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NEURODIDACTICS IN THE TRAINING OF PROFESSIONALS IN EARLY CHILDHOOD EDUCATION: SYSTEMATIC REVIEW

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ABSTRACT

This systematic review article explores the integration of neuroscientific principles into teacher training. It argues that neurodidactics is crucial for improving teaching and learning by enabling educators to adapt their strategies to students' cognitive and emotional characteristics. However, significant challenges in its implementation are identified, such as resistance to change and a lack of ongoing training in Latin America. The study uses the PICO method to structure the research and the PRISMA method to establish inclusion and exclusion criteria, addressing key questions about the effectiveness of neurodidactic strategies in pre-service teacher training. The review of academic articles reveals a paucity of research in the region, underscoring the need to promote studies that evaluate these practices. The article concludes that neurodidactics should not only be theoretical but also applied in specific educational contexts, promoting meaningful learning and contributing to the improvement of pre-service education by developing specific, professional competencies for future pre-service teachers.

Keywords: Neurolearning – Neurodidactics – Professional training – Educational strategies

INTRODUCTION

Current educational training scenarios integrate components that strengthen the foundations of neuroscience (Llatance et al, 2024). In this context, actors in the educational process need to better understand how the brain and mind link knowledge with cognitive development (Nicolson & Fawcett, 2019). This understanding facilitates the application of neurodidactic strategies in teaching and learning. From this perspective, it seeks to satisfy the learning needs of students through professionals trained in the application of alternatives that promote meaningful learning, adapted to current socio-educational contexts. This process requires that teacher professional education be oriented towards the fulfilment of Sustainable Development Goal (SDG) 4, in particular target 4.4, which promotes the development of quality competencies and educational relevance. Likewise, UNICEF's Strategic Plan 2022-2025 (2022) highlights the importance of promoting skills for the future. However, political, administrative, and economic factors have affected the quality of education in the region. For this reason, UNICEF proposes to improve learning outcomes in terms of quality and equity, considering the generation of research and training processes as a strategy.

In Latin America, the offer of training in the area of neuroeducation is scarce (Carvajal, 2023) ; the training of teaching professionals, in different situations during their training process, is limited to cognitive structures aimed at neurodidactics as the basis of disciplinary knowledge (Calzadilla & Carvajal, 2022); there is a diversity of criteria, approaches, methods, resistance, and routine practices, in addition to little updating of knowledge (Jácome & Campos, 2023).

Neurodidactics, as an alternative and training strategy; it becomes a tool for university-level teachers, in the strengthening of different cognitive, procedural, and aptitude skills, as stated by Leyes et al. (2020) and Sotelo (2021), who also agree that this training helps to solve situations present in the educational and professional field.

In relation to neurodidactics, Marina, (2019), Ocampo, (2019) refer to identifying the process, methodology, techniques, activities that can be applied in and for education from the basis of brain functioning; This includes why and how to study the factors that affect learning, analyze in depth how these processes work, and find practical methods to evaluate the effectiveness of different teaching styles. Following Tacca et al., (2019), neurodidactic strategies are classified as: operational, socio-emotional and methodological:

The first refers to planning actions from the contents, taking into account the contexts of the population, interests and needs, which can be adapted during the learning process. The second strategy is based on the emotions and motivations of both the teacher and the students and how these contribute significantly to the relationships between all the actors; they help to incorporate elements of commitment, participation. The last one is aimed at the construction and consolidation of knowledge; it promotes curiosity, innovation and is based on the interrelation of the first two strategies.

The principles of neurodidactics in education are based on the participation of all those involved, the first is to be alert to the stimuli of the environment in order to capture as much information as possible (González, 2017); followed by balance, it is activated when the strategy allows stimulating several areas of the brain and finally the principle of holistic vision interrelates social elements, emotions and cognition in a conscious way.

Professional teacher training; part of the components of basic and initial skills and those that describe specific skills and improvement for teachers (Arregui et al; 2024); aimed at fulfilling and assuming the responsibilities of the productive world of work that are continuous, cumulative during the time of professional practice. Future teachers are expected to consider the personal scenarios and the work relationship, which permeates the field of education from public policies, the curricular model, methods, strategies, and techniques towards teaching (Ramírez et al; 2022) that directly influences professional practice.

To channel the beginning of the investigative process; the PICO method is used (Sánchez, et al; 2023); It helps to identify the paradigmatic approach with some questions, which in turn direct the starting point for decision-making to the researcher. After the search for sources of bibliographic information; for the present study, the main question is established: To consider neurodidactics as a key focus in the training of professionals in Early Childhood Education?, which is based on understanding the importance of knowledge of brain functions aimed at teaching-learning (Vargas, et al; 2024).

The present study is justified from its importance, in contributing to education with quality standards, integrating neuroscientific principles for teachers and allowing them to develop competencies that optimize the learning process aimed at cognitive interests and needs. It is pertinent and innovative to the extent that it can identify socio-educational contexts and apply relevant and effective neurodidactic strategies to the demand for quality professional training and offer tools that can transform traditional educational practices, promoting more meaningful learning. The usefulness of the study is manifested, in its potential to influence educational policies, in the continuous training of teachers, contributing to the improvement of early education in the region. The general research objective is described: To determine neurodidactics as a key focus in the training of professionals in Early Childhood Education, a systemic review.

METHODOLOGY

This systematic review article was designed using the PICO method, adapted to the educational field with a holistic approach. Research questions were structured in line with the object of study. Additionally, the PRISMA method (2020) was applied to establish the review criteria and validate the bibliographic search, considering aspects such as databases, type of journal, year of publication, authors, methodology, findings, and recommendations. For the analysis, two main categories were defined: "Neurodidactic strategies" and "Professional training of students", both linked to the Initial Education Career and oriented to the specific needs of the educational context.

As specific scientific questions, related to the population under study, the following were raised: How does the integration of neurodidactic knowledge contribute? For the level of intervention, to what extent does the implementation of neurodidactic strategies contribute? In the comparison component, what training alternatives are used in a conventional model and one with neurodidactic strategies? Finally, in results, what have been the results of the application of neurodidactics?

The databases "Scopus", "Web of Science" (WoS) and Scielo were used to search for information. The key terms or words were "Neurodidactics", "Vocational Training" and "Early Childhood Education", in Spanish

and English, using Boolean operators "AND" and "OR" to broaden or narrow the search (Lluís, 2017). The equations used were: Neuroscience or Neuroeducation or Neurolearning or Neurodidactics; "Vocational training" and "career guidance" and "Initial education" or "early childhood education". Subsequently, inclusion and exclusion criteria were established that facilitated the selection of data, acting as filters and parameters from the initial search (Ramos & García, 2024). These criteria were: temporality or date: from 2018 to 2025; thematic area: Social Sciences, Arts and Humanities, Neuroscience; language: English - Spanish - Portuguese; Document type: article; Limited to open access and final: article; country: Latin American - USA - Spain; keywords: Teacher training - Early education - cognitive development - teaching - neurodidactics; Revision: of the abstract. The selection process is presented in a flowchart that describes the search carried out step by step (Figure 1).
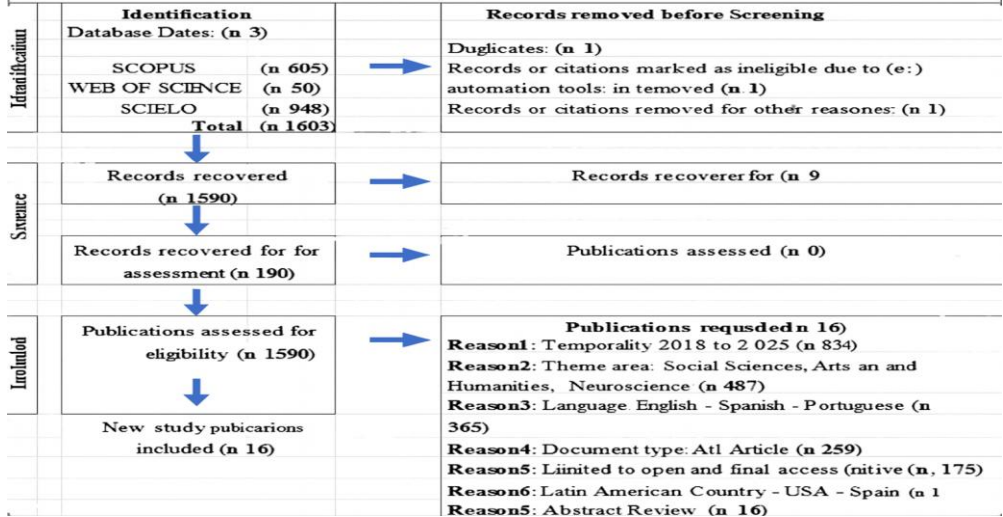

FIGURE 1. SELECTION PROCESS FLOWCHART

Finally, 16 academic articles were selected and analyzed and organized in a bibliographic matrix.

DEVELOPMENT AND DISCUSSION

The articles included in the systematic review were ordered and classified according to various criteria: name of the journal, indexing database, year of publication, authorship, recommendations and relevance of the source. This classification allowed to establish a synthesis of ideas and arguments relevant to the study.

TABLE 1. ANALYSIS SYNTHESIS OF SELECTED ARTICLES

No.	Journal	Database	Author(s)	Methodology	Recommendations	Relevance of the Source to the Research
1	Frontiers in Education	Scopus	Piyna-Medina, C., Morales-Loro, V., Ferrer-Ribot, M., Oliver Barceló, MDM (2024)	Mixed methods approach combining qualitative and quantitative techniques	It is suggested to reflect on professional competencies for early childhood educators, as this is crucial for improving initial teacher training and strengthening the teaching community	The source is relevant as it has a mixed approach and includes a double perspective: exploratory and critical. It discusses the necessary competencies for early childhood educators, key in the current

						educational context
2	Revista de Currículo y Docencia	Scopus	Mike Arthur Herán Suárez, Alejandro Cruzata-Martínez, Miguel A. Saavedra-López, Ronald M. Hernández (2024)	Quantitative approach using a descriptive and correlational design	It is recommended to implement training programs focused on the use of technologies to foster classroom integration	The source is relevant as it comes from a peer-reviewed journal focused on education, guaranteeing quality and relevance of the content
3	Ciencias de la Educación	Scopus	Macías-Gómez, A., Diez-R., M., Serrano-Luján, L., & Bordás-Gené, O. (2021)	An experiment was conducted with two groups: one experimental (used the "Educational Hall Escape") and one control (with a traditional format). Technological tools were used as content and evaluation strategies	Implement strategies such as "Educational Hall Escape" in course design to introduce new concepts. Adapt the activity to focus on learning new concepts, not just reviewing existing ones	The source is relevant as it is based on an educational innovation approach and focuses on "gamification" and "serious games," providing a solid context for the study
4	Revista Interuniversitaria de Formación del Profesorado	Scopus	Betegón Blanca, E., Rodríguez Medina, J., & Iturria Muñiz, M. J. (2019)	Qualitative design: Pretest-Intervention-Posttest method in a multiple case study. Observation of non-participant behavior before and after audiovisual stimuli were presented	Implement flexible methodologies with brief interventions. Personalize strategies based on students' specific needs	The article has a qualitative approach relevant to educational contexts
5	Electrónica Interuniversitaria de Formación del Profesorado	Web of Science	Casillas-Martín, S., & Cabezas-González, M. (2024)	Quantitative study with an experimental, descriptive, and inferential	Include neuroscience-related content in Education Degree study plans. Promote	The source is relevant as it analyzes the relationship between neuroscience

				design. The ALFANED scale was used to measure knowledge of neuroscience among future educators, with descriptive and inferential analysis using SPSS	reflection on neuroscience in teacher training	and educational practices, especially how neuroscientific knowledge impacts future teachers' training
6	Education Sciences	Web of Science	Peregrina Nievas, P., & Gallardo-Montes, C. d. P. (2023)	Coding of public university study plans in Andalusia for the 2022/2023 school year was carried out. Frequencies of content and competencies were analyzed	It is recommended to improve neuroscience training for future teachers in Early Childhood and Primary Education in Andalusia. It is suggested to incorporate neuroscience content in degrees to raise awareness of its relevance	The study was conducted rigorously. The journal (Education Sciences) goes through a review process, which supports its relevance due to its focus on teacher training and educational neuroscience
7	Matices: Educación y Sociedad	Web of Science	Borlot, C. M.; Sette, F. A. da S.; Souza, K. R. A. (2023)	A study conducted in Brazil with a qualitative approach. Experiences were collected from early childhood educators who use financial education in teaching, based on the Brazilian Central Bank guidelines	It is suggested to encourage the creation of educational projects that combine financial education with classroom content	The source is relevant as it offers a critical and situated view of financial education in a global context, especially in vulnerable populations
8	Revista Electronic Educare	Web of Science	M. Painemal, S., C. Sepúlveda, & C. Muñoz (2021)	Qualitative approach through semi-structured interviews	Use multiple sources to examine different views and explore contrasts	A critical approach is taken in teacher training and educational innovation, with relevant contextualizatio

						n for Latin America

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No.	Journal	Database	Author(s)	Methodology	Recommendations	Relevance of the Source to the Research
9	Revista de Educación	Scielo	Andrade Magalhães, Wladimyr; Souza, Q. (2024)	Qualitative methodology based on collaborative narratives of students, analyzed using the non-adaptive narrative approach by Seligway & Dawson (2013)	Promote innovation from the perspective of teachers and the need to rethink their training to include emotional and human development aspects, such as conflict resolution, empathy, and emotional intelligence	The source is relevant because it reflects a critical and situated perspective that enriches teacher training. It values emotional and human aspects as keys for teachers' professional development
10	Revista Brasileira de Educação	Scielo	Zibetti, Claudio; Hergesel, D.; Alves, A. (2023)	25 lessons with university students who explored educational proposals using neurotechnology. These were analyzed using the "Brain Reading" and neuroeducational didactic resources framework	It is recommended to include technological innovation proposals, such as neurotechnology, in teacher training. This will strengthen pedagogical reflection and improve the cognitive and emotional development of students	The article provides an updated and rigorous look at the inclusion of neurotechnologies in education. It justifies the importance of strengthening teacher training with a focus on neuroscience and technological innovation
11	Revista Electrónica de Investigación Educativa	Scielo	Barroso de Alencar, H.; Meneghetti, M.; Bignotto, M.; Bignotto, M. M. (2020)	Qualitative narrative analysis of 10 social sciences students. Narratives were categorized based on the development of language and school socialization	The study highlights critical reflections on the role of teacher training programs in the development of language and school socialization. Proposals focus on didactic strategies to enhance students' expressive and social skills	Provides key insights into training future teachers in language and socialization development. Its critical approach adds depth to the analysis of the training process
12	Revista de Estudios y Experiencia	Scielo	Duque de Chinchilla, C.; Ojeda Alvarado;	25 lessons within the curriculum of the "Didactic	Recommends the inclusion of innovation strategies in	The source is very useful for understanding how storytelling,

	s en Educación		Villareal Donoso (2019)	Resources" course, applying educational innovation strategies	teacher training. Highlights the use of different types of resources: collaborative, visual, multimedia, etc., as well as the application of storytelling, gamification, flipped classroom, and emerging technologies	gamification, and flipped learning contribute to the diversification of teaching and the improvement of teacher training
13	Educación y Educadores	Scielo	Malagón, M.; Pulido, C. H.; Martínez, A. M.; Lagos, Y. (2022)	Qualitative study using a case study design based on the critical paradigm. The study explored the conceptions of pre-service teachers regarding critical pedagogies	The study suggests reflecting on the development of critical thinking, autonomy, and transformative action. It also proposes integrating reflection and action in teaching training to foster critical education	It is a relevant and current article. It presents a solid approach to teacher training based on critical pedagogy and reflection–action. It supports rethinking traditional education through teacher empowerment
14	Revista Electrónica Educare	Scielo	Hernández, Rodríguez, Y. M.; Cisneros-Cohernour, E.; Valverde-Porras, A. M. (2022)	Qualitative methodology with semi-structured interviews conducted with pre-service teachers. The research explored emerging educational narratives related to the SDGs and 2030 Agenda	The article recommends including sustainability topics in teacher training, focusing on planetary awareness, climate change, and the development of ethical and sustainable educational practices	The source is powerful because it connects teacher training with global sustainability challenges. It reflects the integration of the 2030 Agenda and offers insights into innovative pedagogies aligned with global development goals
15	Formación Universitaria	Scielo	Pérez-Moreno, M.; Méndez, M.; Martínez, M. M. (2023)	Qualitative methodology using content analysis of reflective journals and class discussions. The study was conducted with	It is suggested to include reflection on teaching practices, emotional aspects, and metacognitive skills. The study highlights the role of metacognition	The contributions are especially relevant in today's context, where reflective practice and metacognitive skills are fundamental. It

				students from the Master's in Teacher Training program	and emotional intelligence in reflective and transformative training	reinforces the need for emotional and cognitive balance in teacher training
16	Aula de Encuentro	Scielo	Yuste-Domínguez, M. J.; Blanco-Gijón, J. M.; Rodríguez-Brito, R. A. (2019)	Descriptive-comparative design to assess beliefs and metaphors about teaching among education students	The authors suggest creating training programs focused on identifying teaching beliefs and metaphors to understand how future teachers conceive their role and teaching models	The study is relevant because it reveals teaching beliefs that influence professional identity construction. It supports critical reflection and the need to consider student representations in teacher training

During the review of the articles, the relationship of each one with the two categories of analysis defined for this study was verified: "Neurodidactic strategies" and "Professional training of students", both linked to the Early Childhood Education career.

TABLE 2. ANALYSIS SYNTHESIS OF SELECTED ARTICLES ACCORDING TO ANALYSIS CATEGORIES

No.	Journal	Database	Author(s)	Category of Analysis: Neurodidactic Strategies in Early Childhood Education	Category of Analysis: Professional Training of Early Childhood Education Students
1	Frontiers in Education	Scopus	Piyna-Medina, C., Morales-Loro, V., Ferrer-Ribot, M., Oliver Barceló, MDM (2024)	The study focuses on the importance of neurodidactic strategies for early childhood education, emphasizing socio-emotional skills and play-based learning. It proposes that reflective and critical training contributes to understanding and applying neurodidactic strategies in the classroom	The article highlights the development of professional competencies in early childhood education, especially emphasizing emotional and social dimensions. It proposes future teachers should be trained to critically reflect on their pedagogical work in the early years
2	Revista de Currículo y Docencia	Scopus	Mike Arthur Herán Suárez, Alejandro Cruzata-Martínez, Miguel A. Saavedra-López, Ronald M.	The study presents perspectives on the integration of technologies in teaching practice, including tools supported by neuroscience and digital didactics. It underlines the	The article highlights the development of competencies and skills related to the professional training of early childhood educators

3	Ciencias de la Educación	Scopus	Maciás-Gómez, A., Díez-R., M., Serrano-Luján, L., & Bordás-Gené, O. (2021)	The use of the "Educational Hall Escape" strategy is analyzed, focusing on the development of innovation. It strengthens motivation and participation through neurodidactic tools such as games, ludic challenges, storytelling, and sensory simulations	Although the study is conducted with undergraduate students in general, it allows reflection on professional training in early childhood education, especially in contexts where playful strategies can be applied
			Hernández (2024)	importance of technological tools for promoting motivation, attention, and meaningful learning in early education	
4	Revista Interuniversitaria de Formación del Profesorado	Scopus	Betegón Blanca, E.; Rodríguez Medina, J., & Iturria Muñiz, M. J. (2019)	Neurodidactic principles are identified in the use of audiovisual and multisensory activities. The study addresses students' attention and emotional activation and relates these elements to neuroeducational development and the need to incorporate sensory and emotional resources in teaching	The study proposes the inclusion of multisensory resources and emotional development in teacher training. It values neurodidactic principles to promote inclusive and meaningful learning
5	Electrónica Interuniversitaria de Formación del Profesorado	Web of Science	Casillas-Martín, S., & Cabezas-González, M. (2024)	The study highlights the importance of including neuroscience content in the curriculum of teacher training. It analyzes the perception of future educators and their relationship with neurodidactic concepts and results	Although the main focus of the study is not early childhood education specifically, the integration of neurodidactics into teacher training allows the design of more inclusive practices
6	Education Sciences	Web of Science	Peregrina Nievas, P. (2023) Gallardo-Montes, C.d.P	The study identifies that in the Andalusian university context, neurodidactic strategies are not always explicitly mentioned, but there are indirect references to neuroscience and its applications in pedagogy. The authors highlight the need to strengthen the neurodidactic approach through teaching strategies that promote	It clearly highlights that professional training in early childhood education lacks a strong neuroscience foundation. The article emphasizes the importance of strengthening academic programs to include such content

Note: the first data-row fragment ("Hernández (2024)...") belongs to row 2 continuation above row 3.

No.	Journal	Database	Author(s)		
				executive functions, attention, and motivation	
7	Matices: Educación y Sociedad	Web of Science	Borlot, C. M.; Sette, F. A. da S.; Souza, K. R. A. (2023)	Neurodidactic strategies are observed in cases of play-based and context-based financial education proposals for young children. These strategies promote executive function and decision-making in real-life contexts	The study provides valuable insight into how financial education and decision-making can be incorporated into early childhood teacher training through neurodidactic strategies
8	Revista Electrónica Educare	Web of Science	M. Painemal, S., C. Sepúlveda, & C. Muñoz (2021)	Neurodidactic concepts are identified in the implementation of interdisciplinary didactic strategies that include art, physical education, and social sciences. Attention is placed on how these proposals stimulate sensory and emotional development	Neurodidactic strategies are connected to interdisciplinary learning and inclusive training. The study proposes reflection on how these strategies contribute to early childhood education teachers' training in both pedagogical and emotional dimensions

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No.	Journal	Database	Author(s)	Category of Analysis: Neurodidactic Strategies in Early Childhood Education	Category of Analysis: Professional Training of Early Childhood Education Students
9	Revista de Educación	Scielo	Andrade Magalhães, Wladimyr; Souza, Q. (2024)	The study analyzes the importance of socio-emotional development and emotional intelligence in training processes. It proposes that educators must be trained to work with emotional and cognitive tools in neurodidactic learning environments	The article is relevant because it highlights the importance of emotional competencies in early childhood education, as well as the need to understand them through critical-reflective teacher training
10	Revista Brasileira de Educação	Scielo	Zibetti, Claudio; Hergesel, D.; Alves, A. (2023)	It examines the contributions of neurotechnologies to learning and motivation processes in education. The integration of neurodidactic strategies is essential for understanding attention,	It highlights the importance of incorporating emerging technologies in teacher training. It stresses the need for training that includes technological innovation and

				memory, and emotional engagement	neuroeducation in early childhood education
11	Revista Electrónica de Investigación Educativa	Scielo	Barroso de Alencar, H.; Meneghetti, M.; Bignotto, M.; Bignotto, M. M. (2019)	It emphasizes cognitive and socio-linguistic processes in the development of language and interaction. The authors propose the inclusion of emotional and reflective training as essential neurodidactic strategies for teaching	The authors highlight the value of reflection, storytelling, and role-playing as key neurodidactic practices. These practices help improve cognitive-emotional skills, which are crucial in early childhood training
12	Revista de Estudios y Experiencias en Educación	Scielo	Duque de Chinchilla, C.; Ojeda Alvarado; Villareal Donoso (2019)	It recommends including neurodidactic tools such as storytelling, visual strategies, and simulations to enhance attention and sensory learning. It proposes that future teachers integrate creativity and innovation in the classroom	The article suggests a competency-based model for teacher education. It supports integrating neurodidactic tools into early childhood teacher training to promote innovation and creativity
13	Educación y Educadores	Scielo	Malagón, M.; Pulido, C. H.; Martínez, A. M.; Lagos, Y. (2022)	The study identifies neurodidactic components such as critical thinking and reflection in teacher training. It encourages educators to reflect on emotional and cognitive practices to foster significant learning	It stresses that neurodidactics are foundational in early childhood teacher education. The study emphasizes the importance of forming professionals with critical, reflective, and emotionally conscious profiles
14	Revista Electrónica Educare	Scielo	Hernández, Rodríguez, Y. M.; Cisneros-Cohernour, E.; Valverde-Porras, A. M. (2022)	It explores diverse narratives around neurodidactics and teacher experiences. It proposes that educational practices must integrate environmental awareness and emotional development through neurodidactic strategies	It supports teacher training that includes sustainability and neurodidactics. It suggests designing lesson plans that reflect emotional awareness and environmental responsibility through neurodidactic resources
15	Formación Universitaria	Scielo	Pérez-Moreno, M.; Méndez, M.; Martínez, M. M. (2023)	The study explores how neurodidactic strategies such as metacognition, emotional regulation, and reflective thinking contribute to the development of meaningful and inclusive learning environments	It indicates that teacher training should integrate emotional intelligence, motivation, and metacognitive strategies. It supports building reflective

					and emotionally aware teachers in early childhood education
16	Aula de Encuentro	Scielo	Yuste-Domínguez, M. J.; Blanco-Gijón, J. M.; Rodríguez-Brito, R. A. (2019)	It proposes didactic metaphors that promote emotional development and imagination. These strategies are important for the development of neurodidactic awareness in future teachers	The article emphasizes the role of metaphor in professional identity building. It highlights the importance of imagination and creativity in neurodidactic training for early childhood education

DISCUSSION

When applying the inclusion and exclusion criteria for the classification of academic articles, a clear trend was identified in the relationship between the categories of "Neurodidactic strategies" and "Professional training of students". The final sample was made up of 16 academic articles.

TABLE 3. FINAL ARTICLES INCLUDED FOR ANALYSIS

SCOPUS	4	25%	**Publication interval between the years 2018 to 2024**
WEB OF SCIENCE	4	25%	
SCIELO	8	50%	**Publication language: English - Spanish - Portuguese**
Total	**16**	**100%**	

Note: Based on indexing basis

Of the 16 articles selected, 25% come from the Scopus database, another 25% from Web of Science, and the remaining 50% from Scielo. The publication interval runs from 2018 to 2024. In terms of language, Spanish predominated, although articles in English and Portuguese were also included.

With regard to methodology (**Table 1**), most of the selected articles employ qualitative or mixed approaches, with emphasis on descriptive analyses through interviews, documentary analysis, and participant observation. These methodologies made it possible to identify contextualized perceptions and practices in the educational environment, especially with regard to the dimensions of teacher training and professional competence. Other articles focused on literature reviews on neuroplasticity and neurodidactics, with the aim of integrating neuroscience findings into teacher training, as Narváez (2018) points out.

Regarding the relevance (**Table 1**), of the sources, 68% of the studies justify the inclusion of emerging issues in pedagogy, the integration of neuroscience in teacher training, the detection of neuromyths in education and the impact of educational technologies. In addition, several works refer to the need to update university curricula to strengthen teaching competencies in the Early Childhood Education career. In terms of the components addressed, 56% of the articles focus on practical aspects of vocational training, while 31% highlight theoretical elements related to formative research and the understanding of neuroscience. Finally, 13% of the studies analyse both aspects, especially in the context of public education and curriculum policies. These results coincide with what was stated by Carriazo et al. (2020), who affirm the need to develop comprehensive professional competencies that respond to the realities of all actors in the training process.

For the analysis categories "Neurodidactic Strategies" and "Professional Training of Students" (**Table 2**), related to the selected articles, it was found that they are based on the principles of neuroscience and brain plasticity. The use of multisensory didactic alternatives, gamification, the development of sensation perception, the enhancement of attention and memory, as well as the creation and adaptation of learning environments articulated from a theoretical basis to practice in real or simulated environments are proposed. In addition, the development of competencies in both hard and soft skills is highlighted, which complements comprehensive training and the professional graduate profile (Arceo & Herrera, 2022).

Other findings that support this systematic review study, from the theoretical elements that direct the categories of analysis of the articles included, allowed us to approach the main objective, based on the

research process that recognizes neurodidactics as a key approach in the training of professionals in Early Childhood Education. An argumentative and descriptive response is provided to each of the components of the PICO method.

In relation to the (**P**) **Population**: students in training in Early Childhood Education, the question posed was: How does the integration of neurodidactic knowledge contribute to the training of students in the Early Childhood Education Career? It is observed that this population, in the future, will be responsible for the education of children and must demonstrate, both theoretically and practically, specific professional competencies (Tobón, 2013). To contribute to early childhood training, these future professionals are expected to understand neuroscience as an approach applicable to education, developing socio-emotional competencies, knowledge about neuroplasticity, and skills to implement pedagogical strategies based on neurodidactic evidence. Likewise, it seeks to minimize adherence to neuromyths that limit the transfer of knowledge to the work context.

Regarding component (**I**) **Intervention**, the question was oriented to the implementation of neurodidactic strategies in the initial training of students: To what extent does the implementation of neurodidactic strategies contribute to the training of students in the Early Childhood Education Career? The analysis shows the relevance of including neurodidactics in the teacher training curriculum, not only to teach neuroscientific theories, but also to promote the practical application of this knowledge through active methodologies that promote participation and meaningful learning. The reviewed articles suggest that neuroscience training helps educators better understand how children learn and tailor their teaching strategies to students' needs and characteristics. It also makes it possible to identify and minimize the cultural tendencies associated with neuromyths (Casillas & Cabezas, 2024) and to integrate socio-emotional actions focused on neuroeducation.

Following the PICO method, element (**C**) **Comparison** refers to conventional training without integration of neurodidactic strategies. The question posed was: What training alternatives are used in a conventional model and in one with neurodidactic strategies for students of the Early Childhood Education Career? When comparing both alternatives, it is observed that innovative methodologies can increase motivation and academic performance, as well as favor the development of hard and soft competencies and skills, benefiting educational practice and consolidating professional confidence. In addition, it is essential to develop cognitive and metacognition processes (Espinoza et al., 2022).

Finally, component (**R**) **Result** assesses the improvement of competencies in the training of students in Early Childhood Education. The corresponding question was: What have been the results of the application of neurodidactics in the training of students of the Early Childhood Education Career? The results show an improvement in students' understanding of learning processes, as well as a greater development of socio-emotional skills, essential for early education. It is anticipated that educators trained with a neurodidactic approach will be more effective in their teaching practice, with a greater capacity to implement innovative pedagogical strategies (Nieves, 2024). In addition, they demonstrate greater motivation and satisfaction in the training process, which translates into more meaningful learning and a better overall development of the children.

CONCLUSIONS

Neurodidactics emerges as an essential approach in the training of professionals in early education. This approach allows for the integration of neuroscientific principles that not only enrich the teaching-learning process, but also promote a deeper understanding of how students learn. Evidence suggests that by applying neurodidactic strategies, educators can adapt their pedagogical practices to the cognitive and emotional characteristics of their learners, thus improving educational quality. Therefore, it is critical that teacher education programs include neuroscience-related content to prepare future educators holistically.

Despite the potential benefits, the implementation of neurodidactic strategies faces numerous challenges in the Latin American context. The scarcity of continuous training and resistance to new methodologies are factors that limit the adoption of these practices. In addition, the lack of updating in the curricula that do not respond to the current demands of education. Thus, it is crucial to address these barriers to ensure that neurodidactics is not only a theoretical concept, but a practical reality in classrooms.

The systematic review infers the need to promote continuous research in the field of neuroeducation. The scarcity of studies in Latin America on neurodidactics highlights the urgency of generating more research that evaluates the effectiveness of these strategies in specific contexts. This will not only contribute to the creation of a robust body of knowledge, but will also inform education policymakers about the importance of integrating neuroscience into teacher education programmes. Research should be aimed at identifying best practices and adapting neurodidactic strategies to the cultural and socioeconomic particularities of the population.

CONFLICT OF INTEREST

The authors of this article have no conflict of interest to publish it, because it is the product of their own original research work.

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