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Introduction
The Current State of the Biofunctional Theory of Cognition

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In an introduction to an earlier volume on brain and education, Iran-Nejad, Hidi, and Wittrock (1992) suggested that "a new level of understanding for sorting out relevant and irrelevant practices is necessary for a genuine solution to problems of schooling" (p. 408). More specifically, they argued that the way in which the nervous system functions has indispensible implications for research and practice in education. Analyses focussing exclusively on the abstract structural organization of knowledge from cognitive and cognitive developmental perspectives cannot provide a full picture of cognitive functioning. The biofunctional theory presented by Iran-Nejad and his collaborators in the six target articles of this invited volume provides an alternative perspective on cognition and education that considers the functioning of the nervous system. In response to these target articles, scholars offer their support for and/or criticism of the theory. Whether one focuses on the positive or the negative side of the evaluation continuum, it is undeniable that the biofunctional approach presents a novel and strikingly different approach in comparison to other current theories.

The unifying theme of the papers is the critical role of the nervous system in cognitive functioning. According to the biofunctional theory, all knowledge is created by the biological subsystems that comprise the nervous system. Knowledge is always the live experience of individuals, dynamically

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maintained, and in a perpetual state of change, rather than simply recorded responses or memory traces. According to Iran-Nejad, there are two sets of self-regulatory processes: executive self-regulation processes that are active, intentional and associated with effortful learning, and dynamic self-regulation processes that are involved in incidental, effortless and non-strategic learning.

It is important to stress that dynamic self-regulation is hypothesized to be non-executive, unintentional and effort-free in nature, whereas executive self-regulation is seen as active and person regulated. It is a central premise of the biofunctional theory that only through an interaction of these two systems of self-regulation can effective complex learning take place. Thus, learning that is holistic, responsive to context, and occurs in natural settings always relies on multisource internal regulation. In fact, context is a critical factor in this approach as a rich context can facilitate and maximize the interaction between dynamic and active self-regulation.

Knowledge is also produced through intuitive self-awareness. To know is to be aware of the substance of what one has acquired through experience. Therefore, the live experience that determines learning is the result of both intuitive self-awareness and multisource self-regulatory processes that efficiently and flexibly create and recreate ongoing knowledge schemes. Intuitive self-awareness and multisource self-regulation serve two critical communicative functions. First, they provide for individuals' private and direct (nonsymbolic) communication with their own nervous system. Second, they externalize in an indirect (symbolic) code system to communicate with others in the external world.

Once we acknowledge that biological subsystems of the nervous system create knowledge "on-line," a radically novel view of cognition emerges. Complex mental structures have no separate existence from the ongoing functioning of the nervous system. Knowledge cannot be viewed as an object that is located in the brain that is acquired, stored, lost or retrieved from that location. Thus, we have a brain-based theory of learning and remembering that assumes that the brain constructs, reconstructs and self-regulates as opposed to stores and retrieves specific traces from long-term storage systems.

An additional aspect of cognitive functioning according to the biofunctional approach is that processing is not localized but distributed. Focussing on the functioning of the system as a whole is a major shift from trying to construct models of specific structural features of mental products. Iran-Nejad and his collaborators present arguments to show how their theory can explain various features of cognitive development such as language, intelligence, morality. Ultimately, however, their argument that the brain and the functioning of the nervous system must be considered as literal foundations of thinking will have to be linked to newly emerging neuroscience data that I

predict will support many aspects of their theory. Iran-Nejad and Homaifar state that the physical brain is not the proper domain for psychological research. However, any theory that attributes a critical role to the ways in which the brain functions within the nervous system has to make sure that available neurophysiological evidence supports its premises. Thus, sooner or later the relationship between the biofunctional model and neuropsychological and neurophysiological evidence will have to be considered. What I am suggesting is not a reductionist view seeking to explain all levels of psychological functioning by neurophysiological measures. Rather, I believe that aspects of cognitive functioning set out by the biofunctional theory must be compatible as opposed to conflicting with "neuroscientific" evidence.

Some of the biofunctional theory's major premises could already be linked to such data. For example, the biofunctional view of the brain consisting of specialized subsystems that self regulate, create and recreate knowledge and functions in a synchronized manner can already be supported by findings from neuropsychology. On the other hand, some aspects of the theory, as Brewer notes in his commentary, may be incompatible with brain functioning defined by cognitive neuroscience. If so, such incompatibilities will need to be examined.

Iran-Nejad and his collaborators argue that the twentieth century is likely to be remembered as an era during which the brain has been considered to be irrelevant for the study of the mind. In order to have our next century characterized by a more integrated study of brain and mind, psychological and neuroscientific research will have to inform each other. Only then will we come to understand how brain and behavior operate as a functional system. Such understanding will provide a more coherent reference point for distinguishing effective and ineffective practices to solve the real problems of schooling.

References

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