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Chapter III

REVIEW OF RELATED STUDIES

The present study was intended to identify the hemispheric preferences of neurological teaching and learning of teachers and students at primary level. With the major theme in mind the investigator made an attempt at reviewing the important research studies that have direct bearing on the theme. The studies reviewed were categorized under the following sub heads such as

i. Studies Related to Importance of Brain Compatible Research.

ii. Studies Related to Importance of Brain Compatible Research.

iii. Studies Related to Cerebral Asymmetries.

iv. Studies Related to Asymmetries Related to Temporal Lobe.

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x. Studies Related to Hemisphericity and Functional Integration between the two Hemispheres.

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xv. Hemisphericity and Tourette’s Syndrome.

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xx. Studies Related with Learning Styles in Education

xxi. Importance of Cognitive Learning Style in Education.

xxii. Studies Related with Hemispheric Preference Learning Style

3.1. Studies Related to Importance of Brain Compatible Research.

Connell (2006), concludes that the neurological style influences the way the teachers teach and helps the students to explore their individual learning preferences. She also remarks neurological styles influence the way of teaching and learning. She opined that hemisphericity preference will negatively affect the learning style of learners whose hemispheric preferences are markedly different from teachers.

Kovilak (2006), have been identified nine brain compatible elements in the integrated thematic instruction. The integrated thematic instruction model designed by her includes meaningful content, choices, movement to enhance learning, environment, adequate time, collaboration, immediate feedback and mastery at application level.

McGeehan (2005), conducted research on brain based learning and the key points in her findings is that emotion in the gate keeper to learning, intelligence in the function of experience and the brain stores most effectively what is meaningful from the learner’s perspective.
Allen (2003), points out that the stimulation of important centers of brain, help to improve the function of brain cells. He also opines that brain’s different skills do not compete with each other for space or resources, but rather support one another.

Konecki et al. (2003), opines that brain compatible learning will maximize learning, limits the stress of children’s ability to learn, establishes immediate connection to the real world which will increase learning and development, encourages active processing needed to keep connections and foster memory.

Sousa (2001), Suggested that specific brain function are not fixed at birth as previously thought. Brain based research focus on the brain as an organ of thinking and learning. Brain based learning offers a constructivists active model which encourages student involvement in learning.

Caine and Caine (1991), has been conducted much research in Brain based learning and identified three condition for complex learning to occur, there must be relaxed alertness - a low threat, high challenge state of mind, orchestrated immersion - a multiple, complex, authentic experience and Active procession - making meaningful connections through experience processing. He proposed that brain compactable learning theory is based on the structure and function of the brain and hence it is a comprehensive approach to instruction based on how current research in neuroscience suggest that the brain learns naturally.

Van et al. (1984), studied the effect of three types of brain based instructions on mathematic achievements and attitudes of second grade students. The study
explored the effect of a left-hemispheric, right hemispheric or integrated teaching approach of students achievement and attitudes.

3.2 Studies Related to Cerebral Asymmetries.

Schachter (1997), opines that approximately 70% of the normal population share a particular pattern of cerebral asymmetries. He argues that specific intrauterine factors such as testosterone and immune system elements could disrupt genetically programmed neuronal migration and maturation, thereby interfering with the development of standard structural dominance, resulting in anomalous standard and functional dominance. Again if this disruption occurred late in foetal life, when the left hemisphere grows more rapidly than the right, left hemisphere function would be predominantly affected and hence, language function might be adversely affected, resulting in a rightward shift of language dominance, language based learning disabilities, or thought disorders.

Fleschsig (1908), noted that the left temporal plane posterior to the transverse gyri was more often larger than the right. Pfeifer (1936), pointed out that the planum temporale, which was posterior to Heschl’s gyri, was commonly larger on the left.

Heschl (1878), noted differences in the surfaces of the eight and left temporal lobes of human brain. He described transverse gyri and sulci on their superior anterior surfaces and noted they were different on the two sides. In addition, he observed that two transverse gyri were present more often on the right.
3.3. Studies Related to Asymmetries Related to Temporal Lobe.

Dorfsman (1997), reported that temporal plane is 2/3 longer in the left hemisphere than in the right hemisphere for most population. 70% of the people who lacks this asymmetry possess dyslexia.

Steinmetz et al. (1991), evaluated that left right asymmetry of planum temporale surface area using magnetic resonance imaging (MRI) and found that left plana temporale in twenty two out of twenty six right - handed subjects.

Von Economo & Horn (1930), reported that Heschl’s gyri was more often doubled an the right, observations that were confirmed by European and Japanese investigators.

3.4. Studies Related to Asymmetries Related to Frontal Lobe.

Albanese et al. (1989), measured the weight and surface area of the inferior frontal gyri and found that 63% of brains studied had leftward predominance of the anterior speech region (pars opercularis and caudal portion of the triangularis) and that 13% had right ward asymmetry, percentages that are intriguingly similar to those of the planum assymetries found by Geschwind and Levitsky.

Falzi et al. (1982), measured the surface of the pars opercularis and pars triangularis, which are in Broca’s area, and showed that the left frontal opercular region in the brains of right handers contains an average of 22% more infolded cortex than the corresponding region on the right.

Deuel and Moran (1980), measured the right - left differences on the frontal poles with CT scans and found larger right frontal poles. Further, men showed
greater degrees of asymmetries than women, and reversal of the typical asymmetries are more common in women than men.

Galaburda (1980), narrates area 44 (of Brodmann) a part of Broca’s speech area, is located in the posterior portion of the third frontal gyrus with in the frontal operculum and is identified by its unique pigmentation in lipofuscin stains. Area 44 was larger on the left hemisphere in 8 of 10 brains studied by Galaburda.

LeMay and Kido (1978), used Computerised tomography (CT) to measure frontal lobe widths. The frontal lobe was wider on the right than the left in 58% of right-handers, and the sides were equal in width in 30% and wider on the left in 12%. In an earlier study, in (1977), he found that forward protrusion of the right frontal bone in skulls and noted that this asymmetry correlated with CT-visualized lobar asymmetries.

3.5 Studies Related to Asymmetries Related to Occipital Lobe

Bear et al. (1986), measured the right-left differences of the occipital poles with CT scans and found larger left occipital poles. Further, as with frontal lobe asymmetries than women, and reversal of the typical asymmetries was more common among women than men.

Kertesz et al. (1986), found that the left occipital lobe was wider than the right in 90% of right handers.

Murphy (1985), measured the volume of striate cortex (area of 17 of Brodmann, primary visual cortex) in 31 serially sectioned human brains from Yakolev collection at the Armed Forces Institute of Pathology in Washington, D.C. In 24, out of 31 cases, the right striate cortex was larger, consistent with the known
right hemisphere dominance for visual stimulus localization. Sex and age (from 33 weeks gestation to 94 years) were not associated with variations in striate cortical volume.

Weinberger et al. (1982), also utilized the Yakolev collection and measured that in 32 out of 40 brains, the left occipital lobe volume was larger than the right. The asymmetries in fetal and infant brains were similar to those in adult brains.

LeMay and Kido (1978), used CT to measure occipital lobe widths. Among right handers, 75% had longer left occipital lobes and 90% had larger right occipital lobes. He also noticed the backward protrusion of the left occipital bone.

McRae et al. (1968), found that the left occipital horn of the lateral ventricle is usually longer than the right in right-handers. Strauss and Fitz (1980), studied the pneumo-encephalograms of 75 patients aged 5 months to 18 years. The occipital horn was longer on the left in 29 cases and longer on the right in 13 cases, consistent with a rightward asymmetry in mass of occipital brain tissue.

3.6. Studies Related to Asymmetries Related to Parietal Lobe

Habib et al. (1995), found leftward asymmetry of the parietal operculum with MRI, which, when present with convergent leftward planum asymmetry, strongly correlated with right-handedness.

Kertesz et al. (1986), found that the opercular parietal demarcation of sulci on MRI scan was sharper on the right side in 60% of right handers.

Eidelberg & Galaburda (1984), states, area PG, located on the angular gyrus and related to language function, is larger on the left in brains with a larger left planum temporale, where as area PEG, possibly clinically relevant to disorders of
attention and visuo-spatial functions and located on the dorsal tip of the inferior parietal lobule, is larger on the right.

Hochberg & LeMay (1975), demonstrates that two third of right – handed patients who under went cerebral angiograms had sylvian point angles that were over $10^0$ larger on the right than the left.

Geschwind (1972), concluded that arteriography may play a role in localizing speech and other brain functions.

Le May and Culebras (1972), found that coronal sections of carotid arteriogram through the posterior ends of the Sylvian fissures showed that the left parietal operculum was larger, and it is pressed the distal left middle cerebral artery downward as it exited the sylvian fissure. Further, the middle cerebral artery branches leaving the posterior end of the sylvian fissures are narrower in right handed people.

3.7. Studies Related to Language and Brain Asymmetry.

Floel et al. (2003), The language and the hand motor system are still tightly linked in modern man Pulvermuller et al. (2001), Rogalewski et al. (2003), narrated that in some animals an asymmetry of motor functions may be behaviorally adaptive. Today, the degrees of hand and language lateralization in humans are correlated, although right-handedness is not a precondition for left-hemispheric language lateralization.

Corballis (2003), suggested that, left-hemispheric language dominance may be a characteristic of the biological pre-adaptations for language rather than of the neural language system in modern man. It has often been proposed that the language
dominance of the left hemisphere evolved from its control over the right band, and may be a relatively recent evolutionary adaptation of the neural system of skilled movement and gesture.

Szaflarski et al. (2002), said that through the course of evolution the relation between handedness and language may have become weakened but the basic organizational principle was likely conserved.

Sousa (2000), suggests that the inter-individual variable of cerebral language lateralization indicates the degree of freedom with which the brain can instantiate language. This degeneracy poses a chance for the restitution of language function after brain damage.

Dorfsman (1997), described that the language areas in the brain are Broca’s area, Wernicke’s area and angular gyris. 98% of the total population and 2/3 rd of the left handed population have language functions in the left hemisphere. Others possess it in the right hemisphere. Among the hemispheres most activated one with analytical function, look at details and arithmetic functions is the right hemisphere. Right hemisphere is most activated during pattern identification, holistic and spatial perceptions.

Boroojerdi et al. (1996), demonstrated that the development of the asymmetry principle may date back to a time prior to the comparatively recent emergence of the human species. For the motor system, transcallosal inhibition presents an important mechanism to optimize performance. It serves to solve incompatibilities between sensori-motor functions of homologous hemispheric regions during limb movements or speech processing.
Netz et al. (1995), language-dominant hemisphere seems to exert more inhibition of the non-language-dominant hemisphere than vice versa.

Eberstaller (1884), demonstrated the existence of cerebral asymmetries and Paul Broca (1861), established a correlation between language and the posterior portion of the left inferior frontal gyrus.

Pieniadz et al. (1983), reports degree of language impairment and extent of resolution in patients with focal cortical lesions provide additional evidence that left–right asymmetries in language cortex have functional difference.

Ratcliff et al. (1980), found that patients with right hemisphere language dominance have atypical asymmetries in the sylvian branches of the middle cerebral artery. Eidelberg and Galaburda (1982), found that the left lateral posterior nucleus of the thalamus is commonly larger than the right.

However, an earlier study by Wada et al. (1975a), did not find significant left right asymmetry or infant - adult differences in relative inter hemispheric size of the frontal operculum.

Wada et al. (1975b), analyzed the brains of 100 adults and 162 infants and concluded that left planum temporale was larger than the right and there was a greater degree of asymmetry in the adults. They opined frontal opercular region contains part of Broca’s area, a region central to the expression of language.

Geschwind and Levitsky (1968), concluded that the planar asymmetries were consistent with functional asymmetries in the two hemispheres.
3.8 Studies Related to Gender & Cerebral Asymmetry

Spencer, Steel and Quinn (1999), more recent scanning studies indicate that gender differences in computational processing are minor and become even less important when the brain encounters higher mathematics.

Wishaw & Kolb (1985), reported less of the variance in anatomical asymmetry of the cerebral hemispheres can be associated with differences between males & females than with differences related to handedness.

Harshman. (1983), reported that females excel at both perceptual speed and visual memory, whereas males are better at perceptual closure & the disembedding of visual patterns from complex arrays.

Bryden (1982), concluded that majority of the verbal dichotic and verbal tachistoscopic studies show any sex-related effects indicate a greater degree of lateralization in males; on tests in both visual and tactile modalities.

Ustamsing & Holloway (1982), reported that posterior pact of the corpus callosum is significantly larger in females than males. There exists qualitative difference also.

Wada (1975), noted that more females than males exhibiting a reversed asymmetry pattern in planum temporale.

Mac Coby & Jacklin (1974), demonstrated that girls have greater verbal ability than boys and at the age of 11 years, the sexes begin to diverge. Girls are far beyond boys in receptive and productive language and on ‘high-level’ verbal tasks. But males excel in visual - spatial ability. On the test of recall and detection of shapes, mental rotation of two/three dimensional figures, geometry, mage learning,
map reading aiming at and tracking objects, and geographic knowledge males perform better on average than females. They also concluded that boys excel in mathematical abilities and are physically more aggressive than females.

3.9 Studies Related to Hemisphericity and Functional Integration between the two Hemispheres.

Berk (2002), suggests certain areas of the brain affect particular behaviours. In most of us, the left hemisphere of the brain is a major factor in language processing, and the right hemisphere handles much of the spatial - visual information and emotions.

Knech et al. (2001), point out that a non-lateralized, bilateral representation of language seems to exist without any obvious behavioral disadvantage because linguistic proficiency is influenced neither by the side, nor by the degree of language lateralization.

Byrens and Fox (1998), viewed that different areas of the cortex seen to have different functions, even though different functions are found in different areas of the brain, these specialized functions are quite specific and elementary. He also opined that to accomplish more complex functions, such as speaking or reading, the various areas of the cortex must work together.

O’Boyle and Gill (1998), Opines that females on average seem to show less hemispheric specialization than males. Before lateralization, damage to one pact of the cortex often can be over come as other parts of the cortex take over the function of the damaged area. But after lateralization, the brain is less able to compensate.
Byrnes & Fox (1998), views that the differences in the performance by the brain’s hemisphere, however, are more relative than absolute, one hemisphere is just more efficient than the other in performing certain functions. Nearly any task, particularly the complex skills and abilities that concern teachers, requires participation of many different areas of the brain in constant communication with each other. So he argues that practice of teaching to different sides of the brain is not justifiable.

Stanovich (1998), reports there is no mental activity that is exclusively the work of single part of the brain.

Miller (1997), concluded that repeated transcallosal transitions of neural impulses between hemispheres during complex linguistic operations were believed to decrease processing speed and efficacy.

Dorfman (1997), also opined that in higher order functions, people seem to use both their hemispheres.

Anderson (1995a), reported that many areas of the cortex are necessary in processing language. He stated that Broca’s area has a role in setting up a grammatically correct way of expressing an idea and Wernick’s area is necessary for connecting meaning with particular words. A person with a functioning Broca’s area but a damaged Wernick’s area will say meaning less things in a grammatically correct structure. Damage limited to Broca’s area, on the other hand, is associated with short, ungrammatical sentences, but words are appropriate.
3.10 Studies Related to Deferential Brain Functioning & Hempheric Specialization.

James & Marice (2005), concluded that students with right hemispere dominance exhibited high reasoning ability and while there is no significant difference between problem solving ability and left-right hemisphere dominance.

They assessed the effect of reasoning and brain hemisphericity on problem solving of the learners. They concludes that reasoning ability, hemisphericity and some selected demographic variables are determinants of problem solving ability among XI standard science group students of Palakkad District in Kerala. They also concluded that students with right hemispheric preference differ significantly in problem solving ability owing to the difference in certain selected socio-economic variables.

Corballis (2003), suggested that, left-hemispheric language dominance may be a characteristic of the biological pre-adaptations for language rather than of the neural language system in modern man. It has often been proposed that the language dominance of the left hemisphere evolved from its control over the right band, and may be a relatively recent evolutionary adaptation of the neural system of skilled movement and gesture.

Floel et al. (2003), The language and the hand motor system are still tightly linked in modern man. Pulvermuller et al. (2001), Rogalewski et al. (2003), narrated that in some animals an asymmetry of motor functions may be behaviorally adaptive. Today, the degrees of hand and language lateralization in humans are correlated, although right-handedness is not a precondition for left-hemispheric language lateralization.
Szaflarski et al. (2002), said that through the course of evolution the relation between handedness and language may have become weakened but the basic organizational principle was likely conserved.

Geschwind et al. (2002), proposes that cerebral lobar volumes in humans have a genetic component, pre and postnatal events can affect planum temporale asymmetry development and disrupt twin concordance in brain structure. He also added it is usually the right hemisphere which is the seat of unpleasant behaviour in the patients with disconnected hemispheres. He noticed that the patients with stroke in right side recover from the same recapitulates their language functions. He also noticed that when the visual and temporal area of the left brain get damaged the loss of capacity to reading words also get damaged.

Knech et al. (2001), point out that a non-lateralized, bilateral representation of language seems to exist without any obvious behavioral disadvantage because linguistic proficiency is influenced neither by the side, nor by the degree of language lateralization.

Deason et al. (2000) suggested that hemispheric asymmetries for different functions within an individual appears to be independent.

Knecht (2000), observed that language lateralization in humans follows a bimodal distribution. Majority of individuals are lateralized to the left and a minority of individuals are lateralized to the right side of the brain. However a biological advantage for either lateralization is lacking. He also concluded that neural substrate of human language is that some critical components are lateralized to one (usually
the left) side of the brain. However, they are also found in the right side, and in some individuals in both hemispheres.

Sousa (2000), suggests that the inter-individual variable of cerebral language lateralization indicates the degree of freedom with which the brain can instantiate language. This degeneracy poses a chance for the restitution of language function after brain damage.

Martin & Jones (1999), examined the visual identification of fragmented pictorial stimuli and found that, right handed people are quicker to identify left facing animals and vehicles and left handed people are quicker to identify right facing ones.

Springer and Deutsch (1998), pointed out that asymmetries in the function of the two hemispheres include differences in the ability to produce and understand language and differences in the ability to process complex spatial relationships, among the individuals.

Ivory & Roberson (1998), concluded that the left hemisphere is more efficient at processing or attending to information from cells with small receptive fields or information from high spatial-frequency modules, whereas the right hemisphere is more efficient at processing or attending to information from cells with large receptive fields or information from low spatial-frequency modules.

Chabrise Kosslyn (1998), suggested that indicated that specific-exemplar shape recognition and specific spatial-relations encoding exhibit right-hemisphere advantages, whereas abstract-category shape recognition and abstract spatial -relations encoding exhibit left-hemisphere advantages.
Miller (1997), concluded that repeated transcallosal transitions of neural impulses between hemispheres during complex linguistic operations were believed to decrease processing speed and efficacy.

Dorfsman (1997), evidenced from clinical support, opined that musicians enjoy music using their right hemispheric part and less talented in music enjoy(?! it with left hemispheric part. Trained musicians could recognize a melody with their right ear faster than that of left ear. Metaphors which use words are part of language and occupy the left hemisphere.

Boroojerdi et al. (1996), demonstrated that the development of the asymmetry principle may date back to a time prior to the comparatively recent emergence of the human species. For the motor system, transcallosal inhibition presents an important mechanism to optimize performance. It serves to solve incompatibilities between sensori-motor functions of homologous hemispheric regions during limb movements or speech processing.

Netz et al. (1995), language-dominant hemisphere seems to exert more inhibition of the non-language-dominant hemisphere than vice versa.

Objemmann et al. (1994), reported that stimulation of the right hemisphere disrupts the judgments of line orientation labeling of facial expressions and short term memory for faces, the effects coming exclusively from the temporal cortex a result consistent with the presumed role of this cortex in the visuo-spatial behaviour. Stimulation of the left hemisphere would have negligible effects on visuo-spatial functions. But it will accelerate production of speech.
Springer & Sally (1988), inferred that the right hemisphere of right handers have some lexico semantic capacity which is, least quantitatively and probably even qualitatively, different from that of the left hemisphere.

Chiarello (1988), proposed that right hemisphere is involved in the maintenance of alternative meanings of ambiguous words and phrases encountered during language comprehension. These alternative readings are available initially to both hemispheres, but at later stages of processing, the left hemisphere actively inhibits alternative meanings, which are there after available only to the right hemisphere.

Regard et al. (1986) viewed that the process of gathering meaning from written information is associated with left - hemisphere dominance. But Depending on the hemisphere stimulated two different reading processes are at work. ie, he suggests right hemisphere is sensitive to emotional aspect of the lexical meaning of words.

Gibson & Bryden (1983), by conducting dichaptic test concluded that subjects should a right - hand advantage for identifying letters and a left - hand advantage for identifying nonsense shapes.

LeMay (1982), conducted a study on lateral eye gaze and reported that right handed people usually been turn head and eyes to the right when solving verbal problems, but look up and to the left when solving numerical and spatial problems.

Glucksberg et al. (1982), suggested that right hemisphere is specific to metaphoric processing. i.e., the right hemisphere play a major part in responding appropriately on the basis of metaphoric equivalence once it has been understood.
Rasmussen & Milner (1977), have provided clear evidence of cerebral asymmetry and remarked that stimulation of the left hemisphere can block the ability to speak where as stimulation of the right hemisphere seldom does so.

Nachson and Carmon (1975), conducted somatosensory study and viewed that left hemisphere has a special role in sequential analysis, a capacity that would presumably be very important in the control of the complex movement.

Rudel et al. (1974), found that both blind and sighted subjects read Braille more rapidly with the left hand. He opined that since Braille patterns are spatial configuration of dots, this observation is congruent with the proposal that the right hemisphere has a role in processing spatial information not shared by the left hemisphere.

Sperry (1966), concluded that analysis is a dominant mental process of the left hemisphere, where as holistic and synthetic thought process are right hemispheric mental activities.

3.11 Studies Related to Cognitive Disabilities on Learning and Hemisphericity.

The findings of Geschwind and Levitsky (1968), have prompted research into the left - right asymmetries of language - related cortex in subjects with language based - disabilities such as dyslexia and other behavioural disorders.

3.11.1. Hemisphericity and Dyslexia.

Hynd et al. (1990), noted smaller right anterior widths and left plana temporale in ten dyslexics than in age - and sex-matched controls.

Drake (1968), opined anomalous structural dominance was associated with dyslexia.
Hier et al. (1978), found that 10 of 24 selected dyslexics had reversal of the usual asymmetry, and that this finding correlated with low mean verbal IQ scores.

3.11.2. Hemisphericity and Attention Deficit Hyperactivity Disorder.

Hynd et al. (1993), used MRI to evaluate the morphology of the head of the caudate nucleus in normal children and children with ADHD. Where as nearly three quarters of the normal children had a left ward asymmetry, 64% of the children with ADHD had reversed asymmetry because of a significantly left caudate nucleus.

3.11.3. Hemisphericity and Tourette’s Syndrome.

Peterson et al. (1993), found that in patients with Tourette’s syndrome, the usual leftward asymmetry of basal ganglia volume was lacking because the volume of the left lenticular region was reduced.

Singer et al. (1993), found a significant reduction in the left - right asymmetry for putamenal and lenticular region volumes in children with Tourette’s syndrome. Further the left globus palidus was significantly smaller in children with both Tourette’s syndrome and ADHD.

3.11.4. Hemisphericity and Schizophrenia.

Falkai et al. (1995), found a 20% reduction in the volume of the left planum temporale and a 20% reduction in the anterior-posterior diameter of the left planum temporale in the brains of 24 schizophrenic patients compared with age - and sex-mat - ched controls.

Pretty et al. (1995), point out that volume of the left posterior superior temporal gyrus correlated with the severity of the thought disorder.
Crow et al. (1989), conducted a postmortem study of brains of schizophrenic patients and found enlargement of the left temporal ventricular horn.

Shenton et al. (1992), found that right handed male schizophrenics had significant reductions in gray matter volume in the anterior hippocampus-amygdala, the left parahippocampal gyrus, and the left superior temporal gyrus.

3.12 Studies Related to Genetic Background of Hemispericity.

Le Grand et al. (2003), tight interactions between gene dependent pre specifications and epigenetic control are beautifully exemplified in the development of expertise for face recognition in the right hemisphere of human brains. Visual inputs is necessary for the establishment of face recognition competence.

Rogers & Johnsten (1999), proposes that individual asymmetry formation is determined by epigenetic factors, genes give an overall framework directing the influence of these epigenetic factors in a population. Genes seem to determine population asymmetries by different mechanisms: Genetically controlled morphogenetic events lead to positional asymmetries that direct the action of an environmental factor always in the same direction. Genes determine differences in developmental speed of the left and right hemispheres, causing left-right differences in the susceptibility to epigenetic factors the asymmetric expression of specific genes leads to left-right differences in the amount of neuronal substrate. Such endogenous left-right differences can be modified or even overridden by environmental factors.


3.13 Studies Related to Handedness and Hemisphericity.

Martin & Jones (1999), examined the visual identification of fragmented pictorial stimuli and found that, right handed people are quicker to identify left facing animals and vehicles and left handed people are quicker to identify right facing ones.

LeMay and Kido (1982), correlated frontal and occipital lobe widths in 165 patients. Among 80 Rights handers, 75% had longer left occipital lobes and only 9% had larger right occipital lobes.

Witelson (1980), found that 70% of left handers supposed to have language represented in the left hemisphere 15% in the right hemisphere and 15% bilaterally.

Baken (1973), argued that there is a high probability of stressful births. Among left handers, which increases the risk of brain damage and hence maintains the incidence of left handedness.

3.14 Studies Related to the Importance of Learning Style in Education.

Kumar (2000), suggested identification of the learning style preferences will be helpful for a teacher to design everyday classroom transactions. One the learner’s style of learning is identified, teaching strategies can be adjusted in accordance with the stylistic modalities of the learner. If the materials to be learned are reached to the learner through the preferred stylistic pattern for which the learner is predisposed, learning at that situation will be highly effective. I

Moustafa (1999), recommended teachers to identify the student’s preferred style of learning and take them into consideration when designing instruction and administer to provide training about learning style.
Hong and Lee (1999), concluded that parents can also help children to develop life long learning skills and can work directly with young adolescents in the areas of leaning style, in dependent learning skills, study skills and learning strategies.

Dunn (1991), views that a student’s learning style is claimed to be resistant to change. Instruction designed to accommodate a student’s style is preferable to instruction which attempts to change student’s preferences. He adds that achieving successful learning outcomes is largely a matter of learner and teachers capitalizing on the preference of the individual.

Price et al. (1991), suggests that learning style helps to predict and channelize the different levels and types of academic performances shown by students along with well established traits to form an individual style profile.

Park (1976), found that even when students were required to demonstrate understanding, they still showed differing strategies in the way tackled learning materials. Based on his Gandlemuller Taxonomy, he concluded that there are two based categories of learning styles, namely holist style and serialist style. He also opined that holist style is more suitable for learning in the humanities and serialist style, in the sciences.

3.15 Studies Related with Learning Styles in Education

Wapner (1978), suggested that cognitive development of cognitive teaching style/ cognitive learning style will enhance greater communication through the use of similar communication modes and greater mutual interaction between teachers and students.
Witkin et al. (1977), provided the most comprehensive analysis of the educational implications of cognitive learning styles. It highlights the importance of learning process rather than the teaching techniques and focused on pupil’s strength and weakness. They opines that behavioural correlates of cognitive style can be modified by education and training.

The reviewed studies explore the fact that hemispheric specialization of brain functions exists among human beings. Different anatomical differences existing in the left and right hemispheres, split-brain experiments of patients from neurological field and ethnographic studies support the notion that there exists functional specialization in brain function.

3.16 Studies Related with Hemispheric Preference Learning Style

Saleh (2009), in a correlation study between brain hemishpericity and academic majors and indicated that students from science, engineering and business area showed a left hemispheric dominance, while students from communication, law and nursing were also found to possess right brain dominance. The study indicated that students select their study subject that accommodate their cognitive styles.

Research has demonstrated that students are able to master new skills when they are taught with methods that are complimentary to their hemispheric preference. (Boyle & Dunn, 1998; Dunn, 1990)

Several studies have narrated that children taught through methods that matched their hemispheric styles achieved statistically significant test scores than that of the scores when they were taught with other teaching styles and methods. (Brennan, 1984).
Studies have demonstrated that hemispheric preference is associated with different careers and academic majors. (Kolb, 1979, Mc Carthy, 1996). Kolb believed people select majors/field based on the congruence between their norms of their learning field and learning styles. Kolb opined that people select their academic majors based on the compatibility between norms and hemispheric dominance. Thomson and Hanson.

Academic subjects like arts, humanities and architecture are subjects which require global, synthetic and spatial orientation which make them more suitable for right brain dominant students and science, engineering, and language are easy for left brain students who emphasize logical, mathematical, verbal and mathematical operations than the above group. (Hermann, 1982)

Lavach (1991), examined the brain hemispheric preference of students from different majors and reported that humanities students showed preference for right hemispheric preference and natural science students demonstrated left hemispheric mode. He added that social science group students showed preference for left hemispheric preference for left hemispheric dominance.

3.17 Studies Related with Teaching Style

Studies Related with Hemispheric Preference Teaching Style

Summary of Major Trends

The review of related studies indicates certain major trends relating to factors influencing the hemispheric preference for neurological teaching styles and neurological learning styles.
1. There results a clear relationship between hemispheric preference for neurological teaching and neurological learning, as evidenced by increased gain scores. The studies explored reveal the fact that hemispheric specialization of brain functions exists and also there exists differences in the functioning of left and right hemispheres.

2. There are many studies revealing the fact that students when taught through their hemispheric learning styles are performing better than that of other teaching styles and methods. That is to say, hemispheric preferences for neurological learning has great impact upon student outcomes.

3. The review of studies clearly establish the role hemispheric preference learning styles and neurological teaching styles on gender, locale and the functional integration between the two hemispheres.

4. A close examination of the review of studies reveals the fact that very few studies are reported in the Indian context and not a single study being reported from the Kerala scenario.

5. Thus the investigator feels herself satiated in the selection of a topic, where very rare attempts are made and that she hopes the present study, a path finder for the future researchers as this area.
References

