

# Exploring Educational Neuroscience as a Professional Practice

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## Abstract

Educational neuroscience can be viewed through two lenses: as an academic discipline and as a professional practice. This review specifically focuses on the latter, arguing that a clear picture of the professional landscape of the field is as important as defining its disciplinary boundaries. In this context, the first part of this review examines whether educational neuroscience meets the criteria for professional specialisation. The analysis shows that educational neuroscience fulfills the standards of a professional specialty, with experts having the necessary training and skills to provide educational services to individuals, groups, or organizations. Consequently, they deserve legal authorization and formal recognition like their peers from other disciplines. However, in order to pave the way for professional recognition, educational neuroscientists must clearly outline career opportunities within the field and articulate the roles and skills each career requires. Accordingly, the second part of the paper is dedicated to identifying potential career opportunities for graduates in educational neuroscience. Currently, career opportunities for educational neuroscientists are often limited to academic roles in colleges and universities or involvement in research institutions. However, as the field develops, there's potential for a wider range of new and exciting career opportunities, such as scientist-practitioners working with educators to design effective pedagogical interventions and educational science writers translating complex scientific findings into clear and accessible materials for the public. To help the field flourish as a profession, it is strongly recommended digital networks be created for educational neuroscience professionals from diverse backgrounds. These networks would provide opportunities for them to share experiences, exchange perspectives, and actively shape professional practice within the field.

**Keywords:** educational neuroscience, profession, career opportunities, job description, mind, brain, and education

## Resum

La neurociència educativa es pot veure a través de dues lents: com a disciplina acadèmica i com a pràctica professional. Aquesta revisió se centra específicament en aquesta última, argumentant que una visió clara del panorama professional del camp és tan important com definir els seus límits disciplinaris. En aquest context, la primera part d'aquesta revisió examina si la neurociència educativa compleix els criteris d'especialització professional. L'anàlisi mostra que la neurociència educativa compleix els estàndards d'una especialitat professional, amb

experts que disposen de la formació i les habilitats necessàries per proporcionar serveis educatius a persones, grups o organitzacions. En conseqüència, mereixen l'autorització legal i el reconeixement formal com els seus companys d'altres disciplines. No obstant això, per a aplanar el camí per al reconeixement professional, els neurocientífics educatius han d'esbossar clarament les oportunitats professionals dins de l'àmbit i articular els rols i les habilitats que requereix cada carrera. En conseqüència, la segona part del treball es dedica a identificar les oportunitats professionals potencials dels graduats en neurociència educativa. Actualment, les oportunitats de carrera per als neurocientífics educatius sovint es limiten a rols acadèmics en universitats i col·legis o la participació en institucions de recerca. No obstant això, a mesura que es desenvolupa el camp, hi ha potencial per a un ventall més ampli de noves i emocionants oportunitats professionals, com ara científics-practicants que treballen amb educadors per dissenyar intervencions pedagògiques efectives i escriptors de ciències educatives que tradueixen treballs científiques complexes en materials clars i accessibles per al públic. Per ajudar al fet que el camp prosperi com a professió, és molt recomanable crear xarxes digitals per a professionals de neurociència educativa de diversos orígens. Aquestes xarxes els proporcionarien oportunitats per compartir experiències, intercanviar perspectives i configurar activament la pràctica professional dins del camp.

*Paraules clau:* neurociència educativa, professió, sortides professionals, descripció laboral, ment, cervell i educació

## Introduction

Educational science, also known as pedagogy, is a discipline that studies the theory, practice, and policy of education. As an independent discipline, educational science is a specific body of knowledge with its own terminology, conceptual frameworks, theoretical perspectives, and research methodologies<sup>1,2</sup>. However, it has always drawn on insights from several fields of knowledge, including but not limited to philosophy, psychology, and sociology, which together form the foundation of education<sup>3</sup>. In recent decades, neuroscience has emerged as a powerful new contributor, offering valuable insights into the neurobiological processes underlying learning and development that are usable for directing educational thought and practice<sup>4,5</sup>.

Since the 1990s, educational researchers have increasingly turned their attention to the practical applications of neuroscience. This scholarly interest coincided with significant advances in our understanding of neural processes within the human brain. Subsequently, in the early 21<sup>st</sup> century, sever-

al formal associations and academic programmes emerged at the intersection of mind, brain, and education. During this period, new academic societies and Special Interest Groups (SIGs) were formed with a specific focus on the application of neuroscience to educational contexts. Among these were the International Mind, Brain, and Education Society (IMBES), the Special Interest Group on Brain, Neuroscience, and Education (SIG-BNE) within the American Educational Research Association (AERA), and the Special Interest Group on Neuroscience & Education (SIG 22) of the European Association for Research on Learning and Instruction (EARLI). These academic communities aimed to foster cross-cultural collaboration between researchers in psychology, neuroscience, cognitive science, and education<sup>6,7</sup>.

Graduate programmes in the field use a variety of labels, including "Educational Neuroscience", "Mind, Brain, and Education" and "Neuroeducation", each representing a unique perspective on the integration of neuroscience and education. For a full understanding of the distinctions between these labels, readers may find the review by Nouri and colleagues

particularly insightful<sup>7</sup>. Acknowledging their nuanced differences, these terms will be used interchangeably throughout this paper.

Regardless of the naming debate, the field referred to here as “educational neuroscience” is defined as an interdisciplinary endeavour that seeks to integrate findings from neuroscience and psychology with educational theories in order to improve educational practices and policy<sup>8-10</sup>. However, the field is often criticized for being primarily a meta-scientific discourse that emphasises the promise and pitfalls of applying neuroscience to education, rather than focusing on its applications in educational settings<sup>11</sup>. In response to this criticism, a recent trend has emerged within the field to focus on translating scientific research findings on the neural mechanisms of learning and development into practical applications for educational policy and practice<sup>12-15</sup>.

While the application of neuroscience to educational practice is no longer controversial, it remains important for the field of educational neuroscience to move beyond a simple “neuroscience-applied-to-education” approach. In this view, moving the field forward requires the training of a new generation of hybrid professionals who are well versed in both neuroscience theory and research and educational practice and policy, and who are able to build bridges between the mind and brain sciences with educational practice<sup>7,16</sup>.

Indeed, it’s an exciting time for educational neuroscience! We are at a point where educational neuroscience is being recognised as a scientific field with specialised graduate programmes that train professionals in the field, sometimes called “translational scientists”<sup>7</sup>. However, these emerging educational neuroscience professionals face significant challenges related to the inherent responsibilities associated with their roles<sup>16</sup>. This raises a major challenge that is not new but is becoming increasingly important: Should educational neuroscientists identify themselves primarily as researchers, clinicians, or educators? While such questions are common in emerging interdisciplinary fields where roles and expectations are still in the process of being defined<sup>17</sup>, it is important to explicitly define what educational neuroscientists do that their peers from other disciplines are not able to do. Defining such a job description for educational neuroscience plays a central role in shaping the professional identity of

those who are working in the field. However, the development of a professional identity is a complex process that requires the internalisation of professional values and competencies and their incorporation into individual personalities and behaviours<sup>18</sup>. The most important step is to initiate serious discussions about educational neuroscience as a profession in the community. Such discussions are fruitful not only in explaining the status of the field as a profession but also in promoting the continued development and maturation of its disciplinary boundaries. This review aims to contribute to these discussions by exploring the challenges and opportunities associated with the professionalisation of educational neuroscience.

## The Profession of Educational Neuroscience

Educational neuroscience can be considered from two perspectives: as a scientific field of study and as a profession. As a field of study, educational neuroscience explores the connections between the mind, the brain, and education. As a profession, educational neuroscience is concerned with potential careers in the field and effective strategies for pursuing them. Although these two perspectives are interrelated, the focus of this review is specifically on understanding educational neuroscience as a profession.

More than fifty years ago, Jocelyn Fuller & James Glendening<sup>19</sup> initiated an insightful discussion about the emerging role of a new professional they called the “Neuroeducator”. These professionals, trained from an interdisciplinary perspective, were described as having an understanding of both brain function and effective teaching methods. In the years that followed, several departments and research groups were established, and graduate students completed their masters and doctoral programmes in this evolving discipline<sup>7,20</sup>. However, an important question remains unanswered: Is educational neuroscience really a profession?

While there is no universal consensus on the defining characteristics of a profession, the criteria proposed by Tapper & Millett<sup>21</sup> provide a comprehensive framework for assessing whether educational neuroscience can be recognised as a profession. Among the characteristics that are often considered to define professions are (1) being based on a body of

specialised knowledge (2), having an ideal of service and responsibility to the public good, (3) operating as a self-regulating community, (4) having intensive training and formal qualifications (5) generating applied knowledge, and (6) being guided by a code of ethics or shared ethics<sup>21</sup>.

Educational neuroscience can indeed be seen as a profession, in line with the six characteristics outlined above. First, educational neuroscience involves a specialised body of knowledge about educational practice and policy that is acquired by synthesising insights from different disciplines such as psychology, education science, and neuroscience. Second, educational neuroscientists use this knowledge base to provide services that improve educational practice and outcomes, ultimately benefiting the public good. Third, the interdisciplinary field of educational neuroscience benefits from a network of international and national associations and special interest groups. These organisations play a central role in advancing research, fostering collaboration, and promoting the professional development of educational neuroscientists around the world. At the same time, the establishment of influential academic journals—including *Trends in Neuroscience and Education*, *Mind, Brain and Education*, and *Neuroeducation* - has fostered a self-regulating community within the field. Within this collaborative platform, researchers freely share their findings, exchange innovative ideas, and explore cutting-edge developments. Fourth, becoming an educational neuroscientist requires rigorous training and formal qualifications. There are a growing number of colleges and universities offering an undergraduate major in educational neuroscience and an increasing number of graduates obtaining degrees from these programmes. Fifth, the field of educational neuroscience generates practical knowledge. Rather than being purely theoretical, the findings of educational neuroscience have direct implications for educational practice and significantly influence the development of educational policy. Finally, educational neuroscientists are committed to improving education through scientific inquiry and adhere to ethical codes promulgated by professional societies such as “the International Mind, Brain, and Education Society”, “the American Educational Research Association (AERA)”, “the American Psychological Association (APA)”, “the Society for Neuroscience (SFN)” and others to which they may belong.

Having established the characteristics of a profession, it’s important to recognise that educational neuroscientists are not the only professionals interested in understanding human learning and/or studying educational issues through a systematic scientific approach. Educational science, psychological science, neuroscience, and cognitive science all have important roles to play in understanding learning and how to optimising educational practice. In addition, educational issues attract the attention of a wide range of specialties, including philosophers, journalists, politicians, and lawyers, highlighting the broad societal implications of understanding how we learn. However, educational neuroscientists are the only professionals who seek to develop an insightful understanding and holistic picture of the relationships between mind, brain, and education<sup>4,5</sup>. Accordingly, educational neuroscience has the potential to be a valuable complement to existing psychology, education, and neuroscience disciplines. It should build on and contribute to these foundational fields<sup>22</sup>. Therefore, educational neuroscientists can define their professional identity as educators trained in the science of mind-brain-education relationships who provide evidence-based educational services across the lifespan, from infancy to the elderly years.

It has been clarified that educational neuroscience meets the standards of professional practice and that experts in this field have the necessary training and skills to provide educational services to individuals, groups, or organisations. Accordingly, they should be legally authorised and receive the same licensing and recognition benefits as their counterparts in other disciplines. To pave the way for their recognition as a profession, educational neuroscientists need to clearly outline their roles and skills. The first key step involves identifying and describing the career opportunities within educational neuroscience. These opportunities are explored in the next section.

## Career Opportunities in Educational Neuroscience

The decision to apply for a postgraduate degree in educational neuroscience is both stimulating and challenging. Indeed, the range of professional career options available to educational neuroscientists may not be as varied or as broad as those in other education-related disciplines, such as educational

psychology, school counselling, and curriculum development. Currently, career opportunities for educational neuroscientists are often limited to academic roles in colleges and universities or involvement in research institutions, as evidenced by a review of major job boards such as LinkedIn and Indeed. The specialised nature of the field is likely to contribute to this situation, potentially leading to a narrow view of educational neuroscience as a predominantly an academic and research-oriented discipline. However, as the field develops, there's potential for a wider range of career opportunities to emerge.

Despite the limited number of potential careers in educational neuroscience, a 2020 International Survey on Mind, Brain, and Education<sup>23</sup> sheds light on potential opportunities for graduates. The survey identified 12 different roles, with a high response rate for positions like K-12 teachers or principals, researchers, teacher educators, and educational consultants. Notably, the survey also identified roles focused on applying neuroscience principles to educational practice, such as instructional designers and educational materials developers. This suggests that while the field is still developing, graduates can find rewarding careers that bridge the gap between research and real-world educational settings.

Based on the findings of the 2020 International Survey on Mind, Brain, and Education, graduates with a degree in educational neuroscience can pursue a variety of roles. While this diversity is encouraging, it also highlights a potential challenge – role overlap with established professions in education. For example, being an educational neuroscientist is neither a prerequisite nor a guarantee for a teaching role. Furthermore, graduates from other fields, such as educational psychology, school counselling, and curriculum development, have been providing services such as counselling, curriculum design, and instructional planning long before the advent of educational neuroscience. This overlap of roles could potentially lead to issues of professional recognition for educational neuroscientists. As a result, many leaders in the field choose not to identify themselves as educational neuroscientists. Instead, they may find it more appropriate to align themselves with a discipline-based descriptor, such as “Neuroscientist”, “Psychologist”, or “Educator”<sup>7, 23</sup>.

While the overlap of roles with established professions in education may pose challenges for the

professional recognition of educational neuroscientists (as discussed above), they may find unique opportunities to contribute to the field of education. Educational institutions offer interesting opportunities for educational neuroscientists to contribute as scientist-practitioners<sup>24,25</sup>. In these roles, educational neuroscientists use their understanding of the brain and learning to work with other professionals such as teachers, curriculum designers, school psychologists, or special education teachers. They work closely with students to assess their academic abilities, identify areas of strength and weakness, and develop personalised interventions to support their learning needs. This collaborative approach extends beyond individual classrooms or schools. Educational neuroscientists are making a significant impact by helping education districts to design, implement and evaluate new education programmes through research-practice partnership projects<sup>26</sup>. They work with a diverse group of educators, including policy makers, teachers, and administrators, to develop evidence-based learning programmes that can benefit a wider range of students.

Building on their expertise, educational neuroscientists can inform teachers' professional development and guide them to design curricular interventions that are well supported by research<sup>27-29</sup>. They can do this through a variety of means, such as workshops, seminars, or online resources. By equipping teachers with the latest research-based strategies, educational neuroscientists play a crucial role in optimising the learning experience for all students.

A new and exciting career opportunity for educational neuroscientists interested in research careers and bridging the gap between science and the public is the role of “Educational Science Writer” or “Science Communication Specialist”. These professionals act as bridge-builders, translating complex scientific findings from researchers into educational materials suitable for non-scientific audiences. In doing so, they facilitate the dissemination of scientific knowledge beyond academic circles, ensuring that valuable research findings reach educators, parents, and the wider community.

Postdoctoral training remains a necessary step for educational neuroscience PhD graduates seeking academic research positions. This additional training provides them with the specialised skills and experience needed to conduct independent research and

make a significant contribution to the advancement of the field.

The diverse career opportunities discussed above highlight the potential for educational neuroscience to contribute significantly to educational practices. Recognising and supporting educational neuroscience as a professional practice has immense potential to transform education and empower both teachers effectiveness and students learning. This can be done by establishing clear career paths, promoting professional development opportunities for educators to integrate educational neuroscience into their practice, and encouraging collaboration between educational neuroscientists and other educational professionals.

### Concluding remarks

Based on the arguments presented, it can be concluded that educational neuroscience meets the standards of professional specialty practice. However, the path to becoming an educational neuroscientist has its challenges. Role ambiguity resulting from unclear job descriptions and overlap with similar professions, may limit career opportunities for educational neuroscientists. To address this, the field needs to develop clear career roadmaps that distinguish the roles of educational neuroscientists from those in established professions. This clarity is key to identifying areas for improvement within the profession and the professional practice in educational neuroscience.

For the field to flourish as a profession, educational neuroscientists need to engage in continuous education professional development. They must actively acquire the necessary skills, knowledge, and expertise through pre-service and in-service programmes to effectively contribute to the field and achieve their career aspirations. This commitment to lifelong learning ensures that they have the most up-to-date knowledge and skills to effectively translate research into practical applications that benefit educational practice and student outcomes<sup>30</sup>.

It's worth noting that preparing professionals for a career in educational neuroscience has become increasingly fascinating and challenging. With the rapid pace of technological advances, such as the rise of wearable neurotechnologies and artificial intelligence in education, the types of services and

products required are undergoing changing dramatically. As a result, educational neuroscientists need to continually adapt and develop their professional skills to keep up with the rapidly changing world<sup>31</sup>. Understanding the career options of educational neuroscientists can provide valuable insights into the profession, such as the demand for specific skills, emerging job roles, and potential career trajectories. Further research is therefore needed to explore the types of jobs preferred and secured by educational neuroscience graduates.

Furthermore, there is a growing need to create dedicated digital networks for educational neuroscience professionals, possibly in collaboration with established organisations such as the International Mind, Brain, and Education. Within these networks, educational neuroscientists from different backgrounds would have the opportunity to share their experiences, exchange perspectives, and actively contribute to shaping the profession. In addition, these networks could act as searchable databases, directly connect individuals and organisations seeking expertise in educational neuroscience with qualified professionals, thereby facilitating global collaborative partnerships. In doing so, these efforts would contribute significantly to the advancement and expansion of the profession.

Finally, as a field, educational neuroscience struggles with a significant challenge due to the use of different terms for its name. Researchers often use terms such as "educational neuroscience", "mind, brain, and education", and "neuroeducation" interchangeably. However, there is an ongoing debate, and some leaders deliberately distinguish between these terms. Each concept has its proponents who argue for their preferred terminology. Those who use "educational neuroscience" believe it more accurately describes the nature of a field that aims to bridge the disciplines of neuroscience, psychology, cognitive science, and education. Some experts favour the term "mind, brain, and education" because of its broader scope. They argue that this term encompasses all scientific disciplines relevant to understanding the mind, brain, and education, going beyond psychology and neuroscience. Others, however, prefer the term "neuroeducation", seeing it as more closely associated with educational science. They argue that this term inherently conveys the idea that education is at the heart of integrating the disciplines

of neuroscience, psychology, and education<sup>7,32,33</sup>. Indeed, all of these descriptors refer to essentially the same concept, as evidenced by a 2020 International Survey on Mind, Brain, and Education where most experts (43%) saw no difference between the terms<sup>23</sup>. This compelling evidence suggests that there is an urgent need to establish a single, unified term for the field. The establishment of a single term is therefore

strongly recommended to improve internal communication and public understanding of the goals and applications of the field. Given the evidence for shared meaning and its alignment with the scientific focus, “educational neuroscience” is proposed as the most appropriate option. However, it’s important to recognise that some individuals may still have a preference for specific terms based on their perspective.

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