# Editorial. Educational neuroscience: An opened challenge

## *Editoriale. Neuroscienze educative: una sfida aperta*

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In the last few years, neuroscience research has started having an impact on education, by expanding the theories of learning with interesting implications also from an operational and practical point of view. Already in 2017, the Organization for Economic Cooperation and Development (OECD) suggested technology and neuroscience are two key areas of development for education, as the consideration of the learners' brain-body functioning can support the development of better teaching methodologies and technology-enhanced learning practices; however, the integration of neuroscientific research findings into educational theory and practice, avoiding direct and simplistic applications, is still an open issue.

In recent decades, a debate in the research community on this subject has been fostered by the contribution of John Bruer, where he stated that "*neuroscience has little to offer teachers in terms of information about classroom practice*" (1997, p. 4) and that cognitive psychology is the only viable bridge to link knowledge about brain functioning and educational theory. His point of view represents a critical response to the rapid proliferation during that time of misconceptions created by misreading or simplifying scientifically established data to justify the use of brain research in educational practice. Subsequently, several scientists have focused on clarifying how knowledge of brain structure and functioning can have a positive impact on the school system and educational field, arguing that Educational Neuroscience is not only a way to improve teaching but should aim to explain how students learn and how learning processes change our brain (Howard-Jones et al., 2016), and that different bridges need to be built to characterize this field of research "*with multiple methodologies and levels of analysis in multiple contexts*" (Ansari & Coch, 2006, p. 146). However, within this debate, it is also argued that the gap between neuroscience and education cannot be solved by supporting the interaction between neuroscientists and teachers or by building a "*bridge*" between different fields, but rather by the development of *evidence-based education* (Della Sala & Anderson, 2012); moreover, evidence that the brain changes in response to teaching may have no relevance to teachers, since the only relevant question is whether students learn and how learning is reflected in their behaviors (Bowers, 2016).

To date, these different theoretical viewpoints promote ongoing critical discussion among educational researchers and stakeholders.

An interesting recent review has attempted to better contextualize the contemporary aims of Educational Neuroscience using a thematic analysis of all the definitions and mission statements reported in the academic literature over the past three decades, identifying three key pillars: applying neuroscience knowledge to the classroom and to educational and instructional innovation; providing a strong and necessary interdisciplinary collaboration; and translating languages and methods historically belonging to different contexts and ensuring mutual interaction (Feiler & Stabio, 2018). Based on this evidence, the authors claim that Educational Neuroscience should be considered an independent field, covering the social and applied sciences and aiming to improve educational practices in real-world contexts: the intersection of knowledge from different research areas (such as cognitive and social neuroscience, psychology, etc.) and the investigation of how this knowledge can be applied to educational contexts may offer interesting new perspectives. The second feature that seems to strongly characterize Educational Neuroscience is the close collaboration between different professionals; however, despite international examples of interdisciplinary teams, there still persist barriers to the identifying of shared goals, probably related to the challenges of creating a common language among disciplinary fields and bringing demands arising from real learning settings into research laboratories (Tokuhama-Espinosa, 2019).

In light of this brief introduction, exploring how neuroscience findings can potentially be reflected in the design and implementation of effective pedagogical methodologies and innovative educational technologies remains a significant area for future investigation and reflection. In addition, the study of how Information and Communication Technologies (ICTs) can be enriched by evidence from science on the functioning of the brain and the human mind seems to be a significant research target. The present issue of Italian Journal of Educational Technology is evidence of current research efforts to explore the role of education and technology in supporting the "learning brain" and promoting innovative approaches to teaching and learning based on neuroscientific knowledge. The variety of approaches, methods and goals of educational neuroscience is evidenced by existing research projects and academic studies and is clearly represented in the following contributions.

We are pleased to open this special issue with the article "*Neuroscience in education: Not a recipe book*" by Roberto Cubelli and Sergio Della Sala, among the leading experts in the field. The authors argue against the straightforward and simplistic use of neuroscientific research findings in education and their views are especially relevant today, considering the still persistent prevalence of "neuromyths" - misconceptions about brain functioning- that negatively effects on several educational and training contexts, and in light of the existing debate briefly described above.

The second article "*Teaching to read: An interesting interface between neuroscience and education*" by Antonio Calvani, Paola Damiani, Sergio Miranda, Lorena Montesano and Luciana Ventriglia presents the results of a large experimentation aimed to verify the advantages and sustainability of a rigorous phono-syllabic program compared to programs that include marked traits of global and ideo-visual methods. The interesting evidence presented by the authors is also discussed in light of the prevalent teaching methods that, without any scientific basis, continue to proliferate and have a negative effect on school practices.

In the third article, "*On the utility of the P3 as a neuromarker of academic performance: A brief review"*, Adam Privitera summarizes previous papers on P3 component, an event-related potential (ERP), associated with a number of measures of academic performance, as well as a range of cognitive processes underlying learning; then, the author proposes the use of this robust neuromarker to enhance traditional assessment practices based only on self-report instruments.

The fourth contribution "*Neuroscience in the classroom: Making teachers learning visible*" by Sara Mori, Silvia Panzavolta and Alessia Rosa presents the results of research-training aimed at understanding how neuroscience can improve educational practices in natural settings and describes how teachers, started from

an online professional development course, were able to reflect on their teaching practice to implement new methodologies in the classroom.
In the fifth contribution "*Serious games for promoting active and healthy ageing and monitoring frailty in the elderly*" Sara Palermo provides a framework for understanding and developing ICT-IoT products for the elderly people in light of the potential role of serious games in enhancing health, empowering and habilitating cognition, promoting new skills, and fostering social inclusion.
In the last article, "*A theoretical proposal for the development of educators' preparedness in relation to educational neuroscience*", Spyridon Doukakis, Maria Niari and Chrystalla Mouza propose that the development of in-service and pre-service educator knowledge on Educational Neuroscience could be based on the five developmental stages and axis (*Recognize, Accept, Adapt, Explore and Advance*), adapting the TPACK framework.
In agreement with Dehane (2019), who argued that learning is our brain's greatest talent, a vital principle "invented" by evolution, we hope that the research community will continue to reflect on this promising field of multidisciplinary inquiry.

## 1. REFERENCES

Ansari, D., & Coch, D. (2006). Bridges over troubled waters: Education and cognitive neuroscience. *Trends in Cognitive Sciences*, *10*(4), 146-151. doi: 10.1016/j.tics.2006.02.007

Bowers, J. S. (2016). The practical and principled problems with educational neuroscience. *Psychological Review*, *123*(5), 600. doi: 10.1037/rev0000025

Bruer, J. T. (1997). Education and the brain: A bridge too far. *Educational Researcher*, *26*(*8*), 4-16. doi: 10.3102/0013189X026008004

Dehaene, S. (2020). *Imparare: Il talento del cervello, la sfida delle macchine*. Milano, IT: Raffaello Cortina Editore.

Della Sala, S., & Anderson, M. (Eds.). (2012). *Neuroscience in education: The good, the bad, and the ugly*. Oxord, UK: OUP.

Feiler, J. B., & Stabio, M. E. (2018). Three pillars of educational neuroscience from three decades of literature. *Trends in Neuroscience and Education*, *13*, 17-25. doi: 10.1016/j.tine.2018.11.001

Howard-Jones, P. A., Varma, S., Ansari, D., Butterworth, B., De Smedt, B., Goswami, U., & Thomas, M. S. (2016). The principles and practices of educational neuroscience: Comment on Bowers. *Psychological Rev*iew *123*(*5*), 620–627. doi: 10.1037/rev0000036

Organisation for Economic Co-operation and Development. (2017). *OECD skills outlook 2017: Skills and global value chains.* Paris, FR: OECD. Retrieved from http://hdl.voced.edu.au/10707/429058

Tokuhama-Espinosa, T. (2019). The learning sciences framework in educational leadership. *Frontiers in Education*, *4*, 136. Frontiers Media SA. doi: 10.3389/feduc.2019.00136