# NEUROPEDAGOGY FOR MULTICULTURAL CLASSROOMS: NEUROMETHODOLOGY FOR INCLUSION

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**Summary**. The main objective of this article is to learn about neuropedagogy in order to apply neuromethodologies in multicultural classrooms for the inclusion of students. For this purpose, a bibliographic review was carried out in which updated articles and book chapters were collected that dealt with neuropedagogy and neuromethodology as an inclusion strategy in today's classrooms, which are pluricultural contexts. The results obtained have been different neuromethodologies that can be applied in the classroom, among which we highlight *Mindfulness*, meditation, competency-based learning, project-based learning, game-based learning, cooperative learning, *flipped classroom*, *design thinking*, gamification or a neuromethodology closely linked to the current technological era such as *mobile learning.* In conclusion, we can highlight the need for these neuromethodologies in student learning in order for them to become future active citizens in society. Together with the need to train teachers and future teachers in neuropedagogy with the ultimate goal of implementing these neuromethodologies in the classroom and to attend to the diversity of students in an inclusive way in a school that is for all, based on equity and educational quality.

**Key words:** neuropedagogy, neuromethodology, multicultural, inclusion, classrooms.

# NEUROPEDAGOGÍA PARA LAS AULAS PLURICULTURALES: LA NEUROMETODOLOGÍA PARA LA INCLUSIÓN

**Resumen**. Este artículo tiene como objetivo principal es conocer la neuropedagogía para aplicar las neurometodologías en las aulas pluriculturales para la inclusión del alumnado. Para ello se ha llevado a cabo una revisión bibliográfica en la que se han recogido artículos y capítulos de libro actualizados que trataban la neuropedagogía y la neurometodología como una estrategia de inclusión en las aulas actuales, las cuales son contextos pluriculturales. Los resultados obtenidos han sido diferentes neurometodologías que pueden aplicarse en el aula, entre las que destacamos el *Mindfulness*, la meditanción, el aprendizaje basado en competencias, el aprendizaje basado en proyectos, el aprendizaje basado en el juego, el aprendizaje cooperativo, *flipped classroom*, *design thinking*, gamificación o una neurometodología muy ligada a la Era Tecnológica actual como es el *mobile learning.* A modo de conclusión se puede destacar la necesidad de estas neurometodologías en el aprendizaje del alumnado para que sean futuros ciudadanos activos en la sociedad. Junto con la necesidad de formar al profesorado y a los futuros docentes en neuropedagogía con el objetivo último de implementar estas neurometodologías en el aula y atender a la diversidad del alumnado de forma inclusiva en una escuela que sea para todos desde la equidad y calidad educativa.

**Palabras clave:** neuropedagogía, neurometodología, pluricultural, inclusión, aulas.

## Introduction

We are currently witnessing a boom in neuropedagogy as a step beyond neuroscience applied to education. Thus, congresses and training courses on neuropedagogy are beginning to appear in Spain due to the imperative need for training in this branch of neuroscience for today's teachers. This is because we live in a society of continuous change in which many cultures coexist, which leads to multiculturalism in our classrooms and the inherent need for the inclusion of students in the school.

However, according to Hernandez (2022) it is possible to find the term neuropedagogy in the scientific literature, but there are no entries to international impact journals that investigate the term or show its components.

Similarly, as De Barros (2022) points out, neuromethodology does not present research in global databases either.

Since multicultural contexts imply the coexistence and coexistence of different groups from different cultures, in these contexts it will be necessary to work on the group identity process (Lapresta and Huguet, 2006).

Therefore, an inclusive school must prepare students to identify and accept cultural diversity in order to be able to develop in a multicultural context, becoming aware of and rethinking their own cultural identity to break with the prejudices and limits established throughout history with the aim of building societies that live together in cultural diversity and accept the cultural differences of others, even sharing customs (Arnaiz and De Haro, 2003).

Currently in force in Spain is Organic Law 3/2020, of December 29, which amends Organic Law 2/2006, of May 3, 2006, on Education, known as LOMLOE. The principles of this law are inclusion and participation, quality, equity, non-discrimination

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and equality in access and continuity in the educational system and universal accessibility for all students. In addition, it advocates that in primary education it should be a priority to ensure educational inclusion with personalized attention to students and their needs, guaranteeing participation and coexistence (Government of Spain, 2020). In other words, the LOMLOE goes one step further than equality, equity, which is characterized by offering each person the necessary help to achieve the same objectives as their peers, since this is the basic principle of inclusion and this is the basis of educational quality, participation and equal access without discrimination based on personal, physical, ethnic, etc. issues.

Studies and research on neuroscience clearly highlight its beneficial contribution to education (Ruiz and Kwan, 2020). Neuroscience aims to participate in offering new knowledge to teachers to change and improve their teaching-learning process. Therefore, teachers will have to be attentive and know what aspects they can include in their pedagogical practice in a way that benefits students and brings more quality to their teaching. Therefore, it is important to know well all those neuroscientific strategies that can be applied in the classroom and avoid those fallacies about the teaching-learning process that have been created around neuroscience, known as neuromyths, i.e., they should base their practices on studies that are already validated (Flores, 2022).

Thus, neuroeducation arises to improve education and teaching techniques, that is, the teaching-learning processes, based on knowledge of other sciences related to the brain with the restructuring of pedagogical practice. It is an interdiscipline and a transdiscipline in which neurologists, psychologists and pedagogues work together and collaboratively to make education of quality and contemplate all people in an equitable manner (Luis and Marcelino, 2020).

Today our classrooms are multicultural, which means that we must take into account the inclusion of students from neuroeducation. According to Borsese (2022), neuropedagogy is a way of helping to know and enhance people's abilities, which is why it is necessary in schools. For it is linked to a cultural view of teaching that honors reflection and metacognition, rather than the usual efficiency and speed to which the educational system is accustomed. That is to say, class work should be based on creating cognitive processes to build their knowledge in an autonomous way. This implies a pleasant climate in which learning creates feelings and emotions with its consequent motivation, through the connection of the contents with reality.

With neuropedagogy in the classroom, the brain sequence of the students' diversity will be possible, according to the idea of Borsese (2022) in environments that promote learning through affective development and adaptability of the brain with flexibility and plasticity. It is important to increase the brain's potential, so students will learn in a multisensory and interdisciplinary way and teachers will take into account the brain diversity and learning styles of their students (Esteban et al., 2022).

According to Palomares (2022), neuropedagogy is a discipline that seeks to develop the potential of our brain to increase our learning capacity. Furthermore, as Palomares (2022) states, according to Esteban et al. (2022) and Borsese (2022), is a discipline that is based on emotions, motivation, classroom climate, respect for different learning rhythms, memory, movement and social interaction.

Therefore, neuropedagogy, according to Pérez (2022) is a science that studies the way in which neurons and their brain connections are activated, through teaching and

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learning processes so that brain activity is fully developed. Therefore, neuropedagogy causes brain changes that improve the teaching and learning process. Neuropedagogy is, therefore, an applied science to study new forms of education through the correct use of neuropsychological resources, i.e. cognitive and affective, so that the student can learn in different and adequate scenarios for personal growth.

In other words, neuropedagogy is a science that studies education from a neuroeducational perspective, with the aim of configuring, from education, neurotheory and neuromethodology, with its practice that is neurodidactics (Hernández, 2022).

Therefore, we need to know what neurodidactics is. It can be qualified as a new discipline that arises with the progress in neuroscience. Neurodidactics deals with the analysis of the bases of the brain that are involved in the teaching-learning process. Through neurodidactics we try to understand and enrich the teaching processes. That is, neurodidactics bets on knowing the functioning and brain structures that are responsible for learning (De Barros and Hernández, 2018).

Neurodidactics is the application of knowledge about education in the classroom. Neurodidactics is very important as it is linked to emotions and thoughts building neural bases for learning, memory and emotions that are daily stimulated in the classroom (Perero and Rodriguez, 2020).

For neuroeducation to be effective in the classroom, teachers can use various techniques or methodologies that make student learning meaningful. Some examples of this would be: encouraging an appropriate classroom climate in which students feel comfortable and safe. Together with a good organization of the classroom and the environment, in a personal and relaxed atmosphere with teachers and peers, etc. (Luis and Marcelino, 2020; Moreno et al., 2020).

This means that creativity, the ability to synthesize, understand, analyze or develop skills in all subjects that make up the school curriculum should be encouraged, because this way learning can be taken from the classroom to everyday life, that is, learning can be applied in day-to-day life as it will go beyond the walls of the school. That is why neuropedagogy attaches so much importance to emotional learning, which will provide students with tools that will enable them to recognize, regulate and express emotions at school and in life outside the school (Luis and Marcelino, 2020; Moreno et al., 2020; Hernández, 2022).

From neuroscience and education, multiple didactic strategies are advocated, along with attractive materials to make the teaching-learning process better and motivating and, in turn, enable students to acquire knowledge and understand their environment so that they can make significant contributions to society. To motivate learning, materials must be attractive (Luis and Marcelino, 2020).

Thus, according to Professor and Dr. According to Barros (2022), for our educational system to be of quality, it is essential to talk about neuromethodology from a neurodidactic perspective. Following this idea, he also states that teaching methods must be transformed into neuromethods. Thus, neuromethodology will be considered essential for teacher training. Thus, neuromethodology can be defined as the group of strategies, methods, techniques, instruments and didactic resources that integrate technology and

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inclusion for an innovative and quality education on a neuropedagogical basis (Melero, 2022).

Therefore, the aim of the article is to learn about neuropedagogy in order to apply neuromethodologies in multicultural classrooms for the inclusion of students.

## Methodology

*Design*

The design of this research has been a literature review of scientific papers and articles related to neuropedagogy through neuromethodology for inclusion in multicultural contexts.

*Search strategies*

The search strategies followed were, first of all, a search in international databases including the terms neuroscience, neureduction, neuropedagogy, neuromethodology, inclusion and multicultural contexts. In none of the searches of the above databases was the year of publication limited.

*Selection criteria*

The inclusion criteria followed were based on the studies being conducted through neuropedagogy for inclusion in multicultural contexts with emerging neuromethodologies. On the other hand, articles that did not show anything related to neuroscience, neuropedagogy, neuroeducation, neuromethodology, inclusion or multiculturalism were excluded.

*Data extraction*

A search of international databases was carried out for data extraction. From the total results of these databases, we selected about 30 documents, including articles and book chapters, after reading their abstracts, which contained relevant information for this review

*Data analysis*

The analysis of these articles has allowed us to detect the different neuromethodologies available through neuropedagogy for inclusion in multicultural contexts.

## Results

It is necessary to highlight the following neuromethodologies:

Mindfulness: helps the teacher to effectively manage stress academically and emotionally. This improves emotional self-regulation, decreases the level of stress, increases attention and concentration and also helps students to be resilient, creative and positive (Luis and Marcelino, 2020). Some studies also show a decrease in childhood depression, which leads to a better quality of life for students and increased levels of attention (Palomero and Valero, 2019).

Meditation and relaxation: also helps self-control, improves concentration and attention, self-awareness of the body and the environment, decreases anxiety, among others (Luis and Marcelino, 2020). In addition, according to several studies carried out, meditation in the classroom causes students to become aware and self-confident, which leads to the development of empathy and improves their ability to relate socially with others (Vargas, 2010).

Cooperative learning: which is carried out with group work to improve attention, involvement and knowledge acquisition as the person is involved with other people (Hernández, 2022). In addition, it is also a strategy that improves classroom coexistence and implies a relationship with others, which leads to the development of social competence (Gracía, Traver & Candela, 2001).

Project Based Learning: or PBL, is an innovative teaching-learning strategy to educate and at the same time try to create an active society with meaningful learning, which implies an active role of the students who construct their learning and make it more enriching (Zambrano et al., 2022). Project Based Learning involves forming teams composed of people with different profiles, disciplinary areas, professions, languages and cultures who work together to carry out projects to solve real problems. These differences offer great opportunities for learning and will prepare students to work in a diverse and global environment and economy (Galeana, 2006).

Competency-based learning: o ABC for the acquisition of knowledge and development of generic or transversal skills that will enable students to apply their learning to the context in which they develop (Hernández, 2022). Therefore, in view of the new requirements of the context, many countries have sought to develop training proposals that guarantee integration, comprehensiveness, transferability and applicability of knowledge, relevance and evidence of results. Some of these features have become evident in the so-called competency-based educational approaches and models (Villa and Poblete, 2007).

Game-Based Learning: or ABJ is based on the game to learn (Conellà et al., 2020). It is an innovative and practical methodology that makes students feel motivated and involved in their learning (Martín and Pastor, 2020). In addition, the teacher will have the role of learning guide and will mediate in the emotional, cognitive and educational processes of the students, which leads to an improvement in the students' academic results and more motivation towards learning (Martín and Pastor, 2020).

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*Flipped Classroom*: or Aula Invertida in Spanish, is a model in which the students assume the role of teacher and are the protagonists of their learning, while the teacher is a guide (Hernández, 2022). To do so, students will have to work on their topic at home beforehand. Through this methodology it is possible to work on empathy, since it is necessary to position oneself in the place of the other (Melero, 2022).

Gamification: it is not the same as ABJ. With this method, play is the basis of the teaching-learning process. This technique is intended to contribute to the social and psychological behavior of the students and to encourage participation in the game. With gamification, game elements are used in non-playful contexts through student roles and with active participation through intrinsic motivation to obtain meaningful and functional learning as a result. Learning is taken as positive and motivation, curiosity, effort and cooperation are worked on in the classroom (Hernández, 2022).

*Design Thinking*: it is a phased approach to create various innovative solutions according to the needs and characteristics of each person, since multiple issues are worked on. Creativity is worked with essays until innovative ideas emerge and this makes the students' motivation to learn high (Melero, 2022). It is usually confused with *Visual Thinking*. However, *Visual Thinking* is one of the visual tools based on mental maps of images that can be used in *Design Thinking* (Chon and Sim, 2019; Hernandez, 2022).

*Mobile Learning*: is a new strategy that aims to make students learn through different technological means such as cell phones, tablets, consoles, iPads, etc. It is an innovative and motivating methodology for students as it is very contemporary to the technological revolution in which we live. In addition, it also benefits from the exchange of opinions, knowledge, reflections, etc. through forums, blogs, Wikis and this will generate learning (Melero, 2022).

### Discussion and conclusions

Therefore, the neuromethodology, since it is based on the best way of learning according to the neurodiversity of people, will be based on the Universal Design of Education (UDE) contemplating theories on inclusion, together with constructivist, cognitivist, behavioral, plurisensory and multisensory, as well as contextual theories, according to Martínez et al. (2022) from the perspective of quality education and equity with a Universal Learning Design (ULD) with materials focused on the teaching-learning process valid for all students regardless of their personal characteristics and educational needs (Delgado, 2021).

Teacher training in multiculturalism is essential to reformulate the school structure and promote the development of intercultural educational policies. Therefore, changes aimed at educational reform to achieve a democratic and intercultural society must favor the training of teachers to carry out intercultural school practices, curricular reforms and promote the educational principles required by cultural diversity in society. To this end, spaces for discussion and debate should be created to help teachers reflect on and acquire the philosophy, methodological skills, social, political and moral commitment involved in the practice of an intercultural educational project (Escámez, 2002).

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For schools to be inclusive it is necessary for teachers to be trained or have experience in inclusive environments (Guevara and Zacarias, 2016). However, teacher training should not be from an individual perspective to develop their profession in isolation, but should be from a joint perspective that allows them to participate in the teaching activity (Giné and Durán, 2017). Since teacher training will make teaching and environments of quality for the improvement of the center, which will lead to a sustainable education in accordance with the UN Sustainable Development Goals SDGs for 2030.

While it is true that neuropedagogy is an emerging term in recent years, authors such as Hernández (2022), point out the imminent need to establish neuropedagogy in the training of teachers in the 21st century.

Thus, as Fernández (2022) and Pérez (2022) point out, in order to be sure that teachers develop our didactic actions in appropriate learning environments that favor the comprehensive development of students and the use of personalized and participatory methodologies in accordance with inclusive education, it is necessary to include neuropedagogy in the curriculum of the degree in Education.

In short, according to the conceptualizations presented in this article, it is necessary to train teachers from neuropedagogy so that the teaching-learning processes are based on neuromethodologies in accordance with the cultural diversity of the student body that we find in Spain today, since it is necessary for education to be inclusive and to offer the same opportunities for all and to educate in interculturality so that when this interculturality is overcome by education, it gives way to a transcultural education in which different customs are shared among the students, passing first through the intraculturality that entails knowing and valuing one's own culture. In this way, education will be of quality, equitable and sustainable, and students will be seen as inclusive citizens, capable of solving their daily problems.

In addition, the students' motivation to learn is also evidenced by the innovation and the active role of the students in the neuromethodologies. We must not forget that we are working with children and that we must involve them and motivate them so that they can learn. Therefore, I believe that in addition to all the inclusive neuromethodologies in multicultural environments that have been exposed, we must always rely on "People Based Learning" because children, as individuals and future citizens must feel the excitement and acceptance during learning and this will be achieved in comfortable environments for them where all people are equally respected and included.

The main limitation of this article has been the scarcity of research on neuromethodology for inclusion in multicultural contexts. Therefore, a proposal would be to continue with quantitative and qualitative research about neuromethodology to further expand this field of research with the foundations laid by Dr. De Barros in 2022 to advance and improve our educational quality and equity and achieve the utopia of a school for all that has been pursued for so many years by knowing how the brain of each person works with minimally invasive techniques such as those being initiated by Dr. Hernandez in 2022 using the EPOC helmet to learn about the electrical impulses of the brain during the teaching-learning process.

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