Contribution ID: **58** Type: **Oral Presentation**

A CLASSIFICATION SCHEME FOR BASIC PHYSICS CONCEPTS: LEARNING AND THINKING FROM NEURODEVELOPMENTAL SCIENCE PERSPECTIVE

Friday, 5 October 2018 08:50 (20 minutes)

During structured actions on an event in physical-sociocultural (PSC) environments, peripheral neurosensors capture patterns and changes in variety of PSC-environmental energies and convert into electric signals. These signals travel through specified neural paths to various brain areas where they persistently fire neighboring neurons to form neural circuits by synapsing with them. A neuron "persistently firing" to synapse with the other neurons is called neural learning, which follows specific rules. The persistent firing depends upon the level of neurotransmitters, which are responsible for emotions. The paper draws an analogy between the neural and electric circuits.

The earliest synaptic connections are found around 5 weeks and simple neural circuits are observed between 18-22 weeks of gestation age. After formation, the neural circuits continue to modify owing to further relevant sensory experiences. The biochemical traces the signals leave in the circuits during the formation and their modification is storage of learning, which is memory.

Structured relations are associated in real time emotional context to the active neural circuits through a self-regulating, holistic "structured" process that reaches a level of equilibration with its environment, and does not further undergo genetic change. The "structure" and its development are the result of probabilistic epigenetic process triggered by the environmental affordances for the purpose of survival. We begin learning to associate since birth and continue thereafter throughout lifetime. These associations lead to uni-and multimodal-associated learning. The structured process, which is called "thought process," transforms external structured actions into a particular kind of internal structured relations, which are "thoughts" and these are internal representations of the events. Such thoughts are expressed using semiotics, which include meanings and feelings. The thought process, which is learnt, and the thoughts continue to undergo nonlinear developmental changes owing to the new associations to the continuously modifying neural circuits that result from further relevant sensory experiences. The new thoughts thus generated are hierarchically more complex than the previous ones.

This paper utilizes Fischer's Developmental Model to explain how simpler thoughts transform into complex thoughts, including how the thought processes also undergo developmental changes.

Using the Fischer's model, this paper analyzes basic physics concepts to classify them into a hierarchically complex classification scheme. The paper proposes a mechanism for how a physics concept is associated to a set of patterns in the information that corresponds to the patterns in the event, and how simpler concepts develop into more complex concepts. Furthermore, it explains what transformation rule develops a set of simpler concepts into a particular complex concept, and how the "newly" developed complex concepts relate to the "prior" simpler concepts, as well as how to identify the sets of required patterns from vast database of information in order to associate a concept. The paper argues that this classification helps develop student skills to learn how to develop complex physics concepts from simple concepts as well as how to help students to identify sets of required patterns from the sensory information to associate with a concept.

Apply to be
 considered for a student
   award (Yes / No)?

No

Level for award
 (Hons, MSc,
   PhD, N/A)?

N/A

Primary author: Prof. CHEKURI, Nageswar Rao (Woodbury University)

Presenter: Prof. CHEKURI, Nageswar Rao (Woodbury University)

Session Classification: Parallel Session 2

Track Classification: Track D - Teaching and Learning of Physics Concepts