

Dissertation Title:

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Image-Based Learning

The notion that humans learn by creating, adjusting, and changing mental models to correspond to information received through their senses is neither new nor radical. The concept of image has appeared in academic writing for centuries. Polak (1973 translation) describes its background and progression as follows: the general theory of images may be thought of as "*eidetics*," derived from the Greek *eidolon*, meaning "image." Plato, Epicurus, and Democritus used the term to refer to knowledge and the learning process. Francis Bacon also later made reference to it. The term *eidetisch* appears in the writings of German psychologists, especially E.R. Jaensch, who specialized in research on children between the ages of thirteen and fifteen. Jaensch related certain types of eidetic endowments to physical constitution (*Körperbau*) and to personality type. On the basis of this, he outlined a theory of the development of culture (p.12).

John Dewey describes thought as having three forms--an automatic, unrelated flow; imagination; and the third which is synonymous with *beliefs*. Dewey (1933) describes a belief as "a mental picture of something not actually present; thinking is the succession of such pictures" (p. 5).

During the latter part of this century, the influence of mental images on thinking and learning began to appear more frequently in academic literature (Boulding, 1956; Polak, 1973; Piaget, 1952, 1969). Details of Boulding's account are as follows: human beings operate through mental images; messages--verbal, visual or experiential--form the images; images affect behavior, which offers clues to the images; and images can be changed by strategic messages. Messages may be designed which address both

the desired and undesired mental models of students. This view is consistent with cognitive theorists (Vygotsky, 1934/1978; Brooks, J.G. & Brooks, M. G., 1993; Dewey, 1902/1915/1938) that the learner constructs her/his own concepts and knowledge. Vygotsky cites German psychologists Narciss Ach & Franz Rimat as he defines stages of concept development. Concepts arise or are "constructed through a goal-directed process composed of several operations that function as means for solution of a basic task" (p. 124). Boulding (1956) and Vygotsky (1978, translation) both purport that images have individual and social aspects and affect both the individual and his/her culture. Piaget (1969) viewed the human mind as a dynamic set of cognitive structures that help us make sense of what we perceive. His premise is that "all knowledge has to do with structures" which may be either "figurative" (perceptions or mental images) or "operative" (action or operation) (p. 356). He further cautions that it is not always wise to distinguish between the two types of knowledge. He uses Klein's work with transformative geometry as an example in which both aspects are mutually indispensable at some level. According to Piaget, the essence of operational intelligence considers experience to be a progressive restructuring, rather than a simple recording of information, and deduction to be a coordination of operations, rather than simply an exercise in logic (p. 358).

Learners affect such restructuring as connections are made among experience, messages of theory, personal study, and creative dialogue. When several aspects of a situation are consciously identified in the learning process there is potential for meaningful learning. The National Council of Teachers of Mathematics' (NCTM) Curriculum and Evaluation Standards for School Mathematics (1989) (hereafter

referred to as the Curriculum Standards) views students and teachers as partners in a new classroom dynamic of developing ideas and problem-solving.

The formation of stable concepts or images is enhanced by meaningful learning activities. Belenky, Clinchy, Goldberger, and Tarule (1986) document preferable approaches to affect *connected and inclusive learning*. Throughout their book, Women's Ways of Knowing, are examples of the importance of the learner understanding herself as a retainer of information and as a sharer of truth. Taylor, Stevens, Peregoy, & Bath (1991) discuss Indian learning in a meaningful mode and as connected to cultural and family roots. John Dewey's progressive education movement in the early part of the century examined the *nature of the school*, and introduced the idea that schools could be student-centered and expansive beyond the building itself and with formal connections to the community (Dewey, 1902). Jacqueline Grennon Brooks and Martin Brooks (1993) state that we should concern ourselves with getting thinking and re-thinking installed into our high school culture by moving from "imitative behavior" to that which results in students "deep thinking" (p. 16).

While most of these authors agree on the intent and general direction of learning activities, we are still searching for a comprehensive planning process that delivers such results. This historical case study provides definitive information on one new approach.

Much research in the cognitive literature has explored mental models (Johnson-Laird, 1995, Slotta, J., 1997). Senge (1990) defines an image as a "mental model" which is a "deeply ingrained assumption, generalization, or even picture or image that influences how we understand the world or how we take action" (p. 8). He further defines this phenomena:

Mental models can be simple generalizations such as "people are untrustworthy," or they can be complex theories, such as my assumptions about why members of my family act as they do. Mental models are deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world or how we take action. Very often, we are not consciously aware of how we understand the world or how we take action (p. 175).

Recently, the role of image in curriculum development has been discussed (Brooks, J. G. & Brooks, M. G. 1993; Posner, Strike, Hewson, & Gertzog, 1982; Slotta, J., 1997). Slotta's premise is that

The general goal of learning or cognitive research has been to develop a cognitive theory of instruction which provides a detailed description of learning in terms of a student's initial knowledge and how that knowledge interacts with an instructional message. Teachers and curriculum designers must first discern whether a concept is likely to have been ontologically misplaced by a student, then proceed with a two-phased approach: first, train the student in target ontology, which amounts to providing some knowledge of the relevant attributes of concepts of this type; second, provide instruction which relates the concept to these attributes while completely avoiding any connection with faulty ontology. (p. 1)

Johnson-Laird (1994, 1995) writes of the connection between mental models or images and thinking or probabilistic reasoning. "They construct mental models, which each correspond to an infinite set of possibilities."

The important cognitive issue of math-reluctant students is directly linked to the subject of image theory. Taylor (1996) comments that "you can never have an experience that is 100% affective or entirely cognitive, for the two are always intertwined. While one experience may be primarily cognitive, it still has an affective component and, inversely, while another experience is primarily affective, it still has a cognitive component. Furthermore, one's actions relate to these cognitions and feelings" (p. 62).

A related learning theory is that of situated cognition (Lave, & Wenger, 1991). These theorists purport that "activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning. . . . To ignore this aspect of learning is to overlook the fact that learning involves the construction of identities" (p. 53).

In conclusion, all school experiences do involve image work on the part of the stakeholders. The task is to clarify and intentionalize the use of images in learning. Cognitive theorists agree that the learner forms mental models through his or her active experience. These cited authors mention multiple variables in this practice, including the student's interest in the topic, cooperative approaches, initial knowledge, the degree of entrenchment, and the student's emotions or receptivity. Such multiple variables imply that a strategy of image-based learning is not a simple one. However, with much academic attention focused on the cognitive process, and much political and media attention focused on the processes of education and instruction, the role of images in learning will continue to be a focus for research attention. This study contributes to that new knowledge.