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Teaching Both Brains

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Introduction

In the advanced vertebrates, including man, the two large hemispheres of the cerebrum of the brain serve as centers of perception, of voluntary motion, and of the higher mental faculties such as thought and memory. The two hemispheres are connected by several bands of nerve tissue the major tissue being the *corpus callosum*. The two hemispheres control the motor and sensory responses of the opposite sides of the body. Some hemispheric differences in function were reported as early as 1861 when Dr. Paul Broca observed that patients with lesions on their left cerebral hemispheres were more likely to suffer loss of speech than were those with lesions on their right hemispheres (2). From a host of such observations it was concluded that the left hemisphere of the cerebrum controls the function of speech.

Within the last 12 years, the contributions of the neurobiologist Roger Sperry and his colleagues have provided clues concerning organizational differences in the two hemispheres with respect to the processing of information (1). In attempting to control seizures, Sperry and his team surgically separated the two hemispheres by cutting the corpus callosum in intractable epiliptics (3). In cutting the tissue, the seizures, which occur in one hemisphere, were successfully regulated by allowing the other hemisphere to take over control of normal body functions without harm to patients.

Split Brains

Since then, many interesting studies have been conducted on patients with split-brain surgery. In one study, a patient was asked to feel an object (hidden from sight) with his right hand and to describe it. After describing the object, the experiment was repeated with the left hand using another object, but in this case the subject was unable to verbalize the sensory input even though he could pick out the object from a collection of items. Thus, even though the patient knew what he had felt, he could describe the object only if he grasped it in his right hand.

Other experiments tested this hemispheric specialization using visual input only. Such experiments were designed so that when the phrase "key ring" was shown to a split brain patient, the word "key" sensitized the right hemisphere and the word "ring" sensitized the left hemisphere. When asked to read the phrase at the end of the experiment, the patient said "ring" but when asked to retrieve the object with his left hand, the subject picked up the "key." According to Sage (3), the patient was unaware of the conflicting responses.

To illustrate the modes of problem solving employed by the two hemispheres, consider another experiment involving split brain patients.

Assume a special optical apparatus which channels visual input from one of two geometric puzzles to the right hemisphere and visual input from the second puzzle to the left hemisphere. Under such conditions, subjects work both puzzles simultaneously. The right hand approaches the puzzle analytically while the left hand works holistically. Sage (3) reports that the left hand solves the puzzle quicker than the right hand.

Implications

The degree of specialization of the two hemispheres goes beyond speech. The left hemisphere which controls the right hand side of the body carries out mental processes more closely associated with logical linear thought. The right hemisphere specializes in processes associated with spacial imagery. Thus, the left hemisphere is associated with linear analytical processes while the right hemisphere specializes in holistic relationships (4).

In academics, teachers accent the development of the left hemisphere while teachers of art, crafts, music and physical education are more concerned with the development of the right hemisphere. Under normal circumstances, with the corpus callosum intact, the brain uses both hemispheres so that their functions are in concert with one another. However, there is strong evidence that some individuals are more specialized in some of these functions than other individuals.

Conclusion

What are the implications to science educators at all levels of instruction? Many classroom experiences are designed for the culturally dominant left brain through analytical training. But this is not the only approach used in science. Einstein speaks of an intuitive approach which can be tested later by analytical methods. Both modes of thinking are required in science.

What kinds of activities can be designed to develop the intuitive hemisphere? W.J.J. Gordon suggests that the metaphor be used as a tool to cultivate perceptions in the "minor" hemisphere (5). Consider a synectics activity in astronomy. The synectics activity may consist of (a) a warm-up activity, (b) a direct analogy, (c) a personal analogy and (d) a compressed conflict.

In a warm-up activity, students are asked to complete the sentence, "A star is a ____ ." Students may give analogies such as: light, sun, furnace, bomb, gem, poem, creation or wink. In a direct analogy, students may be asked, "How is a star like a ____ ?" Students may respond with answers like: "It sends a message.", "It sparkles.", "It inspires.", or "It kindles imagination." For illiciting personal analogies students might be asked, "How would you feel if you were a star?" Typical responses might be: "Big!", "Lonesome!" or "Expanding!" The compressed conflict requires putting together two terms which seem to be in conflict with one another, yet describe the object. With reference to a star, typical answers to compressed conflict analogies might be: "Lonely-warm" or "Peaceful-bomb!" The purpose of such activities is to stimulate creative associations which enhance the analytical physical concept of a star through holistic associations stimulated in the non-analytical hemisphere of the brain.

The development of perceptions through body movement is a right hemispheric phenomenon. Such activities might consist of asking students to pretend they are seeds growing into plants or pretend they are molecules diffusing from a perfume bottle or to pretend they are different sized particles settling in an alluvial basin of a stream. Teachers interested in the holistic mental development of students can obtain help by consulting a series of guides in *Strange and Familiar*, SynecticsEducational Systems, 121 Brattle Street, Cambridge, Massachusetts 02138.

Literature Cited

1. Bogen, J. E., Some Educational Aspects of Hemispheric Specialization. *UCLA Educator* Spring, 1975, pp. 24-32.
2. Buck, Craig, Knowing the Left from the Right. *Human Behavior*, June, 1976, pp. 29-33.
3. Sage, W., The Split Brain Lab. *Human Behavior*, June, 1976, pp. 25-28.
4. Ornstein, Robert, *The Psychology of Consciousness*, W. H. Freeman & Company, 1972.
5. Gordon, W.J.J. and T. Pose, *The Metaphoric Way of Learning and Knowing*, Synectics Education Systems, 1973.

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Plant Hemoglobin

Plants die so that man might eat. Now they're also bleeding so that scientists might understand how hemoglobin, the oxygen-carrying molecule in human blood, is made. About 40 years ago, hemoglobin was discovered in the roots of soybean plants, says Dr. Kenneth Nadler, Assistant Professor of Botany and Plant Pathology at Michigan State University.

Human and soybean hemoglobin are chemically different and there are no plans for trying to develop plants to grow blood. But, Dr. Nadler explains, we believe that the hemoglobins are produced by similar types of control mechanisms. If these pathways and controls were better understood, there might be a better chance of dealing with some of the more common types of human anemias and blood diseases.

Plant cells and bacterial cells cooperate, in the soybean plant, in manufacturing hemoglobin which is necessary for supplying the bacteria with low levels of oxygen. The bacteria manufacture the heme portion of the molecule and the plant provides the globin. Because hemoglobin production is split between two cells, it's easier to study the chemical process and control mechanisms involved.

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