Research Paper Education

Neurocognitive Precept of Constructivism in Science Education

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ABSTRACT

Neurocognitive research from neuro-practitioners has attained a remarkable improvement and educational researches having constructivism in general and science Education in particular rose to give implications. As these two major areas attain certain research scope, the interface between these two areas would result in multidisciplinary research and in synthesizing holistic learning theories which can have the message to curriculum design,curriculum transaction, evaluation and scientific based strengths to practitioners.

Keywords : Neurocogntive model, cognitive neurososcience, zone of proximal development, & Biological heritage.

Educational research in future is to hold high priority from multidisciplinary approaches to establish and synthesize new theories. As to the past more being borrowed from Philosophy, Psychology and Socio-cultural strands, The sophistication made in Neural Science opens up new vistas for educational research from applied one to fundamental nature, and as the consequence a more comprehensive theory of human learning may be researched and standardized. On the other hand, the constructivist philosophy of science learning and teaching has already become a guiding model for instructional design which is more reflected in NCF 2005 (National curriculum frame work NCERT 2005) for school education.

It is to explore the interface between these two modern perspectives, which can pave way to arrive at Neurocognitive model of constructivist cognition by integrating evidence from cognitive (constructivist) and neuroscientific researches as empirical base. The aim of constructivism in education is to explore the unique person-defining attributes, not by reducing them to a set of materialistic axioms but rather to explore more deeply how wisdom from several different sources of scholarship can enlighten how meaning is constructed from experience.

As philosophy about learning, constructivism proposes learning need to build their own understanding of new ideas, adverting to this stilt of constructivism, focus on every individual learner as a unique entity to build his own understanding, there is a complementary and dynamic relationship among our biological heritage, socially constructed culture and individually constructed personalities poses the quest, how in the future one can better maximize his capacities to fulfill biological and cultural heritages as increasingly and intelligent human being.

The biological heritage (physical and physiological) is a less focused area of Educational research, though it began well before the emergence of social groups to explore and construct personal identities.

The lacking focus on one or a few the sight of remarkable generative capacity of human thought, creativity and epistemology are let unexcavated. Current advances by cognitive scientist and science education are beginning to make insightful of Neurobiology to learning. The field of Cognitive, Neuroscience may offer helpful insights for all stakeholders of Education. It is a wide filed embracing rich kinds of experiments and approaches. Some of the data collecting mechanism in Cognitive Neuroscience are Biochemical assay, Autopsy, Single Cell Spike Recordings, Position Emission Tomography (PET),Thermal imaging, functional Magnetic Resonance Imagining (fMRI) Electroencephalograph (EEG) and Magnetoencephalograph (MEG).

Cognitive Neuroscientific explorations can answer the following some eternal questions that pose challenge to teachers at all the time of schooling.

1 Why do some children lag behind the others in learning?
2 Is intelligence a genetic heritable component? and
3 Why do males and females appear to think differently?

Cognitive Neuroscience reveals that no two human brains are identical and constructivism as a philosophy lays that each unique individual need to build their own understanding of ideas which do have message that uniqueness of each child in cognitive behaviors such as learning, memory, intelligence, emotion remembering and forgetting,are fundamental to learning

Neurocognitive Bases of Constructivism

Modern Neurocognitive views have departed from behaviorist thought of learning to more cognitive information processing paradigms that recognize the central role of internal organizing states in cognition.

Current neurophysiological research also clarifies a distinction between learning based on conditioning through reinforcement, in contrast to higher cognitive process, critical thinking and communication. Critical thinking and constructivist approaches to learning maximize the internal function of the neocortex the biologically most recent cerebral elaboration of the brain (Anderson 2009).

A constructivism based cognitive model combines elements from cognitive science, and Neurophysiology. The brain continuously engages in constructive activity either internally initiating interactions among functional modules to self regulate and initiate new internal states or by mobilizing internal representation to actively perceive and incorporate incoming sensory experiences into existing system of logic and knowledge

networks. The constructed interpretation may result in further dynamic sensory information processing through redirected attention or manipulated responses leading to further information intake and processing. While the entire brain acts as a coordinated information processing unit, variations in activity occur within and among functional modules.

Socio – cultural base of Neurocognition and Constructivism.

Knowledge construction is mediated through social interaction whereby linguistic communities, often with a common cultural heritage, share information to arrive at a consensus explanation of experiences. In the words of Vygotsky (1961), Cognitive development assisted by the role of language in mediating transitions from earlier developmental stages to later ones. His concept of Zone of proximal development is a developmental transitional stage where there is a potential to move into a higher cognitive state, mediated through languages is essential by engaging the learner in challenging discourse that would construct knowledge.

Since cognitive representations are contextually bound and embedded in prior experiences, cultural and social heritages are intimately involved in such higher brain functions.

Avoiding bias in Neurocognitive manipulations

To avoid cultural biases in describing brain functions it is important to begin with the most reductionist categories of function that may serve as the foundation to emerge out, for cultural effects in neurocognitive activities. Hence, to begin with the biologically most basic building blocks in describing the hierarchical functioning of the brain is fundamental. Beginning with highly derived categories pose the problem of certain cultural imaginary bias, each social learning environment produces different expressions of the cognitive functions build upon basic genetic operations.(Functional invariants of Piaget) Through maturation and enculturation, the individual constructs adaptively appropriate cognitive functions emerging from the genetically based operations. These genetically based operations are free from culture biases

Implications for science learning

The following are the Implications for Science Learning.

1. Close attention to be given to arrange learning environments to promote effective individualized cognitive development of basic operations.
2. Learning in a culturally appropriate context to help the learner to build higher order thinking that are mutually supportive and social contexts where the learner will be an active participant.
3. Age relevant curriculum development and as the consequence stressful- schooling can be changed into successful - schooling.
4. The better up in basic operations such as signification/ categorization, equivalence judgments, ordinal relations and proportional relations through constructivist instruction enhances higher order thinking in Science and Mathematics.
5. Transactional curriculum can be revamped into transformational curriculum, that is when the basic function of brain are well-flourished (extent to which it can be flourished is to be ascertained by Neurocognitive research) and placed in conductive learning environment (scaffolding on the basic operational skills) the ease of higher order skills development is ascertained.
6. Neurocongnitive perspective on creativity may involve mobilization and seamless transitioning among major representational and active centers of the brain, instruction be designed to promote creativity by mobilizing diverse motor and cognitive representations of experience in memory including a capacity to switch flexibly among a variety of sensory and motor representations of experience when analyzing information .

CONCLUSION

Major shift from rote learning to rational learning become the centre of gravity in all educational research approaches, it is to be encouraged to get a deeper understanding how constantivism works, and the philosophical postulate of knowledge construction can be investigated empirically through modern advancements in Neurocognitive field. Neurocognitive investigation could help in the educational stakeholders to redesign curriculum, revised attempt to classroom interaction and educational administration. A thorough investigation of neurocognition could open a new academic discipline encompassing the spheres and interface of neurocognition and constructivism.

REFERENCES

• Anderson, O.R, (2009) The role of knowledge network structures in learning scientific habits of mind : Higher order thinking and enquiry skills | • Anderson, O.R, Mangles J. & Furman, M, (2006) Neurocognitive correlates of science learning: Information networking in memory and recall of quantitative data. | • Anderson, O.R, (1999) Neurocognitive bases for Constructivism in Education. | • Bentley, M.L, (2007) Teaching constructivist science K-8: nurturing natural investigations in the standards-based class room. • Bhaskar, K. ,Sivakumar , P, (2007) Effectiveness of Constructivist approach on the acquisition of Science Process Skills among secondary level students' – unpublished M.Phil., Thesis, Alagappa University Karaikudi. | • Bransford, J.D Brown A.L. Cocking R.R (EDS) (2000) How people learn: Brain, mind, experience and school. | • Davis, P.L,. Rose, J.D, (1999) Assessment of cognitive development in adolescents by means of neurophysiological tasks. | • Fink .A., Grabner, R.H., Benedek, M, Reishofer, G, Fally, M., Neuper C., Ebner, F, Neubauer A.C. (2009) The creative brain : Investigation of brain activity during creative problem solving by means of EEG and fMRI: Human brain mapping.