, which in turn generates activity to resolve the tension. This activity associated with problem solving thus creates the opportunity for new learning.

A discrepancy can only be perceived if the child is at a sufficiently advanced developmental stage to detect the discrepancy. After all, expectations cannot be violated where none exist.

The constructivist perspective, then, assumes that:

1. The individual develops by actively constructing his reality.
2. Development takes place through a process of discrepancy resolutions.
3. Discrepancy perception is limited by the individual's current expectations or knowledge.

Constructions of knowledge are organized into conceptual representations. These concepts are transformed mentally into some type of symbol, perhaps a picture, word, design, or kinesthetic sense. These *internal* representations, which are products of constructions, are communicated through *external* representations—words, photographs, music, gestures, maps—each of which presents some inner thought or wish (Sigel, 1978).

The ability to represent, which is called *representational competence* (Copple and others, 1984), is as peculiar to humans as thinking is. In fact, for Piaget, representation and thinking are similar (Piaget, 1962). My work indicates that the ability to represent, albeit generic, will vary with the quality of the individual's social and cultural experiences, assuming the child is neurologically intact.

Three general developmental principles guide the formation of representational competence:

1. Human beings understand the world through representations of it.
2. Representational competence develops in an orderly sequence (Piaget, 1951; Werner, 1957 and 1978).
3. Representational competence develops fully only in response to interactions with appropriate physical and social environments.

Distancing Strategies As Teaching Tools. The remainder of my discussion will address this last principle in terms of teaching strategies that promote representational competence. Social encounters which serve this purpose require the child to deal with experiences (objects, events, actions) separate in time or space from the immediate present. Circumstances or behaviors that create such mental demands are called *distancing events* (Copple and others, 1984).

Distancing strategies can vary in level, form, and content. Some strategies make minimal demands on the child's cognitive ability, like asking the child to label an object; others are more taxing, like asking a child to discover a relationship between events or to construct a class of objects. Distancing strategies provide opportunities for the child to differentiate or integrate or re-integrate experience. Essentially through distancing strategies, teachers can actualize the orthogenetic principle. By so doing, these same strategies may contribute to stage development in terms of logical-mathematical reasoning. (See Figure 1 for a list of strategies.) Research has shown that when parents employ low-level strategies their children are less likely to demonstrate competence in planning, anticipating consequences, and reconstructing past events. Low-level distancing strategies seem to contribute to less effective thinking and problem solving (Sigel and McGillicuddy-DeLisi, 1984). Results from two preschool programs (Copple and others, 1984) indicate that the frequency with which teachers employ higher-level distancing strategies is positively relat-

Figure 1. Types of Distancing Strategies.

High-Level Distancing	*Medium-Level Distancing*	*Low-Level Distancing*
evaluate consequences	sequence	label
evaluate competence	reproduce	produce information
evaluate effect	describe similarities & differences	describe, define
evaluate effort and/or performance	infer similarities & differences	describe—interpret
evaluate necessary and/or sufficient	sense differences	demonstrate
inferencing, for example, causal relations and their effects	classify symmetrically	observe
generalize	classify asymmetrically	
plan	enumerate	
confirm a plan	synthesize classifications	
conclude		
propose alternatives to resolve conflicts		

ed to children's performance in tasks requiring reconstructive memory and the ability to predict outcomes (Johnson and Sigel, 1977; Sigel, 1979).

Teaching that enhances representational competence will:

1. Place the cognitive demand on the child. For this purpose, an authentic, carefully worded question is often more effective than a statement.

2. Draw the child's attention to a discrepancy, contradiction, or inconsistency. Inquiry that resolves the illogic and results in a new integration of ideas should follow.

3. Involve the child in mental activity that requires going beyond the obvious concrete event—how far beyond will depend on the child's understanding of the task and what the teacher wants to know about it (Sigel and Saunders, 1983). (This point is consistent with Brooks and Grennon's Cognitive Matching program.)

The Classroom as a Teaching Environment

The foregoing description of teaching strategies has been described as though the teacher is engaged in a one-to-one interaction with the child, yet I am actually describing a teaching approach that occurs in a group setting.

Since every teacher is concerned with keeping order in the classroom, eliciting maximum participation of the pupils, and ensuring that all students gain from the classroom experience, inquiry in a group setting raises practical problems. To use inquiry takes time. Not every child can participate, and not every child is interested in listening to peers. Further, older children who have to take tests may question whether this approach will help them do well on tests which are usually objective and ask for recall rather than reasoning.

Do these problems for implementing inquiry teaching rule out for use in ordinary classrooms and suggest that the method is appropriate only for individualized or small group instruction? My answer is an unqualified no. I contend that the type of instructional model advocated in this essay can work in the typical classroom if teachers are trained to be sensitive and skilled in applying distancing strategies.

Other instruction, even though it takes place in a group setting, is in reality one-to-one interaction. The teacher asks a child a question; the child responds, and the teacher goes on to the next child. The rest of the class observes this teacher-pupil interaction. Pupils do not usually interact. Another common instructional strategy is for the teacher to address the whole group, thereby creating another dyadic interaction—teacher vs. group. Neither of these models fosters a classroom climate that yields the greatest opportunity for classroom inquiry and social interaction. Rather, teachers should encourage students to interact with each other—to generate cognitive demands on their fellow students.

By developing skills in group management, teachers can become adept at creating a social climate conducive to the use of inquiry strategies. Otherwise, they will not be able to implement the inquiry strategies to the benefit of the class.

Further, I believe that advocates of teaching through inquiry and discussion must take into account the broader school context with the built-in expectations typical of administrators and parents who are emotionally and intellectually invested in children's performances. All are familiar with the argument that teaching through discussion, while interesting, still provides no guarantee that content to be covered will be completed, and that poses problems for teachers and administrators who rely on so-called objective test scores as *the* criterion of academic achievement. The educator's double bind for the 80s is the necessity of developing children's representational competence through reflection, discovery, and inquiry, while also producing effective test scores likely to result from didactic teacher-centered strategies.

Lest the reader conclude that the computer will somehow magically resolve the dilemma, let it suffice to point out that the computer is but an instrument that *could* contribute to the representational competence of children with provocative and insightful software; on the other hand, it could also persist in didactic strategies transferred to the computer from past educational practices.

The choice of how best to teach thinking faces the educational community and the public. Nothing is more basic or deserving of prompt attention and resolution. We can begin by ensuring that future theory underlying methodology is consistent with what we know already about the way children learn.□

[1]A more detailed description of the role of inquiry and principles for inquiry are available from the author.

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