ED 393 896 TM 024 848

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TITLE Wholetheme Constructivism and Whole-Brain Education: Educational Implications of the Research on Left and Right Brain Hemispheres.

PUB DATE Nov 95

NOTE 27p.; Paper presented at the Annual Meeting of the Mid-South Educational Research Association (Biloxi, MS, November 8-10, 1995).

PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.

DESCRIPTORS *Biological Influences; *Brain Hemisphere Functions; *Constructivism (Learning); *Cultural Influences; Educational Practices; Genetics; *Lateral Dominance; Nature Nurture Controversy; Neuropsychology; Perceptual Development; Thematic Approach; Verbal Ability

IDENTIFIERS Analytic Ability; *Whole Brain Learning

ABSTRACT

The left side of the brain has been said to process speech along with logical, rational, convergent, objective, and sequential tasks. The right side of the brain is thought to process nonverbal, spatial, musical, and analogical information. This paper discusses the research on brain hemisphericity from the perspectives of traditional and wholetheme constructivism. Hemisphericity refers to the re'ıtive dominance of the left or right cerebral hemisphere in an individual's functioning, irrespective of the cognitive nature of the task, and is thought to be reflected in the individual's cognitive style. One of the controversies that surrounds brain hemispheric dominance is the origin or cause of the phenomena. While some scientists contend that cerebral dominance is genetic in origin, others argue that it is the result of cultural and educational practices. A biofunctional theory allows for the roles of genes and culture. It is argued that cultural and educational biases for verbal and analytical abilities resulted in the traditional piecemeal approaches that break the content of new information into parts and offer it in a sequential style. This has resulted in consistent use of the left hemisphere, and consequently in cerebral dominance. (Contains 1 table and 47 references.) (Author/SLD)

WHOLETHEME CONSTRUCTIVISM AND WHOLE-BRAIN EDUCATION:

EDUCATIONAL IMPLICATIONS OF THE RESEARCH ON

LEFT AND RIGHT BRAIN HEMISPHERES

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Presented at the Mid-South Educational Association, Biloxi, Mississippi, '995

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Abstract

The left side of the brain has been said to process speech along with logical, rational, convergent, objective, and sequential tasks. The right side of the brain is thought to process nonverbal, spacial, musical, and analogical information. This paper discusses the research on brain hemisphericity from the perspectives of traditional and wholetheme constructivism

WHOLETHEME CONSTRUCTIVISM AND WHOLE-BRAIN EDUCATION: EDUCATIONAL IMPLICATIONS OF THE RESEARCH ON LEFT AND RIGHT BRAIN HEMISPHERES

The idea that the two hemispheres are specialized for different modes of thought has led to the concept of hemisphericity. Hemisphericity refers to the relative dominance of the left or right cerebral hemisphere in an individual's functioning, irrespective of the cognitive nature of the task (Sackheim et al., 1984). Brain hemisphericity is thought to be reflected in the individual's cognitive style, viewed as the individual's characteristic mode of perceiving and organizing information about the environment (Messick, 1984). Torrance (1980) measured whether students perceive information primarily in a right hemisphere, left hemisphere, or whole brain mode. Torrance et al. (1977) have devised a "Style of Thinking" questionnaire on which participants can rate themselves on 36 different items, each with three alternatives, one said to signify "left-hemispheric specialization," another signifying "right-hemispheric specialization," and the third indicating an "integrated hemisphericity." Examples of alternatives signifying a "left-hemispheric specialization" include "not good at remembering faces" and "inhibited in expression of feelings and emotions"; the "right hemisphere" alternatives are " not good at remembering names" and "able to express feelings and emotions freely." Alternatives signifying an "integrated" brain style are "equally good at remembering names and faces" and "controlled in expression of feelings and emotions" (Torrance et al., p. 563).

Brain hemisphericity refers to the functioning of the neocortex, which is the most recently evolved portion of the brain (Harth, 1990). The neocortex has 3/4 of the brain neurons and is divided into two halves or hemispheres connected by a bundle of nerve fibers called the corpus callosum (Harth, 1990). Each hemisphere is the mirror image of the other. The left hemisphere controls the right side of the body; the right hemisphere controls the left side of the body (Harth, 1990).

The literature on brain hemisphericity mostly deals with the tasks for which each hemisphere is specialized. Some researchers attribute brain hemisphericity to genes and heredity, while others attribute it to cultural bias and teaching practices. This chapter looks at brain hemisphericity in the light of the biofunctional model (Iran-Nejad, 1989,1990). The biofunctional model offers an explanation to the controversy that surrounds the cerebral dominance issue through the concept of self-regulation. The idea is that the locus of active self-regulation is the chief contributor to brain hemisphericity, while dynamic self-regulation is the cause of whole brain functioning. Active self-regulation is subject to influences of cultural and educational practices and values, thus, it could be argued that brain hemisphericity is greatly influenced by culture and educational practices, not genes. Consequently, the author believes that educators should consider the importance of what cultures and educators value and emphasize, because what they value--whether it is the ability to speak and think analytically and logically or the ability to distinguish patterns and see the whole picture-- determines brain hemisphericity. Another issue educators should contemplate is redesigning educational curricula to take advantage of both active and dynamic self-regulation and whole-brain functioning.

Literature Review

Brain hemisphericity

In 1836, Marc Dax presented a paper at a medical conference based on his observation of patients with aphasia. He asserted that each hemisphere performs different functions, and more specifically, the left hemisphere controls speech. This paper was considered a great failure at the time because Dax was unable to find a single case that involves damage to the right hemisphere and to provide enough evidence to his conclusion of specialization of tasks or assignments that each hemisphere control (reported in Springer & Deutsch, 1989).

Later, Broca (1972) was able to report evidence consistent with Dax's (1836) claim. He performed a postmortem examination of patients who died after suffering brain damage that resulted in loss of speech. He concluded that damage to the left cerebral hemisphere results in language impairment. Broca identified a certain area of damaged tissue in the left frontal lobe as the cause of loss of speech. Broca presented extensive evidence for his conclusions from his anatomical findings. He commented on the importance of the left hemisphere to speech:

> I have been struck with the fact that in my first aphemics (loss of speech due to brain damage) the lesion always lay not only in the same part of the brain but always the same side-- the left. Since then, from many postmortems, the lesion was always left sided. One has also seen many aphemics alive, most of them hemiplegic, and always hemiplegic on the right side. Furthermore, one has seen at autopsy lesions on the right side in patients who had shown no aphemia. It seems from all this that the faculty of articulate language is localized in the left hemisphere, or at least that it depends chiefly

upon that hemisphere (quoted in S. Diamond, p. 45).

This study was later supported by Wernicke (1874), Freud (1953), Penfield & Roberts (1959), Blakemore (1977), and Travarthan (1984). Broca, also, related right handedness to the left hemisphere and vice versa.

However, Broca and others who attributed loss of speech to a damage to the left side of the brain, neglected the fact that there are other aspects to speech than loss of overt speech. Wernicke (1874) was the first one to show, through observation of brain-damaged patients, that damage to the back part of the temporal lobe of left hemisphere resulted in flaws of comprehension skills-- patients demonstrated difficulties in understanding speech of others. In 1865, John Hughlings Jackson studied a patient with a tumor in the right hemisphere who suffered difficulties in recognizing objects, persons, and places. He concluded that perception is located in the right hemisphere.

Weisenberg & McBride (1935) did a study on 200 patients with brain damage employing 40 different tests (both verbal & non-verbal). The results showed that left-brain damaged patients did poorly on tests that employed verbal ability, while right-brain damaged patients did poorly on non-verbal tests. Some right-brain damaged patients had difficulty comprehending distance relationships and mental images of maps and forms. This study supports the contention that the left hemisphere of the brain is analytical, and more responsive to the messages and details of the print word. On the other hand, the right hemisphere is holistic, global, spatial and emotional (Torrance, 1980). The left hemisphere deals with input in a logical, linear and sequential manner, while the right hemisphere deals with input in a holistic, global manner

(Stice et al., 1989).

Levy (1978) studied the performance of split brain patients on tasks such as matching wooden blocks held either in the left or the right hand to two-dimensional representations selected from drawings of blocks. She found that the left hand was better than the right hand, but also observed that the two hemispheres employed different strategies to perform the same task. She analyzed the patterns of errors made by each hand and found that the right hand (left hemisphere) uses patterns that can be described, to the patient, in words and difficult to discriminate visually, while the left hand (right hemisphere) uses patterns that employ visual discrimination. The right hand could not match wooden blocks based on the overall appearance, but was able to match these blocks based on verbal descriptions such as width and length.

Myers and Sperry (1958) performed a study and inferred that the corpus callosum serves as the means through which information travels from one cerebral hemisphere to the other. They showed that visual information introduced to one hemisphere in cats with disconnected corpus callosum fails to reach the other hemisphere. In most higher animals, the corpus callosum is the principle means of information transmission between hemispheres. In other words, each eye projects the visual stimuli to both hemispheres. In cats, it is the exclusive means. In cats with disconnected corpus callosum, the remaining fibers in the optic nerve transmit information only to the hemisphere on the same side. Visual input to the left eye is sent exclusively to the left hemisphere, and input to the right eye is sent only to the right hemisphere. Myers and Sperry taught cats with disconnected corpus callosum a visual-discrimination task with one of the eyes patched. An example of such task is to make the cat pull on a lever when it sees a circle and not pull on it when it sees a square. Myers and Sperry found that cats with a disconnected optic chiasm were able to perform the task with either eye when tested after the one-eye training. However, when the corpus callosum was disconnected in addition to the optic chiasm, the cats trained with one eye open and one eye patched would learn to do a task well; but when the patch was switched to the other eye, the cat was unable to do the task at all. Myers and Sperry concluded that disconnecting the corpus callosum had kept the information going into one hemisphere from reaching the other hemisphere (Myers & Sperry, 1958).

After extensive research on epileptic patients, Sperry (1961) concluded that the brain hemispheres are specialized in a complimentary fashion (Springer & Deutsch, 1989; Travarthen, 1993; Alptekin & Atakan, 1990). They perceive different meanings in identical stimuli and each solve best its own kind of mental problem. As Sperry (1974) observed in epileptic patients with disconnected corpus callosum:

> Each hemisphere . . . has its own . . . private sensations, perceptions, thought, and ideas all of which are cut off from the corresponding experiences in the opposite hemisphere. Each left and right hemisphere has its own private chain of memories and learning experiences that are inaccessible to recall by the other hemisphere In many aspects each disconnected hemisphere appears to have a separate "mind of its own" (p. 1751).

Travarthen (1993) asserted that both left and right hemispheres deal with tasks such as perception and reactions in different manners. Both hemispheres "interact in synchrony and with the closest coordination various states of mind may arise not from the separate action of the two hemispheres, but from their joint action" (158). Levy & Travarthen (1976) after observing the dynamics of perceiving in a number of commissurotomy patients pointed out that adjustments in the whole brain, could turn on or off all or part of high level processes in the cerebral cortex of one hemisphere. They asserted that both awareness and ability to move could be adjusted by this channeling of internal facilitation or activation into one or the other of the divided forebrain. They called this phenomenon "meta-control" of consciousness, which qualifies the permanent differences in functional capacity of the separated hemispheres.

Dunn et al. (1992) proposed a meta-control model in which complex tasks are hypothesized to involve many circuits in both hemispheres working in a parallel manner. They suggested that the brain circuits use a holistic approach of building patterns and analyze them "concurrently for categorical, temporal, logical, or sequential relationships using an analytic strategy" (p.460). This model supports metacontrol and biofunctional approaches proposed by Iran-Nejad et al. (1992). They both acknowledged that the brain subsystems employ holistic and analytical processes in both hemispheres.

Dunn and Reddix (1991) studied the amount of alpha activity recorded from the cerebral cortex and its relationship to styles of thinking. They identified a person with an analytical style of thinking as one who engages in more sequential circuits in the brain than a holistic ones, and a person with holistic style of thinking is an individual who engages in more pattern forming circuits than sequential ones. Dunn and Reddix found that individuals with a holistic style generated more alpha activity than individuals with an analytical style.

Luria (1966) identified two integrative activities that take place in the brain: simultaneous and successive. Simultaneous, Luria distinguished as the activity "involving immediate apprehension and integration of various elements of experiences" (p.495), while successive processing is the activity involving "the sequential integration of stimuli into an organized temporal or serial order" (p.495). However, Luria did not assign different tasks to different hemispheres. He asserted that both hemispheres take part in both kinds of processing. At the same time, he acknowledged that individuals usually "approach tasks with primary emphasis on successive or simultaneous processing" (p.496).

Springer and Deutsch (1989), divided the characteristics most associated with each hemisphere in the literature into five main groups, forming a kind of hierarchy (Table 1). However, Springer and Deutsch point out that the descriptions near the top of this figure are based on the results of clinical experiences, while the descriptions at the bottom of this figure are more speculative than factual. They caution the readers that the ideas regarding the nature of hemispheric functioning are diverse and yet unsettled. They also point out that a lot of the literature concerning brain hemisphericity have moved further away from research findings and "the distinction between fact and speculation is often blurred" (p. 287).

Nature

Several genetic models have postulated separate genes coding for left-hemisphere and right-hemisphere dominance. Annett (1964) hypothesized the presence of a single gene with two different forms (alleles). One dominant form, R, associated with right handedness (left hemisphere) and a recessive form, L, associated with left handedness (right hemisphere). Annett suggested that a person inheriting the R-form (allele) from both parents would be right handed, as well as a person who inherited an R-form (allele) from one parent and an L-form (allele) from the other parent. Left handers would be those individuals who inherited the L-form from each parent. However, Annett failed to explain the fact that 54% of the offspring of left-handed parents are right handed (Annett, 1964).

Levy and Nagylaki (1972) suggested that handedness, and consequently brain hemisphericity, is the result of two genes, one gene determines the hemisphere that controls the speech and handedness. The other gene determines whether the hemisphere that controls speech controls the dominant hand. Nevertheless, this model lacks evidence as to the existence of these two genes.

Other research suggested that the cytoplasm can carry certain traits such as brain hemisphericity from one generation to another (Zurif & Bryden, 1969; Corballis & Morgan, 1978). Bryden (1975) conducted a study on 49 families to assess their dichotic listening performance in which he obtained ear-advantage scores for parents and off spring. Results showed significant ear asymmetry but negative correlations between siblings within the family. These results give little support to the heredity theory of brain hemisphericity because they fail to explain the negative correlation between siblings.

Liederman & Kinsbourne (1980) studied the head-turning preference in infants. They observed the infants tendency of turning their heads in response to visual or auditory stimuli presented simultaneously to the left and right. They found a positive correlation between right-head turning response to stimuli by infants of two right handed parents and a negative correlation between responses by infants of two left-handed parents. The researchers hypothesized that since the infants were a few days old, learning could not be a factor in head-turning preferences. Thus, they suggested that heredity has a significant role in brain asymmetry.

Culture

The role of the environment on hemispheric dominance has received great attention from scientists. Some studies showed that children from middle socioeconomic groups have great left-hemispheric dominance, while low socioeconomic groups showed right-hemispheric dominance. Dorman and Geffner (1974) and Borowy and Goebel (1976) studied ear superiority in children from low and middle socioeconomic backgrounds using a dichotic digits test. They found that children from middle socioeconomic background showed right-ear advantage, while the majority of the children from low socioeconomic background showed left-ear advantage.

A case study of an adolescent girl of age 13 1/2, Genie, who had been isolated completely since she was two years old has been reported in the literature in psycholinguistics. Two years after she was found, she was learning to speak. Genie showed right hemispheric dominance. The scientists observing Genie attributed her right hemispheric dominance to confinement and disuse of her verbal abilities. Later, when she started to learn the language, the right hemisphere assumed control because its functions had been exercised.

Collins (1975) performed a study on mice to investigate consistent paw preferences in reaching for food in a glass tube. He asserted that the offspring of mice with right paw preference show 50% left preference and 50% right preferences. He also showed that mice that have not yet shown a preference for either paw become predominantly right-pawed if they are presented with glass tubes placed toward the right side of the cage. This study showed that brain hemisphericity could be attributed to the environment, not genes.

Blau (1946) investigated all the literature on handedness and concluded that, "preferred laterality is not an inherited trait. There is absolutely no evidence to support the contention that dominance, either in handedness or any other form, is a congenital, predetermined human capacity" (p. 126). The author argued that right handedness is the result of educational and cultural values and left handedness is the result of a physical defect, faulty education, or emotional imbalance. However, Blau's argument leaves the reader with several unanswered questions . For example, if right-handedness is a response to cultures, why is it that right handedness was found all over the world and why would cultures prefer right-handed people.

Education

A study compared the performance of 1220 persons from different backgrounds (Hopi Indians, urban blacks, and rural and urban whites) on two tests to show hemisphere preferences (Street Gestalt Completion Test, and Similarities Sub-test of the Wechsler Adult Intelligence Scale). The study showed that Hopi Indian and urban black subjects revealed more right-hemisphere dominance than rural and urban white subjects (Bogen et al., 1972). Bogen and his colleagues argued that this study suggests that brain hemisphericity is the result of nature, not culture. However, other scientists (Zook & Dwyer. 1976) have argued that the differences in mental processing are the result of the lack of educational opportunities to non-white populations.

Stellern et al. (1986) conducted a study on Native American Indians students in regular American schools to examine the language and spatial lateralization. They found that they are not right-hemispheric dominant as previous studies have indicated. They also found that there is a strong positive correlation between right-hemisphere dominance and failure or behavior problems in the schools. This failure could be attributed to the lack of flexibility in the educational systems. Educational curricula and values prize verbal, analytical and logical thoughts and fail to accommodate and value the holistic thoughts associated with right-hemisphere dominance.

This study's results imply that brain hemisphericity is an acquired mode of thinking through schooling and cultural practices that emphasize and value the left hemisphere' s analytical abilities as suggested by Ornstein (1970). This also would explain the failure of right-hemisphere dominant students who were unable to adapt to the schools' analytical and global practices.

Vygotsky (1931) conducted several studies in the field of neuropsychology and concluded that although some language functions can be attributed to particular sites in the left hemisphere, he believed that the speech process itself results from neural processes in both hemispheres.

The Biofunctional Model

The biofunctional perspective provides explanations of the external and internal conditions that control the brain perception and interpretation of information. Iran-Nejad (1989) hypothesized three different sources of control that contribute to biofunctional schema construction: external, active and dynamic. Iran-Nejad (1989) postulated that, "comprehension, learning, and remembering occur as a result of the simultaneous, operation of attention, inquiry, closure, combination and information-creation processes, all of which are under the control of the external, active and dynamic sources of self-regulation" (p. 2).

Iran Nejad (1990) defined the process of active self-regulation as the conscious (intentional) effort by the person's internal executive control process to acquire new material or information. He stated that there are two kinds of self-regulation that take place in the brain:

active self-regulation, which involves conscious or intentional learning of new material, and dynamic self-regulation, which is unconscious or unintentional learning.

In the brain, dynamic self-regulation is controlled by the subsystems of the nervous system and is inherently simultaneous in many different parts of the brain while active self-regulation is inherently sequential and can only take place one step at a time. The biofunctional model explains how an individual's system is biologically designed for both active and dynamic self-regulation of learning (Iran-Nejad, 1989). This could explain the different mental processes that take place in both hemispheres.

Iran-Nejad (1989) stated that the brain microsystems can engage in three different types of activities, one is the thematic knowledge, which use the elements of the microsystems distributed throughout the entire nervous system. The second type is the categorical knowledge which is created by momentary blinks at the unit level of knowledge. The third type is a propositional knowledge which results from the sequential generation of categorical knowledge.

The biofunctional theory of multisource self-regulation assumes that learning is the reorganization of the individual's intuitive knowledge base, as controlled by the three sources of self-regulation.

In the brain, all microsystems have the capacity to regulate themselves dynamically. This kind of self-regulation undertake a whole theme reorganization of information. This reorganization require the brain microsystems to undergo a simultaneous and flexible self-adjustment in a context of an ongoing whole-brain coordination pattern. Worthy to note, however, that while dynamic self-regulation events can occur simultaneously in many different parts of the brain, active self-regulation can only occur one at a time or sequentially (Iran-Nejad, 1989, 1990).

Brain hemisphericity, and the Biofunctional Model

Active self-regulation is slow and takes place under the "conscious control of the central executive process, requires allocation of central capacity resources, and is inherently sequential." Dynamic self-regulation is rapid, and takes place "under the spontaneous control of the non-executive components themselves, and is inherently simultaneous" (Iran-Nejad, 1990, p.573). This paper hypothesizes that active self-regulation is responsible for brain hemisphericity. The cerebral dominance is the result of conscious and intentional effort. On the other hand, the dynamic self-regulation represents the unconscious activities carried out by both hemispheres. The concept of active and dynamic self-regulation is supported by Luria's hypothesis of the two processes that take place in the brain: simultaneous and successive.

Implications

The biggest problem that faces school graduates is their inability to see the whole picture and to recognize patterns in new information introduced to them. This problem is the result of generations of teaching methods that implement the piecemeal approach. This approach tends to break the content of new information into small pieces and introduce them to the students in a sequential fashion. The students are not able to recognize the whole picture or the goal of the new information until they reach the end.

The authors contend that these practices encourage students to practice analytical functions more than global ones. The schools' practices force the students to use analytical, verbal, and logical thinking tasks. This contention is supported by Dorman & Geffner (1974), Bogen (1975), and Stellern et al. (1986). Dorman & Geffner (1974) did a study on children from low and middle socioeconomic classes. They found a right-ear advantage for both groups, but the middle socioeconomic group showed a right ear advantages of greater significance. This study suggests that environmental factors affect brain lateralization. Bogen (1975) argued that schools and society emphasized propositionality (a term used to describe the left hemisphere's dominance for speaking, writing, and calculation) at the expense of appositionality (a term used to describe the right hemisphere's dominance for holistic, spatial and artistic abilities). Stellern et al. (1986) did a study to examine brain hemispheric dominance in Native American students in regular American schools. They found that most of the subjects were left hemispheric dominant, which it could be attributed to the school teaching practices.

Consequently, the school practices in the west are believed to neglect of the holistic aspects of the brain. The piecemeal approach along with cultural biases to the verbal abilities and logical thinking, the author believes, are the reasons behind cerebral dominance. This assumption is supported by Ornstein's (1970) and Bogen's (1975) arguments against western cultures emphasis on the analytical and verbal abilities.

Ornstein (1970) argued that western cultures make use of the left hemisphere and neglect the right hemisphere through their emphasis on language and logical thinking, while in eastern cultures, the right hemisphere is more exercised through their religions, languages, intuition and mysticism. Ornstein stressed that the cerebral hemisphere perform different types of mental processes and he pointed out that schools teach students only left-hemispheric skills.

> . . . with the result that we have learned to look at unconnected fragments instead of at an entire solution . . . . As a result of this preoccupation with isolated facts, it is not

surprising that we face so many simultaneous problems whose solutions depend upon our ability to grasp the relationship of parts to whole. . . Split- and whole-brain studies have led to a new conception of human knowledge, consciousness, and intelligence. All knowledge cannot be expressed in words, yet our education is based almost exclusively on its written or spoken forms. . . But the artist, dancer, and mystic have learned to develop the nonverbal portion of intelligence (p. 78).

The literature on brain functioning and its relationship to education suggests that educational curricula should address the right hemisphere by developing tasks that require spatial and holistic thinking as well as artistic skills. By doing so, researchers contend that children will be able to activate the "neglected hemisphere." However, the author argues that this practice will yield the same results as teaching practices that emphasize the verbal and analytical functions. Educators must acknowledge that both hemispheres work together, guided by the meta-control system, to acquire knowledge. Emphasizing one kind of skill to activate one hemisphere is an inefficient way of teaching that deprive our children from their natural abilities to employ both hemispheres.

The whole-theme approach offers a solution to the problem of educational methods' emphasis on the use of the left hemisphere. It stresses the introduction of the whole picture. The whole-theme approach is a suitable way of learning by employing all subsystems operations that take place in the brain (Iran-Nejad, 1994). The whole-theme approach supports taking advantage of students' curiosity and interest in the learning processes and content that can only be achieved by employing both aspects of self regulation, active and dynamic (Iran-Nejad &

Cecil, 1989). The whole-theme approach advocates the use of practices that help create thematic knowledge, which is upheld by the ongoing functioning of brain subsystems that work together in the whole brain (Iran-Nejad, 1989).

Conclusion

Neurological research has suggested that each hemisphere carry out mental processes in a different and unique way. Scientists has suggested that the left hemisphere analyze information in a linear and logical fashion, while the right hemisphere deals with information in a holistic visual manner. Other scientists argued that both hemispheres carry out both kinds of processing--analytical and holistic.

One of the controversies that surround brain hemispheric dominance is the origin or the cause of that phenomena. Some scientists assert that cerebral dominance it is the result of genes, while others contend that is the res t of cultural and educational practices.

The biofunctional theory offers a solution to the problems that are usually raised in the field of neuropsychology regarding brain hemisphericity. The biofunctional theory provides a reasonable explanation for brain hemisphericity. The biofunctional theory contend that the mental processes that take place in the brain can be divided into two kinds: active self-regulation and dynamic self-regulation. Active self-regulation involves conscious or intentional learning, while dynamic self-regulation is the unconscious or unintentional learning.

The authors believe that culture and the human brain are intertwined; they both act on each other. This belief is supported by Lerner (1984), who pointed out that the environment can change the brain structure. Diamond (1988) stated that, "we now have clear evidence that the environment can play a role in shaping brain structure and, in turn, learning behavior. It is the area of the brain that is stimulated that grows" (p. 18). Diamond rationalized that nerve cells branch out and form new branches as they receive input consequently in areas where no stimuli/input is received nerve cells do not branch out. However, we must acknowledge the role of nature (genes) in brain structure.

The authors believe that cultural and educational biases for verbal and analytical abilities resulted in the traditional teaching methods that employ piecemeal approaches that break the content of new information into parts and offer it in a sequential style. This resulted in the consistent use of the left hemisphere and negligence of the right hemisphere, and consequently in cerebral dominance.

References

Alptekin, C. & Atakan, S. (1990). Field dependence-independence and hemisphericity as variables in L2 achievement. Second Langauge Research, 6(2), p. 135-149.

Annett, M. (1964). A model of the inheritance of handedness and cerebral dominance. Nature, 204, 59-60.

Blakemore, C. (1977). Mechanics of the mind Cambridge: Cambridge Univ. Press.

Blau, A. (1946). The master hand. New York: American Ortho-Psychiatric Association.

Bogen, J. E., DeZare, R., TenHouten, W. D. & Marsh, J. F. (1972). The other side of the brain IV: the A/P ratio. Bulletin of the Los Angeles Neurological Societies, 37, 49-61.

Bogen, J. E. (1975). The other side of the brain: VII: Some educational aspects of hemispheric specialization. UCLA Educator, 17, 24-32.

Broca, P. (1972). cited in S. Diamond, The Double Brain. London. Churchill-Livingstone (Original work published 1865).

Collins, R. L. (1975) When left handed mice live in right handed worlds. Science, 187, 181-184.

Corballis, M. & Morgan, M. J. (1978). On the biological basis of human laterality: I. Evidence for a maturational left-right gradient. Behavioral & Brain Sciences, 2, 261-336.

Diamond, M. (1988). Enriching Heredity. New York: Free Press.

Diener, E., & Iran-Nejad, A. (1986). The relationship in experience between various types of affect. Journal of personality and social Psychology, 50, p. 1031-1038.

Dorman, M. F. & Geffner, D. (1974). Hemispheric specialization for speech perception in six years old black and white children from low and middle socioeconomic classes. Cortex, 10, 171-176.

Dunn, B & Reddix, M. (1991). Modal processing style differences in the recall of expository text and poetry. Learning and Individual Differences, 3, 265-293.

Dunn, B, Dunn, D, Andrews, D. & Languis, M. (1992). Metacontrol: A cognitive model of brain functioning for psychophysiological study of complex learning. Educational Psychologist, 27 (4), 455-471.

Freud, S. (1953). On aphasia: A critical study. In E. Stengel (Trans.), New York: International Universities Press.

Harth, Erich. (1990). Dawn of a Millennium: Beyond evolution and culture. Boston: Little, Brown & Company.

Iran-Nejad, A. (1989). A nonassociative schema theory of cognitive incompatibility. Bulletin of Psychonomic Society, 27, p. 429-432.

Iran-Nejad, A. (1989). Associative and nonassociative schema theories of learning. Bulletin of Psychonomic Society, 27, p. 1-4.

Iran-Nejad, A. (1990). Active and dynamic self-regulation of learning processes. Review of Educational Research, 60, p. 573-602.

Iran-Nejad, A. & Cecil, C. (1992). Interest and learning: A biofunctional perspective. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), The role of interest in learning and motivation. Hillsdale, N.J.: Erlbaum.

Iran-Nejad, A. & Chissom, B. (1992). Contributions of active and dynamic self regulation to learning. Innovative Higher Education, 17, 125-136.

Iran-Nejad, A. (1994). The global coherence context in educational practice: A comparison of piecemeal and whole-theme approaches to learning and teaching. Research in the Schools, 1(1), 63-76.

Lerner, R. (1984). On the nature of human plasticity. New York: Cambridge University Press.

Levy, J. & Nagylaki, T. (1972). A model for the genetics of handedness. Genetics, 72, 117-128.

Levy, J. & Travarthen, C. (1976). Metacontrol of hemispheric function in human split-brain patients. Journal of Experimental Psychology: Human Perspective and Performance, 2, 299-312.

Levy, J. (1978). Lateral differences in the human brain in cognition and behavioral control. In P. Bauser & A. Rougeul-Bauser (Eds.), Cerebral correlates of conscious experience. New York: North Holland Publishing.

Liederman, J. & Kinsbourne, M. (1980). The mechanism of neonatal rightward turning bias: A sensory or motor asymmetry? Infant Behavior and Development, 5, 223-303.

Luria, A. (1966). Human brain and psychological processes. New York: Harper & Row.

Messick, S. (1984). the nature of cognitive styles: Problems and promise in educational practice. Educational Psychologist, 19, 59-74.

Myers, R. & Sperry, R. (1958). Interhemispheric communication through the corpus callosum: Mnemonic carry-over between the hemispheres. Archives of Neurology and Psychiatry, 80, 298-303.

Ornstein, R. (1970). The psychology of Consciousness. New York: Harcourt Brace

Jovanovich.

Penfield, W. & Roberts, L. (1959). Speech and brain mechanism. Princeton, N. J.: Princeton Univ. Press.

Sackheim, H. A., Greenberg, M. S., Weiman, A. L., Gur, R. C., Hungerbuhler, J. P., & Geschwind, N. (1984). Hemispheric asymmetry in the expression of positive and negative emotions: Neurological evidence. Archives of Neurology, 39, 210-218.

Sperry, R. W. (1961). Cerebral organization and behavior. Science, 133, 1749-57.

Sperry, R. W. (1974). Lateral specialization in the surgically separated hemisphere. In Schmitt, F. O. & Worden, F. G. (Eds.), Neuroscience, Third Study Program. Cambridge, Mass.: MIT Press.

Springer, S. P. & Deutsch, G. (1989). Left Brain, Right Brain. New York: W.H. Freeman & Company.

Stellern, J., Collins, J., Gutierrez, B. & Patterson E. (1986, January). Hemispheric dominance of native American Indian students. Journal of American Indian Education, 8-18.

Stice, C., Bertrand, N., Lender, D. & Dunn, M. (1989). Personality types and theoretical orientation to reading: An exploratory study. Reading Research and Instruction, 29 (1), 39-51.

Torrance, E. P., Reynolds, C. P., Riegel, T. & Ball, O. (1977). Your style of learning and thinking, forms A and B: Preliminary norms, abbreviated notes, scoring keys, and selected references. Gifted Child Quarterly, 21, 563-573.

Torrance, E. (1980 Form C-Your Style of Learning and Thinking. Interpretation report, Department of Educational psychology, Athens, GA: University of Georgia Press.

Travarthen. C. (1984). Hemispheric specialization. In I. Darian-Smith (Ed.), Handbook of Psychology. Washington, D. C.: American Psychological Society.

Travarthen, C. (1993). Brain science and the human spirit. Brain, Culture, & the Human Spirit. Lanham, Maryland: University Press of America, Inc.

Vygotsky, L. (1931). cited in Marcel Danesi and Anthony Mollica, From right to left : A "bimodal" perspective of language teaching. The Canadian Modern Language Review, 45 (1), 76-90.

Weisenberg, T. & McBride, K. E. (1935). Aphasia: A clinical and psychological study. New York: Commonwealth Fund.

Wernicke, C. (1874). Der Aphasische synpotementkomplex. Poland: M. Cohen & Weigart.

Zook, J. A. & Dwyer, J.H. (1976). Culture differences in hemisphericity: A Critique. Bulletin of the Los Angeles Neurological Societies, 41, 87-90.

Zurif, E. B. & Bryden, M. P. (1969). Familial Handedness and left-right difference in auditory and visual perception. Neuropsychology, 7, 178-187.

Table 1

Characteristics associated with each hemisphere

The Left Hemisphere	The Right Hemisphere
• Verbal	• Non-verbal, Visuo-spatial
• Sequential, Temporal, digital	• Simultaneous, spatial, analogical
• Logical, analytical	• Gestalt, Synthetic
• Rational	• Intuitive
• Western Thoughts	• Eastern Thoughts

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