The Neuroeducator: Professional of the Future
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The Neuroeducator: Professional of the Future

After decades of research on teaching styles, student-teacher interactions, and countless other aspects of the educational process, we are only beginning to discover the nature of "good teaching." Theories of how people learn have been based, for the most part, on behavioral observation. Not until recently have educators seriously taken into account the role of the brain in individual learning.

The issue of how the brain is built and how it works in the learning process is believed by some to be one of the most profound questions being asked in contemporary educational circles. Understanding how the brain processes information and usefully applying that knowledge may lead to unique techniques for improving the entire educational process—a process which often relies heavily on imprecise instructional strategies.

This focus on the brain and its function in human learning forms the basis for a new field of educational inquiry known as neuroscience. The purpose of this article is to (a) look at the brain as it is utilized in learning; (b) consider how our better understanding of the brain can be used to improve the educational process; and (c) discuss the emerging role of a new professional—the neuroeducator—a person trained from an interdisciplinary point of view and able to understand the concepts of both brain function and good teaching.

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The Human Brain

During the early years of the electronics age the term *black box* was used to describe an opaque package used to house top secret electronic gadgetry such as the equipment kept with the president of the United States to permit instant communication with the military in the event of war. Recently the black box concept has been used to describe the mysterious workings of the human brain, conjuring up the image of an infinitely complex set of circuits.

To attempt to fathom the brain's complexity, one might consider its makeup: A single human brain has approximately 10 to 12 billion neurons as well as billions of non-neural connector cells. According to Thompson (1975), the number of possible interconnections among the neurons "is greater than the number of atomic particles that constitute the entire universe."

Although far more sophisticated, the brain is in some respects similar to a computer, and the analogy may provide some insight on the brain's functioning. A computer requires both hardware and software to function effectively. The hardware is the actual physical equipment or machinery necessary to do the job. The software is a set of specific information and instructions used to direct the internal activities or behavior of the computer, much as a road map helps direct a person traveling in a car. Software is used to program the computer so that it will behave in specific predefined ways.

The neuroscientist views the human brain as an infinitely complex piece of "hardware." In the place of solid metallic connections and circuitry, the human brain uses specialized neurons, synapses, and neurotransmitter chemicals as its wires and circuits. When all physical aspects of the brain are in place and working well, the foundation exists for optimizing the learning experience. However, if the brain is in some way deficient (as a result of genetic characteristics, infection, or injury), it may function, but not in an efficient manner. Individuals manifest creative thought and exhibit behaviors according to both the soundness of the brain's neurological endowments and the flexibility and sophistication built into the "software" of information, instruction, and experiences.

Learning may be described as a type of road map by which the human brain formulates decisions appropriate for navigating daily life. While individual human learning is often random and unpredictable, educational programs seek to structure learning in specific meaningful ways. Education contributes to the process of programming the human brain, not to limit choices or behavior (as happens in the computer), but rather to expand human potentials and possibilities. The human brain, unlike the rigid computer, has infinite ways for handling and using the educational programming available to it.

Our educational process spends years feeding different educational programs into the black box of the learner and waiting to see the quality of the results which emerge from the other side. Although education input and output have been examined, not much attention has been paid to the processing that occurs inside the system.

Brain Function and Learning

Research indicates that learning is a biological phenomenon. The manner in which we learn to read, write, use language to communicate, solve mathematical problems, etc., results from biochemical functions within the nervous system (Tarnopol & Tarnopol, 1977). Tarnopol and Tarnopol state that the central nervous system (CNS), particularly those portions of the brain that are dedicated to higher order functions, is the primary mediator of learning abilities. Any dysfunction in those higher order functioning areas of the brain disturbs the learning process.

Luria (1972) cites several examples of the use of brain functioning theory to enhance learning. He discusses the case of Zasetsky, a soldier, who had a traumatic bullet wound to the left hemisphere of his brain in the temporal/parietal area. Due to the injury, Zasetsky had forgotten how to hold a pencil, form a letter, or spell. He had developed what modern neuropsychologists refer to as construction apraxia and spelling apraxia. When he attempted to write, all he could do was draw some crooked lines. Zasetsky later described his writing attempts as looking something like the scribbling of a child who still hasn't learned the alphabet.

Luria reports that Zasetsky tried to learn as a child would, visualizing each letter as he formed it. However, this was extremely difficult since his brain dysfunction impaired his memory of the shapes of letters. For adults, writing is an automatic skill, a series of pre-learned movements which Luria called "kinetic melodies." Luria reasoned that Zasetsky should try to use what skills he still had, such as his kinesthetic motor functions, and suggested that he try writing rapidly and automatically rather than letter by letter. Zasetsky found he could write rather well when he wrote spontaneously.

Zasetsky's case illustrates the importance of past learning. In another situation where a child had a visual-perceptual disability that interfered with his visual-motor integration, and also had an intact auditory and auditory-motor functions system, the procedure of spontaneous writing was not used. Because this child had never learned to read or write in the past, he did not have that previous learning experience as a resource. Instead he was taught to write by being blindfolded so that he could use his intact auditory abilities without interference from his visual-perceptual disability.

The literature is filled with reports of successful applications of brain function to learning. Educators have known for years that problems in learning may arise from one or more of the brain-related sensory learning modalities within the visual, auditory, and somesthetic systems. Some children can learn letters by sound but are unable to learn visually. Others may be able to learn visually but cannot reproduce their learning in terms of written language. For some children the information they receive in one sensory channel interferes with information received in another channel.

Through research and the use of neuropsychological testing we are beginning to understand the brain functioning of the individual. Neuropsychological tests such as the Halstead-Reitan Neuropsychological Battery provide sophisticated measures with which to assess specific brain/behavioral losses, as well as areas of brain/behavior strength within the individual. These assessments are vital to precision teaching which involves addressing the specific brain/behavior assets and deficits of each individual.

The Role of the Neuroeducator

The role of the neuroeducator is to study and understand the known relationships of brain/behavior and apply those relationships to the learning process. This individual will integrate the contributions of many disciplines in order to prescribe precision educational programs for the child with learning difficulties, as well as the gifted child.

In the school system the neuroeducator will be a consultant to special programs. Trained in educational and neuropsychological testing and interpretation, he or she will be able to assess specific neuropsychological and learning problems, leading toward the development of a prescription of an in-depth program of learning. This professional will work with teachers in the classroom to help them better understand the neuropsychological aspects of each child's learning process.

Neuroeducators will not only be practitioners, they will also be leaders in the field of neuroeducational research. They will be the pioneers in studying the specific ways in which brain/behavior relationships relate to and interact with the learning process. Unlike educators in the past who have been trained primarily in education programs, neuroeducators will be trained in interdisciplinary programs. Course work will be drawn from the areas of learning disability research, education for the gifted, psychology, neuropsychology, neurology, and medicine. The integration of interdisciplinary topics will allow students to effectively draw information from different professions and assimilate that information into an optimal and efficient individual learning package.

With the rapid advent of new knowledge concerning brain/behavior relationships and learning, the need for the neuroeducator is now. Such an individual is essential to the utilization and integration of research and information from our major scientific disciplines in order to facilitate a learning environment which will produce motivated, excited, and efficient learners.

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