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Neuroscience Contribution in Educational Leadership. Challenges and Perspectives

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Abstract

Education is founded upon the instruction process and its outcomes, commonly called learning outcomes. The underlying foundation of this entire process is the brain. Neuroscience encompasses the study of brain function, including the intricate processes involved in human learning. It also investigates the factors that contribute to variations in learning abilities among individuals. Therefore, it is unsurprising that individuals engaged in educational science are highly interested in integrating the discoveries of neurosciences with educational theories of learning. Neuroscientific research has been conducted for approximately three decades. However, there has been a growing interest in integrating neuroscience and education in recent years. This is evident from the numerous articles published in books and scientific journals that explore the relationship between these two fields. Additionally, the integration of neuroscience into educational leadership presents both opportunities and challenges. Educational neuroscience posits that insights from neuroscience can enhance teaching in the classroom. However, there are practical and principled issues associated with educational neuroscience, which need to be addressed. Neuroscience is revealing to educational leadership that it is a social process, with the human brain being a social organ interacting with others in social contexts. Incorporating neuroscience into educational leadership has the potential to increase its effectiveness, but contradictory studies address the critical nature of this integration. The application of advances in psychology, behavioral economics, and cognitive neuroscience to study school leaders' decision-making processes is a tantalizing area. Finally, it is essential that neuroscientific data and interpretations are rooted in education to be embraced by the education profession.

Keywords: *Educational Leadership, Neuroscience, Learning, Cognition, Neuroeducation*

1. Introduction

In the last twenty years, researchers have acquired substantial knowledge regarding the brain's learning process, leading to a new academic discipline. This emerging field of study, "Educational Neuroscience" or "Mind, Brain, and Education," investigates how research findings in neuroscience, education, and psychology can reshape our understanding of education and learning—how this knowledge will be implemented in educational practice. In recent decades, the idea that the sciences are independent and self-contained has been replaced by the idea that they are complementary. This shift occurred because it was recognized that the specialization and fragmentation of knowledge within individual scientific fields were inadequate for addressing the complex problems that shape our reality. As a result, an interdisciplinary approach is now widely regarded as the most effective method for resolving complex issues. The study of learning is a highly intricate matter in contemporary educational societies. Therefore, the interdisciplinary field of educational neuroscience holds significant importance (Geake, 2009).

Furthermore, neuroscience has garnered interest in educational leadership, presenting possible contributions and challenges. Integrating neuroscience and education has been acknowledged as a promising undertaking to improve learning practices (Amran et al., 2019). Nevertheless, the diverse origins of the disciplines present challenges when attempting to integrate theoretical and methodological perspectives coherently and effectively (Han et al., 2019). Although educational neuroscience has great potential, there have been criticisms regarding its practical and principled educational implications. One of the main concerns is the need for a more direct impact on classroom teaching (Antonopoulou et al., 2021a; Bowers, 2016).

Moreover, the use of neuroscience in educational settings has raised ethical concerns, as Gkintoni et al. (2022) pointed out. The capacity of neuroscience to impact leadership research and practice has been recognized. Nevertheless, it has been observed that the real impact might not be as groundbreaking as initially expected (Lindebaum & Zundel, 2013). Integrating neuroscience into educational leadership encounters various obstacles, such as establishing a clear connection between brain activity and leadership behavior, employing advanced technologies for fundamental research, and acquiring the necessary knowledge or technology to effectively apply neurological discoveries to leadership development (Aboiron, 2022). Moreover, the ethical ramifications of utilizing neuroscience to choose and cultivate leaders have faced criticism (Robertson et al., 2016). Notwithstanding these difficulties, there is a burgeoning interest in the role of neuroscience in educational practice, as the application of neuroscientific research in the classroom is regarded as a novel and stimulating undertaking to enhance learning (Amran et al., 2019; Sortwell et al., 2023).

2. Neuroscience

Neuroscience or neurobiology, as Ayd (2000) described, is the scientific investigation of the nervous system. Neurobiology is a field of biology that integrates various disciplines, such as biochemistry, anatomy, molecular biology, and the study of neurons and neural circuits. In addition, it incorporates knowledge from various disciplines, including mathematics, linguistics, pharmacology, computer science, physics, engineering, and psychology (Longstaff, 2011). The field of neuroscience has broadened to encompass the various methodologies employed to investigate the molecular, cellular, developmental, structural, functional, evolutionary, and computational aspects of the nervous system. Neuroscientists have broadened their range of techniques, from examining individual nerve cells at the molecular and cellular level to studying sensory and motor brain processes using imaging methods. Neural network research has also contributed to recent advancements in neuroscience theory (Gkintoni & Dimakos, 2022; Gkintoni et al., 2023c). Due to the increasing number of scientists researching the nervous system, several prominent neuroscientific organizations have been established to facilitate discussions among neuroscientists and educators.

A Historical Review

The concept that examining the brain is the starting point for understanding the mind, initially proposed by Hippocrates in the 5th century BC, is supported by contemporary neuroscience. Neuroscience integrates various scientific fields, including molecular biology, neurophysiology, anatomy, embryology, cell biology, and psychology (Kandel et al., 2000/2006). Neuroscience seeks to comprehend the mental processes involved in perception, movement, thinking, learning, and memory by recognizing that all behavior manifests in neural activity. Alternatively, it aims to interpret behavior by examining brain activity (Kandel et al., 2006). Within the Greek academic community, it is contended that the term "neuroscience" or, more commonly, "neurosciences" emerged due to the need for an interdisciplinary approach and comprehensive research on the nervous system. This was necessary because individual fields of study could not adequately address many of the brain's and behavior's complexities. Modern neuroscience emerged due to the integration of neuroscience with other fields, such as neurobiology, neuroanatomy, neurophysiology, neurochemistry, and neuropsychology, during the early 1960s. Neuroscience, which previously experienced substantial growth, has recently faced significant funding limitations due to its relatively low research outcomes compared to the large amounts of funding allocated in previous decades. This funding was intended to enhance our understanding of the brain's structure and function and develop treatments for nervous system diseases.

Learning

Learning is the act of assimilating new information into individuals or things, converting it into data that is suitable for the functions of the individual or thing - using an inherent or identifiable code, or both - and retrieving it when needed. Each of the procedures above may or may not be subject to some level of evaluation. The learner, whether an organism from the animal or plant kingdom or a sophisticated machine, is the focus of the learning process. Some materials possess primary learning mechanisms in a general sense. The level of consciousness ranges from complete absence to the highest level observed in humans. It is noted that the subject of learning can be seen as both an object and a facilitator, depending on the interactions with the conditions and the nature of the process. This allows for different approaches to studying the subject. Human learning encompasses a wide range of abilities, from simple reflexive and instinctive responses to complex management of abstract concepts through communication.

Is Learning Linear?

Previously, educators held the belief that the process of acquiring knowledge resembled ascending a ladder. Schools are organized according to this criterion. According to this theory, learning exhibits a linear progression as we advance from one grade to the next, from one year to another. Nevertheless, cognitive scientists have demonstrated that learning is more complex than initially thought. A divergence occurs in the flow when novel alternative methods and approaches are created.

Consequently, this model becomes less popular, and alternative learning theories are introduced. Cognitive psychology professor Robert Siegler refers to the theory of intellectual development as "Overlapping Waves" by cognitive psychology professor Robert Siegler. Contrary to the linear model's suggestion of progressing from level 1 to level 2, the teacher observed a regression of old knowledge and the influx of new knowledge when we introduced novel approaches to the child's mind by alternating between familiar and unfamiliar concepts. A child can exhibit fleeting expertise in a particular subject within a brief timeframe, only to lose that knowledge as a new interest emerges. Hence, knowledge can be described as intermittent surges and withdrawals. The research demonstrates the application of this model to students across all age groups.

Another model was formulated by Professor Fisher, a pioneer in the academic discipline of "Mind, Brain, and Education". He named the model the constructivist web of development, believing that the linear model was inadequate in capturing cognitive change and learning mechanisms. Fisher's model elucidates the process by which new skills develop, marked by the accumulation of discontinuities through ongoing reorganization and the emergence of fresh opportunities. Such discontinuities can be observed in reading, speech, and numeracy abilities. Occasionally, different elements of development converge and synchronize, such as when spelling and phonics combine to acquire reading skills, while at other times, they remain distinct. For instance, addition and multiplication are perceived as distinct operations.

Misunderstandings and Mistakes

The presence of misconceptions, commonly called "myths," hinders effective teaching by causing confusion and misperceptions among teachers who lack accurate information (Howard-Jones, 2014). Expressly, teachers in the UK, Greece, China, the Netherlands, and Turkey commonly accept the following erroneous notions:
a) Students' brains undergo a reduction in size if they fail to consume six to eight glasses of water daily, and their memory is impaired when they consume sweets or snacks.
b) Our brain utilization is limited to only 10% (5% or 3%). This expression has attained cliché status within the broader populace. Nevertheless, there is a lack of references to any primary research that would have demonstrated such a phenomenon. Furthermore, what is the precise definition of 10%? What is the brain's mass percentage? Is there a tumor in the brain tissue? What are neurons? What are synapses? What are astrocytes? What is metabolic activity? Indeed, none of this is explicitly stated. The term likely originated in the early 1900s, when electrophysiological techniques mapped only a portion of the human brain from a functional standpoint. Alternatively, a version suggests that fraudsters created the phrase to promote techniques for enhancing the cognitive abilities of the purportedly untapped "90%".
c) Each student's brain exhibits individual learning differences, resulting in absolute left or right hemispheric dominance. Engaging in short gymnastics exercises enhances the collaborative functioning of both cerebral hemispheres, leading to improved cognitive integration. Frequently, it is stated in literature and discussions that the left cerebral hemisphere is associated with analytical functions, whereas the right hemisphere is linked to synthetic or artistic abilities. Once more, these concepts were based on misconceptions and oversimplifications of the data obtained from previous decades' experiments on the surgical separation of the cerebral hemispheres. Both human cerebral hemispheres possess histologically similar structures that can perform mental functions, including compensatory ones, in the event of damage. In the collaboration of the two hemispheres, one may assume a dominant role in specific functions for practical or ergonomic purposes. The current proposition suggests that small circuits in the left or right hemisphere are likely to be specialized or differentiated to play a more active role in various behaviors. This is because the key to understanding how neurons function lies not so much in the overall size of the hemispheres but rather in the local transmission of signals at the microscopic level through synaptic connections (Nielsen et al., 2013). d) The selection of teaching methods according to the individual "type" of each student (auditory, kinesthetic, visual) enhances their education despite the lack of experimental evidence supporting this claim. Furthermore, educational interventions cannot remedy learning difficulties arising from variations in brain function during development. Educators are frequently presented with comparable concepts supposedly backed by neuroscience evidence, even though contemporary neuroscience cannot substantiate them. Consequently, they need more educational merit and are frequently linked to ineffective teaching methods. It is possible that desires, uneasiness, and a preference for oversimplified explanations are to blame for misrepresenting neurobiological elements as myths. One can observe the emergence of new myths and revised versions of old ones. Providing overly simplified explanations about the brain to educators can result in misconceptions and perplexity regarding concepts like neural plasticity and the

implementation of advanced educational policies. Neuroscientific findings have direct implications for education in various domains. For instance, insights into the early stages of learning, the maturation of the brain during adolescence, and the understanding of learning disorders like dyslexia and attention deficit hyperactivity disorder can all be readily applied in educational contexts. What is required is the enhancement of the interaction between neuroscientists and educators and the improvement of communication between them. For education to fully benefit from neuroscience, it is necessary to establish the scientific basis of neuroeducational research by integrating both disciplines. The extent of collaboration between neuroscience and education will determine whether education will be enhanced or misguided.

3. Intelligence and Learning

The inaugural Intelligence Quotient (I.Q.) test was devised in 1905 by the French psychologist Binet. It consisted of 30 questions about shared knowledge and practical matters. Subsequently, the American psychologist Lewis Terman introduced the intelligence quotient I.Q. Therefore, educators widely believed that a student with a high intelligence quotient (I.Q.) has significantly more advantageous learning opportunities than a student with a below-average I.Q. Subsequently, a question arose regarding the nature of intelligence, specifically whether it is determined by biological factors or influenced by cultural perceptions. Additionally, it was considered whether judgments about intelligence are shaped by implicit personal and cultural interpretations of the concept, particularly within educational settings.

Various viewpoints contribute to the definitions of intelligence, as individuals in the field of education influence our self-perception, others' perceptions of us, and our potential. Teaching our students, the concept of intelligence as dynamic and changeable is crucial. It is essential to instill in them the belief that they can enhance their intelligence through diligent work and unwavering effort (Donna et al., 2013). Brain plasticity refers to neuronal cells' capacity and synapses to undergo changes throughout an individual's lifetime. This implies that the brain can adapt and form new connections between neurons, indicating that intelligence is not predetermined at birth. Studies demonstrate that the brain possesses a remarkable ability to adapt and change, commonly called plasticity. Plasticity refers to the capacity of neurons, which are cells in the brain and synapses, to undergo modifications. Synapses are anatomical connections that facilitate the transmission of information between neurons via electrochemical mechanisms. *Synaptogenesis* is the process of forming new synapses, while pruning refers to eliminating unnecessary synapses. As students accumulate diverse experiences, their minds continuously learn and adapt to the evolving environment. No scientific evidence from the field of neuroscience demonstrates the brain's ability to change and generate new neurons throughout an individual's lifespan. Therefore, we challenge the notion that intelligence is predetermined at birth, constraining students' academic achievement when implemented. The most effective educators prioritize their instruction using evidence-based techniques and integrate understanding of neuroplasticity, neurogenesis, emotion, attention, executive function, mobility and learning, the arts and learning, sleep and learning, and creativity. They refrain from employing teaching methods that rely on the notion of fixed intelligence quotient (I.Q.) and other misunderstandings about learning.

4. Learning and Metacognition

The term metacognition, coined by Flavell (1979), refers to the ability of individuals to be conscious and knowledgeable about their cognitive processes and strategies. Metacognition encompasses an individual's understanding of their cognitive processes and associated aspects. He defines *metacognition* as the "knowledge and beliefs about tasks, actions, or strategies that interact to influence the learning outcome of any intellectual endeavor." It pertains to the active oversight, control, and coordination of these processes concerning the knowledge objects or data accessible in order to achieve a specific objective. In the field of cognitive psychology, metacognition is commonly described as a type of executive control that encompasses the processes of "monitoring" and "self-regulation," as supported by other researchers (McLeod, 1997; Schneider & Lockl, 2002). In addition, Schraw (1998) characterizes metacognition as a multifaceted collection of general skills rather than specialized ones. These skills can be objectively differentiated from general intelligence. They may make up for deficiencies in either general intelligence or previous knowledge about a subject necessary for problem-solving. Experts propose the implementation of "self-regulated learning" in schools to address the lack of instruction on metacognition, critical thinking, and cognitive development. This approach involves teaching student-centered and actively engaging students in the learning process to achieve the highest cognitive goals and foster advanced thinking skills. The student assumes accountability for acquiring knowledge, constructs his cognitive framework, and cultivates his capacity for analytical reasoning.

To attain this self-regulation, the student must establish a goal, employ cognitive strategies, evaluate their efficacy, and modify them to reach their ultimate objective. Metacognition is an essential strategy for self-regulated learning, as it plays a crucial role in this process. While the learner aligns his cognitive functions to accomplish his objective, he determines the necessary skills and strategies and the appropriate timing and manner in which they should be employed. Assume our objective is to cultivate a continuous learning mindset in students throughout their lives. Under such circumstances, individuals must acknowledge the significance of comprehending their brains. A pragmatic approach would involve educators fostering students' understanding of the vital role played by active engagement and independent thinking in brain function and imparting the knowledge that learning has a tangible impact on the brain. Frequently, students acknowledge their inability to excel in certain subjects and rationalize this pessimistic attitude by failing to take advantage of opportunities to stimulate their brain's plasticity, acquire new knowledge, and modify their brains. Aristotle famously stated: "Our consistent actions form our character and identity; true greatness is not a singular event but a regular practice." Students can enhance their cognitive capacity by developing a heightened awareness of their individual learning process by engaging in deliberate practice and fostering collaboration. Enlightened educators openly instruct students on their brains' functioning and capacity to acquire new skills. Research supports several strategies to enhance metacognition, including refraining from labeling oneself as "smart," "good," or "bad" in a particular subject to avoid self-perceived weaknesses.

Additionally, it is crucial to teach students to identify and manage negative emotions that hinder their ability to grasp new concepts. Encouraging intentional connections between new and existing knowledge is also effective in deepening understanding and retaining previously acquired knowledge. Learning is optimized through the dynamic exchange between the instructor and the learner and the utilization of diverse media that facilitate active and immersive learning experiences. Additional strategies include effectively managing time and incorporating breaks during study sessions to allow the brain to assimilate new information. It is also beneficial for students to have the opportunity to discuss and share the acquired knowledge with their peers, as this aids in solidifying understanding. Lastly, maintaining a well-structured study routine is crucial to prevent excessive anxiety, which can disrupt the learning process.

Education, Multiple Tasks and Learning

Computers possess the capacity to concurrently manage multiple tasks or programs, which is referred to as multitasking and multiprogramming. Multitasking refers to the cognitive capacity of individuals to engage in multiple activities concurrently. It can also be described as the ability to achieve multiple challenging objectives within a given timeframe by alternating between tasks to complete them or by simultaneously engaging in multiple undemanding tasks, such as texting and watching TV while listening to a radio station. Contrary to popular belief, multitasking is ineffective and can hinder our learning performance despite its reputation to manage multiple tasks and provide relief and relaxation. Simultaneously, research indicates that individuals who engage in task-switching or perform multiple activities experience heightened blood circulation in the frontal cortex region.

Consequently, this leads to the release of stress hormones and adrenaline, which, if unregulated, can potentially result in health complications and contribute to the deterioration of short-term memory (Rosen, 2008). Excessive workload in educational settings results in reduced memory and executive function. Furthermore, it harms cognitive function and impairs higher-level thinking, potentially leading to heightened neuronal apoptosis. Hence, educators must acknowledge that multitasking significantly impacts "deep learning" more than simple learning (Halkiopoulos et al., 2022). Consequently, they must actively address the misconceptions prevalent in this domain. Recent research provides a comprehensive account of how the thalamic reticular nucleus (TNR), located deep within the brain, regulates our attention toward incoming information from different stimuli. Scientists assert that this phenomenon enables the brain to concentrate exclusively on a current task while disregarding other incoming stimuli. Eliminating extraneous information that diverts our attention is crucial. When an individual concentrates on a task, their brain intensifies the processing of relevant stimuli while diminishing the impact of other stimuli bombarding the brain. This process functions like a switch, selectively processing information from the frontal cortex and allocating varying degrees of attention to different senses (Gkintoni & Ortiz, 2023). They hold the belief that comprehending the mechanics of this process will enable us to devise strategies to aid individuals who have attention deficit disorders, such as attention deficit hyperactivity disorder and autism.

5. Emotion in Education

In the present era characterized by high-stress levels, fostering a positive school environment and cultivating quality relationships between teachers and students can substantially impact students' academic achievements. Several factors can influence a positive environment, while their reversal can heighten stress and harm learning. Two branches of neuroscience are relevant to this topic. One field of study is emotional neuroscience, which focuses on understanding the neural processes underlying emotions (Gkintoni et al., 2023). This branch also encompasses the psychological examination of personality and mood. Another field of study is social neuroscience, which examines the neural mechanisms underlying social interactions and connections. These connections facilitate the growth of nerves that are essential for learning. Emotions play a crucial role in both cognitive processes and making decisions (Giannoulis et al., 2022a; Giannoulis et al., 2022b).

The cognitive processes most significantly impacted by emotion and, therefore, fall within the realm of emotion processes in education, including learning, attention, memory, decision-making, motivation, and social functioning (Halkiopoulos et al., 2021a; Gkintoni et al., 2017). Consequently, as teachers, we should prioritize our students' emotional growth and equilibrium as primary objectives in our interventions. Nevertheless, how can we accomplish this? According to Sylwester (1994), emotions are a reality. We acquire knowledge of them in a different manner than we commit phone numbers to memory or comprehend historical events and altering them is a complex task. However, disregarding them is also not a viable option. Within this framework, facilitating occasions for emotional articulation, conveying sentiments to the collective, fostering emotional engagement in the educational setting via group exercises, role-playing, and similar methods, as well as cultivating a favorable classroom atmosphere, can significantly contribute to emotional growth and improving learning outcomes. We enhance our emotional self-regulation by assisting our students in identifying and assessing their emotions and suitably reacting to them. Emotional equilibrium tends to positively impact children's academic performance and overall receptiveness to learning (Antonopoulou et al., 2021).

The limbic or coronal system in the midbrain is a crucial psychological center for humans, primarily responsible for emotional processing. While emotional reactions are commonly examined from a social perspective, it is essential to note that emotions also have a biochemical impact on learning (Gkintoni et al., 2022a). The emotional center is crucial in either impeding or facilitating memory and learning. It consolidates an individual's experiences to provide a framework for perceiving and interpreting the world (Antonopoulou et al., 2022a). The release of neurotransmitters from this center can influence the duration of learning, depending on how the environment influences an individual's emotions (Antonopoulou et al, 2023). When an individual experiences joy, the limbic or coronary system releases neurotransmitters that enhance the rate of learning (Gkintoni et al., 2016; Gkintoni et al., 2021a).

Nevertheless, stress triggers neurotransmitters and impedes the brain's capacity to retrieve or process information. While numerous instances exist of a student's failure to grasp a specific procedure despite the teacher's persistent efforts, research is scarce on this physiological phenomenon, suggesting that the student may be incapable of learning (Halkiopoulos et al., 2021b). If the stress is alleviated and the problem is reframed, the limbic or coronary system can once again facilitate the learning process. Numerous strategies exist for effectively handling stress. As mature individuals, we can recognize and acknowledge our stress and know effective strategies to alleviate and manage it (Gkintoni et al., 2021b). Nevertheless, students may possess varying levels of awareness regarding their anxiety and may lack knowledge about effective strategies to address it. Indeed, each individual is unique. The most effective strategies for students to reduce stress involve identifying and acknowledging the causes of stress and effectively expressing their emotions. Multiple strategies are available to manage and control students' behavior to enhance their well-being (Halkiopoulos et al., 2023b). For instance, techniques include controlled breathing exercises, basic meditation, mental imagery of the stressful scenario, physical activity, and enjoyable pastimes.

6. Neuroeducation and Leadership

The convergence of education and leadership has garnered significant attention, especially in light of the rise of neuroeducation. Neuroeducation, a field combining neuroscience and education, can significantly impact educational leadership practices. The direct correlation between neuroscience and education is demonstrated, with emotional neuroscience playing a crucial role in learning (Gkintoni et al., 2023e). In addition, the study has examined the viewpoints of educational leaders and educators on neuroeducation, revealing insights into how neuroscience can potentially influence leadership in educational environments (Serpati & Loughan, 2012). Therefore, gaining a comprehensive understanding of the consequences of neuroeducation on learning and the perspectives of educational leaders can offer valuable insights into incorporating neuroscience in educational leadership. Furthermore, the changing environment of educational leadership, which involves cultivating leadership skills and adherence to specific standards, highlights the ever-changing nature of educational leadership (Riveros & Wei, 2019). Thus, investigating neuroeducation and its influence on educational leadership offers a chance to improve leadership practices and contribute to developing educational leadership theories and methodologies (Antonopoulou et al., 2019; Antonopoulou et al., 2020; Antonopoulou et al., 2021b; Gkintoni et al., 2022b).

Furthermore, there is an increasing interest in combining educational leadership and neuroscience, as evidenced by the existing literature. Educational neuroscience enhances teaching methodologies by incorporating neuroscientific discoveries into educational approaches (Bowers, 2016). This entails a comprehensive framework that combines brain and cognitive sciences with education, offering specific instances in different areas of learning (Han et al., 2019). Integrating neuroscience and education is a valuable opportunity to connect these two fields and utilize neuroscience findings to improve education and enhance learning (Sigman et al., 2014; Tzachrista et al., 2023). Nevertheless, there exist divergent viewpoints, with critics contending that neuroscience might not directly impact education and instructional practices in the classroom (Howard-Jones et al., 2016). However, "Educational Neuroscience" focuses on improving learning and comprehending education's biological and cognitive mechanisms (Amran et al., 2019). According to the literature, educational neuroscience is a beneficial collaboration that combines neuroscience, psychology, cognitive science, and education to develop solutions for 21st-century learning based on solid evidence (Carew & Magsamen, 2010; Gkintoni et al., 2023a).

Neuroeducation, the interdisciplinary field that combines neuroscience and education, has received considerable attention in the realm of educational leadership (Antonopoulou et al., 2022b). The connection between neuroscience and education is immediate, and the learning process is significantly influenced by emotional neuroscience (Geake & Cooper, 2003). This highlights the capacity of neuroeducation to provide information and improve educational leadership practices. Moreover, there has been a growing relevance in qualitative studies investigating the perceptions of educational leadership, specifically in early childhood education (Gkintoni et al., 2021c). These studies have provided valuable insights into the connection between neuroscience and leadership within educational environments (Gkintoni et al., 2023c). Therefore, comprehending the consequences of emotional neuroscience on learning and the perspectives of educational leaders can offer valuable insights into incorporating neuroeducation in educational leadership.

7. Conclusion

Recently, there has been significant attention towards utilizing educational neuroscience in the context of school learning. Nevertheless, educators require further elucidation regarding the applicability of neuroscientific findings in the classroom. However, it is essential to acknowledge that neurosciences are utilized to benefit education. Based on their research, students can receive educational support to enhance their skills and learning capacity.

To conclude, incorporating neuroscience into educational leadership offers both prospects and difficulties. The capacity of neuroscience to enhance educational practice and optimize learning is clearly demonstrated in the study conducted by Amran et al. (2019). Nevertheless, it is crucial to confront the practical and ethical concerns associated with educational neuroscience to guarantee its practical implementation in educational leadership (Bowers, 2016). The potential of educational neuroscience lies in its capacity to contribute to fundamental research that addresses the requirements of students and teachers, thus improving educational practices (Gabrieli, 2016). Moreover, the principles and practices of educational neuroscience establish this interdisciplinary field's present objectives and extent, highlighting the necessity for a logical and evidence-based approach to direct learning in the 21st century (Howard-Jones et al., 2016). Given the progress of educational neuroscience, it is crucial to contemplate the ethical consequences and guarantee the efficient application of neuroscientific research in educational leadership practices (Gabrieli et al., 2015). Integrating neuroscience and educational leadership presents a promising opportunity to enhance learning and teaching methods, if the obstacles are successfully tackled, and the viewpoints are thoroughly examined.

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