

INTRODUCTION TO EDUCATIONAL NEUROSCIENCE

COURSE OVERVIEW: The course introduces several concepts of neuroscience and its application in the field of education. It encourages an understanding of the human brain and its functions with respect to learning, It also enumerates the deficits in educational performance due to different anomalies of the brain. Finally it highlights the role of technology in education – its implications in improving the teaching – learning context and creating a better educational environment.

COURSE OBJECTIVE: This course aims to develop the skills to undertake a critical approach to making connections between neuroscience and education. To introduce students to the use of technology for learning in changing educational contexts; to help them use digital technologies for Design and integration of technology into teaching and learning.

COURSE CONTENT:

Theory: Introduction to Neuroscience and educational neuroscience, the developing brain, neuroimaging methods, cognition and information processing, attention and executive control, learning brain, cognitive load, working memory, , creativity and imagination, problem solving and Decision making, social cognition, affective processes in learning, language learning and literacy, numeracy and mathematics learning, Attentional problems and Learning Problems, Cognitive assessment and use of technology, challenges and important issues in education, important social and theoretical debates impacting use of technology in education.

MODULES:

Unit I: Brain in Education – 5 lectures

Introduction to Neuroscience and Educational Neuroscience

The Developing and the growing Brain – CNS, ANS, Cortical and subcortical areas involved in cognition and emotion

Neuroimaging methods: EEG, MEG, fMRI, PET

Unit II: Cognitive processes and Education – 18 lectures

Cognition and information processing: brain and cognition, information processing theories, problems in information processing, Intelligence and cognition, educational implications

Attention and executive control: Types of attention, executive function, prefrontal executive function in children, academic achievement and executive function, attention in classroom, technological aids for evaluation, use of technology to sustain attention in classroom, other learning platforms

The learning brain: Individual brains, Hebb's model of synaptic plasticity, multimodal processing, learning from multiple representations, cognitive load, Implicit versus explicit knowledge, metacognitive and regulative skills

Working memory: Theories, brain and memory, assessment, tapping the working memory in the classroom, use of technology for aiding working memory

Creativity and Imagination: Fluid analogising, Creative Intelligence, Imagination. Applications in the educational setting.

Decision making and Problem Solving – Organisation of conceptual knowledge in the brain, theories of problem solving, use of algorithms and heuristics in classrooms, decision making in MCQs

Social Cognition and social learning by observation – Bandura's social learning theory, Learning through imitation in classroom, mirror neuron systems, designing instructional visualisations for the teaching

Affective Processes in Learning – Emotion and education, temperament, emotion regulation, role of emotion in learning and memory, role of anxiety in learning and academic performance, assessment tools, use of technology to aid assessment and emotion regulation

Unit III: Language and Mathematics – 6 lectures

Language Learning and literacy: Phonological development, syntactic development, neurobiological maturation, second language acquisition, language development deficits, developing alternative pathways, use of technology to develop language aids in education

Numeracy and Mathematics Learning – understanding of numbers and arithmetic, neural roadmap, Cerebral Bases of Number Processing and Calculation, individual differences in mathematical achievement, mathematical thinking, mathematical creativity, Dyscalculia, Educating the mathematical brain, role of technology

Unit III: Disabilities and management – 8 lectures

Attentional Problems and Learning Problems – ADHD, Dyslexia, Dyspraxia, Dysgraphia – role of brain, educational implications

Psychological assessment – I – Assessment of Learning Problems

Psychological assessment – II – Cognitive assessment and use of technology

Adaptive technologies for learning and cognitive training

Unit IV: Important issues in Educational Neuroscience – 4 lectures

Challenges in the use of technology for education: use of online platforms for learning and assessment, Technology mediated learning environment

Important social and theoretical debates impacting use of technology in education, role of the teacher

1. Recommended text books:

Mareschal, D., Butterworth B and Tolmie A. (ed) Educational Neuroscience (2013), Wiley Blackwell. West Sussex. UK.

Geake, J G. The Brain at School (2009). Mc Graw Hill Open University Press. Beerksire. England.

Jong, T. D., Gog, T. V., Jenks, K., Manlove, S., Hell, J. V., Jolles, J., Merrienboer, J. V., Leeuwen, T. V. and Boschloo, A. Explorations in Learning and the Brain (2009). Springer. NY. USA.

2. Reference books:

M. S. Gazzaniga (ed). The New Cognitive Neurosciences . Second edition. (2000). MIT Press.

Patten K E. and Campbell, S. R. (ed). Educational Neuroscience. Initiatives and emerging issues. (2011), Wiley Blackwell. West Sussex. UK.