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medunab@unab.edu.co  
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*Editorial*

# Focus on neuroscience: from synapses to education

Foco en neurociencia: de la sinapsis a la educación

Foco na neurociência: das sinapses à educação

**Mario Rosero-Pahi**  

mrosero671@unab.edu.co 

Cognitive and Translational Neuroscience Lab, Faculty of Health Sciences.  
Universidad Autónoma de Bucaramanga. Bucaramanga, Santander, Colombia

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In the last three decades, we have witnessed an acceleration of technological development in neuroscience, in parallel with remarkable methodological and conceptual achievements in the understanding of brain function. Complex analytical techniques and more precise instruments have enabled researchers to establish new causal relationships between neural dynamics and neurologic and neuropsychiatric disease states, learning and memory, sensory processing, cognitive development, affective states, decision-making and action. These advances have not only boosted the generation of innovative scientific knowledge in neuroscience, but have also contributed to the dissemination of neuroscientific knowledge across fields, including computational science, economics, and education.

One area in which the methodological and conceptual advances in neuroscience have opened new avenues is educational neuroscience. This emerging field seeks to translate research findings on neural mechanisms of learning into educationally relevant outcomes. In this special issue, MedUNAB presents a collection of papers highlighting some of the recent advances and future challenges in educational neuroscience.

Building upon the advances in cellular and molecular neuroscience, developmental neuroscience, cognitive neuroscience and education, the educational neuroscience has the potential to significantly improve our understanding of the neurophysiological basis of learning in educational contexts and provide new opportunities for the development of effective educational practices. Remarkably, educational neuroscience has experienced a rapid growth in recent years. A significant number of educational neuroscience research institutes and training programs have been formed in recent years across the world. In addition, there is a continuing growth in the number of scholarly journals and scientific articles in the field. The progress the educational neuroscience continues to emphasize its huge potential. In this issue, Michael Thomas analyzes the relationship between neuroscience and education to delineate the borders of educational neuroscience. From a holistic perspective, he discusses the importance of direct-to-classroom application of neuroscience findings in order to improve educational outcomes. Furthermore, he outlines some key principles based on educational neuroscience that teachers should know about how the brain works and how these relate to principles of teaching. Finally, he discusses the contribution of educational neuroscience research to education, and provides an example of a successful application of neuroscience findings into the classroom.

Despite much progress, several methodological and epistemological issues must be addressed to advance

this field. Neuroscience and education are based on different epistemic objects, concepts and methods, which make integration of these two disciplines difficult. The methodological integration of applications of neuroscience in education, the interdisciplinary collaboration, and the effective translation of the technical language of neuroscience are some of the main challenges faced by educational neuroscience. Pedro Maldonado discusses how the knowledge of neurodevelopment and the biological diversity found in the classroom may play a key role in the design of educational strategies. He also analyzes the relevance and implications that educators have access to practical knowledge in neuroscience, including knowledge about the effects of sleep and exercise on learning. Finally, he offers his perspective on the methodological and epistemic gaps between neuroscience and education and their consequences for the development of educational neuroscience.

Our understanding of neurocognitive processes underpinning mathematics has been advanced significantly. For instance, analysis of brain activity patterns has revealed that numerical magnitude processing and phonological processing are crucial process for learning arithmetic. Notably, these insights are helping educators to develop successful educational interventions. Conventionally, it has been assumed that mathematics and decision-making are independent processes. Santiago Alonso challenges this view. Spanning from cognitive sciences to the neuroscience, he examines evidence about the unidirectional and bidirectional relationship between mathematics and decision-making, stressing on the role of numeracy and decision parameters. He concludes that there is a reciprocal influence between mathematical ability and decision-making skills. He also discusses some implications of this relationship for the future of mathematical education.