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REVIEW

Neuroeducation in initial basic education: Strategies and benefits for early learning

Neuroeducación en la educación básica inicial: Estrategias y beneficios para el aprendizaje temprano

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ABSTRACT

Introduction: the teaching-learning process in children, an important part of their personal development, cannot be conceived without considering its complexity, making it a key issue in the field of neuroeducation.
Objective: the purpose of this article was to describe the benefits of neuroeducation for stimulating early learning.
Method: a systematic review was conducted, examining 20 digital documents from 2017 to 2024, indexed in academic repositories: Dialnet, SciELO, and Redalyc. The methodology used was PRISMA with a qualitative approach. The inclusion criteria included articles published in the last decade with a maximum length of 6500 words. Doctoral theses, systematic review and those documents not available to be downloaded were excluded.
Results: it is described that although neuroeducation can adapt to any age, strategies and teachings that seek to facilitate natural learning should be prioritized. However, this requires educators to have a greater understanding of children's brains and, above all, a commitment to their own professional development to gain competence in applying new proposals.
Conclusions: in the educational role of teachers in basic education, the application of neuroeducational strategies is essential to enhance early learning. Educators need to understand the characteristics of child development and use innovative, easily accessible resources in the classroom. Professional development in neuroscience improves attention, concentration, and stimulates cognitive and socio-emotional skills, as well as intrinsic motivation in children.

Keywords: Natural Learning; Brain; Early Basic Education; Strategies; Neuroeducation; Children.

RESUMEN

Introducción: el proceso de enseñanza-aprendizaje en los niños, parte importante de su desarrollo personal, no puede concebirse sin considerar su complejidad, lo que lo convierte en un asunto clave en el ámbito de la neuroeducación.
Objetivo: el propósito de este artículo fue describir los beneficios de la neuroeducación para estimular el aprendizaje en edades tempranas.

Método: se realizó una revisión sistemática que examinó 20 documentos digitales desde 2017 al 2024, indexados en repositorios académicos: Dialnet, SciELO y Redalyc. La metodología utilizada fue PRISMA con un enfoque cualitativo. Los criterios de inclusión abarcaron artículos publicados en la última década con una extensión máxima de 6500 palabras. Se excluyen tesis doctorales, revisiones sistemáticas y los no disponibles para su descarga.
Resultados: se logra describir que aunque la neuroeducación posibilita adaptarse a cualquier edad, deben privilegiarse estrategias y enseñanzas que busquen y faciliten un aprendizaje natural. Sin embargo, se exige a los educadores un mayor conocimiento sobre el cerebro de sus niños, pero sobre todo un compromiso con su propio desarrollo profesional para adquirir la competencia en la aplicación de nuevas propuestas.
Conclusiones: en la labor educativa del docente en la educación básica la aplicación de estrategias de neuroeducación es básica para beneficiar el aprendizaje temprano. Los educadores necesitan conocer las características del desarrollo infantil y utilizar recursos innovadores de fácil acceso en el aula. La superación docente en neurociencia mejora la atención, la concentración y estimula las habilidades cognitivas, socioemocionales así como la motivación intrínseca en los niños.

Palabras clave: Aprendizaje Natural; Cerebro; Educación Básica Inicial; Estrategias; Neuroeducación; Niños.

INTRODUCTION

Teachers in charge of educating children and young people have the task of gaining a deep understanding of the learning processes that affect children's development. In this sense, neurolearning is a fundamental area of study, combining neuroscience, psychology, and pedagogy to improve teaching strategies.[1] This is especially relevant in a global context that emphasizes the importance of the mental health of children and young people to create more positive school environments.[2]

Neuroeducation, also known as Neuropedagogy, is a discipline that integrates neurodevelopment, evolutionary biology, and the educational sciences and is based on experiential pedagogy and technologies that allow the human brain to develop in a way that is dependent on the task as an element of learning.[3] When education is mentioned, it refers to comprehensively training individuals to foster all their qualities, abilities, and possibilities so that they grow as individuals. It is also intended that they should achieve a whole life and participate in the progress of their social environment.

Since the last decade of the last century, research in neuroscience has contributed to a new way of approaching education based on the capacities of the brain. These discoveries about brain knowledge and functioning allow educators to carry out their work more effectively in managing the teaching-learning process.

Education at an early age cannot be carried out without mentioning neuroeducation. The brain is the main organ of human stimuli; it participates in all acts of life; it is the neurological support of all cognitive and affective processes and the motor functions that occur in a body that act as a means of relating to the world. It is where impulses are elaborated; from here, the impulse of relation with the outside world is initiated and elaborated.[4]

Neuroeducation represents an innovative perspective in teaching based on brain functioning. This discipline seeks, through neuroscience, to identify methods for implementing in the classroom existing knowledge about the brain mechanisms linked to emotion, curiosity, and concentration, essential processes for activating understanding through the processes of learning and retention.[5]

Currently, many students are educated using an obsolete approach that lacks the tools and alternatives necessary to face the challenges of the present century. This situation affects the essence of education and becomes a process in which students prepare more to pass an exam than to acquire and deepen their knowledge. In the classroom, the pedagogy of fear prevails; students fear failure, and many have lost not only fear but also interest and curiosity in attending classes, which affects the essence of learning.

As an intrinsic part of a systematization of the theory and its transit through the problem being investigated, the epistemological gaps and the causes that condition the problem to be investigated are delimited, establishing a delimitation in its field of study and the categorical and epistemological body for the particular sciences and those that dialectically underlie the need to understand neuroeducation as a cognitive resource that allows the inculcation, from the educational sphere, of adequate and correct patterns of behavior through the exhaustive analysis of early stimulation techniques that contribute to the psychomotor development of the child.

The above analysis allows the authors of this review to pose the following research question: How does neuroeducation impact early childhood education? The objective is to describe the existing literature on neuroeducation in early childhood education for the achievement of learning at an early age. In this sense, the research contributes to the understanding of the subject based on theoretical foundations that determine the strategies, benefits, and applicability of neuroeducation in early basic education.

METHOD

This review article focused on a study with a qualitative design that reviewed the description of the qualities of the event or phenomenon, which in the present case was to describe neuroeducation for learning achievement at early ages. The method used was a systematic review according to the PRISMA methodology, which included defined and replicable goals and strategies, an exhaustive search for studies, an internal evaluation of the results, and a presentation of the findings. The review was carried out in four phases: search, evaluation, analysis, and synthesis. This led to the implications of the manifestations and perspectives of the information provided and its possible understanding.

The inductive method formulated general conclusions based on various publications and procedures. Similarly, the analytical-synthetic method was distinguished by breaking down what is available into components to analyze cause and effect relationships, which were then integrated into a general synthesis; that is, it connected individual facts to establish links between them.

In addition, a search was carried out in different journals using Boolean operators such as “Early learning,” “Early childhood education,” and “Neuroeducation.” The language filter included articles in Spanish, English, and Portuguese. A publication date range between 2017 and 2024 was defined, and original scientific articles such as “Complete documents” and “Journals” were considered, taking as references prestigious journals indexed in Dialnet, Scielo, and Redalyc.

The names and summaries of the documents found in the initial search were examined to assess their relevance. Aspects to include were implemented, such as the length of the articles between 4000 and 6500 words. Articles that did not meet the inclusion criteria were eliminated. A thorough analysis was also carried out on selected articles to obtain relevant information on the application of neuroeducation in early childhood education, and important data, such as authors, study titles, and relevant results, were recorded.

In the synthesis phase, the results of the chosen articles were examined and synthesized concerning the research objectives. Patterns, recurring themes, and differences between the studies were recognized. In addition, general conclusions were formulated, and suggestions for future research were highlighted. During the preparation of this research, a thorough analysis of 20 articles was carried out, of which nine were finally included, taking into account the exclusion and inclusion criteria.

RESULTS

After analyzing each of the sources consulted, the diagram in figure 1 illustrates the phases of study selection in the systematic review, divided into three stages. In the first stage, which consisted of identification, 20 articles were obtained from various databases for review, and one duplicate article was eliminated before selection. In addition, five sources were discarded because they were a doctoral thesis, a systematic review article, and three reports that were not available for download.

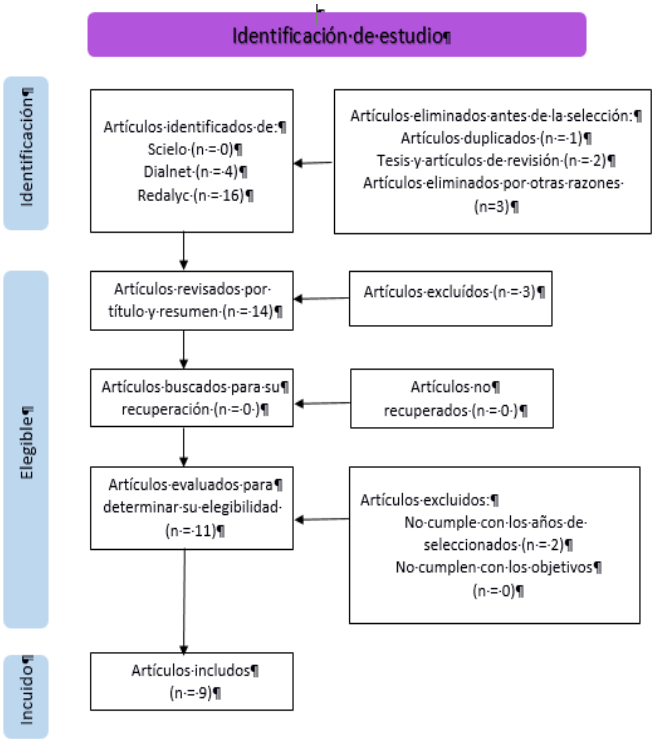

Figure 1. Flow chart

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In the second stage of eligibility, 14 articles remained for review after duplicates and illegible articles were eliminated. Of these, three articles were excluded because they did not meet the established inclusion criteria, and no additional articles were requested for retrieval. At the end of this stage, 11 reports were evaluated to determine their eligibility, finally including nine investigations in the systematic review.

Table 1 below details these nine articles selected due to the stages of information analyzed after executing the search criteria, strategies, and filters mentioned in the previous point.

Table 1. List of articles included

Authors	Title	Results
Betegón[6]	Neuroeducation and Self-control: how to link what we learn with what we do. A multiple case study in a group of Early Childhood Education.	A flexible methodology is proposed, consisting of neuroeducational incentives at school.
Coello[7]	Early stimulation and development of language skills: Neuroeducation in early education in Ecuador.	Examines the neurological and conceptual elements that underpin the early stimulation program for children in initial education in Ecuador.
Peyro[8]	Neuroeducational model of early channeling for children with learning disabilities.	It proposes a guide to be able to identify and channel early learning difficulties observed in the classroom and understand their connection.
Guibo[9]	Considerations on the contributions of neuroscience to the teaching-learning process.	It encourages teachers and students of pedagogical programs to use knowledge from the neurosciences; it seeks to optimize the teaching-learning process.
De Souza Martins[10]	Neuroeducation: a pedagogical proposal for early childhood education.	It highlights the relevance of neuroeducation as a pedagogical tool in early childhood education, based on the stages of learning offered by neuroeducation.
Meza[11]	ICT and neuroeducation as a resource for innovation in the teaching and learning process.	The research presents technological and neuroeducational resources that serve as tools to facilitate the implementation of didactic strategies in the acquisition of knowledge, which move away from traditional methodologies and improve the quality of education.
Rivera[12]	Neuroeducational findings from neuromotor stimulation at preschool level.	Describes the fundamental relationships involved in education from the perspective of neuroeducation in relation to the development of children in the third year of preschool.
Reza[13]	Modeling-based Learning Assisted with Artificial Intelligence in Natural Sciences: a proposal for neurodidactic intervention.	It trains teachers in Model-Based Learning and the use of Artificial Intelligence and promotes the design and implementation of neurodidactic sequences applicable in the classroom.
Islas[14]	Connectivism and neuroeducation: transdisciplines for training in the digital age.	It reveals how the cross-disciplinary fields of neuroeducation and connectivism.

The authors agreed that neuroeducation is a discipline that studies the brain and learning processes, providing valuable information for teaching. Likewise, the objective of this discipline is to achieve better results in the student's acquisition, retention, and application of learning. This is demonstrated by Peyro[8], who, in his model, involves the educational part and the mental health part, known as the neuroeducational integration process, in the hope that the gap between the different branches dealing with children can function more harmoniously and compellingly and thus be able to guide the family in terms of these children's learning.

The essence of neuroeducation lies in the fact that, through various strategies, new teaching methodologies can be developed that align with brain development at different stages of a person's life. For example, it is essential that those who design learning environments understand how learning takes place, what factors motivate it, what aspects are most valued, and how the information received is retained and used.

According to Meza[11], in his research, he manages to implement technological and neuroeducational resources in the teaching-learning process. This allows us to see that the use of these tools becomes a didactic strategy for the assimilation of knowledge in an innovative, dynamic, and motivating way, relegating to the background those traditional methodologies that many teachers still tend to use in their classes. These strategies contribute to improving the quality of education.

If educators understand how the brain works, it is easier to create educational contexts in which students adapt through their behavior and can transform it if necessary. Betegón[6] is recognized for contributing to his study a methodology that uses neuroeducational incentives in school and helps children interact in different educational contexts, in which they exchange and develop the skills that allow them to increase their cognitive performance.

The different research studies consulted consider neuroeducation to be a source of support for resources, experiences, and practices in the teaching-learning process. Neurolearning is the basis of the conceptualization of these learning styles since it is based on teaching strategies based on cognitive and emotional development.

Neurolearning is fundamental for students, as it allows the use of resources that make classes more attractive and practical, providing them with tools to stimulate learning more precisely and in line with progress in understanding cognitive processes, especially at an early age in initial education.

DISCUSSION

Neuroeducation in early basic education allows for the construction of more knowledge because as new information is integrated, the brain will be able to make more neural connections, giving the individual a greater capacity to understand, connect, and, most importantly, acquire more knowledge through tools that will help solve the problems that arise every day.[10,12] Therefore, pedagogical strategies and approaches must be prioritized to foster organic learning, which values invisible learning and reinforces meaningful learning. On the other hand, superficial and artificial learning, which arises when learning is based solely on obligation, must be identified and avoided.[16]

The various uses of neuroscience in both popular culture and academia illustrate another phenomenon, namely the relevance of neuroscience to the current sociocultural and ideological climate. Based on this line of thinking, neuroeducation is another neurocultural phenomenon that aims explicitly to integrate neuroscience into a new field: education.[17] Several studies show that in educating children and young people, the family must also be involved in the educational process, satisfying their needs and supporting their growth.[9,18,19] Furthermore, the development of cognitive functions is related to behavior and brain growth in children, as well as their integration into their social and family environment.[14] In this sense, cognitive development is linked to how upbringing takes place in the family environment and how the family dynamic regulates itself, resolves conflicts, and establishes effective forms of communication.[5,18,19]

In carrying out a critical evaluation of this study, the results are compared with other studies which, although they do not explicitly use the term neuroeducation, their results contribute significantly to this discipline, such is the case of Dilone[20], who, in his research proposes the design of strategies that allow the integration of ICT in the Pedagogical Projects of Initial Education; the activities that are planned stimulate the needs and interests of the students and their environment. These findings reflect that these technologies are resources related to neuroeducation and influence it and stimulate neurolearning, as demonstrated.[11]

Likewise, the application of constructivist strategies such as error management, the balance between exploration and curricular objectives, and the use of emerging technologies foster cognitive skills such as reasoning, problem-solving, and memory.[21] However, the authors identified challenges such as lack of concentration and dependence on teacher guidance in some infants, aspects to be taken into account in future research.

Finally, the methodological strategy is analyzed, including a careful selection of reading materials that challenge and stimulate critical thinking, fundamental aspects to take into account when analyzing neuroeducation, as well as the implementation of activities that encourage reflection, debate, and in-depth analysis of texts for educational institutions to implement in their planning.[22] Although a significant percentage of the students surveyed did not achieve the planned learning outcomes, the role of the teacher in cultivating critical capacity in students is emphasized, a perspective that is analyzed both in the present systematic review and in the aforementioned research on training children to be readers with critical thinking skills.

CONCLUSION

The work of the teacher in early basic education is essential for applying strategies from a neuroeducation perspective, as only in this way is knowledge used to benefit the child's early learning. Educators need to be clear about the key aspects of child development to encourage the most appropriate ways of intellectual and affective growth, using the proper resources to the maximum extent possible, based on an innovative education that is easy to implement in the classroom.

Teachers should be trained in neuroscience, destroying false beliefs and applying scientific evidence to pedagogical techniques. In addition, they should learn that intrinsic motivation stimulates the pleasure of learning.

Neuroeducation offers benefits for early learning, such as improving attention and concentration and stimulating cognitive and socio-emotional skills.

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