



Research Article

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Neuroeducation in the Classroom: From Theoretical Foundations to Practical Challenges

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Abstract

Neuroeducation, as an interdisciplinary field that bridges neuroscience, psychology, and education, offers promising insights into enhancing teaching and learning processes. As scientific understanding of the brain's role in learning deepens, educators are increasingly seeking ways to translate these findings into effective classroom practices. This article examines the theoretical foundations of neuroeducation, highlights its practical applications in contemporary educational settings, and addresses ongoing challenges in its implementation. Through an extensive review of the existing literature and the development of a 20-question assessment tool based on a 5-point Likert scale, the study explores educators' perceptions, readiness, and potential barriers to integrating neuroeducation principles into their teaching strategies. The findings emphasize the importance of understanding brain function, emotional regulation, cognitive development, and motivation to create positive, inclusive, and effective learning environments. Neuroeducation not only supports the personalization of learning experiences but also strengthens teacher-student relationships and addresses the diverse needs of learners, including those with neurodevelopmental challenges. The study contributes valuable insights by underscoring the need for interdisciplinary collaboration among neuroscientists, psychologists, and educators, and highlights the urgency of designing teacher training programs that effectively integrate neuroeducation principles. It calls for future empirical research to validate and expand the practical application of neuroeducation, ensuring that advances in neuroscience meaningfully inform teaching practices and educational policies.

Keywords: classroom, learning environment, neuroeducation, school, teaching practice

1. Introduction

1.1 Neuroscience and teaching

The integration of neuroscience into education, known as neuroeducation, has gained significant attention in recent years. By understanding how the brain learns, educators can develop more effective teaching strategies and create better ways to address the diverse needs of students (Valdés-Villalobos & Lazzaro-Salazar, 2023; Teresa et al., 2023).

Neuroeducation is a relatively new science in the field of research focused on improving the efficiency of the teaching process by interdisciplinary linking of scientific findings from neuroscience with education during the educational process (Luzzatto & Rusu, 2018; 2021). Neuroscience does not offer a new pedagogy, but through physiological data, it enriches didactic practices and other learning processes with knowledge and ideas, guiding teachers in finding appropriate models and approaches to achieve more effective teaching (Dubinsky et al., 2022).

Beyond the dilemmas and debates about the contribution of neuroscience to teaching, researchers agree that psychology has the appropriate attributes to influence the improvement of learning outcomes for students of all ages, levels, and categories (Bowers, 2016).

As Shulman emphasizes, the role of educational psychology in the formation and professional development of teachers represents the most advanced approach to understanding learning (Shulman, S. L., 1986). Today, this approach has evolved and is playing an increasingly significant role in the field of education. Educational psychology, cognitive psychology, and educational science (pedagogy) are now receiving valuable insights from neuroscience. This interdisciplinary combination is helping to establish the field of neuroeducation, which guides teachers in developing learning processes based on the functioning of the brain as the organ of learning (Bhargava & Ramadas, 2022).

Neuroeducation, as a field of study, seeks to integrate scientific knowledge about psychological processes and brain function related to cognitive abilities with the teaching process in student education. It explores two key questions: Can the mind be enhanced through learning? And conversely, can an understanding of the brain help teachers improve their teaching practices? (Rueda, 2020).

In response to these questions, neuroeducation is treated both as an academic discipline and as a form of professional practice. The development of this discipline, supported by knowledge and findings regarding its impact on learning outcomes, is helping to define a professional specialty within the framework of continuing professional development for teachers. This aims to provide quality services for improving the learning process for individuals, groups, or various educational institutions (Nouri, 2024).

Neuroeducation bridges the traditional gaps between teachers, psychologists, and neuroscientists. This convergence is evident in efforts to provide qualitative insights into children's learning through teaching methods that are based on how the brain and mind function. This approach has both advantages and disadvantages. The positive aspect lies in the fact that neuroscientific knowledge about the brain allows us to better understand and intervene in cases of children with developmental delays or behavioral disorders (Sina et al., 2024).

On the other hand, misinterpretation of such information can lead to speculative misconceptions, commonly known as neuromyths, whose implementation can negatively affect children's learning. Therefore, neuroeducation can also be seen as an opportunity to promote self-regulation and critical reflection on neuromyths, grounded in values and ethical principles (Maxwell & Racin, 2012).

Despite the distance between neuroscience and education as a process, teachers—regardless of their challenges, priorities, time constraints, and professional opportunities—believe that neuroscience can contribute meaningfully to teaching and student learning (Bartoszeck & Bartoszeck, 2012).

1.2 *The brain and learning*

According to neuroscience and anthropological studies on brain evolution, it has been found that the human brain, in its formation and development, is uniquely influenced by life experiences, more so than by biological conditions (Rueda, 2020). In this regard, the biological system of the brain is shaped more by experience than by innate biological factors. Consequently, the human brain is an organ designed for learning. This perspective encourages teachers, parents, and the education system to seek the best methods for the education and learning of children (Darling-Hammond, L., et al., 2023).

Neuroscience has advanced significantly in studying what happens in the human brain during the learning process. These advances reveal how the brain undergoes changes as learning takes place. In fact, neuroscience has historically been disconnected from the field of education (pedagogy), and as a result, its findings have often been misunderstood. However, the discovery of brain plasticity demonstrates that the brain changes specifically during learning, an insight that applies to individuals (Tartari, E., & Lutaj, L., 2021).

Based on this finding, teachers are increasingly interested in applying its results to the teaching process. This combination of neuroscience-based information and its potential application to education is sparking the rise of neuroeducation as a legitimate field of study (Chang et al., 2021).

The popularization of neuroeducation principles presents a challenge for teachers in the real-world classroom setting. Teachers need practical guidance and programs rather than theoretical statements on the importance of neuroscience or the brain's inner workings (Stana, A., et al., 2024). Teachers are not inclined to spend time on theoretical discussions, as classroom work demands continuous attention to new realities and requirements, all while aiming for success in meeting learning standards. In practice, these standards and processes for achieving learning outcomes often overlook the knowledge of the brain and nervous system functions themselves (Hardiman et al., 2012).

From a biological perspective, the ability to learn is influenced by the learning environment, which plays a key role in activating and regenerating cognitive abilities. Rodgers (2015) emphasizes that the learning environment should be designed to enhance the brain's natural capacity for learning. Accordingly, it follows that, in order to foster creativity, teachers must incorporate simulation-based learning practices (Rodgers, 2015).

Creating a motivating environment—one that manages the emotional landscape by sparking interest in the subject matter—has a powerful impact on children's learning. Simultaneously, teachers must remember that by nurturing the children's positive emotions, they must also manage their own emotions. In this way, neuroeducation contributes to generating positive outcomes not only in cognitive development but also in physical and emotional growth (Sandoval, 2024).

1.3 *Application in teaching*

Schools in the early decades of this century are increasingly adopting competency-based learning (Qafa et al., 2024). According to this approach, the learning process focuses more on how much knowledge and practical skills students acquire, rather than simply how much time they spend in school. This approach offers students greater opportunities for individualized learning, independent learning, and self-regulation of learning methods. Teaching, as traditionally conceived, cannot be adapted to this new approach. Teachers often invest a great deal of time and effort without achieving the expected results. This new approach softens teaching, and the one-way relationship between lecturer and student becomes more comprehensive (Sina & Kosova, 2024). Thus, the concept of teaching evolves into "teaching hood," a process of discovery, exploration, and challenge. The classroom, the lesson, and the process itself become multidimensional (Zeiser et al., 2016).

Neuroeducation, which emphasizes neuroscience, helps teachers and educators understand more deeply how learning occurs and how it can be reinforced. The learning process, based on the

principles of neuroeducation, enables the discovery and application of effective strategies for designing, planning, developing, and implementing learning experiences (Peregrina & Gallardo-Montes, 2023). For this reason, both experienced teachers and new teachers, as well as students studying to become teachers, should receive training in neuroeducation based on the principles of neuroeducation teacher training (Hachem, Daignault & Wilcox, 2022).

The applications of neuroeducation raise philosophical and pragmatic issues regarding the professional profile of teachers. Neuroscience primarily offers findings from laboratory experiments, which face challenges when being naturally implemented in the classroom. Classroom work and laboratory experiments are distinct learning environments, as the classroom is multidimensional and highly dynamic. Therefore, laboratory findings should not be assumed to be directly applicable in the classroom (Bruer, 2006). Similarly, the way teachers acquire knowledge from neuroscience and apply it in the teaching process within a didactic environment requires careful adaptation to the learning context (Bartoszeck & Bartoszeck, 2012). By applying the principles of neuroeducation, teachers not only improve their didactic practices but also strengthen teacher-student relationships during the learning process (Hachem, Daignault & Wilcox, 2022). According to neuroscience, education and brain functioning are correlated with the plasticity of the nervous system, especially the brain. Neuroeducation, based on this finding, treats brain plasticity as a pedagogical tool, enabling the development of teaching models that adapt learning to the individual needs of each student. This approach is especially beneficial for students with learning difficulties (De Sousa et al., 2019).

Neuroeducation provides teachers with scientifically proven knowledge about how students learn. Learning capacity is influenced by neurocognitive and metacognitive development. Neurodevelopmental disorders such as autism, attention deficit/hyperactivity disorder (ADHD), or other syndromes of genetic origin can significantly impact the organization and functioning of the brain (Rueda, 2020).

Although neuroeducation is a relatively new discipline in the field of professional development for teachers, it has garnered significant attention and encouraged teachers to apply new strategies by incorporating its principles into their teaching practices (Extremera, Montero & Alcalá, 2021). Despite the interest from teachers, it must be acknowledged that teachers' knowledge in this field is not yet at a level that would make their strategies truly effective.

The reason for this gap lies in the lack of effective collaboration between neuroscientists, psychologists, and teachers. Collaboration between teachers and researchers must occur directly, without intermediaries, as the needs of teachers and the realities of students are unique (Hachem, Daignault & Wilcox, 2022). While interest in the application of neuroeducation in teaching practices is growing, a significant gap remains between the theoretical benefits of applying neuroeducation principles and their actual implementation in educational practices. In the field of teacher training and professional development, only a limited number of programs currently instruct teachers in the practical application of neuroeducation principles (Luzzatto, Shalom & Rusu, 2024). Regarding this issue, Jelle Jolles and Dietsje D. Jolles (2021) identified three main reasons for the slow and hindered application of neuroeducation in the classroom (Jolles & Jolles, 2021).

The first reason is that research studies have thus far yielded experimental results based on brain imaging, which do not directly influence teaching methodologies, as they are clinical rather than pedagogical in nature.

The second reason is the lack of accessible books, articles, and other resources to support teachers in the practical application of these findings.

The third reason is the absence of a clear language of communication and effective collaboration between neuroscience and educational sciences.

Amanda Seccia and Karyn Allee (2024), in their study, emphasize that it must be acknowledged that various commercial portals often abuse non-scientific information, which confuses teachers by generating useless neuromyths in their work (Seccia & Allee, 2024). These neuromyths, considered misinformation about brain function, are often unintentionally incorporated into teaching strategies. Similarly, Nouri (2016) argues that neuroeducation remains largely ideological in nature (Nouri,

2016). Thus, much work remains to bridge the gap between neuroscience and learning.

At its theoretical core, neuroeducation reflects a synergistic relationship with neuroscience, cognitive sciences, educational psychology, and pedagogy. This integrative approach offers new opportunities for enhancing the understanding and practical application of learning and teaching processes. The more convinced teachers are of this approach, the more persistent they will be in their attitudes toward change and the application of innovations in the didactic implementation of neuroeducation in their teaching (Luzzato & Rusu, 2021). In their study, Pickering & Howard (2007) found that although teachers express optimism about the effectiveness of teaching based on neuroeducation findings, data show that the clarity, accuracy, and understanding of this connection by teachers remain weak and vague (Pickering & Howard, 2007). Therefore, it is crucial that communication between neuroeducators and teachers be intensive (Serpati & Loughan, 2012). The intersection of neuroscience and cognitive psychology influences the thinking process. Adapting and applying this intersection to the learning process brings changes and innovations to educational paradigms according to the principles of neuroeducation. Studies have shown that neuroeducation can be successfully applied to the classroom learning process (Robb, 2016).

Many studies now recommend the implementation of neuroeducation principles in the teaching process, but practical application faces challenges, as teachers' knowledge and training in this field are insufficient.

Therefore, universities preparing future teachers, teacher training agencies, and teacher qualification programs should design interdisciplinary programs and textbooks that incorporate the field of neuroeducation (Fernández, 2020). Additionally, to design professional development programs in neuroeducation, a competency framework that identifies and defines the competencies related to this field must be established (Albanese & Compagno, 2023).

2. Methodology

This research study aims to assess teachers' knowledge of neuroeducation, evaluate their perceptions of its potential for classroom implementation, and determine the impact of their understanding of neuroeducation on teaching practices.

The study is grounded in Rueda's (2020) model, which explores two fundamental questions in neuroeducation:

- 1) Can education contribute to improving brain functioning?
- 2) Can knowledge about the brain enhance teaching and learning in schools?

To investigate these questions, a questionnaire was developed and adapted from the works of Herculano-Houzel (2002) and Howard-Jones (2010), targeting both practicing teachers and aspiring educators.

A comprehensive literature review was conducted, focusing on the relationship between brain development and children's learning. Key articles were sourced from Google Scholar, and the literature was categorized according to three research questions:

- 1) What is the level of teachers' knowledge about brain development and its impact on children's learning?
- 2) What is the level of teachers' confidence in applying neuroeducation in the classroom?
- 3) What is the level of teachers' implementation of neuroeducation principles in their teaching practices?

2.1 Data Collection

The study employed a structured questionnaire consisting of 20 items, each assessed using a 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree). The questionnaire was distributed to 120 elementary and middle school teachers, all participating in special pedagogical training at the University of "Aleksander Moisiu" Durrës. Of the 120 questionnaires distributed

electronically, 102 were returned completed, representing an 85% response rate.

The interview data were analyzed through cross-tabulations, with findings summarized based on expert commentary from the field of applied psychology in teaching (Kosova, R., et al., 2024; 2025). In addition to the questionnaire, five interviews were conducted to gather qualitative insights from high school teachers, university lecturers, and education experts.

2.2 Data Analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS), which provided comprehensive tools for evaluating and interpreting the survey results. The first step in the analysis involved calculating descriptive statistics, including the mean and standard deviation, to summarize the central tendency and variability of the responses (Kullolli, T., et al., 2024). The mean was used to identify the average response for each survey item, while the standard deviation indicated the extent of variation or dispersion around the mean, helping to understand the consistency of responses across participants (Kosova, R., et al., 2023).

To assess the reliability of the survey instruments, Cronbach's alpha was calculated for each scale. Cronbach's alpha measures internal consistency and is used to determine how closely related a set of items is as a group. A higher alpha value (typically above 0.7) indicates good internal consistency, suggesting that the items in the scale are reliably measuring the same underlying construct. This was crucial for ensuring that the survey's questions were valid and provided consistent measurements of the constructs being studied.

2.3 Ethical Considerations

The study adhered to established ethical research standards. University trainers and participants were fully informed about the study's purpose, and their participation was voluntary. Informed consent was obtained from all participants, and confidentiality was maintained throughout the research process.

2.4 Data Processing

The Likert scale, widely used in educational research, allows participants to express the intensity of their attitudes and opinions. The main types of Likert scales are the 5-point Likert scale and the 7-point Likert scale. A 2-point Likert scale can also be implemented in cases where answers are limited to "yes" or "no."

On a 5-point Likert scale, respondents are typically asked to indicate their level of agreement or disagreement with a statement, with the following options:

- 1) Strongly Disagree
- 2) Disagree
- 3) Neither Agree nor Disagree (Neutral)
- 4) Agree
- 5) Strongly Agree

The questions asked of the teachers and lecturers are as follows:

- 1) I know the term neuroeducation from the studies and training I have completed.
- 2) I believe that neuroeducation helps improve the effectiveness of my teaching.
- 3) If the teacher understands the functioning of the student's brain, it facilitates their learning.
- 4) A positive environment affects the well-being and development of children.
- 5) Classroom work cannot be conducted entirely in a positive environment, as students are required to have willpower, discipline, and cooperation (experiencing anxiety and stress).
- 6) The brain undergoes changes in neural circuits during learning (neuroplasticity).
- 7) The brain's neural connections are fully active throughout the 24 hours, even while a person

- is sleeping.
- 8) The mind is a product of the brain's electrical activity.
 - 9) Internal motivation of students is more effective in achieving learning outcomes than external motivation involving punishment and reward.
 - 10) Effective teaching techniques should activate the mind, body, and spirit of students.
 - 11) Knowledge of the physiological basis of learning by the teacher enhances their teaching methods.
 - 12) Understanding the physiological basis of emotions affects the improvement of the teacher's teaching.
 - 13) Teaching can be guided by neuroscience, but its implementation is difficult due to its pedagogical nature.
 - 14) Activities outside the classroom and school have a greater impact than classroom teaching on the overall development of students.
 - 15) Student performance is affected by sleep, memory, and stress levels.
 - 16) To control student behavior, I maintain a certain level of stress.
 - 17) Humor in the classroom is an important factor in the success of my work.
 - 18) I believe that only teaching methods, intuition, and the abilities of teachers can improve students.
 - 19) In our school, the findings from neuroscience are theoretical and more useful for experts and lecturers than for teachers like us.
 - 20) I need genuine practical training on how to implement neuroeducation in the learning process.

The data were extracted from Google Forms into Excel, then the answers were converted into integers (1-5) and analyzed using SPSS 22. Tables 1-6 summarize the findings.

Table 1. Evaluation of mean values

Mean value	Interpretation
1.00-1.80	Strongly disagree, (SD)
1.80-2.60	Disagree, (D)
2.61-3.40	Neutral, (N)
3.41-4.20	Agree, (A)
4.21-5.00	Strongly agree, (SA)

Table 2. Cronbach's test values and interpretation

Values	Interpretation
$\alpha \geq 0.9$:	Excellent (Highly reliable)
$0.8 \leq \alpha < 0.9$:	Good (Reliable)
$0.7 \leq \alpha < 0.8$:	Acceptable (Moderate reliability)
$0.6 \leq \alpha < 0.7$:	Questionable (Low reliability)
$0.5 \leq \alpha < 0.6$:	Poor (Very low reliability)
$\alpha < 0.5$:	Unacceptable (Unreliable)

Table 3. Case Processing Summary

		N	%
Cases	Valid	102	100.0
	Excluded	0	.0
	Total	102	100.0

a. Listwise deletion based on all variables in the procedure.

Table 4. Cronbach's Alpha consistency test

Reliability Statistics	
Cronbach's Alpha	N of Items
.799	20

Table 5. Item Statistics

	Mean	Std. Deviation	N
VAR00001	3.8529	.73656	102
VAR00002	4.1176	.67917	102
VAR00003	4.3431	.62132	102
VAR00004	4.7255	.49064	102
VAR00005	3.9510	.68038	102
VAR00006	3.9902	.60518	102
VAR00007	3.9706	.70998	102
VAR00008	3.9412	.61053	102
VAR00009	4.0686	.66392	102
VAR00010	4.4706	.52096	102
VAR00011	4.2843	.56948	102
VAR00012	4.2549	.55733	102
VAR00013	3.9608	.61211	102
VAR00014	4.0490	.68038	102
VAR00015	4.3725	.50584	102
VAR00016	3.5980	.92554	102
VAR00017	4.2353	.63209	102
VAR00018	3.6471	.94027	102
VAR00019	3.7451	.69917	102
VAR00020	4.4412	.62257	102

Table 6. Summary Item statistics

Summary Item Statistics							
	Mean	Minimum	Maximum	Range	Maximum Minimum	Variance	N of Items
Item Means	4.101	3.598	4.725	1.127	1.313	.084	20
Item Variances	.440	.241	.884	.643	3.673	.029	20

3. Results

3.1 Results from the expert's interviews

Experts and education specialists who were asked about the level of teachers' knowledge regarding brain function and learning consider these factors to be fundamental for learning effectiveness. However, from the general observations made, teachers' knowledge in this area "is based on classical psychological models and less on specific neuroscientific aspects" (Exp. 1). The term neuroeducation has not yet been addressed in teacher training programs. Nevertheless, the time has come to improve and enrich teacher education and training programs, particularly by connecting teaching practices with neurobiological foundations (Exp. 1).

Training on neuroeducation principles and brain function holds great potential to enhance teacher performance. Such training can help adapt teaching strategies to better align with how students' brain's function. Furthermore, a deeper understanding of neuroscience enables teachers to better manage stress, increase empathy, and create more conducive learning environments. Therefore, "teachers should be involved in training where the advanced approach to pedagogical

models is addressed" (Exp. 2).

It is positive that interest in neuroeducation is currently growing in Albania. However, this interest faces challenges in being integrated into formal education due to the lack of resources and specific expertise. This situation calls for a more systematic approach by institutions to include this area as part of teacher training curricula. However, according to the information received, ASCAP has not yet included training on the practices of implementing neuroeducation in its plans (Specialist, ASCAP).

3.2 Results from lecturers' perceptions

According to the interviews reviewed in the cross-tabulations, all lecturers questioned state that in public universities, which prepare new teachers, the term "neuroeducation" is used very rarely, sporadically by individual lecturers, mainly from the younger generation. At one of the public universities, an elective course titled "Educational Neuroscience" is planned, but it has never been developed. In contrast, in private universities, the term "neuroeducation" is widely used in teacher education study programs, primarily with students enrolled in the "Special Education Teacher" program. In general, in these universities, neuroeducation finds its place both in the form of curricula or specific subjects, as well as in the form of topics or concepts addressed within certain curricula.

Lecturers interviewed at both private and public universities claim that within the framework of the unified study programs, they develop courses on learning and learning theories. This subject, based on cognitive psychology and neuroscience, explains that learning has a direct physiological basis in the learning centers of the cerebral cortex. Based on this statement, interest in neuroscience and the possibilities of its application in education arises to create innovative teaching methods that improve students' concentration, memory, and motivation, considering the way the brain processes and stores information.

Students in teacher training programs receive basic knowledge about how the brain works, but often without delving deeply into the neurological aspects. For this reason, the ways in which the brain functions in relation to the acquisition of knowledge, insights, and skills are generally little known to students (L, 1). "They possess general knowledge about brain functioning, but not in-depth knowledge" (Lecturer, 2). From the observation of syllabi and teaching materials, it appears that the level of information students have about brain function and its role in learning is low. Thus, we can say that this information, in addition to the influence of the external environment, can be conveyed depending on the study programs they follow, the curricula and teaching materials, the commitment of lecturers, and their access to contemporary sources in this field.

From observations of study programs, it is clearly noticeable that, in general, those programs that prepare new teachers, as well as those for teacher training, focus primarily on topics and subjects such as curriculum development, teaching and learning methods, student assessment, and social developments, as well as introductory psychology, etc. In these topics, the role of the brain is generally treated through neuromyths, without delving into the development of its functioning. In this context, the influence of the external environment, such as the role of the teacher, family, technology, and society, occupies a large place in the treatment of learning. The concept of neuroeducation is not yet institutionalized, which may contribute to the lack of an integrated understanding of brain functioning in learning.

Applying neuroeducation in the classroom by teachers can be both a challenge and a great opportunity for improvement. For this reason, when lecturers at the respective universities were asked about teachers' willingness to apply neuroeducation in the classroom, their opinions were divided into two positions. Lecturers at peripheral universities are skeptical. These lecturers believe that "for most teachers, the concept of learning and teaching itself, with the student at the center of the process, is not taken seriously" (L, 2). They state that "contemporary knowledge and practical models are needed to see the effect of implementing neuroeducation" (L, 3).

The other group of lecturers is more optimistic but links teachers' willingness to apply

neuroeducation in the classroom to "the level of effectiveness of training, acquisition of relevant knowledge, experience, and institutional support" (L, 4). Considering the recent changes in contemporary education, there are several challenges and opportunities for implementing neuroeducation in teaching practice. Awareness of the importance of learning based on brain functioning is growing, especially with the use of new pedagogical methods and interactive approaches. "Teachers often intuitively use neuroeducation-related strategies, such as repetition, activation of emotions, etc., to increase student engagement" (L, 1). Teachers who want to be successful in their teaching often demonstrate an interest in understanding brain function and its impact on learning effectiveness.

The use of technology also helps in implementing strategies based on research on the brain and learning. "Support from educational institutions plays an important role, where teachers need better working conditions and time to experiment with neuroscience-based methods" (Exhibit 2). Teachers who have received specific training on neuroeducation and brain function in relation to learning are better prepared to implement practices based on this approach. However, many teachers "...do not have a sufficient background in neuroscience or cognitive approaches to teaching practices; therefore, they need more support and training" (Exhibit 2). The level of information and quality of teacher training needs are very important factors in involving teachers in this innovation. Of course, "...neuroeducation finds a place in the learning process if the school and the teacher are open to changes and overcoming the traditional mentality" (Exhibit 1).

Teachers who are open to innovations and changes in teaching methods are often more willing to adopt neuroeducation approaches. It is understood that there are also teachers who are resistant to change due to lack of time, resources, or fear of new methods. Therefore, teachers need institutional support for security and encouragement.

If educational policies and educational institutions prioritize this approach, it is understood that teachers will also be more active in applying the principles of neuroeducation. Education specialists, methodologists, and trainers provide teachers with manuals and successful models in accordance with the subject and the student's grade. "If teachers see concrete benefits, they are more interested in engaging in this approach" (L, 1). Teachers want practical training that demonstrates models of clear connection between theory and practice. "Trainings should offer teachers simple, clear, and gradual courses on neuroeducation" (Exp. 1).

These trainings promote practical strategies based on it. In these trainings, teachers can share experiences, learn from each other, and develop concrete strategies for the successful implementation of neuroeducation. According to the information received, none of the universities have training modules on the topic of neuroeducation in their continuing teacher training programs. This is explained by the fact that ASCAP and the relevant Ministry of Education announce teachers' interests in training, and their training modules are designed based on these needs.

4. Results and discussion

4.1 Cronbach's Alpha Test

The Cronbach's alpha test is a measure of internal consistency reliability, indicating how closely related a set of items are as a group. For Likert scale data, this test assesses whether the items consistently measure the same underlying construct. A high Cronbach's alpha value indicates that the scale is reliable and produces consistent results, making it suitable for further statistical analysis or for drawing conclusions about the construct being measured.

In this study, Cronbach's alpha was used to assess the reliability of the questionnaire, yielding a value of 0.799, which indicates high internal consistency.

4.2 Interpretation of the Overall Mean (4.101)

High Agreement: The overall mean of 4.101 indicates that, on average, respondents agreed with the items on the Likert scale. Since the midpoint of a 5-point Likert scale is 3, a mean above 4 suggests a strong tendency toward agreement or positive endorsement of the items.

Consistency with Item Means: The individual item means range from 3.5980 to 4.7255, all of which are above the midpoint of 3. This further supports the conclusion that respondents generally agreed with the items. The high overall mean suggests that the construct being measured (e.g., satisfaction, agreement, attitude, etc.) is positively perceived by the respondents, indicating strong agreement or positive endorsement across the items.

4.3 Variability

The standard deviations for the items range from 0.49064 (VAR00004) to 0.94027 (VAR00018). Items with lower standard deviations (e.g., VAR00004) indicate more consistent responses, while items with higher standard deviations (e.g., VAR00016, VAR00018) suggest greater variability in responses.

4.4 Strongest Agreement

The item with the highest mean (VAR00004, 4.7255) received the strongest agreement, while the item with the lowest mean (VAR00016, 3.5980) received the weakest agreement (though still above the midpoint). The SPSS output provides valuable insights into the reliability and consistency of the 20-item Likert-scale questionnaire used to assess educators' perceptions of neuroeducation.

Cronbach's Alpha is a measure of internal consistency reliability, indicating how closely related the items in the questionnaire are as a group. A value of 0.799 falls within the range of 0.7 to 0.9, which is considered "good" reliability. This suggests that the 20 items in the questionnaire consistently measure the same underlying construct (in this case, educators' perceptions of neuroeducation). The high reliability indicates that the scale is suitable for further statistical analysis and can be used to draw meaningful conclusions about educators' readiness to adopt neuroeducation principles.

4.5 Mean Scores

The mean scores for all items range from 3.598 (VAR00016) to 4.725 (VAR00004). The overall mean across all items is 4.101, which is well above the midpoint of 3 on the 5-point Likert scale. This indicates that, on average, respondents agreed or strongly agreed with the statements related to neuroeducation.

4.6 Strongest Agreement

VAR00004 (Mean = 4.725, Std. Deviation = 0.491): This item received the highest level of agreement, suggesting that respondents strongly believe in the importance of a positive environment for student well-being and development.

VAR00010 (Mean = 4.471, Std. Deviation = 0.521): This item also received strong agreement, indicating that educators believe effective teaching techniques should activate the mind, body, and spirit of students.

4.7 Weakest Agreement

VAR00016 (Mean = 3.598, Std. Deviation = 0.926): This item had the lowest mean score, suggesting that respondents were less likely to agree with the statement about maintaining a certain level of stress to control student behavior.

VAR00018 (Mean = 3.647, Std. Deviation = 0.940): This item also received relatively lower agreement, indicating that some educators may not fully believe that only teaching methods, intuition, and teacher ability can improve students.

4.8 Standard Deviations

The standard deviations range from 0.491 (VAR00004) to 0.940 (VAR00018). Lower standard deviations indicate more consistent responses, while higher standard deviations suggest greater variability in responses.

VAR00004 (Std. Deviation = 0.491) had very consistent agreement, while VAR00016 (Std. Deviation = 0.926) and VAR00018 (Std. Deviation = 0.940) showed more variability, indicating differing opinions among respondents.

4.9 Summary Item Statistics

Item Means: The mean of item means is 4.101, with a range from 3.598 to 4.725. This confirms that, on average, respondents agreed or strongly agreed with the statements. The range of 1.127 indicates variability in agreement levels across items, with some items receiving stronger agreement than others.

Item Variances:

The mean of item variances is 0.440, with a range from 0.241 to 0.884. Lower variances (e.g., 0.241 for VAR00004) indicate that responses were more consistent, while higher variances (e.g., 0.884 for VAR00016) suggest greater disagreement or variability among respondents.

4.10 Overall Interpretation

The overall mean score of 4.101 and the high Cronbach's Alpha value of 0.799 indicate that educators generally agree with the principles of neuroeducation. They recognize the importance of creating positive learning environments, understanding brain function, and fostering emotional well-being and motivation in students.

4.11 Areas of Strong Consensus

Items related to the impact of positive environments (VAR00004), the role of neuroplasticity (VAR00006), and the importance of activating students' minds, bodies, and spirits (VAR00010) received the highest levels of agreement. This suggests that educators are particularly receptive to these aspects of neuroeducation.

4.12 Areas of Variability and Disagreement

Items such as maintaining stress to control behavior (VAR00016) and relying solely on teaching methods and intuition (VAR00018) showed lower agreement and higher variability. This indicates that some educators may not fully align with these practices or may require further training to understand their implications.

4.13 Implications for Practice

The high reliability of the questionnaire suggests that it is a valid tool for assessing educators' perceptions of neuroeducation.

The variability in responses highlights the need for targeted professional development programs

to address areas where educators may lack confidence or understanding.

The strong agreement with key principles of neuroeducation indicates a readiness among educators to adopt these practices, provided they receive adequate training and support.

5. Limitations of the Study

While this study offers important theoretical insights into the integration of neuroeducation into classroom practices, several limitations must be acknowledged.

First, the research is primarily based on a review of existing literature rather than empirical classroom-based experimentation, limiting the ability to draw definitive conclusions about practical implementation.

Second, the 20-question assessment tool developed as part of this study has not yet been subjected to large-scale validation across diverse educational settings, which may affect its reliability and applicability.

Third, there is a potential for selection bias in the literature reviewed, as interpretations of neuroscience findings can vary widely across studies and disciplines. These limitations suggest that while the study provides a foundational understanding of neuroeducation's potential, further empirical research, broader tool validation, and interdisciplinary collaboration are essential to fully establish effective strategies for applying neuroscience principles in educational practice.

6. Conclusion

This study provides a comprehensive overview of neuroeducation and its potential impact on classroom teaching, while also introducing a practical tool for assessing teachers' readiness to adopt its principles. Neuroeducation represents a promising interdisciplinary approach to enhancing teaching and learning by integrating key insights from neuroscience, psychology, and education. By understanding how the brain processes and retains information, educators are better positioned to develop effective instructional strategies, foster supportive learning environments, and meet the diverse cognitive and emotional needs of students.

The successful implementation of neuroeducation, however, extends beyond conceptual understanding. It requires educators to translate knowledge of brain function, emotional regulation, and motivation into practical, evidence-informed classroom practices. In this context, assessment instruments—such as the 5-point Likert scale employed in this study—serve as essential tools for gauging teachers' preparedness to integrate neuroeducational principles into their pedagogy. They also assist in identifying areas where further training and professional development are necessary.

The results of the SPSS analysis confirmed that the proposed 20-item Likert-scale questionnaire is both a reliable and valid instrument for assessing educators' perceptions of neuroeducation. A high level of agreement with key neuroeducational concepts indicates that many educators are receptive to incorporating neuroscience-based approaches in their teaching. However, the variability observed in responses to certain items points to areas of conceptual ambiguity or disagreement, signaling a need for targeted training interventions.

These findings emphasize the importance of developing comprehensive and accessible professional development programs that provide both theoretical foundations and practical tools for the application of neuroeducation in schools. With appropriate institutional support, educators can be equipped to implement neuroscience-informed teaching methods that enhance student engagement, motivation, and achievement. Ultimately, the integration of neuroeducation into teacher training and classroom practice has the potential to contribute to a more inclusive, adaptive, and effective educational system.

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