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Narratives of mathematics teachers about situations experienced in classes with blind students

Narrativas de profesores de matemáticas sobre situaciones vividas en clases con alumnos ciegos

Récits de professeurs de mathématiques sur les situations vécues en classe avec des élèves aveugles

Narrativas de professores de matemática sobre situações vividas em classes com estudantes cegos

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Abstract

The article presents part of a study that aimed to understand communication in inclusive classes based on the narratives of teachers who teach mathematics in classes with blind students. The research uses studies on inclusive education and critical mathematics education to produce data from narratives of the teachers who participated in the research through episodic interviews conducted remotely in 2022 during the COVID-19 pandemic. To analyze them, analytical categories refer to the concepts of accessibility and dialogue anchored in the theoretical approaches of reference. The analyses highlight the teachers' concern about including blind students in the narrated activities, even if, sometimes, inclusion was not made explicit in the narrated episodes. These results confirm the findings of other research that the presence of students with different disabilities causes doubts and uncertainties in teachers, both related to

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didactic choices and to the way of acting and teaching. We conjecture that overcoming these difficulties involves adequate physical infrastructure, availability of appropriate teaching resources, and access to initial and continuing training that discusses inclusive education.

Keywords: Inclusive education, Blind students, Critical mathematics education, Situation experienced, Narratives.

Resumen

El artículo presenta parte de una investigación que tuvo como objetivo comprender la comunicación que ocurre en las clases inclusivas, a partir de narrativas de docentes que imparten matemáticas en clases con alumnos ciegos. Se basa en estudios sobre Educación Inclusiva y Educación en Matemática Crítica para producir datos a partir de narrativas de profesores que participaron de la investigación, a través de entrevistas episódicas realizadas de forma remota, en 2022, durante el período de la pandemia provocada por Covid-19. Para analizar los datos utilizamos – basándonos en enfoques teóricos de referencia – categorías analíticas que están asociadas a los conceptos de accesibilidad y diálogo. Los análisis resaltan la preocupación de los profesores por incluir a los estudiantes ciegos en las actividades narradas, aunque, a veces, la inclusión no está explícita en los episodios narrados. Estos resultados confirman los hallazgos de otras investigaciones en la que la presencia de estudiantes con discapacidad provoca dudas e incertidumbres entre los profesores, relacionadas tanto con las elecciones didácticas como con la forma de actuar y enseñar. Se conjetura que la superación de estas dificultades depende de factores que incluyen infraestructura física adecuada, la disponibilidad de recursos apropiados para la enseñanza y el acceso a la formación inicial y continua que aborden la Educación Inclusiva.

Palabras clave: Educación inclusiva, Alumnos ciegos, Educación matemática crítica, Situación vivida, Narrativas.

Résumé

L'article présente une partie d'une étude qui avait pour but de comprendre la communication qui a lieu dans les classes inclusives, à partir des récits d'enseignants qui enseignent des mathématiques dans des classes ayant des élèves aveugles. Il se base sur des études relatives à l’éducation inclusive et l'éducation mathématique critique pour produire des données à partir de récit d’enseignants qui ont participé à la recherche, par le biais d'entretiens épisodiques réalisés à distance, en 2022, pendant la période de pandémie provoquée par le Covid-19. Pour les analyser, nous avons utilisé des catégories analytiques qui renvoient aux concepts

d'accessibilité et de dialogue ancrés dans les approches théoriques de référence. Les analyses mettent en évidence le souci des enseignants d'inclure les élèves aveugles dans les activités présentées, même si, parfois, l'inclusion n'était pas explicite dans les épisodes narrés. Ces résultats confirment les conclusions d'autres recherches selon lesquelles la présence d'élèves ayant différents handicaps suscite des doutes et des incertitudes chez les enseignants, tant en ce qui concerne les choix didactiques que la manière d'agir et d'enseigner. Nous supposons que pour surmonter ces difficultés, des facteurs tels qu'une infrastructure physique adéquate, la disponibilité de ressources pédagogiques appropriées et l'accès à une formation initiale et continue sur l'éducation inclusive sont nécessaires.

Mots-clés : Éducation inclusive, Élèves aveugles, Éducation mathématique critique, Situation vécue, Récits.

Resumo

O artigo apresenta parte de uma pesquisa que objetivou compreender a comunicação que ocorre em classe inclusivas, a partir de narrativas de professores que ensinam matemática em classes com estudantes cegos. Fundamenta-se em estudos sobre a educação inclusiva e a educação matemática crítica para produzir dados a partir de narrativas dos professores que participaram da pesquisa, por meio de entrevistas episódicas realizadas remotamente, em 2022, no período da pandemia causada pela covid-19. Para analisar os dados, utiliza-se –com base nas abordagens teóricas de referência– de categorias analíticas que estão associadas aos conceitos de acessibilidade e de diálogo. As análises colocam em evidência a preocupação dos professores em incluir os estudantes cegos nas atividades narradas, mesmo que, por vezes, a inclusão não tenha ficado explícita nos episódios narrados. Esses resultados confirmam os achados de outras pesquisas de que a presença de estudantes com deficiências causa dúvidas e incertezas nos professores, relacionadas tanto às escolhas didáticas quanto ao modo de agir e ensinar. Conjectura-se que a superação dessas dificuldades passa por fatores que incluem a infraestrutura física adequada, a disponibilidade de recursos apropriados ao ensino e o acesso a formação inicial e formação continuada que discutam a educação inclusiva.

Palavras-chave: Educação inclusiva, Estudantes cegos, Educação matemática crítica, Situação vivida, Narrativas.

Mathematics teachers' narratives about situations experienced in classes with blind students

The research that gives rise to this article falls within the domains of inclusive education and critical mathematics education to investigate mathematics teaching in classes with blind students in elementary school.

Diffuse and mistaken ideas about blindness are common in societies and are part of people's collective imagination, passed on from generation to generation. As Castro (2014) highlights, such ideas may derive from the fact that vision is responsible for capturing a large part of the information from the environments in which we live –and, therefore, the problems in this sensory channel bring about other forms of perception, which even influence learning school content. Therefore, teachers who teach visually impaired students are urged to use strategies that meet their specific characteristics, whatever the area of knowledge studied.

This research addresses this context and prioritizes mathematics teaching from the perspective of inclusive education, seeking to overcome misconceptions related to people with disabilities, who, for a long time, have been stigmatized and socially segregated. According to Mônaco (2008), the inclusion movement in different social segments gradually seeks to "redeem a debt owed to a population segment that, historically, has been left on the margins of society" (p. 19).

Sassaki (2010) presents the construction phases of the concept of inclusion, which has come a long way and has incorporated exclusion, institutional segregation, and integration. Those concepts are reflected in how the educational system was organized until reaching the regular class –also known as the inclusive class–, in the current inclusive educational system, and are based on diversity and no longer a utopian homogeneity. Inclusion induced and still induces debates among educators, researchers, governments, and society in general, which are vectors to produce research in education and teaching, whether in relation to teaching or to school knowledge learning.

To address those themes, we chose as theoretical lenses the critical mathematics education (Skovsmose, 2007, 2014) approach, which is anchored in concepts such as democracy, inclusion, and social justice, which embody the ideas of liberation and transformation so advocated by Freire (1987). Returning to the master's teachings in his work *Pedagogia do Oprimido* [Pedagogy of the Oppressed], Lima et al. (2021) emphasize that

“Freire (1987) advocates a liberating, dialogical, and transformative education carried out by the oppressed, exploited, subaltern, expropriated, enslaved, exiled, refugees, deprived of freedom..., against all forms of oppression existing in society” (p. 4).

Among those central characters are people with disabilities, who fight against the barriers and invisibility that society often insists on imposing on them.

Anchored in such concepts, critical mathematics education envisions new possibilities for teaching and research within mathematics education. Aligned with Bartell, Silva et al. (2021) reflect:

> Bartell (2013) highlights the double imperative faced by mathematics education: the need to offer students all the mathematical repertoire necessary for them to be successful in education systems and, at the same time, provide opportunities for them to use the mathematical knowledge built to expose, confront, and overcome the obstacles imposed on their realities. For the author, teaching mathematics from the social justice perspective meets both imperatives simultaneously. However, she argues that teaching mathematics for social justice requires teachers to (re)acknowledge the specific sociocultural contexts in which schools and students are inserted. (pp. 23-24)

Mathematics teaching from this perspective brings critical mathematics education and inclusive education closer to each other and enhances the relevance of the teacher’s role in the didactic relationship because it is the teacher’s role to define the class objectives and choose the teaching strategies and activities. When teaching in an inclusive class –in this research, classes with blind students–, the teacher feels the need to consider the specificities of each educational context and each person. To this end, one of the concepts inspired by Freirean theory and recommended by Alrø and Skovsmose (2006) is dialogue, which goes beyond the idea of a simple conversation because it considers the protagonism of the people who participate in it.

From this perspective, an essential characteristic of dialogue is people’s encounters and respect for each other’s arguments, whatever their hierarchical positions, to generate exchanges of experiences and build new knowledge. It is not just about respecting the other person’s thoughts but also what they are in essence and differences, as inclusive education presupposes.

Dialogue in those terms certainly includes accessibility conditions that can guarantee social equity. Section I of Article 3 of the Brazilian Inclusion Law (LBI) (Lei n. 13.146, of July 6, 2015) deals with accessibility as a minimum necessary condition for people with disabilities or reduced mobility to access material and social goods of a public and private nature shared

by the community. Even considering the relevance of the advancement of regulatory frameworks in recent years and the implementation of significant public policies, there are still barriers to access to such goods that affect the school environment, and these, as highlighted in that law, may be linked to architectural, instrumental, methodological, programmatic, attitudinal, or communicational dimensions.

Although assessing that those dimensions are intrinsically linked to inclusive education, our research prioritized the communicational dimension. Among the mathematical fields addressed in elementary school, we chose geometry, including geometric quantities, as we see that at least two possibilities for representing geometric objects can influence communication: graphics (visual communication) and physics (visual and tactile communication).

The possibilities and motivations we listed led us to the following question: What do teachers who teach mathematics reveal about communication in inclusive classes with blind students? In search of elements of answers, we aimed to understand communication in inclusive education based on narratives from teachers who teach mathematics in classes with blind students. This article addresses this objective through answers from two teachers who narrated situations experienced when teaching geometric content in inclusive classes with blind students, which are the core of the analyses presented below. First, however, we briefly reflect on concepts associated with disability, notably blindness, and critical mathematics education.

Disability: concepts and reflections

The ideas constructed by society around disability have changed over time due to historical and social factors that, in turn, have driven relevant advances in regulatory frameworks, as we have already announced. Consequently, erroneous and prejudiced conceptions that were previously attributed to people with disabilities and which referred, for example, to defects and disabilities, have been gradually overcome.

Among such conceptions is that of ableism, which, according to Dias (2013), "is a conception present in society that sees people with disabilities as not equal, less able, or not capable of self-management" (p. 2). It places people with disabilities in a position of inferiority vis-à-vis others, which culminates in the denial of rights, impositions of restrictions, dependence on other people to carry out day-to-day activities, and even a lack of understanding of their potential. Such denials and deprivations of rights place those people in situations of

subalternity as they are seen as limited people. Overcoming conceptions like those is important to make society fairer and more humane, as advocated by inclusive education.

Disability has been defined based on three conceptual models –medical, social, and biopsychosocial– that differ depending on focus and functionality and can be based on biological, environmental, social, psychological aspects, or a combination.

The medical (or biomedical or biological) model attributes a patient's condition to a person with a disability. In this case, the problem is in the body, and the "person with a disability is the one who needs to be cured, treated, rehabilitated, etc., to be adapted to society as it is, without major modifications" (Sassaki, 2010, p. 29). One of the functions of this model, which still predominates in Brazil, is to produce reports that inform the type of disability and each person's needs regarding the necessary referrals. Decree n. 5.296 of December 2 (Decreto No. 5.296, 2004) –which regulates Law n. 10.048 of November 8 (Lei No. 10.048, 2000) and Law n. 10.098 of December 19 (Lei No. 10.098, 2000)–, provides characterizations of various types of disabilities: physical; mental/intellectual; auditory; visual; and multiple disabilities. The characteristics presented in the document are used as parameters for health professionals' evaluation and subsequent issuance of reports.

The social model that prevails over the medical model today, according to Sassaki (2010), considers that disability is not an inherent issue and believes society creates problems and disadvantages for them. The author believes that this results from several aspects, such as

> [...] its restrictive environments; discriminatory policies, and prejudiced attitudes that reject the minority of all forms of differences; its debatable standards of normality; its objects and other assets that are physically inaccessible; its prerequisites attainable only by the supposedly homogeneous majority; its almost total misinformation about disabilities and the rights of people who have these disabilities; its discriminatory practices in many sectors of human activity. (Sassaki, 2010, pp. 44-45)

From this perspective, disability is something society imposes on someone who suffers an injury, such as the loss or absence of a limb or a sense, such as vision. As Bentes et al. (2016) state, someone's identity is not characterized by the absence or need for something or even a physical attribute. We therefore consider that the identity of people, of any person, arises from several factors, such as their histories and sociocultural environment.

The coexistence of the two models –the medical and the social– led, for a long time, experts in the field to defend and justify their positions and explain their advantages and

limitations depending on what each one sought to prioritize. Thus, the biopsychosocial model that considers that disability occurs due to several factors, such as biological, environmental, social, psychological, and personal factors, subsequently emerged. This model contained in the LBI (Lei n. 13.146, of July 6, 2015) guarantees individual and collective rights, as it considers that a person with a disability "has long-term impairment of a physical, mental, intellectual, or sensory nature, which, in interaction with one or more barriers, may obstruct their full and effective participation in society on equal terms with other people" (Art. 2).

Thus, due to characteristics that can be considered intermediate between the first two models, as stated by Mota and Bousquat (2021), disability "is no longer restricted to the body, but is present in the interactions between health conditions, activities, social participation, personal and environmental factors, and body functions" (p. 852). This concept expands the possibilities of individual and collective activities that favor the experience of inclusion situations. However, for inclusion to occur, such activities must be based on the principle of equity, which, for Seabra (2016), means ensuring equal opportunities and access to those in unfavorable situations, even if this requires providing unequal treatment. This principle, as we said, is the basis of the concept of accessibility, which constitutes one of the categories of our research.

The LBI (Lei No. 13.146, of July 6, 2015) ensures that accessibility for people with disabilities or reduced mobility must be guaranteed through "access to products, resources, strategies, practices, processes, methods, and assistive technology services that maximize their autonomy, personal mobility and quality of life" (Art. 74). To this end, it is necessary to eliminate barriers, which may be urban, in buildings, transportation, and communications; they can also be attitudinal and technological. The document defines barrier as

> [...] any obstacle, impairment, attitude, or behavior that limits or prevents the person's social participation, as well as the enjoyment and exercise of their rights to accessibility, freedom of movement and expression, communication, access to information, understanding, and safe circulation, among others. (Lei n.º 13.146, de 6 de julho de 2015, 2015, Art. 3.º, Inciso IV)

Accessibility barriers are often imperceptible to most people. In the educational sphere, educators, managers, students, families, and the school community as a whole must be on the alert to identify existing barriers in school spaces and seek solutions to eliminate or minimize them. For example, a barrier associated with the architectural dimension may be present in the architecture of classrooms, bathrooms, laboratories, or even school transport. A methodological

barrier represents an impediment for the student to access the contents of the different areas of knowledge worked at school.

Among the barriers studied by the Institute of Social Technology (Instituto de Tecnologia Social - ITS, 2008), some originate from the attitudinal dimension based on prejudice and non-recognition of the rights of people with disabilities. Also noteworthy are those associated with the communicational dimension and can represent "obstacles in all areas of communication, considered in its different forms (spoken, written, gesture, sign language, digital, among others)" (ITS, 2008, p. 10).

Decree n. 5.296 (Decreto No. 5.296, 2004) considers barriers to communication and information "any obstacle or impairment that makes it difficult or impossible to express or receive messages..., as well as those that make access to information difficult or impossible" (Art. 8, Section II, 2004). To overcome those barriers, the legislation provides ways to address different types of disabilities. The 2015 LBI (Lei No. 13.146, 2015) also considers the communicational dimension, for example, when dealing with the "teaching offer of Libras, the Braille system and the use of assistive technology resources, to expand students' functional skills, promoting their autonomy and participation" (Art. 28, Item XII, 2015).

Results from research such as that carried out by Camargo (2010) with students with visual impairments point to communication as one of the main accessibility barriers for them. In this sense, besides the material conditions that educational systems must guarantee, the teacher also plays a crucial role in overcoming this barrier. Our interest in the narratives of teachers who have had such an experience is therefore anchored in this assumption.

Critical mathematics education: dialogue and situations experienced

Skovsmose (2007, 2014) and his collaborators reflected on the relevance of mathematics and its teaching in people's lives and society and on how the forms of use can influence them, both for good and for bad. In other words, there is no neutrality in mathematics –and, therefore, depending on the conception that permeates teaching, it can contribute, on the one hand, to people's liberation or, on the other, to domination and social chaos. In this context, the teacher's role in the classroom stands out. Their knowledge, conceptions about mathematics and teaching, and didactic and methodological choices will define the type of contribution that mathematics will bring to students' real lives. To this end, critical mathematics education

advocates dialogue, investigation, and criticism, among other concepts, to promote teaching for social justice.

The concept of dialogue, rooted in Freire's theory, represents the meeting between people and is characterized by a relationship of cooperation and mutual trust established between them to encourage the exchange and sharing of knowledge already constructed and give rise to new ones. Lima et al. (2020) highlight that, in the context of mathematical investigation, dialogue is the link between criticism and investigation and can give meaning to mathematical knowledge worked on in the school context.

Based on the concerns and concepts that reference critical mathematics education, Lima (2018) remarks:

> Research dealing with critical mathematics education reveals that it is not a teaching methodology, a model, or a curricular subject. It is constituted in the relationship with society and aims to discuss concerns regarding mathematics education, whether regarding the use of technologies, power relations that involve democracy, social justice, or innovative educational practices. (p. 70)

Research on such practices in school and higher education can be a way for mathematics to become an instrument of social transformation in constructing a more fair, equitable, and democratic world. However, for this to reverberate in people's lives, such practices need to be anchored in a dialogue that goes beyond aspects of the present of those dialoguing to bring about future transformations. In the framework of critical mathematics education, this process is called pedagogical imagination, as it allows us to confront "what is the case with what is not the case, but what could become the case" (Skovsmose & Borba, 2004, p. 214). It is, therefore, about taking an experienced situation as a starting point to identify a problem that will create an imagined situation. When put into practice, this can undergo adjustments and become an arranged situation.

For the authors, the relevance of knowing the current situation, both for teaching and research, lies in the means it provides to think about alternatives or possibilities for teaching, i.e., to support pedagogical imagination. Within this article framework, we focus only on two experienced situations, intending to contribute to teaching and research that relates critical mathematics education and inclusive education, notably, in mathematics teaching in elementary school.

By carrying out this relational exercise, we highlight our concern for social justice and equity between people. In contrast to teaching based on universalist bases, we consider that

dialogue between the democratic and the affirmative can ensure equal conditions. To do so, we presuppose the experience of situations such as landscapes of investigation and work with projects. In these landscapes, research is used to teach mathematics in close contact with students and school communities' realities. They constitute teaching and learning spaces that promote reflection, debate, formulation of hypotheses, socialization, and dialogue about the solutions found –besides decision-making.

Working with projects is highlighted by Alrø and Skovsmose (2006) as an alternative to traditional teaching, as it allows articulating school content from one or more areas of knowledge and the diverse themes that permeate the students' realities. Like the landscapes of investigation, such projects allow dialogue, investigation, and criticism through the experience of motivating and challenging situations for the participants.

When we suggested that teachers participating in the research narrate situations experienced in inclusive classes with blind students, we did not intend to characterize landscapes of investigation or project work but rather to find elements of dialogue and accessibility that would allow us to understand the activities these teachers worked and how, based on them, they sought to include students in their classes.

Methodological procedures

The research takes the form of an investigation through narratives, considering, on the one hand, that they are part of the reality of people in their social and communicative activities and, on the other, that this type of analysis constitutes an investigative method that has been used in social and educational research:

> The narrative is part of the history of humanity and, therefore, must be studied within its social, economic, political, historical, and educational contexts. It is common to hear through different narratives that human beings are, by nature, tellers, storytellers, and that generations and generations repeat this act almost involuntarily to each other. (Sousa & Cabral, 2015, p. 149)

The use of narrative in research in education and teaching areas arises, in part, from the need for academic productions to speak "*about* school instead of talking *to* it, *from* it" (Lima et al., 2015, p. 18). In this way, we stop talking about the teacher and start talking to the teacher.

For data production, we chose episodic interviews, which, according to Flick (2008), allow the research of everyday knowledge about objects or processes through answers in short, specific episodes. This choice is, therefore, justified by the fact that we are not interested in

biographical narratives but in specific situations experienced and/or imagined by the interviewees, in this case, teaching situations experienced by teachers in classes with blind students.

Due to the physical distance recommended by health authorities during the COVID-19 pandemic, the research data was produced remotely between January and February 2022 through video conferences on platforms such as Google Meet and Zoom. To prevent the process from becoming exhausting for the participants, the interviews were divided into several sessions and recorded with the prior consent of the teachers.

In this article, we present the production of two mathematics teachers who taught standard classes with blind students in the final years of elementary school in public schools based in municipalities in Pernambuco. In compliance with ethical requirements, researchers and those being researched signed terms of commitment and free consent, in which the commitment was made to keep the identities of teachers and their students anonymous and to use the data produced only for academic purposes. Thus, the teachers were named Teacher Ariano and Teacher Manuel[4]. In this article, we present excerpts from the interviews of these teachers who addressed, respectively, the teaching of geometric solids and the culminating activity of the *Matemática na Construção Civil* [Mathematics in Civil Construction] project, which, among the mathematical contents, worked with geometric quantities.

Table 1 shows, organized in a table, those teachers' academic and professional profiles at the time of the interviews.

Table 1.

Teachers' profile of academic and professional education

Teacher	**Academic background**	**Teaching experience time**	**Previous experience with inclusion**	**Experience teaching blind students**
Teacher Ariano	Teaching degree in Mathematics; Master's degree in Geodetic Sciences and Geoinformation Technology.	10 years and 6 months	No	2021
Teacher Manuel	Teaching degree in Mathematics; *Lato sensu* specialization in Mathematics Teaching.	11 years and 6 months	Student with visual impairment (low vision)	2017 and 2018

[4] With these choices, we pay homage to Ariano Suassuna (1927-2014), a writer from Paraíba who holds the title of citizen of Pernambuco, and the writer Manuel Carneiro de Souza Bandeira Filho (1886-1968), from Pernambuco.

To analyze the data produced with these teachers, we took as a reference the concepts of accessibility and dialogue considering studies on inclusive education and critical mathematics education, respectively. Therefore, we used three analytical categories – facilitating investigation, favoring collaboration, and providing accessibility– as we considered that they could provide access to elements of answers to the question that motivated the development of the research.

Analysis of teachers' narratives

In this section, we present the main findings of the research, and, to this end, we organized per teacher the analysis and discussion of the data. The excerpts presented here were transcribed from interviews with the teachers in 2022.

The class experienced and narrated by Teacher Ariano

Teacher Ariano told us of a videoconference class during the pandemic, in which a blind student, Clarice, was enrolled. Clarice, whose origin of blindness the teacher did not inform, was literate in Braille and, in 2021, was attending the 6th grade in remote and synchronous classes. He described the student as diligent and participative and who almost always had her mother's collaboration.

In the extracts that follow, the teacher details the class.

> Teacher Ariano: *There was a topic about geometric figures from Chapter 1, for students to identify a spatial geometric shape and a flat geometric shape. In fact, Clarice participated in this class. Generally, when a figure appeared, for example, that talked about a truck, I would say: - Look, Clarice, the truck is shaped like a shoe box. I had warned her mother that this week, she would have to have some geometric objects nearby. For example, a marble and a sock ball, so that she could actually have contact with the geometric shapes to differentiate them. That's why I needed spatial geometric figures: to identify what a cube was, to differentiate it from a parallelepiped.*

> Teacher Ariano: *This class was more about differentiating and also working on the idea of solid planning. So, at that moment, I asked the students to show, for example, a cardboard box, a glass, a marble, and a bunch of geometric shapes, and she also showed two or three objects that I don't remember what they were. To bring the reality that mathematics, in this case, geometric figures, was in everyday life, but they did not associate it with the geometric situation or the geometric name we worked with in the mathematics context.*

The teacher sought to contemplate the students' realities using objects from the physical world (concrete) present in their homes, although their description does not indicate an interest

in carrying out a mathematical investigation. The action of asking students to present such objects will likely motivate them, including Clarice, to interact during class. About this, Teacher Ariano narrated: "*It was a party, because not only her, the other students also appeared in the cameras*." The teacher underscored moments of students' interactions and collaboration as something he had not observed in face-to-face classes. He also described that, when Clarice spoke, the other students always stopped talking, and this conveyed the idea that, with this gesture, the class sought to collaborate with her.

Teacher Ariano said that, almost always, the students, except for Clarice, kept their video cameras off during the class –which, however, did not happen on the day of the narrated class because everyone wanted to present their objects, and, according to him, "*This generated enthusiasm and a lot of chatting*." Seeking to establish a more effective dialogue with Clarice, he addresses her: "*Look, Clarice, the truck is shaped like a shoe box*." For the teacher, this statement made sense because, before the class, he had already spoken to Clarice's mother and told her that the class would be about geometric solids content so that she could help her daughter select the objects he had requested.

We do not have the elements to confirm how Clarice interacted with the teacher's speech and how the dialogue was established. It is worth noting, however, that the fact that Clarice always kept her camera active was an important act for the teacher because, as he told us, it allowed him to observe "*the expressions she makes, when she speaks, she even feels the tone of the voice, she can tell the difference when the person is speaking*." Those elements favored collaboration between the teacher and the class and Clarice's inclusion in the remote class on geometric solids.

We observed that, even in the face of the difficulties imposed by remote teaching, adopted untimely by most education networks during the pandemic, Teacher Ariano's choices in the unfolded episode seem to have contributed to the participation of the entire class. Each student's peculiarities, notably Clarice's, do not seem to have been an impediment to promoting collaboration and providing her with accessibility to the mathematical activity the teacher proposed.

In the teacher's report, we highlight the relevance he attributed to the students' faces, voices, and reactions when they answered his questions during the remote teaching classes. Attitudes that he claimed to adopt in these classes –such as "*drawl*" and "*describe the* slides"–

so that Clarice could better understand what was being taught indicate her concern with providing accessibility to the blind student. The collaboration was also manifested in the relationship between the teacher and Clarice's mother in favor of her learning.

Teacher Ariano sought to establish a dialogue between the content covered in class, geometric solids, and objects that are part of the students' daily lives. The fact that the class was experienced in remote teaching does not seem to have represented a difficulty for the students in that class, as they demonstrated enthusiasm when opening their cameras to present the objects the teacher had requested. Interaction through the students' gestures and facial expressions contributed to establishing dialogue and cooperation –notably, in Clarice's case– with the class.

Class experienced and narrated by Teacher Manuel

Teacher Manuel narrated the culminating activity of a project called *Matemática na Construção Civil* [Mathematics in Civil Construction] –which, among the mathematical contents, worked on geometric measurements–, in which a blind student, João, who had been his mathematics student in 2017 and 2018, while attending the 8th and 9th grades of elementary school. The teacher said that João has acquired blindness and that he also has relatives with visual impairments. He also said that the student was literate in Braille, dedicated to his studies, and very sociable and that he liked social networks and playing sports.

Therefore, below, we present two excerpts from the situation the teacher experienced and narrated.

> Teacher Manuel: *We did a mathematics project in civil construction. In this project, we worked with all students at the school, with all segments. João was always participative despite his disability; the difficulty was how to get him into this project. Because it was a project that would be presented to the whole school... As the title was* Matemática na Construção Civil*, we worked with the geometric part, with various segments of mathematics... the difficulty was thinking about all the students, the normal and special ones, to work on the project. With João, the biggest difficulty was knowing what the presentation part would be like. If this presentation... it would be presenting something to the public. It could be a reading, a model, or some data*.
>
> Teacher Manuel: *So, we worked with João in the following way: we prepared a text, and the support teacher transformed it into Braille... He took the entire text home in Braille, learned about it, and kept saying, for example, 'How much sand could be spent on one square meter? How much could be spent on cement? In one square meter to cover a house, how many channel tiles could be used? In one square meter of a masonry wall, approximately how many bricks would fit?' So, João was responsible for making*

this presentation because the other parts were models and illustrations, so there was no way to put him in.

The teacher's report shows that one of his main concerns was defining a way for João to participate in the activity. Even though he was a student dedicated to his studies and sociable, the teacher considered that, at the culmination of the project, unlike the other students, he would have difficulty presenting the models and posters. Thus, with the help of the support teacher, he created an activity in Braille for João. The activity contained questions that included measuring the area of flat figures associated with everyday objects, such as the roof of a house or a wall, as described in the extract from the report we presented.

When we questioned Teacher Manuel about João's contribution to the construction of the text, he explained that there was "*a group just for reading, a group just for building data and research, another group to register, another group to help decorate the room*." This answer may indicate that the text was not written especially for João, and it was exclusive only because of the translation into Braille. However, nothing clarifies João's contribution to the construction of the text or the translation, especially if we consider the information that João "*took home the entire text in Braille*," studying it and repeating what he learned.

Although we could assume the existence of a dialogue between students in small groups, with or without the teacher's presence, the answers given up to that point did not allow us to infer anything about such dialogue, the collaboration established, or accessibility. Were there elements that could be associated with the concept of dialogue that goes beyond a simple conversation? Hence, we asked the teacher for more details about João's participation in the project, to which he responded by citing an interactive moment: "*João, here in this room, we have a floor, and the model here will have a representation of it,... with approximately x square meters*." This answer shows that the teacher is somewhat concerned about allowing João to access the organization of the physical space. However, contrary to what we expected, this answer did not contribute to our understanding of the extent to which he participated in the activity. Considering that a model is three-dimensional and can be built with materials of different textures, we suppose that the means to provide João with accessibility were plausible so that he could be included in the activity. However, the teacher seems not to have chosen or envisioned it, at least not in the narrated episode.

Regarding the collaboration of the other students with João, Teacher Manuel reported that some colleagues were responsible for helping him during the presentation at the

culmination. This collaboration is relevant because it could help João, for example, overcome any architectural barriers on the route and in the presentation room. However, the aspects reported by the teacher do not allow us to infer other elements of that collaboration. He also reported that project participants met weekly and worked in groups that developed specific tasks. The results were presented to the school community with the support of resources such as models and posters displayed in a stand set up in the schoolyard.

In fact, from the perspective of critical mathematics education, working with projects is an alternative to traditional teaching, as it encourages dialogue, investigation, and criticism. However, the teacher's report was almost entirely dedicated to describing the process of organizing and experiencing the culmination of the project, even when prompted to detail the mathematical activities developed by the participants. Thus, even considering the relevance of his choice to teach mathematics through a project, we cannot say that it was experienced from the critical mathematics education perspective (Skovsmose, 2007, 2014) as we did not have access to dialogue, investigation, and criticism from this perspective.

Although João participated in the activities of one of the groups formed during the project, the teacher described the activity proposed, which is different from those the other participants developed. However, the fact that it was the second school year in which Manuel taught mathematics to João leads us to conjecture that he knew him well and that he had already built an important trajectory on how to direct mathematical activities from the perspective of inclusion. However, at some points in the interview, he preferred to seek his comfort zone (Penteado, 2001), such as *when talking about the need for specialized support: "When you are very far from that... you are totally dependent on a support teacher, a specialist*". In this situation, it seemed that the teacher wanted to ground the idea that a specialist teacher would meet João's demands.

Final considerations

We relied on two episodes narrated by mathematics teachers to find elements to answer our question about communication in inclusive classes with blind students. To this end, we use, as analytical lenses, studies on Inclusive education and critical mathematics education.

The research results point to difficulties teachers may face in including blind students in their mathematics classes –case under analysis–even when the resources they use to teach, such as models, allow those students to participate more effectively. In fact, the inclusive

classroom can still be seen by most teachers as a challenging environment that requires them to leave a comfort zone for a risk zone.

Inclusion is a challenging task that requires changes in teaching and learning ways, and the communication practiced. Sometimes, the teacher identifies what needs to be done but cannot always implement what he has planned in the classroom.

The presence of students with different disabilities causes doubts and uncertainties, related both to didactic choices and to the way of acting and teaching. Teacher Manuel, for example, considered: "*When you are very far from that, you have no idea what it is, how you are going to deal with people in these conditions, you get completely lost."* The highlighted expression, in addition to bringing an example of ableism still present in the collective imagination, reveals that the teacher wants to escape the reality of inclusion. At times, the absence of the support teacher could have led him to take on the role of teacher of the blind student, but this did not happen.

Situations like these can lead the teacher to look for new alternatives to teach or, on the contrary, to repeat patterns of interactions known to the participants, often centered only on their speech –and leave the inclusion effort solely to the student with disabilities. However, some teachers' attempts to escape the inclusive educational system to the comfort zone, the standard class, have been pointless, as they are always called back to the risk zone that still portrays the reality of the inclusive class.

Many gaps still seem to be present in the inclusive context, such as inadequate physical infrastructure, the scarcity of appropriate resources for teaching, the lack of specialized support, and the almost absence of initial and continuing education actions that discuss inclusive education. Such problems can cause fears and apprehensions in teachers to the point that they, as we said, prefer not to face reality, avoiding the responsibility of teaching students with disabilities or even advocating that there is nothing they can do due to their sensory, motor, or intellectual conditions. We conjecture that overcoming such fears and concerns involves factors that contribute to reversing those gaps.

Although both teachers revealed concerns about blind students' inclusion, the episodes they narrated indicate more distances than approaches with the concept of dialogue from the perspective of critical mathematics education. However, we identified some possibilities for it to happen: for example, when Teacher Ariano used a real-life reference to teach geometric solids or when Teacher Manuel chose to work with projects.

Such results may reflect the complexity of the dialogue in this approach that presupposes investigation and criticism, even more so in challenging educational contexts such as inclusive

classes and remote teaching, in the case of Teacher Ariano. We must consider that, in 2021, classes with Clarice were in remote mode, which challenged the teachers, surprised by the need to use it in an improvised way to meet the emergency demand the pandemic imposed. Probably, if it were possible, some would have tried to escape this situation, but the educational context did not provide many alternatives to teachers and students. Therefore, everyone had to face that reality that affected people's lives in the health, social, and professional dimensions, among others. The impacts of this historical moment on education and teaching are still being studied and analyzed by researchers and educators, including us, the authors of this article.

The aspect of favoring collaboration was considered close to being effective when the situation showed signs of mutual engagement and respect for differences, in Teacher Ariano's case, and drove away when communication was centered on the teacher or when the blind student's participation was passive, in Teacher Manuel's case.

However, Teacher Manuel, after having this experience with João, began to review some stigmas related to blindness. He and Teacher Ariano expressed the desire to study Braille to better deal with blind students' symbolic/linguistic reality. Although these are embryonic initiatives, they may contribute to more inclusive teaching through more inclusive activities promoting dialogue and accessibility. We therefore consider that the comfort zone that characterizes the inclusive class is not just a problematic region; on the contrary, it is also full of possibilities. When the teacher decides to face it head-on, new ways of teaching and learning can emerge.

The episodes the teachers narrated raised a crucial reflection on the teaching activity of teachers who teach mathematics in classes with blind students. Such reflections took us out of our comfort zone so that, through the communication provided by this article, we sought to contribute to improving teaching and advancing research on inclusive education in the mathematics education context.

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