IMPACT OF NEUROSCIENCE IN CLASSROOM LEARNING

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Abstract: Neuroscience has provided us detailed picture on the basis for learning which has been applied in the arena of teaching learning process. A better understanding of neuroscience helps the educators into self-referential networks which may improve our understanding of the learning process. Brain-based learning attempted to link neuroscience and education. Neural basis for metacognition may encourage the development of new perspectives that may help us to motivate students to learn about their own learning processes in a teaching learning situation. Students have their natural differences in brain function and behavioural traits just as they have differences in academic skills and personalities. By understanding how the brain develops and works and how this impacts students' behaviour in the classroom, educators gain valuable insight into students' strengths, weaknesses, interests, learning styles, and behaviour and are better able to cultivate and foster a positive learning environment.

Index Terms- **Neuroscience, Learning, Memory, Meta Cognition**

I. INTRODUCTION

Brain based learning refers to the role of modern imaging and electromagnetic technology in studying how the brain functions under a cognitive load and its potential application to the classroom. There has been a great deal of work done in the area of brain imaging. It is difficult to collaborate the intersection of education and neuroscience research because the combined discipline encompasses both the activity of microscopic neurons and the complex social interactions of teachers and students in a classroom. There are three major objectives in classroom learning which are optimizing, generalizing and integrating the subject matter. These objectives may be characterized by practical importance, relationship of existing educational and cognitive research, being infeasible to address based on behavioral experiments alone. The focus of the neuroscientific research should be on the brain functioning before, during and after learning.

However, neuroscientific knowledge has its own limitations due to the complexity of brain function. The most effective way for cross-disciplinary research in improving student attainment lies in applying neuroscience to classroom learning. Optimization, generalization & integration are three main aims in neuroscience. Optimization refers to improve an existing intervention to achieve maximal results. Generalization refers to adapt an effective intervention in one domain for application in a different domain or setting. Integration refers to take one or more techniques to combine them into a more comprehensive intervention. A particular technique may be optimized by determining the combination of parameters i.e., length of study session and timing of exams. A particular intervention may be generalized to different contexts or domains, based on the attributes of the neural processes underlying the learning of a particular skill. Finally, two or more interventions may be combined into a single intervention, resulting in a technique that is optimal from both a within-lesson attention perspective as well as long-term retention of memories.

A depiction of how neural processes are composed to generate high-level academic abilities. At the bottom-most level are neurons and processes in which they are directly involved. Emerging from the interaction of these basic elements are higher-level (but still abstract) cognitive processes. These processes are applied in combination to tackle academic problems.

II. THEORETICAL AND CONCEPTUAL FRAMEWORK OF BRAIN IN LEARNING

Neuroscience is on the vanguard of producing research of increased quality and applicability to education. Functional neuroimaging gives us insight into what circumstances and sensory input most successfully promote the brain's acquisition of new knowledge. Among those insights is evidence of increased metabolic activity in identifiable networks neural networks when information is encoded into memory, when memories are retrieved, and when executive functions use is associated with increased neural circuit activity in the prefrontal cortex.

Learning is a natural function of the brain. The brain responds to stimuli and collects information which is further processed. John Bransford (2003), a researcher in brain-based education, believes that the main goal of education is to help students to develop intellectual tools and learning strategies. The brain is made up of billions of nerve cells called neurons. When the neuron gathers information, it gives rise to dendrites. Dendrites constantly scan information because the very nature of brain is to learn. When neurons repetitively communicate with each other, a neural network is formed (Springer, 2002) and a pattern is repeated thus increasing the potential of the brain to learn. The brain is always searching for meaning from gathered information and stimuli. These demands to make subject interesting so that the brain will be excited to gather and process information and learn.

2.1. Brain based learning

All sensory inputs gets sorted, prioritized, processed, stored or dumped by the brain. The brain has three main parts: the cerebrum, the cerebellum and the brain stem. The largest most highly developed portion of the brain is cerebrum. It is made up of billions of nerve cells and is divided into two hemispheres. The both side of the cerebrum controls each other. It is responsible for higher order thinking and decision making functions. The cerebrum is made up of four lobes. These are occipital, frontal, parietal and temporal lobes. The occipital lobe is responsible for vision and reading. The frontal lobe is involved with purposeful acts like judgment, creativity, problem solving, abstract thought processes, and coordination of movement and planning. The parietal lobe is responsible for processing higher sensory and language functions. The temporal lobe is primarily responsible for hearing, memory, music, emotions and meaning. The cerebellum helps in balancing, posture, cardiac and respiratory activities. The brain produces electrical signals which are transmitted by neurons throughout the body. Learning is a connection between the brain cells and the experiences of an individual. Every new experience a person encounter actually alters electrochemical wiring of the neurons. The more novel and challenging stimuli will be able to activate learning.

The Brain Based Learning is also called as brain compatible learning. It is based on the assumption that brain naturally learns best (Slavkin, 2004).Brain based learning depends on the structure and function of the brain. Learning takes place when one neuron communicates with other neuron. When these neurons repeatedly communicate with each other, a neural network is formed and a pattern is repeated, thus learning takes place. (Springer, 2002). Brain based learning is helpful to make connections and retain new information. Brain based learning transforms the student from passive recipients of information to active participants in the learning process. It engages the emotions of the students, provides enriched environment, actively process the information, makes meaning and takes maximum participation of learner with high challenge and low threat. It emphasizes contextual learning and engages learners in decision making, forming cooperative groups, locating resources and applying the knowledge. In an enriched environment, learning can be enhanced. Creation of authentic learning situations increases the brain's ability to make connection and retain new information.

2.2. The Function of Brain related to Academic abilities

The brain is composed of grey matter and white matter. The individual regions of the brain show specialization for particular tasks, such as visual processing, numeric processing, etc. Many real-world activities require the integration of neural activity and this information from different parts of the brain is transmitted by the white matter connections. A change in behaviour or new knowledge indicates a physical change in the brain. This may be a change in synaptic strength or through the growth of new neurons (Murphy et al. and Vukovic et al.), or changes in the neurons themselves. Changes may take place in the grey matter, the white matter or both.

Multiple neural processes is the basic units of conscious cognition, such as selective attention, symbol processing, working memory, pattern recognition and abstract problem solving. These skills may help in different 'academic abilities', such as critical reading, writing, higher mathematics, social interactions, long-term planning and decision-making, etc.

Cognitive performance: It is behaviorally measured by both accuracy and reaction time. The progression from novice to expert is indicated by an improvement in one or both measures.

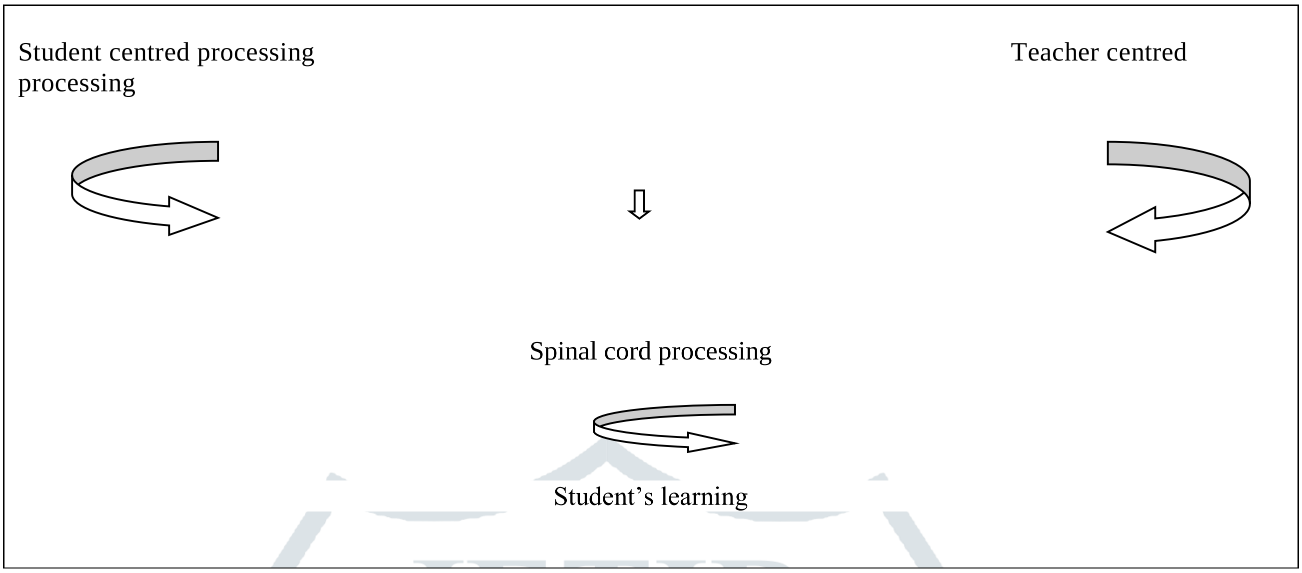
1.1.1 Optimisation. A comparison of activation signatures between novice and expert on a task may show that the same regions are activated in the same order, but with shorter (and/or longer) times spent in each. Activation is the result of automation or better cognitive techniques. This information may be used to adapt an intervention to focus on the acquisition of the relevant factors of expert performance as distinct from novice performance.

1.1.2 Generalisation. Functional activation tasks can lead to generalisation by finding related patterns in terms of timing and regions of brain involved. An intervention improves proficiency in a task which resembles or overlaps with that of another task, it is reasonable to investigate whether the benefits of the intervention transfer to the other domain.

1.1.3 Integration. The integration may be task-specific or more general in the sense of combining task-specific considerations with approaches to structure lessons to align with long-term memory storage. Furthermore, when the intervention is considered as a programme taking place over several weeks, the improvements in the spatial element of the task may occur from leaving longer gaps between interventions and incorporating extra testing. Any of the potential outcomes from collecting activation will eventuate, as both the external environment and the internal workings of the brain are complex; however, the path to address the three objectives is more rigorous in comparison with hypotheses based on behaviour alone.

1. Optimisation. The information adapts an intervention to focus on the acquisition of the relevant factors of expert performance as distinct from novice performance. The intervention may be refocused based on those observations to change the level of visual stimulus or to split the task into visual and non-visual subcomponents.
2. Generalisation. An intervention improves proficiency in a task which resembles or overlaps with that of another task, it is reasonable to investigate whether the benefits of the intervention transfer to the other domain.
3. Integration. The integration may be task-specific or more general in the sense of combining task-specific considerations with approaches to structure lessons to align with long-term memory storage.

Figure 1: The System of Teaching: Brain-based learning attempted to link neuroscience and education.



III. CRITICISM OF EDUCATIONAL NEUROSCIENCE

A significant impediment to the use of neuroscience in education is that much neuroscientific knowledge is far removed from classroom interactions. As such care must be taken in the choice of intervention and the framing of the corresponding neuroscientific investigation, and cognitive psychology research must be incorporated. Fortunately, as neuroscience research and technology continues to advance the gap will lessen. There are at least two important criticisms of educational neuroscience: some facets of neuroscience are not relevant to some facets of classroom learning; and learning disorders such as dyslexia and dyscalculia have relatively less relevance to typical classroom situations. This paper expands on view of a pragmatic framework for applying neuroscience to existing classroom learning.

IV. CONCLUSION

Experience will continue to have the leading role in education research, but the input from neuroscience provides an opportunity to increase the scope and benefit of effective interventions. Neuroscience research will have greatest impact when it builds upon the wealth of existing educational research into effective learning. Here we argue for a narrow focus on optimising, generalising and integrating existing interventions at the cognitive level. Neuroscience has direct impact on other important aspects of student attainment and education. Brain-based education is not a panacea nor magic bullet to solve all of educational problems .The organisation and function of the brain may have relevance to questions of class size and any intervention must be sensitive to the social and cultural aspects of a particular learning environment.

Expertise may be obtained in a variety ways; brain activity provides a measure of temporal and spatial changes that underlie successful (or unsuccessful) educational attainment that is more fine-grained than that achievable by behavioural testing alone. Students are active participants in learning and they have clearly defined goals. This result appears to generalise across domains and would seem to integrate with other, more domain-specific approaches to teaching. To build on such insights with the intention of achieving maximum results, wide applicability and the best of all worlds, the complex social activity of human learning in real environment must be linked to the fundamental process that result in physical changes in the brain. The neuroscience and education argument attempts to link learning, particularly early childhood learning, with what neuroscience has discovered about neural development and synaptic change. Neuroscience has discovered a great deal about neurons and synapses, but not nearly enough to guide educational practice. Currently, the span between brain and learning cannot support much of a load. Too many people marching in step across it could be dangerous. It already is helping us solve educational problems and design better instructional tools. Cognitive psychology, in the hands of cognitive neuroscientists, is also fundamental to our emerging understanding of how neural structures support and implement cognition functions. We should attempt to develop an interactive, recursive relationship among research programs in education, cognitive psychology, and systems neuroscience. Such interaction would allow us to extend and apply our understanding of how mind and brain support learning.

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