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The faces of the investigative prism that constitutes research anchored in neurodiversity

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Abstract: On the international scene, several studies focusing on teaching and learning mathematics are based on the neurodiversity paradigm. However, a reassessment of assumed practices and objectives is essential, as when addressing neurodiversity, some traditional practices and objectives may become inappropriate or harmful to the community of neurodivergent people. Intending to share a discussion about the investigative prism that constitutes research that is based on neurodiversity, this study seeks to answer the following question: What are the aspects of the investigative prism in research anchored in neurodiversity that we can highlight as urgent in mathematics education? Using the conversation technique as proposed in qualitative research in the methodology, three aspects were identified as answers: (1) the stimuli and motivations coming from different agents, (2) individual particularities, and (3) tensions between clinical and sociological perspectives.

Keywords: Autism. Inclusive Education. Mathematics Education. Neurodiversity.

Las caras del prisma investigativo que constituye la investigación anclada en la neurodiversidad

Resumen: En el panorama internacional, varios estudios que se centran en la enseñanza y el aprendizaje de las matemáticas se basan en el paradigma de la neurodiversidad. Sin embargo, es esencial una reevaluación de las prácticas y objetivos asumidos, ya que, al abordar la neurodiversidad, algunas prácticas y objetivos tradicionales pueden volverse inapropiados o perjudiciales para la comunidad de personas neurodivergentes. Con el objetivo de compartir una discusión sobre el prisma investigativo que constituye la investigación que se fundamenta en la neurodiversidad, se presenta un estudio que responde a la siguiente pregunta: ¿cuáles son los aspectos del prisma investigativo en la investigación anclada en la neurodiversidad y que podemos destacar como urgentes en educación matemática? Utilizando la técnica de la conversación propuesta en la investigación cualitativa en la metodología, se identificaron tres aspectos como respuesta a la pregunta: (1) los estímulos y motivaciones provenientes de diferentes agentes; (2) particularidades individuales; y (3) tensiones entre las perspectivas clínica y sociológica.

Palabras clave: Autismo. Educación Inclusiva. Educación Matemática. Neurodiversidad.

As faces do prisma investigativo que constitui uma pesquisa ancorada na neurodiversidade

Resumo: No cenário internacional, várias pesquisas que focam no ensino e na aprendizagem

de matemática se fundamentam no paradigma da neurodiversidade. No entanto, é fundamental uma reavaliação das práticas e objetivos assumidos, pois ao abordarmos a neurodiversidade, algumas práticas e objetivos tradicionais podem se tornar inadequados ou prejudiciais para a comunidade das pessoas neurodivergentes. Com o objetivo de compartilhar uma discussão sobre o prisma investigativo que se constitui em pesquisas que se fundamentam na neurodiversidade, apresenta-se um estudo que responde a seguinte pergunta: quais são as faces do prisma investigativo nas pesquisas ancoradas na neurodiversidade e que podemos destacar como urgentes na educação matemática? Utilizando na metodologia a técnica da conversa tal como proposta em uma pesquisa qualitativa, identificou-se como resposta para a pergunta três faces: (1) os estímulos e motivações oriundos de diferentes agentes; (2) as particularidades individuais; e (3) as tensões entre as perspectivas clínicas e sociológicas.

Palavras-chave: Autismo. Educação Inclusiva. Educação Matemática. Neurodiversidade.

1 Introduction

The development of research that focuses on autism is an increasingly frequent investigative practice in different areas of knowledge, and this is no different in mathematics education. Considering the universe of studies completed up to the beginning of our century, it was observed, based on different reports and literature reviews, that, for the most part, research sometimes focuses on understanding autism in terms of its biological, etiological, and cognitive nature, and sometimes consists of in interventions aimed at minimizing factors that generally characterize autism (den Houston & Pellicano, 2019; Office of Autism Research Coordination, 2017; Wong et al., 2014; Wuo, 2019).

In this universe of studies, we bring to reflection in this article the faces that make up the investigative prism that constitutes research that aims to discuss autism in mathematics education. From a mathematical definition, the prism is a geometric solid, or in other words, a polyhedron composed of *n* faces, besides its two bases. Metaphorically, we use this polyhedron to present, in this text, a discussion about the scientific research process in which studies on autism are inserted, which we understand here as an investigative prism, which is an expression already used by other authors in the scientific literature (Balbino et al., 2022; Chagas, 2018).

Each paragraph represents a pause to consider the process, the research movement, and the principles and practices that underlie a researcher's scientific work. This is the reading we introduce in this article since a researcher very much interested in the process of the investigative path is one characteristic of qualitative research (Borba & Araújo, 2019). Therefore, advancing in the studies we have developed on autism in mathematics education means observing this process more carefully, thoroughly exploring the investigative prism that constitutes it and its various faces.

Our objective in this article is to discuss the investigative prism constituted in autism research anchored in neurodiversity, one of the paradigms currently appearing in the theoretical contributions of different researchers in education and teaching areas. Unlike other explanatory paradigms about autism that are based on medical and clinical assumptions, neurodiversity results from a social and political movement, defending the recognition of autism as one of the differences through which humanity expresses itself.

On the international scene, several studies focused on mathematics teaching and learning have been based on the neurodiversity paradigm (Lambert et al., 2020; Viana, 2023). However, as Dwyer (2022) identified, in the current scientific situation, researchers who develop studies anchored in neurodiversity must revisit and reevaluate the practices and objectives they shoulder in the investigative process because, when approaching neurodiversity,

some practices and objectives traditionally assumed can become inappropriate or even harmful for the neurodivergent community.

Next, we present how neurodiversity fits into the perspective of transformations that appear in scientific research, culminating in the remodeling of the investigative prism that the researcher assumes in mathematics education. We continue sharing a discussion that integrated the triangulation of data produced in research developed at the doctoral level in mathematics education by Viana (2023).

2 The development of research anchored in neurodiversity

Neves (2009) identified the postcolonial perspective as the 'post' era, which is, in turn, marked by the decline of the idea of modernity and its complex structuralist and formalist heritage (structuralism). While the postcolonial perspective generates a political philosophy to confront issues of exclusion and neocolonialism, theories such as the hybridity and border-crossing theories allow an understanding of problems related to identity and space (Adams, Luitel, Afonso & Taylor, 2008).

Discussions on the postcolonial perspective are pertinent when we anchor ourselves in neurodiversity since one aspect of neurodivergence recently identified in the literature highlights how neurotypicality is closely linked to whiteness and colonial ideas of the existence of a normative body (Chapman, 2023; Ngwagwa, 2022; Rosqvist, Chown & Stenning, 2020). According to Ngwagwa (2022), neurotypicality is linked to whiteness through colonialism, imperialism, and capitalism to manufacture ableism in everyday relationships, intensified in specific groups due to the different markers of exclusion that historically intersect. This occurs in the definition of neurotypicality, which generally assumes specific social groups or communities as a reference, a model, a standard to be followed, that is, as "typical."

A post made in 2020 by lawyer and educator Talila Lewis on a blog that discusses social justice from the perspective of intersectionality helps us think about how ableism is magnified when we look at specific groups of people. Talita invites us to consider the following question: "What word or phrase can be collectively created to explain how Black people experience a racially magnified or racially manipulated or informed ableism?" (Lewis, 2020). Understanding how neurotypicality is linked to whiteness, as the literature currently demonstrates, is a discussion that is initially based on the way society defines a neurotypical person and on discussions that are formed in intersectionality. In other words, over the decades, understanding neurotypicality has culminated in understanding the dynamics of interaction, communication, and socialization that are particularly evident in the group of people who are preferably white, heterosexual, male, and from nations commonly understood as developed, from which the definition of what it means to be neurotypical has been extracted.

When we visit the mathematics education literature on the international scenario, and specifically the studies that address neurodiversity, we can observe that both traditional research practices and theoretical frameworks have undergone important transformations in line with this postcolonial perspective and recognition of identity and space. An example is the research by Lambert and Harriss (2022), who, investigating how mathematical thinking develops from the narrative of neurodivergent people, highlights in the last considerations that the stories, told by research participants in their narratives, "[...] comfortably into a tradition of previous research on mathematicians describing their own thinking, research that does not specifically mention neurodiversity" (p. 102). In other words, we must consider the possibility of revisiting traditionally conducted research practices from this new perspective of confronting exclusion and various structured forms of neocolonialism.

Visiting the narratives that emerge in the community of neurodivergent people and anchoring themselves in neurodiversity as a paradigm, we can notice that the concepts of identity and space are given new meanings based on inflection points that arise in the discussions we have in the field of human diversity. As some authors suggest, we can think about how much the discussions that took place before these inflection points were managed by maps where human beings are necessarily located to compose society, which, in other words, means the categorization of human beings from different perspectives.

Neurodivergent researcher Meaghan Krazinski, from Syracuse University (United States), contributes to an understanding of what these maps would be by exposing, in one of her articles, anecdotes from her 'past self' that were rescued from her memory. In Krazinski (2023), the researcher explains what it meant to her personally to be an autistic woman in the community where she grew up.

In her report, Krazinski (2023) mentions that, during her childhood, she constantly choked on the food offered to her during meals. Moreover, the various unpleasant sensations she felt when putting food in her mouth made her, over time, refuse most of them in everyday life. In this scenario of dietary restrictions, Krazinski (2023) describes that her female body, which at the time was not understood as that of an autistic person, became transgressed, as it needed to be located on a map previously drawn by the community. However, her body did not fit into this map, and in this transgression, resilience was a daily exercise, clarifying that, for her mother and many families at the time, resilience meant, in this context, being able to pass as 'normal,' and that:

> "Unless you were head-banging at school, autism was not a thing for girls then (or for anyone who was not a white boy, for that matter). Restrictive diets were recommended as a "cure" for autism, or as a last resort for little girls for whom medical doctors could not explain what was wrong. So, though I did not get the label, I got the disciplining of the body through the medical-industrial complex that told me there was no space for my embodied subjectivity on the map. Hypersensitive. Food sensitive. Hysteric. Stubborn. Spoiled. But not Autistic." (Krazinski, 2023, p. 3)

Reports such as Krazinski's (2023) corroborate the need for researchers to adopt a new stance in their investigations on autism, regardless of the area of knowledge in which the research falls. This new stance aligns with discussions arising from critical studies, which, considering the various systems of oppression that impact everyday life, are anchored in a post-conventional theoretical approach. This means drinking from theoretical sources that, at their roots, put such systems of oppression on the agenda, some examples of these theoretical sources being theories from feminism, postmodernism, queer theory, and critical theories (Shildrick, 2012).

The importance of considering humanity in a nuanced sense arises in this new wave of theoretical sources, with discussions that occur from an intersectional structure, which brings to the surface, for example, interconnections between disability or autism with socially constructed identities, gender, sexual diversity, and social class, among many other aspects of the prism that constitutes us in the community (Annamma et al., 2013; Annamma, Ferri & Connor, 2018; Elder & Migliarini, 2020).

The new stance in research that discusses autism –which accompanies this new wave of theoretical sources and intersectional structures of reflection– is also being revealed in mathematics education, especially from the second decade of our century, if we consider the international scenario of investigations conducted by different mathematics educators (Tan,

2017; Tan, Padilla & Lambert, 2022; Viana & Manrique, 2023; Yeh, 2023).

In Brazil, research developed in mathematics education and focusing on autism has recently become evident with discussions that approach a more sociopolitical perspective, ethics, and social justice (Cordeiro, 2015; Ferreira, 2022; Gaviolli, 2018; Viana, 2023). Such discussions, despite being characterized as essential advances in research related to autism in mathematics education, seem incipient in the current need to follow the new panorama of reflections that is taking shape on the global stage, making the voice and co-participation of neurodivergent people in research a reality in investigative practice.

At the very edge of our decade, those who had the most critical voices in studies on autism were professionals understood as neurotypical, who, in turn, wrote in defense of treatment and cure. Nevertheless, now, we find ourselves in a new global panorama where those defined by humanity as neuroatypical speak, write, and publicize their identity, denouncing historically constituted oppressive systems and becoming a solid community of authors who want to be heard and understood in their differences (Davidson & Henderson, 2010).

Therefore, we need to design a new space for study and research on autism in mathematics education that considers this new wave of theoretical sources and contemplates more effective participation of people who present any type of neurodivergence with their voices, lives, experiences, conflicts, and stories heard and respected. This is what encourages American anthropologist Dawn Prince-Hughes, who, sharing her personal experience as a neurodivergent person, highlights how important it is for the autistic community to have their experiences reported and validated by humanity.

> What I do want to accomplish with this story is to tell some of what other people with autism have experienced, and much of what I have experienced as a person with autism. Much like the deaf community, we autistics are building an emergent culture. We individuals, with our cultures of one, are building a culture of many." (Prince-Hughes, 2008, unpaginated, position 123 of 309)

In neurodiversity, not only people commonly identified with autism but also others identified in different groups formed by varied neurodivergences are contemplated by researchers in recently published studies in mathematics education. An example is the research by Lambert and Harriss (2020), which investigates the narrative of five mathematicians identified with dyslexia, but, as they explain, neurodiversity was used as a theoretical framework. One of the considerations that these researchers share in this investigation is that using neurodiversity as a theoretical framework in research in mathematics education is still a challenge, given the need to overcome: "[…] the deficit-based approach typically used in educational research with students with dyslexia, thus potentially opening new avenues of educational research that move beyond the medical model of disability […]" (Lambert & Harriss, 2020, p. 1154).

Overcoming an approach rooted in deficit principles is not easy, considering the various faces that make up the investigative prism in research based on teaching, an observation that some mathematics educators corroborate through recently published studies. By investigating the development of autistic students in mathematics classes in Indonesian schools and using data from students, families, and teachers, Sabaruddin et al. (2020) identified that one of the factors that influence the development of students identified with autism in the school system is the way these students' families encourage them to have behaviors and practices that are understood as appropriate in mathematics class. In this aspect of the investigative prism that constitutes educational research, factors such as those identified by these researchers must be

considered when dealing with neurodivergent students, as this reveals elements such as the influences and motivations coming from different entities, which, in turn, must be deeply considered in mathematics education.

Based on reflections arising from neurodiversity, such factors revealed in the different faces that constitute the investigative prism began to be analyzed from a critical perspective on the existence and maintenance of a normative body (Ngwagwa, 2022; Rosqvist, Chown & Stenning, 2020), which appears as a form of analysis that emerges as urgent in our current discussions in mathematics education. In neurodiversity, factors such as behaviors and habits stimulated by different agents, assumed by neurodivergent students to feel included in a sphere of supposed regularity understood as appropriate in mathematics classes, begin to be problematized, based on reflections arising from two terms: *masking* and *camouflaging*.

In the paradigm of neurodiversity, terms such as masking and camouflaging have become frequent and are used in current discussions focused on neurodivergent people. However, even though they are terms that appear interchangeably in the literature (Allely, 2019; Cage & Troxell-Whitman, 2019), they mean different processes. While camouflaging is an external process, masking it is an internal process. In practice, there is camouflaging when there is an assimilation with neurotypical social characteristics (for example, making eye contact), and masking occurs when there is a concealment of traits that reveal a state of neurodivergence (for example, avoiding tapping your fingers). So, while camouflaging is an external process so that the person is not visibly recognized in the group as neurodivergent, masking is an internal process in which the person perceives traits of neurodivergence that must be hidden (Hull et al., 2019; Radulski, 2022).

Echolalia is among the masking processes occurring in some neurodivergent people. In this condition, a neurodivergent person repeats something they heard previously, either immediately or sometime later, for days, weeks, or even months (Cohn et al., 2022; Stiegler, 2015). Some research indicates that echolalia is part of the language development of any human being; however, in the autistic population, this phenomenon generally occurs persistently throughout life, with some defending its treatment, reduction, or suppression (Cohn, Harrison & McVilly, 2023), that is, defending what in neurodiversity is understood as masking.

The literature review we have shared so far demonstrates how neurodiversity's reflections contribute to more critical discussions about practices generally conducted in contexts involving neurodivergent people. When specifically concerned with investigative practice, Dwyer's (2022) recommendations are relevant to the study we present in the following topics. According to this author, research that intends to align with neurodiversity must (a) focus both on neurodivergent people in their individuality and on the contexts in which they are inserted; (b) consider not only needs but also potential; (c) recognize and discuss prejudices; and (d) listen to and learn from neurodivergent people.

Based on these assumptions, we present a study that seeks to answer the following research question: What aspects of the investigative prism in research anchored in neurodiversity can we highlight as urgent in mathematics education? In the following pages, we present the methodological trajectory for the development of the study and the discussion it generates.

3 Methodology

Considering the current debate about a methodological research trajectory that aims to fit into the study movement highlighted in the previous topic, several authors agree that research to discuss colonialism, for example, must follow at least four principles: (1) conducting

research in the local language; (2) promotion of local forms of knowledge; (3) encouraging the continuation of the research among participants; and (4) active role of researchers in carrying out decolonizing acts that are based on social justice (Elder & Migliarini, 2020; Skutnabb-Kangas, 2000; Smith, 1999; Warrior, 1995). The way mathematics education understands qualitative research contributes to these principles, i.e.:

> a fluid, vibrant living environment and, therefore, impossible to be bound by fixed parameters, similar to legislation, norms, and formally pre-fixed actions. In qualitative research approaches, there are no fixed models, absolute standardization, static security of numerical treatments, or rigidly exact support. […] We are referring here to experiential maturity in its broadest character: it is the contact with peers, knowledge of the articulations of and within institutions, movement through the academic world in its multiple perspectives, conceptions formed with the understanding of texts, contexts, and theories, and the experience of perspectives that are not, in principle, "ours" but that offer themselves to us as symbols eager to be interpreted. (Garnica, 2001, p. 42)

We exercise Garnica's (2001) multiple perspective traffic in the methodological trajectory of this study, highlighting the need for an investigation conducted according to local particularities and the activity of defense and search for social justice, as proposed in the decolonization movement. The development of methodological support that considers local particularities has become fundamental to research that aims to discuss the state of neurodivergence of some students.

The principles that guide research in the decolonization movement, including thinking about the local language and forms of knowledge and encouraging the continuity of research among participants, mean that when we focus on neurodiversity, we must value the particularities that characterize the communication and interaction of neurodivergent people. In the methodological design of this study, the participation of neurodivergent students who communicate in different ways was valued, with an intention to value the particularities shown in the autism spectrum when we focus on communication. This research involved three students with different forms of communication and interaction, depending on each one's academic background.

Based on a methodological process of pseudonymization (Gibbs, 2009), the participants are referred to as students Daniel, Eduardo, and Fábio in this study. The data we share for discussion in this article were produced together with them in a doctoral research project. The three participants studied at the same school, a public educational unit in São Paulo, SP. Daniel was in the 7th, Eduardo was in the 5th, and Fábio was in the 8th grade of elementary school.

In this research, we analyzed the students' pedagogical reports issued and the academic records focusing on aspects related to communication and interaction announced in this documentary survey. The academic record showed that Eduardo had an intense interest in topics that fall thematically within astronomy. Daniel was a student with autism spectrum disorder (ASD). However, the reports indicated the diagnosis of Asperger syndrome, a no longer used terminology in the health area, but which justified it, as explained in one of the analyzed reports, the communication and interaction that the student presented, and which, according to the school teachers, was a communication very close to that considered satisfactory in the school routine, as it was easy to participate in the classes that were proposed. In turn, Fábio was a participant who presented particularities in communication and interaction, with linguistic practices considered from a clinical perspective as echolalic.

After this documentary survey, reading and appreciating the pedagogical reports, we talked with each of these three students in conversations that lasted a maximum of 45 minutes (class time in the public school system in São Paulo). In this conversation, the researcher (first author) created a friendly communication environment that aimed to help the participant understand what was happening not only at that moment in the conversation but also on other days when the researcher attended the school and observed the practices in which the student was involved.

As Minayo and Costa (2018) define, in qualitative research, a conversation can be understood as a research technique in empirical work, taking place in dialogue between two or more people, encouraged by the researcher, with the purpose of "[…] construct information relevant to a given object of investigation" (p. 12). When using this technique, we seek to maintain the casual space in which the data analyzed here was produced for investigative purposes, as also proposed by Minayo (2015), but we understand that it can also be called by some authors a qualitative research methodology as an individual interview (Flick, 2009; Kaplowitz, 2001).

The data from the conversations we developed with the three students allowed for a discussion we share on the following pages. We highlight that, in the next topic, we present part of a qualitative doctoral investigation in mathematics education (Viana, 2023) completed by the first author, developed from a project approved by the Research Ethics Committee and identified through the Certificate of Presentation of Ethical Assessment (CAAE) number 21361119.6.0000.5482.

Following some authors (Flick, 2009; Kaplowitz, 2001; Santos et al., 2020), Viana's (2023) research was developed with triangulation that introduced a new dimension in data production. In this case, this new dimension was designed in individual conversations, and the data produced in these conversations supplemented the analysis of the data set produced in Viana's research (2023). We go on to share the discussion of the data produced through these conversations with the three students.

4 Discussion about the data produced

Our conversations with the three neurodivergent students aimed to share some aspects we observed in this research. As the participants were teenagers, we proposed to conduct the conversations accompanied by the school's Specialized Educational Service teacher, with this conversation being divided into three moments: (1) creating a welcoming moment, welcoming the student with a brief dialogue about how things are going in the school; (2) talk about what we are doing in the research, clarifying that our objective is to understand how we learn some important concepts in mathematics class; and (3) talk about what the student thinks of the activities they carry out in mathematics classes.

In these conversations, the elements we listed in Chart 1 stood out, which we understand as relevant for discussion in this article.

Chart 1: Elements that stood out in the conversation with students

ELEMENTS LISTED IN THE CONVERSATION THAT ARE CONSIDERED RELEVANT TO THIS RESEARCH	
Conversation with student Daniel	▪ The student said that he does not like mathematics at school but that "he does the activities because his mother asked him to have the lesson in his notebook every day."
Conversation with student Eduardo	▪ When we talked about what he thought of his math activities at school. He said: "Math classes are important for studying the

	universe.” ▪ He also shared in the conversation a question he intends to ask the math teacher: “If the square root of 16 is 4, then the square plant of 4 is 16?”
Conversation with student Fábio	▪ The student did not interact much in the conversation, expressing and repeating several times that “mathematics is cool.”

Source: Researchers’ archive.

Each brought factors worthy of attention to the discussion we shared in these lines, which allowed us to answer the research question. This discussion strengthens the understanding that an investigation that addresses neurodiversity cannot focus only on one of the faces that constitute the investigative prism since all faces intersect and culminate in specific situations of qualitative analysis.

The element revealed in the conversation with student Daniel helps us think about one of these aspects: the stimuli and motivations coming from different agents. In this element that emerged in our analysis, we noticed that, despite the student expressing a probable degree of displeasure in the studies conducted in mathematics class, he makes an effort to carry out the activities requested there, as, in doing so, he meets his family’s expectations. Here, we identify an external process of approaching social practices and behaviors understood in the community as neurotypical in mathematics classes.

This closeness with specific practices in mathematics classes, many of them based on stimuli and motivations moved in different instances, is something that we can observe in all students, regardless of whether they are neurodivergent. However, from the perspective of reflections that arise within the scope of neurodiversity, this closeness, specifically by neurodivergent students, aligns with what is called camouflaging in the literature.

In the Brazilian school context, we could list practices that would indicate adequate performance in mathematics class. However, this list depends on the school, the education system, the school’s pedagogical project, and even the pedagogical concepts that underlie teaching practice. However, if we consider a traditional school context generally, we could, as an example, consider that this list of practices would include completing a list of exercises, solving problems using a certain algorithm, achieving the exact result in a previously requested calculation, or even sitting with a body posture understood as appropriate to perform a specific task given by the teacher in mathematics class. Here are meaningful discussions we must exercise in mathematics education that can be deeply developed based on the notions of camouflaging and masking currently developed within the neurodiversity paradigm.

In the conversation, student Daniel told us how some processes, such as camouflaging, reflect the way other agents, such as families, contribute to the maintenance of a system of mitigating supposed appearances and social manifestations of deficit through masking that constitutes practices, postures, and behaviors understood in the community as a standard of normality, as adequate, as regular.

Unlike student Daniel, the elements revealed in the conversation with Eduardo show better proximity and satisfaction with the studies carried out in mathematics class. However, by stating that mathematics was necessary for “studying the universe,” the student understands mathematics as a relevant instrument for his personal growth in the main center of thematic interest he has developed over the years: astronomy. Here, we can discuss another side of the investigative prism: individual particularities.

In this regard, individual particularities gather factors that vary from person to person. In the situation considered in our analysis, these particularities appear to be at the center of the

student's interest, but we could list here other particularities that are not necessarily located at the center of thematic interest, as they could result from socioeconomic, geographic, cultural, ethnic, linguistic, and identity fields of discussion, among many others that constitute us as humans.

Here, we highlight the importance of bringing to the surface of discussion the particularities that differentiate us as human beings before the descriptors usually listed in the various handbooks in the area of health and psychology. In other words, neurodiversity-based research must highlight the particularities of student X, student Y, and student Z despite the three being under the same nosological umbrella the clinical-medical perspective conceives them.

Student Fábio made a critical discussion emerge in our analysis about another side of the investigative prism that is constituted in research anchored in neurodiversity: the tensions between clinical and sociological perspectives. His school record explained that echolalia was frequent in the communication he maintained in the different spaces of the school routine. Echolalia, as defined from a clinical perspective, was demonstrated in the interaction with the researcher during the conversation with Fabio. Even without any questions being asked, the student repeated several times: "Mathematics is cool."

In our research, when assuming the assumptions of neurodiversity, we understand that in this situation, there is a student who expresses something in the communicative zone, but this expression is restricted by a problem that has not yet been resolved, caused by the tension between the clinical and sociological perspectives. At one extreme, we have the clinical perspective that defends the existence of a phenomenon defined as echolalia, which is characteristic of a population clinically identified with autism spectrum disorder, and at the other extreme, we have the sociological perspective incorporated into the neurodiversity paradigm in the voice of different advocates, who jointly understand the existence of differences and modes of communicative expression that manifest themselves as an intrinsic part of the neurodivergent person's identity (Cohn, Harrison & McVilly, 2023; Milton, 2022). Moreover, when conducting research in mathematics education, how can we consider this situation that arises in the communication field?

This issue is revealed in that aspect of the investigative prism formed as a field of tension that we must deepen in the studies we conduct in our area. In this tension, we agree with Cohn, Harrison, and McVilly (2023), who conclude that, in neurodiversity, this form of expression of the neurodivergent person –which, in turn, is identified from this paradigm as part of human identity– is a catalyst in our discussions for a noteworthy change in the way we understand this "repeated speech," seeing it not only as an exclusive phenomenon or primarily with clinical relevance.

In the discussion generated from the data produced in conversations with investigative purposes that we developed with the three students, we observed that some axes become worthy of attention in research that is anchored in neurodiversity. The first axis is based on stimuli and motivations. A more careful and in-depth investigative analysis not limited to a specific scene generated in qualitative research becomes essential so that we can understand the phenomenon analyzed within the horizon where it occurs. In other words, when we anchor ourselves in neurodiversity, we move through the study assuming the primacy of the participants' lived experiences and perceptions. We understand that within this horizon of analysis, we can understand the motivations and the stimuli that, provoked by different agents, culminate in the understanding of a certain research phenomenon that we develop more consistently. In this axis, for example, phenomena such as echolalia can be discussed within the horizon of the student's

experiences, and not particularly and punctually at the moment when speech is expressed.

Another axis we can highlight is what is revealed in the participants' individualities. An exercise we did in discussing these data, and which we believe is essential to share in this article, is the importance of making an effort to understand the participating neurodivergent students first in their individuality, considering their marks and scars generated, often, by different processes of exclusion that are sometimes implicit and sometimes explicit in everyday school, community, and family life. In research anchored in neurodiversity, we do not start from the report, diagnosis, code, and respective descriptors listed in health manuals. We assume individuality as the driving force, often permeated by different exclusion markers, with clinical diagnosis often being just one of these markers.

A third axis we bring to this discussion refers to the tensions in academic writing. Developing research in mathematics education anchored in neurodiversity does not mean first exploring the medical literature to understand autism. We do not intend to detract from the medical and clinical knowledge and systematization of autism, given its importance in different spheres of life. From this article, we intend to reverberate the importance of strengthening a territory of discussion without radical and more dialogical positions, understanding the meaning and clinical meanings announced not in an exhaustive way but rather with points of reflection that need to pass through the sieve of the sociological lens.

5 Final considerations

The research question that guided the study presented here was: What are the aspects of the investigative prism in research anchored in neurodiversity that we can highlight as urgent in mathematics education? Through the discussion we developed in this article, three aspects were identified in the investigative perspective: (1) the stimuli and motivations coming from different agents, (2) individual particularities, and (3) tensions between clinical and sociological perspectives.

Considering the need to discuss human diversity in mathematics education, we understand that the aspects of the investigative prism identified in this study contribute to a new qualitative research scenario. However, the new scenario does not allow focusing only on students identified with autism with an etiological description of the disorder or diagnostic criteria from health manuals or specific teachers' practices centered only on adaptations of a didactic, pedagogical, or curriculum nature.

We understand that, in this qualitative research scenario, autism must be studied in mathematics education with a broader lens and less imbued with precepts coming from areas of study that ignore what we have constituted as expertise in mathematics education throughout the years. Neurodiversity contributes to our intention, as it allows us to develop an investigative perspective that considers elements of sociological orders crucial for identifying and overcoming exclusionary processes in mathematics classes.

The axes that stood out in the study presented here, such as stimuli and motivations, individual particularities, and tensions between clinical and sociological perspectives, represent just some of the various axes that support the mathematics educator's intentionality in identifying and overcoming exclusionary processes that affect neurodivergent students. However, the axes highlighted here introduce the research community to an urgent and necessary reflection on what to do in the research scenario.

This study is limited, given the number of participants. However, other studies with a larger universe of contributors can enrich the discussions provoked here. Future studies focused

on the practice of qualitative research in studies anchored in neurodiversity can expand the reflections introduced in this article, allowing advances in the methodological trajectories assumed by mathematics educators.

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