

Discussing neurodiversity in mathematics education: the new terminologies that emerge in studies on autism

Discutir la neurodiversidad en la educación matemática: las nuevas terminologías que emergen en los estudios sobre el autismo

Discuter de la neurodiversité dans l'enseignement des mathématiques : les nouvelles terminologies qui émergent dans les études sur l'autisme

Discutindo a neurodiversidade na educação matemática: as novas terminologias que emergem nos estudos sobre o autismo

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Abstract

Intending to explore the terminologies, practices, and attitudes that permeate neurodivergent students' inclusion and are shown in the mathematics teacher's vocabulary, this paper presents a study that answers the following research question: Which assumptions can we identify in mathematics teachers' vocabulary regarding autism? The data produced in the study consisted of registers by eight mathematics teachers from two public schools in the city of São Paulo answering an online questionnaire. The analysis assumes the principles of neurodiversity as a theoretical framework. It identifies three assumptions in the vocabulary of the participating teachers: (1) the recognition of needs arising from neurodivergence as a criterion for validating teaching practice, with the search for adjustment, adaptation, and pedagogical support that complements the school inclusion process; (2) the introduction of terminologies derived from the neurodiversity movement; and (3) medical explanation aligned with definitions and related descriptors in healthcare manuals. We conclude that neurodiversity is a movement with the potential to bring about such changes in the educational scenario. Still, as mathematics

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educators, we are incited to think how close we are to the sociological and critical ground in which this movement originates.

Keywords: Autism, Neurodivergent, Neurodiverse, Neurominority, Assumptions.

Resumen

Con el objetivo de explorar las terminologías, prácticas y actitudes que permean la inclusión de los estudiantes neurodivergentes y que se manifiestan en el vocabulario del profesor de matemáticas, se presenta un estudio que respondió a la siguiente pregunta de investigación: ¿cuáles son los supuestos que podemos identificar en el vocabulario de los profesores de matemáticas con respecto al tema del autismo? Los datos producidos en el estudio consistieron en registros realizados por ocho profesores de matemáticas de dos escuelas públicas de la ciudad de São Paulo que respondieron un cuestionario en línea. El análisis asume como marco teórico los principios de la neurodiversidad, identifica tres supuestos en el vocabulario de los docentes participantes: (1) el reconocimiento de las necesidades derivadas de la neurodivergencia como criterio de validación de la práctica docente, con la búsqueda de adaptaciones, adaptaciones y prácticas pedagógicas. apoyo que complementa el proceso de inclusión escolar; (2) la introducción de terminologías derivadas del movimiento de la neurodiversidad; y (3) explicación médica alineada con definiciones y descriptores relacionados en manuales de atención médica. Concluye que la neurodiversidad se muestra como un movimiento con el potencial de provocar tales cambios en el escenario educativo, pero como educadores matemáticos, nos incita a pensar cuán cerca estamos del terreno sociológico y crítico en el que se origina este movimiento.

Palabras clave: Autismo, Neurodivergente, Neurodiverso, Neurominoritario, Supuestos.

Résumé

Dans le but d'explorer les terminologies, les pratiques et les attitudes qui imprègnent l'inclusion des élèves neurodivergents et qui se manifestent dans le vocabulaire du professeur de mathématiques, il présente une étude qui a répondu à la question de recherche suivante : quelles sont les hypothèses que nous pouvons identifier dans le vocabulaire des professeurs de Mathématiques sur le thème de l'autisme ? Les données produites dans le cadre de l'étude consistaient en des enregistrements réalisés par huit professeurs de mathématiques de deux écoles publiques de la ville de São Paulo répondant à un questionnaire en ligne. L'analyse assume les principes de la neurodiversité comme cadre théorique, identifie trois hypothèses dans le vocabulaire des enseignants participants: (1) la reconnaissance des besoins découlant de la neurodivergence comme critère de validation de la pratique enseignante, avec la recherche

d'adaptations, d'adaptations et d'adaptations pédagogiques un soutien complémentaire au processus d'inclusion scolaire ; (2) l'introduction de terminologies issues du mouvement de la neurodiversité ; et (3) une explication médicale alignée sur les définitions et les descripteurs associés dans les manuels de soins de santé. Il conclut que la neurodiversité se révèle être un mouvement ayant le potentiel d'apporter de tels changements dans le scénario éducatif, mais en tant qu'enseignants de mathématiques, nous sommes amenés à penser à quel point nous sommes proches du terrain sociologique et critique dans lequel ce mouvement prend naissance.

Mots-clés: Autisme, Neurodivergent, Neurodiverse, Neurominorité, Hypothèses.

Resumo

Com o objetivo de explorar as terminologias, práticas e atitudes que permeiam a inclusão de estudantes neurodivergentes e que se mostram no vocabulário do professor de matemática, este artigo apresenta um estudo que respondeu à seguinte pergunta de pesquisa: quais são os pressupostos que podemos identificar no vocabulário de professores de matemática no que se refere à temática do autismo? Os dados produzidos no estudo se constituíram a partir de registros feitos por oito professores de matemática de duas escolas públicas da cidade de São Paulo respondendo um questionário on-line. A análise assume os princípios da neurodiversidade como um referencial teórico, e identifica três pressupostos no vocabulário dos professores participantes: (1) o reconhecimento das necessidades oriundas da neurodivergência como um critério para a validação da prática docente, sendo fundamental a busca de adequações, adaptações e apoio pedagógico que complemente o processo de inclusão escolar; (2) a introdução de terminologias oriundas do movimento da neurodiversidade; e (3) a explicação médica alinhada com as definições e descritores relacionados em manuais da área da saúde. Conclui-se que a neurodiversidade se mostra como um movimento com potencialidades para provocar mudanças no cenário educacional, principalmente por provocar o pensar de maneira sociológica e crítica, bases nas quais esse movimento se origina.

Palavras-chave: Autismo, Neurodivergente, Neurodiverso, Neurominoria, Pressupostos.

Discussing neurodiversity in mathematics education: The new terminologies that emerge in studies on autism

Studies on groups of historically marginalized students occupy a space of discussion in mathematics education, which has expanded mainly since the beginning of the present century (Chen & Horn, 2022; Kitchen et al., 2016). Among these groups, we identified the one composed of people commonly identified with autism spectrum disorder (ASD), but who, in this article, we prefer to call neurodivergent people, as proposed within the scope of neurodiversity.

Neurodiversity is currently defined as a social and political movement represented by those who are neurologically different, composing a new category of research added to others already discussed, such as those focused on social class, gender, and ethnic-racial issues. As a movement, neurodiversity extends the social model of disability, proposing advances for the postmodern era, being introduced in the 1990s by activists who claim that autism is not a problem to be cured or solved in humanity but rather an alternative form of human biology to be accepted and respected (Blume, 1997; 1998; Jaarsma & Welin, 2012; Meyerding, 2014; Sinclair, 1993; Singer, 1999).

Neurodiversity has significantly influenced both the approaches taken and the assumptions that underlie the practices of professionals and researchers from different areas of knowledge, such as speech and language (Constantino, 2018), public policies (Baker, 2011), and health (Doyle, 2020; Jaarsma & Welin, 2012), among others.

There is a consensus among some authors (Abreu, 2022; Blume, 1998) that the formation of the term neurodiversity is based on the term biodiversity, which, in turn, was conceived mainly grounded on the political purpose of defending the conservation of all species, biodiversity being a necessary factor for the development of a prosperous ecosystem. In this sense, the term neurodiversity, according to these authors, was formed by different activists with the same purpose as the term biodiversity.

The term neurodiversity was implemented to argue that society would benefit from the recognition of autism and some other generally related diagnoses by the health sector as one of the characteristics of humanity and not as a pathology, contributing through this argument for the healthy development of humankind (Baker, 2011; Doyle, 2020; Ortega, 2009b).

This healthy development of humanity emerges as an essential objective in our century, given the frequent processes of exclusion that have formed in the trajectory of humanity over the centuries. Such processes were anchored in the paradigm of exclusion, reverberating in the exclusion of some people from social life and even in the extermination of different groups marked by a particular characteristic considered negative, according to a specific dominant ideology that prevailed in society (Jannuzzi, 2012; Orrú, 2009).

We know that this new way of understanding autism, incited by the neurodiversity movement, approaches a more critical discussion on this topic. Still, it is essential to highlight that there is also criticism about the movement, including in our country, the main one being the sub-representation of autistic people, who demand a high level of support in this movement.

This underrepresentation was observed in the literature at the beginning of the formation of the neurodiversity movement, with the organization of the movement being led by what was commonly called at the beginning of our century, “high-functioning autistic people,” who granted themselves the right to express themselves as representatives of all autistic people. However, families whose autistic-identified people present more complexity in communication and interaction, such as those known as “non-speaking” or “non-verbal,” felt uncomfortable with such intended representation (Abreu, 2022; Ortega, 2009a).

The underrepresentation of autistic people with a need for additional support in communication and interaction is recognized by Judy Singer herself, one of those responsible for coining the term neurodiversity. After twenty years of this achievement, she understood that the underrepresentation owes to the fact that the medical model has ignored Asperger’s syndrome –which until recently was listed in health manuals as a cultural identity as it is, causing profound effects on the autistic community (Abreu, 2022; Singer, 2016).

In mathematics education, we identify studies that develop from what is postulated by the neurodiversity movement. However, this investigative conduct is still growing in the research movement. On the international scenario, a literature review conducted at the beginning of our century on how educational needs –mainly of students with disabilities and different disorders– were studied in mathematics education identified that medical models prevailed until then as assumptions in most of the documents analyzed, which resulted in studies that understand difficulties in learning mathematics as innate in the individual, depending on the disability or disorder they present (Magne, 2003).

One of the problems Magne (2003) highlighted from an extensive literature review is that the studies analyzed lacked an analysis based on philosophical and didactic principles when discussing some students' educational needs in mathematics learning. Such principles exist and, even if implicitly, develop the ground on which research bases its objectives and methodological trajectory, constituting an investigative dynamic that seeks to meet the assumptions of a given paradigm.

In Brazil, we have a mathematics education that, in recent years, especially since the second half of our century, has strived to overcome these medical paradigms about autism, using terminologies generated in the neurodiversity movement and accepting the assumptions of more sociological than clinical nature in the basis of research (Cordeiro, 2015; Gaviolli, 2018; Santos, 2021; Viana, 2019; Viana & Manrique, 2020). As Ferreira (2022) identified, what we notice in Brazilian mathematics education is the destabilization of references used by mathematics educators when researching autism, which culminates in the search for new paradigms in their studies.

Thus, discussing neurodiversity requires us to consider this dynamism in which a new investigative ground on autism and other neurodivergence is constituted. This soil is watered by new principles aligned with a more sociological than medical perspective, reflected in terminological changes over the years.

These terminological changes are frequent and expected in special education. This topic deserves researchers' attention, as Osgood (2006) observed when analyzing the evolution and meanings of different terminologies in the field. However, looking specifically at the terminologies that are used in studies on autism, we notice a moment of terminological transition caused mainly by the neurodiversity movement. As Fletcher-Watson (2020) commented, a not-yet standardized vocabulary forms in the community, practice, or research during this transition.

Based on these considerations, we developed a study to explore the terminologies, practices, and attitudes that permeate the inclusion of neurodivergent students and appear in the mathematics teachers' vocabulary. It is worth highlighting that this article is a study of a qualitative and philosophical nature, starting from a post-structuralist perspective that contributes to the deconstruction of totalizing categories. However, in the socio-historical context of this study, we must discuss the use of terminologies and how this use affects the

student's personality formation and the teaching practices implemented during their school inclusion.

The terminologies generated in the neurodiversity movement

Studies have identified that autism and other diagnoses that are related through psychology and psychiatry are in a spectrum composed of a series of interrelated multidimensional traits (Bailey & Parr, 2003; Couteur et al., 1996; Posserud et al., 2006; Larsson et al., 2012).

These studies highlight that such multidimensional traits are not only shown in people diagnosed with autism; they are also shown in a subclinical population, which, in turn, does not have the diagnosis. This phenomenon is known in the literature as the “broader autism phenotype,” and reflects the understanding that there is no exact bimodal distribution that distinguishes people with and without autism, as there are autism traits distributed throughout the population (Steer et al., 2010, p. 2). It is essential to highlight that this does not mean that every human being is autistic or, as some mistakenly say, “a little autistic.”

From this understanding, we can make sense of the definition of neurodiverse, which comprises the entire human population since we all have traits that characterize us in human diversity (Wise, 2023). Therefore, it would be incoherent to talk about the existence of some neurodiverse people since the entire human population is neurodiverse. In other words, being neurodiverse, as Abreu (2022) explains, characterizes us as human beings and is not a characteristic of just a specific group of people.

In this understanding of “neurodiverse,” mainly from the 1990s onwards, we identify people who mobilize politically under the same banner of neurodiversity. We define this mobilization as a neurodiversity movement that seeks civil rights, equality, respect, and full social inclusion for those this movement calls neurodivergent people.

The word “neurodivergent,” unlike the term “neurodiverse,” refers to people who are historically part of minority groups that differ in neurological nature, such as autistic people and those with attention-deficit/hyperactivity disorder, among others. Literature often brings that the activist for autistic people's rights, Kassiane Asasumasu, coined the term neurodivergence to refer to the broad spectrum of neurocognitive functioning, which, in turn, differs from what is generally considered standard (Abreu, 2022; Logan, 2020; Walker &

Raymaker, 2021). Although some works indicate Judy Singer as responsible for coining the term neurodiversity, several authors affirm that the term “neurodivergent” was inaugurated by Kassiane Asasumasu (Fletcher-Watson, 2020; Walker, 2014; Walker & Raymaker, 2021).

Stating that a person is neurodivergent means, in other words, that their minds function in a markedly divergent way from the dominant social conventions the community conceives as standard. In this sense, a person who has neurocognitive functioning that diverges from culturally dominant patterns is neurodivergent, and neurodivergence is the state of being neurodivergent (Walker, 2021; Walker & Raymaker, 2021).

Some authors prefer to use the term neurodivergent identities, thus highlighting the multiple groups that take center stage in this space for discussion, such as those made up of people with dyslexia, epilepsy, and traumatic brain injury, among other people who, as a whole, form the large neurodivergent community, thus avoiding the idea that the group of autistic people is the only group that participates and takes center stage in this space (Egner, 2019).

Here, we must take terminological care because, as Walker (2014) explains, as opposed to neurodivergent, we have the term neurotypical, which can be understood as an adjective that means a neurocognitive functioning that fits into dominant social standards. Based on this definition, it is not appropriate to say, for example, that neurotypical is synonymous with not being autistic because, as we have already clarified, it is not just autistic people who make up the neurodivergent community.

The term neurotypical refers to a neurological configuration predominant in culture, a configuration typical in a particular group of people. The problem that the term neurotypical invites us to think about in the neurodiversity movement is how neurotypical traits are often understood in culture as obligatory or qualitatively superior (Miller, 2003).

As an antonym of the term neurotypical, it is ubiquitous in the neurodiversity movement to use the term neuroatypical, which refers to a person whose neurological configuration is in some way atypical in the group, which directs us to understand how neuroatypical people, both those who are on the autistic spectrum and others who are part of the neurodivergent community, such as people with Tourette syndrome, bipolar disorder, schizophrenia, and other changes in neurological configuration that are generally related by medicine and psychology (Miller, 2003).

Thus, we strive to present the complex network in which the terminologies generated in the neurodiversity movement are located. However, we lack space to deepen some discussions about this network of words that we brought, but we believe it is essential to add here a discussion about the possible mistakes that hinder adequate reflections in the scope of neurodiversity and that have already been identified in the literature.

Avoiding some mistakes in discussions that are anchored in neurodiversity

Some misconceptions about the neurodiversity movement have already been identified and discussed in the literature (den Houting, 2019; Russell, 2020). Den Houting (2019) underscores three of those misconceptions: (1) the claim that the neurodiversity paradigm addresses autism as a difference and a cultural identity but not as a disability, (2) the argument that the paradigm of neurodiversity is best suited for autistic people who do not need much support, generally known as high-functioning autistic people, and (3) the understanding that considering autism in the neurodiversity paradigm implies that autistic people do not need any support, since autism, in this paradigm, is considered a natural variation.

Given the terminological discussion that we presented in the previous topic, we observed that the first mistake identified by den Houting (2019) –that the neurodiversity paradigm addresses autism as a difference and a cultural identity but not as a disability– gains strength from the moment that we are unaware of the meanings and origins of those terms we have exposed so far. In this terminological discussion, we note that autism is understood as a neurodivergence, which is present in part of the human population when we observe its neurodiverse face, which, in turn, is natural in this population and is shaped historically in both cultural and sociological aspects.

Therefore, autism and disability notions are, based on what we have explained so far, distinct but somehow related in specific discussions. The assumptions that underlie the neurodiversity movement come from the social model of disability, which, in turn, understands disability as an inadequate fit between the characteristics (physical, cognitive, or emotional) of a person and the traits of their social context (Oliver, 1996).

Based on this model and within the scope of the neurodiversity movement, the disability does not lie in the fact that the person is autistic because being autistic is part of their cultural identity. The deficiency lies in the fact that in this historical moment, the environment fails to accommodate and meet their needs as part of a neurodivergent community.

Therefore, being autistic does not mean having a disability, but it is fundamental in our century to recognize that disability exists. This disability does not exist as a result of autism itself, but arises as a consequence of everyday life in a society that, at a specific historical moment, tends to be physically, socially, and emotionally inhospitable to autistic people, requiring the provision of different types of support to minimize the barriers identified in the inclusion process of autistic people in the various spheres of society (den Houting, 2019).

The focus on neurodivergent people encouraged the formation of a neurodiversity movement, but like other civil rights movements, it is not composed of a single group or organization, much less directed by a specific leader. The neurodiversity movement comprises a significant number of people, some organized into several groups with diverse points of view, objectives, political positions, methods of activism, and even interpretations of the neurodiversity paradigm (Walker, 2021).

In those multiple ways of expressing oneself in the neurodiversity movement, the neurodivergent community is broad on the spectrum, and the assumption that the neurodiversity paradigm is best suited for autistic people who do not need much support –generally known as high-functioning autistic people– is incoherent. This is the second mistake den Houting (2019) identified.

As we have already explained here, support occurs due to the disability that lies in the interaction between the person and the environment and not in the autism itself. In this way, the support provided in the inclusion process is not a function of the person's position on the autism spectrum but rather the needs identified in the person's inclusion in each environment.

This second mistake raises another problem in using the terminology high functioning or low functioning in relation to autism because, as den Houting (2019) explains, such expressions exclude the possibility of considering individual variations in skills and competencies among autistic people.

We can discuss these variations when we reflect on the third misconception identified by den Houting (2019), the understanding that considering autism in the neurodiversity paradigm implies that autistic people do not need any support since autism, in this paradigm, is seen as a natural variation.

As we have already discussed here, the fact that a person is autistic does not mean that they do not need support because, in the neurodiversity movement, disability exists and is in the interaction of autistic people with the environment, and it is essential to recognize the existence of this disability with the respective provision of support so that the barriers identified in this interaction are overcome. Thus, this third misconception is something that we are already rebutting in this text. However, it is very problematic to justify that autistic people do not need support by saying that autism is a natural variation.

The neurodiversity movement recognizes autism as a natural variation; however, as we have already mentioned here, this movement also simultaneously acknowledges the existence of the disability, considering this historical moment for autistic people. What we noticed in this movement is that supporters of neurodiversity promote campaigns for the acceptance of and respect for autistic people as active members of society, but they also fight for adequate support and services that meet the needs identified in the neurodivergent community.

When referring to support and services aimed at the neurodivergent community, the great reflection that stands out within the scope of the neurodiversity movement is the objectives of such support or service. Many of the interventions and supports that are provided for autistic people have focused on an attempt to reduce or even eliminate core characteristics of autistic people, i.e., the autistic traits in these people (French & Kennedy, 2018).

Barbosa's (2012) focus on autonomy in education allows us to advance the reflection that we stimulated in these lines about the need for support and interventions to include autistic students. As the author explains:

The neoliberal idea of the autonomous individual, widely disseminated in the current world and truly hegemonic over many consciousnesses, gives new meaning to the imaginary of autonomy and translates, among other notions, into the concepts of 'entrepreneurial self,' 'self-managing and self-caring self,' 'responsible self,' and 'self-sufficient self.' (Barbosa, 2012, p. 257)

When we focus on the educational panorama, neoliberal redefinitions of autonomy are identified as elements that cooperate so that people and groups marginalized over the centuries, such as the group of neurodivergent people, are to some extent blamed "[...] for they are not, supposedly, up to the circumstances" (Barbosa, 2012, p. 257). Thus, the responsibility of being active in the school space is transferred to the individuality and personality of the subject under

the aegis of a neoliberal discourse that overvalues autonomy in the process, which constitutes a risk that we need to avoid in the context of neurodiversity.

Public policies that guide the educational system must provide relevant and equitably distributed assistance to autistic students, even within the scope of neurodiversity. The neoliberal vocabulary is installed in different ways in the educational panorama, transmuting meanings and feeding a project of *empowerment*³ which, under the umbrella of neoliberalism, reinforces the idea of individuals who govern themselves based on a discourse of over-responsibility:

Responsibility –in fact, an over-responsibility when one does not have conditions and resources that only the community can make available–, if it cannot be done explicitly, is implicit, giving negatively labeled social groups control over their fate. They are presented as autonomous and solely responsible for their destiny, and consequently, their problems are attributed to personality flaws, own choices, or personal failure. (Barbosa, 2012, p. 258)

The neurodiversity movement invites us to think about, in this scenario, that services and support cannot cease in the current historical situation, i.e., they must continue given the disability situation autistic people are still facing in our century. According to the supporters of this movement, we must think about the objective of those services and support. It cannot minimize traits typical of the cultural identity of the neurodivergent community but rather provide quality of life, well-being, and respect, thus preserving the autistic person's way of being and that person's consent to the provision of such support.

When discussing the possible misconceptions in this topic, the field of vision on how the group of neurodivergent people, and specifying a little more, neurodivergent people identified as autistic people, is marked by processes of exclusion that have come to be considered in reparation processes. This occurs when we expand our understanding of disability not as an attribute of the subject but as a result of their relationship with the socio-historical environment. Reflections that highlight these observations have also been generated in the

³ The expression *empowerment* is used here to enhance the powers of a given group through a training action based on ideals of capacity and productivity that are fundamental in the constitution of a neoliberal ethos (Honneth, 2003; Moreira et al., 2022). We highlight that this expression can be used with other meanings in literature, as Barbosa (2015) explains, identifying that the expression *empowerment* can also be used in an emancipatory and transformative sense, combining “[...] the reinforcement of individual powers with engagement in changing social structures that subvert these powers” (p. 1003).

neurodiversity movement, such as the discussion that has emerged in recent years in the scientific literature about what is being called neurominority.

Neurominority: a new discussion generated within the scope of neurodiversity

From the neurodiversity movement, we have observed the emergence of various discussions that focus on deepening or even proposing new terminologies and definitions for neurodivergent people. An example that has emerged in recent years is the term neurominority, which, according to Dr. Nick Walker, a professor at the California Institute of Integral Studies, can be used either as a noun or an adjective and was coined in 2004, years after the term neurodiversity was disseminated by Judy Singer (Walker, 2021; Walker, 2014; Walker & Raymaker, 2021).

Professor Nick Walker is a transdisciplinary researcher who explores the limits and intersections of somatic psychology, transpersonal psychology, queer theory, neurodiversity, and creativity. He is responsible for discussing another term that also varies from discussions within the scope of neurodiversity –the term *neuroqueer*– which, in turn, was co-created by academics and activists who reject dominant oppressive identities that perpetuate discourses originating from the medical model (Egner, 2019).

According to Professor Nick Walker, the term neurominority refers to a population of neurodivergent people for whom all of the following statements are true: (1) they are people who share a similar form of neurodivergence; (2) the form of neurodivergence they share is innate and inseparable from these people, being intrinsic and pervasive in their psyches, personalities, and ways of interacting with the world; and (3) the form of neurodivergence they share tends to be responded to by neurotypical people with some degree of prejudice, misunderstanding, discrimination, and/or oppression; and often, this response is encouraged by the classification of that neurodivergent way of being as a pathology of a medical nature (Walker, 2014).

Walker (2014) states that not all neurodivergent people are members of neuro minority groups but highlights that among these groups we can find in our century are the groups of people with autism, dyslexia, and Down syndrome.

In our century, we have to reflect on how much mathematics education must discuss and reconfigure itself to reach groups that appear to be neurominorities, something we have

observed in the studies we developed in our research group *ForProfMat* – Professor de Matemática: formação, profissão, saberes e trabalho docente [Mathematics Professor: education, profession, knowledge, and teaching work], at the Pontifical Catholic University of São Paulo (PUC-SP). Discussions using the terminology neurominorities are already proposed on the international scene in other fields of knowledge that make up the areas of education and teaching (Chrysochoou et al., 2022; Dwyer, 2023; Hamilton & Petty, 2023; Moraru, 2023), and we understand It is necessary to implement this type of studies also in Brazil, but without the concern of planting a new term since our purpose at the moment is to understand the theoretical, sociological and philosophical implications that these new terms, such as neurominority, bring to current discussions that we develop in Mathematics Education.

Encouraging reflections for this occupation in research occur internationally, such as the research by Chrysochoou et al. (2022). Focused on existing engineering courses in the United States, they observed that there is an urgent need for a paradigm shift in the offering of these courses to minimize the difficulties faced by neurominority students, constantly marginalized by an educational system often designed to meet the needs of a neurotypical majority.

In Brazil, some mathematics educators have advanced since the end of the second decade of our century with discussions that explicitly address neurodiversity in research on autism (Ferreira, 2022; Guimarães, 2020; Guimarães & Pinto, 2022; Viana, 2019; 2020; 2021; 2023; Viana & Manrique, 2020; 2022; Walker & Borges, 2022), but regarding the discussions that explain the term neurominority, there is still a scenario with little use of this term in academic texts published in our country.

Guimarães's (2022) research seems to be one of the first on Brazilian soil that uses the term neurominority in mathematics education. However, we have observed that such use, with a deeper reflection on its meaning and discussions it raises, emerges now as an invitation to reconfigure the scenario of studies and research on mathematics teaching and learning in Brazil.

Considering the brief literature review that we have presented up to this page, we can note that neurodiversity appears to be a broad field worthy of close attention when we deal with the topic of autism and the harm that historical processes of exclusion have done to this group. Therefore, centered on the terminologies arising from the preoccupation with autism from the

perspective of neurodiversity and on the practices that align with these terminologies, we developed a study as described below.

A study on mathematics teacher vocabulary: from question to method

As we said before, this study explores the terminologies, practices, and attitudes that permeate the inclusion of neurodivergent students and appear in mathematics teachers' vocabulary. From this objective, we approach language as an object to be investigated.

Understanding language as an “[...] incredibly intricate range of social forms of communication and meaning” (Santaella, 2017, p. 6) allows us to observe how complex and branched it is in different forms, as explained by Melo and Melo (2015), who define language as a system composed of several signs that enable communication between beings, which, in turn, is perceived by the sense organs. Therefore, a study dealing with the terminologies that support this complex system in which language is constituted proved relevant to our research.

One way in which language appears in the world is scientific language, generally structured with the absence of the agent and characterized by the nominalization of processes, “[...] increasing lexical density, since the terms used are linked to conceptual meanings that require greater knowledge of the themes addressed in the speeches” (Oliveira & Roehrs, 2023, p. 6). This scientific language is presented in different formats, many accessed by teachers through various means.

Given the proposal to focus on the vocabulary that appears among mathematics teachers, this study assumed an area of inquiry formed by the following research question: Which assumptions can we identify in mathematics teachers' vocabulary regarding autism?

However, we assume a post-structuralist standpoint, considering that discourses are agents in producing individuals for whom the meanings of themselves and their world result from political struggles and social movements they go through. We understand that “discourses reflect a particular point in history, including the specific relationships between people, knowledge, and agency; they define what we consider *normal*” (Gutiérrez, 2013, p. 43). In this sense, identifying assumptions has become necessary to investigate the topic we address here.

The data produced in this study consists of answers written by eight mathematics teachers who work in the final years of elementary school in two public schools in the municipal schools in São Paulo, SP. The data is part of a more extensive study on neurodiversity in mathematics

education carried out within the scope of the Postgraduate Studies Program in Mathematics Education at PUC-SP.

The data comprises mathematics teachers' registers in the Google Forms survey management app. A Quick Response (QR) code was made available on the bulletin board in the teachers' room of each school, with a text inviting mathematics teachers to answer a question in an online form. Math teachers scanned the QR code with their mobile phone cameras, which opened a Google Forms screen. There, they were asked to fill in their full names and roles at school and answer the following question: What do you know about autism?

The data were analyzed qualitatively through reading and discussion as proposed and already carried out in other studies that dealt with language and the analysis of written texts (Coles, 2015; Herbel-Eisenmann et al., 2010). In the analysis, we considered the answers written by the participating teachers as being a corpus in which we identified some patterns through the similarities or differences observable from the words that stood out in the answers.

Below, we present the discussion from analyzing the corpus of mathematics teachers' answers in Google Forms, adopting the literature review already presented in this article as the theoretical framework.

Identification of some assumptions in teachers' vocabulary

In analyzing the data produced in this study, comprising the answers registered by eight mathematics teachers in Google Forms, we identified three assumptions that underlie the vocabulary used by teachers when answering the question: "What do you know about autism?"

In the data analysis, we assumed the principles shown textually as elements potentially influencing the pedagogical work process, considering the teacher's needs in mathematics teaching. In Table 1, we begin by presenting one of them.

Table 1.

Assumption: The recognition of the needs arising from neurodivergence as a criterion for validating teaching practice, being essential adjustments, adaptations, and pedagogical support that complements the process of school inclusion

(A1) The decreased ability to do something "simple." And/or the immense ease when doing something complex.

(A2) These are special children who require special support for learning.

(A3) There are several levels. Some can learn, some need to be attended to with adjustments, some have high visual and auditory stimuli, some must adapt to each moment the environment changes, and some must be self-regulated.

The three answers in Table 1 highlight how teaching practice became the primary ground for discussion before the question asked in the form. Although the question does not ask for a relationship between what the teacher knows about autism and their teaching activities, the answer registered on the forms shows concern about making this relationship, probably because the question is asked in a school environment. These three answers allowed us to identify one of the assumptions of the participating mathematics teachers: the recognition of the needs arising from neurodivergence as a criterion for validating teaching practice, being fundamental adjustments, adaptations, and pedagogical support to complement the process of school inclusion.

The mathematics teachers who contributed to these answers express that recognizing the other—in this case, autistic students—is a criterion to discuss in the pedagogical context to validate a practical action, which, in the investigated scenario, corresponds to the school inclusion of those students. We noticed a concern with elements already known in the school inclusion process, such as adequacy, adaptation, and pedagogical support. However, terminologies that come close to a neoliberal idea linked to self-sufficiency, personal responsibility, self-care, and autonomy are present in the teachers' answers when they relate autism to the “capacity to do,” “need for monitoring,” and “lack of self-regulation.”

The teacher's definition in answer A1 reveals a concern for “doing,” which aligns with the *empowerment* project proposed in neoliberalism. This concern is possibly associated with a teaching practice that values, teaches, exercises, and assesses “doing” in school tasks. From a neoliberalism perspective, this teaching practice combines the reinforcement of the student's capabilities with an activity of personal adjustment to the current social and school order, culminating in making each person responsible for their own actions or, as Young (2011) states, for their own luck or fate.

Another discussion that emerges here—specifically shown in answer A2—is the expression of the existence of “special children.” We notice the constitution of a discourse that

creates an exclusionary relational space through problematic terminologies, such as “special child.” A necessary question is whether the adjective “special,” as understood in this terminology, should add a modification to the noun “child” or their “educational needs.”

Analyzing the different documents and guidelines for the educational system published in Brazil, we observed the constitution of a vocabulary composed mainly of terminologies such as “special education” and “special educational needs.” However, answer A2 highlights how the adjective “special” is transferred to the individual itself –the child– whereas the adjective “special,” as observed in such publications, refers to the educational modality implemented for this child or the needs of an educational nature they have in daily school life.

In this analysis, we observed that confusion is evoked in the definition of who this student is in mathematics class. The student becomes defined primarily by a “special” factor that characterizes them in their individuality, disregarding that this factor is related to educational needs, which seem unique in some aspects, unlike other students’ needs. Therefore, for this reason, they participate in a teaching modality specially structured to meet those needs understood as special in their school career.

In this type of discussion, it is difficult to understand the child, or the student, as being the “special” in the schooling process. But we know, as is the case in some dedicated literature texts, that the terminology “special child” or “special student” is frequent in some discussion circles that focus on special education and that, from the critical perspective we assume in our analysis, it aligns much more with the neoliberal discourse of over-responsibility. In this discourse, the individual is identified with a “label” so that school success or failure is justified in terms of their individuality and not in the provision or absence of public practices and policies that meet the educational needs of the individual, which is, in fact, what is being qualified with the adjective “special” when we read the main guidelines for school inclusion.

Continuing our analysis, Table 2 presents two answers framed within another assumption, approximating terminologies rooted in the neurodiversity movement. This approximation happened with the term “atypical” to designate the students or their behavior.

Table 2.

Assumption: The introduction of terminologies originating from the neurodiversity movement

(B1) It is not a disease but a syndrome. No two autistic people are the same. They are atypical students. We have mild, medium, and severe levels.

(B2) It is a developmental disorder with characteristics of atypical behaviors.

From these two answers, we noticed that another of the assumptions presented by the participating mathematics teachers, even if timidly, is the introduction of terminologies originating from the neurodiversity movement. Despite this exercise observed in the two answers listed in Table 2, we must note that from the beginning of this work, we have tried to clarify that the set of terms rooted in neurodiversity is much broader than “typical” and “atypical.”

The term “atypical” appears to be one of the first to become frequent within schools, resulting from the influence of various media products, such as television series distributed digitally through streaming⁴. Political and social advances are stimulated by seeking terminologies that avoid stigmatization and exclusionary processes. However, we must discuss here how much terminological change is a time-consuming process, even more so when the historically marginalized group bears deep scars of exclusion, as is the group of autistic students.

Although the answers B1 and B2 explain the term “atypical,” we observed that the intention demonstrated in writing to approach updated discussions about autism, the teachers still subjugate this intention to the precepts of a medical and/or clinical nature historically described in the health area. Allocating autism as a syndrome or as a developmental disorder is what we find as a definition in medical and psychological manuals, which we do not invalidate here, given its importance in enriching the studies that humanity encompasses on autism.

In our analysis, we question the extent to which such definitions and medical descriptors enable advances in the school inclusion of neurodivergent students. Neurodiversity invites us to think about other fields of discussion, which, far from medicine, are anchored in sociological and philosophical reflections on autism, and it is this multifaceted way of understanding autism in the educational panorama. We believe this is possible for the creation of new ontological and axiological assumptions on this topic in mathematics education.

⁴ For a more specific understanding of how streaming television series about autism are narratives that influence the spread of the neurodiversity movement, we recommend reading Cruz (2022).

The three answers in Table 3 invite us to reflect further on such observations. We frame those answers in an assumption revealed in another of the identified assumptions, the medical explanation aligned with the definitions and descriptors listed in health manuals, which, like the principles of neurodiversity, are also widely disseminated in the media.

Table 3.

Assumption: The medical explanation aligned with the definitions and descriptors listed in health manuals

(C1) It is a spectrum disorder. Autism spectrum. With different degrees of disorder.

(C2) Disorder that presents different levels and specific behaviors in each individual.

(C3) It is a condition of the individual that compromises areas of development, such as social, communication, and may be linked to other disorders and which may bring some restrictions to the sufferer.

An important marker in the answers presented by the participating mathematics teachers is the consideration that there are levels of autism, as listed in health manuals. As mentioned previously in this text, one of the criticisms observed against the neurodiversity movement is the absence of more active participation of autistic people that require a more accentuated dynamic of support, such as those commonly identified at level 3 by the health sector⁵.

The attempt to categorize autistic people into levels, as proposed in health manuals, is a difficult task to carry out in medicine, given the variability in the spectrum. And when we bring this discussion to the pedagogical circle, we believe that this task becomes more laborious because, among autistic people classified at level 3, we can still identify relevant nuances in discussions of a didactic and pedagogical nature.

We understand that this focus on the levels of autism in the answers presented in Table 3 is due to a scar from an educational system that still overvalues medical reports and the semantics characteristic of this type of document, such as codes, descriptors, and levels.

⁵ The fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-V), published in 2013 by the *American Psychiatry Association* (APA,) lists levels of Autism Spectrum Disorder (ASD) that are defined according to how difficulties in social communication and restricted and repetitive behaviors increase, being described as: (1) Level 1, with the requirement for support; (2) Level 2, with the requirement for substantial support; and (3) Level 3, with the requirement for very substantial support (American Psychiatry Association, 2013; 2015).

Therefore, we must reflect on how documents and observation guidelines, typical of teaching activity, deserve and should have space for us to understand autism in mathematics classes.

Some considerations, some provocations

The discussions we promoted in mathematics education about neurodivergent students' inclusion are increasingly present in Brazilian literature. As we can see throughout this article, these discussions are based on paradigms that, although underlying and implicit, influence how the neurodivergent student community is recognized.

In research we have accumulated on the topic of autism, in mathematics education, we have observed that different models –from those based on medical assumptions to those aligned with more critical and post-structuralist discussions as proposed by the neurodiversity movement– are sometimes present in the participants' description, sometimes in the assumed methodological design. These observations led us to a more careful analysis of such models, focusing on the vocabulary presented by mathematics teachers when invited to say what they know about autism.

Therefore, in this article, we assume the area of inquiry expressed through the question: Which assumptions can we identify in mathematics teachers' vocabulary regarding autism? Answering this question, we identified three assumptions when analyzing data produced with mathematics teachers from two different public schools in the city of São Paulo: (1) the recognition of needs arising from neurodivergence as a criterion for validating teaching practice, with fundamental search for adjustments, adaptations, and pedagogical support that complement the school inclusion process; (2) the introduction of terminologies originating from the neurodiversity movement; and (3) the medical explanation aligned with the definitions and descriptors listed in health manuals.

The assumptions we identified in this study provoke us to expand our reflections on how research related to autism is reaching teachers who deal daily with neurodivergent students in mathematics classes. We do not intend to be exhaustive in our analysis, as we know the complexity involved in the development of assumptions in the educational scenario, but those that were identified in this study invite us to think about how dialogue with those teachers is fundamental so that we can consolidate not simply a new pedagogical vocabulary, but new practices that are inclusive and coherent with the discussions that emerge in this new network of terminologies created.

Neurodiversity appears as a movement that can potentially bring about such changes in the educational scenario. Still, as mathematics educators, we are motivated to think about how much closer we are getting to the sociological and critical soil in which this movement originates and understanding the neurodivergent community not from medical labels and descriptors but from the differences of an educational nature shown in each student's school trajectory.

Investigations to identify the elements that provoke and drive neoliberal ideas, specifically in the inclusion of neurodivergent students, can contribute to the discussions that we introduce through this article. This research is limited, considering the universe of participants and the way data is produced. Nevertheless, this limitation can be overcome with studies that increase the number of participants and diversify the school context of activity.

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