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ABSTRACT

It was discovered a few years ago that a child's capacity for academic learning was partially dependent on visual and audio perception. It was also found that the development of perception in these sensory modalities was sometimes deficient. Educators immediately began to devise programs for perceptual-motor training, but ignored the role of the brain and nervous system in perception. There are many reasons why neurological concepts are not employed in perceptual-motor training. Some of the reasons are that a) great effort is required to acquire concepts from the literature and organize them into a useful theoretical structure; b) it is impossible to assimilate all that is known of brain function, so that any theory cannot be completely correct; c) brain researchers usually deal with one aspect of the brain, but educators need to know about how the brain functions as a whole; d) brain research is incomplete; e) some of the research is inevitably inaccurate; and f) resultant procedures are not obviously related to the objective. There are two ways to deal with the challenge that brain research offers. The challenge can be ignored, or research can be directed to relating sensation, integration, perception, and motor activity to those neural structures which govern them. (PB)

"The Challenge of the Brain"

Speaker: A. Jean Ayres, Ph.D.

A few years ago a new insight into education of the child occurred. We discovered that a child's capacity for academic learning was, to a certain extent, dependent upon the ability visually and auditorily to perceive and that the development of perception in these sensory modalities was not infrequently deficient. Furthermore, the children with the perceptual and learning problems usually scored within normal range on intelligence tests but frequently were clumsy. Immediately, and not necessarily unwisely, we jumped into action and devised many programs of perceptual-motor training, proposing and believing that correcting clumsiness not only helped some children learn academically but that it also provided emotional and social benefits.

There are, of course, perceptual-motor programs with objectives other than influencing learning problems. The remarks of this paper are only slightly less appropriate where the objective of a perceptual-motor training program is generalized perceptual-motor development.

Being members of a scientifically oriented society, we have not overlooked the obligation to scrutinize these efforts, to devise experiments--the currently acceptable method of testing knowledge--and if it is popular to do so, to attack those who make claims of success in enhancing academic learning capacity in children with perceptual-motor deficits. The one thing of which we have done very little is think. Unfortunately, theorizing is not currently looked upon with high favor. The age of reasoning and logical derivation of a conceptual framework seems to have been replaced by, rather than augmented by, the age of scientific method with emphasis on the "how" rather than the "what" or "why."

I am not objecting to scientific method, I have a great deal of respect for it and recommend it; rather, I object to employing it as the sole respectable method of knowledge development or criterion of worth. It is sometimes used almost as an escape from having to think, to reason, to figure things out. Scientific method does have many advantages, one of which is that a hypothesis generally will not be supported unless the underlying thinking has been adequate. We err, though, in assuming that an unsupported hypothesis is necessarily an inaccurate postulate. The problem, frequently, lies in the research methodology.

We tend to place so much reliance upon scientific methodology that we perpetuate the status quo and even errors by basing our future action solely on past scientific evidence even when the evidence may be misleading. Actually, if we followed the principle of scientific method to the extreme, we would not function professionally at all, for truth, like infinity, is to be forever approached but never reached.

It is proposed that the whole area of knowledge of perceptual-motor functions of academic learning is not yet sufficiently well developed to enable generally acceptable application of experimental testing of isolated hypotheses. The evidence to date suggests that experiments designed to test such hypotheses are acceptable and successful to the extent that the thinking underlying the program has been related to knowledge of the nervous system.

As I review the studies of perceptual-motor function with a view of serving as the devil's advocate to this group--and this is what I was asked to do--I find that elementary school teachers have not yet discovered that learning takes place in the brain and that those who espouse perceptual-motor training have not yet discovered that perception occurs in the brain and that the brain generally organizes and directs motor action. By "discovering" I am referring to recognition of the manner in which the brain processes sensation and organizes motion and to cognizance that it is appropriate for this mode of function to be taken into consideration in perceptual-motor training, whether for the sake of developing motor skill or academic processes. I searched long and hard through the highly professional and up-to-date proceedings of the Perceptual Motor Symposium held by this group in 1968, entitled: Perceptual-Motor Foundations: A Multi-Disciplinary Concern, to find a few, almost isolated references to the central nervous system.

Interpretation of most, but not necessarily all, perceptual-motor programs leads to assuming that a child acquires tactile perception handling pieces of paper and cloth of various textures and learning to distinguish them and to verbalize concepts pertinent to texture; that a child's auditory perception is trained by asking him to close his eyes and point to where he hears a sound; that visual form and space perception is developed by crawling around circles and triangles painted on the floor or by drawing lines between dots; and that a sense of directionality is developed through mastery of the words "left" and "right" and cognitively learning which direction is which.

I do not see any of these procedures as incorrect. Rather I see them as that which highly qualified and intelligent professional people would consider appropriate from analysis of the end-product of perceptual-motor development. The typical approach is asking the child to perform the task which his development has failed to prepare him to perform. Furthermore, we generally ask him to think about what he is doing; we ask him to be instructed. We are doing the obvious. We have not asked: How does the brain develop so that learning these tasks is possible? or How can we replicate the neurodevelopmental process so that the child learns more naturally? How many children under five or six years are "taught" perceptual-motor skills? Usually natural growth within the child, coupled with the urge toward action, direct the developmental processes.

How would the following hypotheses alter your approach to perceptual-motor training? Tactile perception develops through tactile stimulation in connection with other somatosensory input of which the individual is only semi-conscious and which is processed through brain stem mechanisms. Auditory and visual perception are both enhanced through vestimular stimulation. Right-left discrimination develops automatically after an interhemispheral integrating mechanism associated with brain stem postural mechanisms mature.

These are the kinds of hypotheses about perceptual-motor development and function that arise when one studies some of the monumental amount of basic research on the brain. Notice how different the concepts are from those which are generally employed. We haven't been completely ignoring the nervous system. Frequent reference is made to the various sensory modalities, and physical educators have become particularly aware of the importance of the vestibular system, that system which contains the highly important gravity and movement receptors. Do you have any rationale as to why it is important? What happens inside the brain when vestibular receptors are stimulated? Did

you know that it has been postulated that the vestibular system has been considered a unifying system for all of the sensory systems and that there is some neuroanatomical basis for the assumption? You probably do know that most children with learning problems show some inadequate processing of vestibular information. Can you provide a neurological rationale as to why that system may be related to academic work?

The cognitive approaches, which are the currently prevalent approaches, would not deny the importance of how the brain functions relative to perception, motion and academic learning. Most of us would admit that whether we understand how the brain functions or not, it is going to go right on functioning by its own rules. Herein lies the greatest limitation of current research on the effect of perceptual-motor training on academic ability; the procedures used often seem to bear only a little recognized relationship to the neurological problem that is interfering with the learning process or to hypothesized principles of brain function.

Some individuals will object to that statement, pointing out that visual and auditory perception are obviously needed for reading and that perceptual defects in these areas are easily and often evaluated and remediated. But, I would ask, is crawling around a square painted on the floor bringing about a major change in the neurological processes subserving the visual perception which is necessary for learning to read? What must develop in the brain before reading can occur? Is crawling around the square doing the job and, if so, through what processes?

Until the neurological relationship between perception and learning is better understood and the perceptual-motor program designed more specifically to enhance neurological integration, experiments testing the effect of training on reading test scores are going to be mostly hit and miss. This state is reflected in the literature. There are some hits and many misses. Unfortunately, when an experimental hypothesis must be rejected, seldom do readers of the report ask whether or not the methodology was a sufficient test of the hypothesis. Without further thinking, especially if it suits his purpose, the reader wrongly assumes the hypothesis false, whereas a more correct conclusion would be that under those conditions the hypothesis was not supported, and the problem may lie in the conditions.

There are good reasons why neurological concepts are not employed in perceptual-motor training. A monumental effort is required to glean them from the literature and to organize them into a useful theoretical structure. After that monumental effort is made and a theoretical structure with demonstrable usefulness built, the theory invariably has many limitations. It cannot possibly be entirely correct. Assimilating all that is known of brain function is beyond the capacity of most of us. At best we can organize only bits and pieces of it into any organized whole, leaving great gaps in any literature survey.

Educators are concerned with the brain as it functions in its entirety. We need principles of how the brain functions as a whole, but brain researchers restrict their investigations and reporting, usually, to functions of some isolated part of the brain. Occasionally a scholar, after he has obtained a secure position in his field, has retired professionally and begun to synthesize what he has learned in his lifelong study of the brain, is willing to theorize about brain function as a whole. Sherrington and Herrick are among those who have enabled lesser beings such as myself to profit from their willingness to combine facts into a unified whole and to

go beyond the facts to produce a theory. Such a theory is not easily testable as a whole, yet if the whole is not employed in the clinical or educational situation attempting to modify brain integration, the effectiveness of the program is less than optimal. It is a general rule that the most effective plans of professional practice are often the most difficult to put to scientific test.

A further obstacle in the utilization of knowledge from basic brain research lies in its incompleteness. It may well be that some of the most important principles of sensorimotor function have not yet been formulated because of lack of brain research related to those principles. No amount of diligence on the part of the clinician can completely fill the resultant omissions.

In addition to inadvertently harboring many inaccuracies about the brain and its mode of operation, theory holds an inevitably strong individualistic flavor, for each theory is an interpretation of the literature by, usually, a clinician who wants to use it. Subjectivity is not popular in a scientific society. This reflection of the theorist combined with inevitable inaccuracies results in vulnerability of the theory. The vulnerable spots invite attack, and usually not of a constructive nature, for frequently attack is a response to threat.

The mere word "brain" seems to threaten many professional people. Handling that threat requires that we look at it and try to analyze it. If an individual has not been exposed to many neurological concepts and incorporated those concepts into his thinking early in his professional career, it seems to be very difficult for him to do so later on. If he feels that he should know about the brain and does not, the threat is doubled and is handled by either denying the value of neurological concepts or by attacking those who appear to know and to utilize them. If those who do not know but feel that they should know would recognize that those who seem to know really have only very limited knowledge, the threat might be reduced. What one does not know is usually more imposing and impressive than that which one does know.

A further difficulty in utilizing neurological concepts or theories in perceptual-motor training, lies in the fact that resultant procedures are not obviously related to the objective. When this is the case, that which the unsophisticated observer sees is quite unconvincing. Often the more complex the theory being implemented, the simpler the actual activity, and only children and not professional people are impressed by the simplicity. A great deal of self-confidence is required to conduct a remedial program based on a neurological theory, for very little support can be expected from colleagues.

There are two ways of coping with the challenge of the brain. We can ignore the brain; we can say that we are interested only in improving motor skill for the sake of a specific skill and the best way to develop a specific skill is to practice it. We can say that not enough is known about brain function to provide a secure basis for professional practice of perceptual-motor training for enhanced cognitive function. We can truthfully add that there is no conclusive research that supports the effectiveness of any theory of perceptual-motor function based on neural constructs. That is the safe way of coping with the challenge and one will not be alone if one chooses it.

The alternate method is more painful. I neither recommend it nor advise against it. I submit it as a challenge and as an almost

inevitable future development but one which can be delayed if so desired. That alternative, of course, is to study the brain research and to try to profit from it, relating sensation, integration, perception and motor activity to those neural structures which govern it. It means dealing with total brain principles and not with isolated sensory modalities. It means "thinking" sensation and integration as much as or more than "seeing" motion. It means only half-way knowing what one is doing neurologically, but half-way is a lot farther than that which is known now. It means giving up the more secure feeling for less security. It means exposing oneself to attack. But in the long run, it will probably mean greater success in achieving the goal of enhanced well-being for children.