10.46551/emd.v9n16a32 ISSN 2526-6136

Deaf teacher, inclusive practices, and ethnomathematical perspectives in the regular classroom

Abstract: This paper presents the results of a study that aimed to examine the presence of a deaf teacher in regular classes in the Elementary School. Using Ethnomathematics as a theoretical and methodological reference, data were generated from a study group comprising hearing and deaf teachers who worked with deaf students in two public schools in municipalities in Mato Grosso, Brazil. The participants designed, developed, evaluated, and redesigned tasks using GeoGebra as an assistive technology. The analysis showed that deaf teachers can work in regular classrooms, provided they have the support of a professional Brazilian Sign Language (Libras) translator-interpreter.

Keywords: Deaf Teacher. Ethnomathematics. Regular Classrooms. Inclusion. Libras Translator-Interpreter.

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Received • 27/03/2025
Accepted • 12/08/2025
Published • 20/12/2025

Editor • Gilberto Januario

DOSSIER — HISTORY OF MATHEMATICS AND CULTURE

Docentes sordos, prácticas inclusivas y perspectivas etnomatemáticas en la educación regular

Resumen: El artículo presenta los resultados de una investigación cuyo objetivo fue problematizar la presencia de una profesora sorda como docente titular en aulas comunes de los primeros años de la Educación Primaria. Con base en los marcos teórico-metodológicos del campo de la Etnomatemática, los datos fueron generados a partir de la conformación de un grupo de estudio compuesto por docentes oyentes y sordos que trabajaban con estudiantes sordos incluidos en dos escuelas públicas de municipios del estado de Mato Grosso, Brasil. Los participantes diseñaron, implementaron, evaluaron y rediseñaron tareas utilizando GeoGebra como tecnología asistiva. El análisis mostró que los docentes sordos pueden desempeñarse en aulas comunes, siempre que cuenten con el apoyo de un profesional intérprete de Lengua Brasileña de Señas (Libras).

Palabras clave: Docente Sordo. Etnomatemáticas. Aulas Comunes. Inclusión. Traductor Intérprete de Libras.

Professor surdo, práticas inclusivas e perspectivas etnomatemáticas na sala de aula regular

Resumo: O artigo apresenta resultados de uma investigação que teve como objetivo problematizar a presença de uma professora surda como regente em turmas comuns dos Anos Iniciais do Ensino Fundamental. Tendo como referenciais teórico-metodológicos o campo da Etnomatemática, os dados foram gerados a partir da formação de um grupo de estudos, com professores ouvintes e surdos, que atuavam com estudantes surdos incluídos em duas escolas públicas de municípios de Mato Grosso. Os participantes elaboraram, desenvolveram, avaliaram e redesenharam tarefas, usando o GeoGebra como uma tecnologia assistiva. A análise mostrou que professores surdos podem atuar em sala de aula comum, com a ressalva de contarem com apoio de um profissional tradutor-intérprete de Libras.

Palavras-chave: Professor Surdo. Etnomatemática. Salas Comuns. Inclusão. Tradutor de Intérprete de Libras.

1 Introduction: contextualizing the research

This article presents the results of a doctoral thesis conducted in a Professional Postgraduate Program in Science Education, aiming to problematize the presence of a deaf teacher as a classroom teacher in regular Elementary School classes.

To achieve this objective, a study group was formed with seven teachers: two who worked in the Multifunctional Resource Room, two educators, a sign language interpreter, and two deaf teachers from two public schools located in Mato Grosso. The group used the methodology known as Lesson Studies to develop continuing education for teachers, and the theoretical and methodological references that supported the research are related to the field of Ethnomathematics, as described by Knijnik *et al.* (2019). In some of the group's meetings, guest teachers were invited to contribute to different topics, such as Ethnomathematics and assistive technologies.

The theoretical dialogue between the listed themes finds support in the studies of D'Ambrosio (1998, p. 5) when he expresses that the field of Ethnomathematics can be understood as the "art or technique of explaining, knowing, and understanding in diverse cultural contexts". Similarly, the author expresses that this field can be understood as the "art or technique of explaining, knowing, and understanding in diverse cultural contexts" (D'Ambrosio, 1999, p. 5).

In fact, Strobel (2018) points out that, when reviewing the history of deaf people over time, he found that it was exhausting and painful to fight for their own identity, being deaf, which is the condition of belonging to a group that has its own culture. This "has existed for many years and contains countless ways of communicating, that is, through sign language, drawings, facial and body expressions, visual images, fighting movements, creations, and pedagogies" (Strobel, 2018, p. 18).

In this sense, communication occurs differently from hearing people, as deaf individuals belong to a group characterized by visual experience, through which they perceive the space in which they live (Perlin, 2016). Perlin reinforces this idea by arguing that "the deaf have a difference, not a disability" and emphasizes that deaf culture can never be compared to that of the hearing, since it has its own particularities in the development of its activities, starting with the creation of symbols experienced within the group.

Thus, "it is clear that these individuals interact with the world mainly through visual experience [...]. However, by sharing a common language — sign language — deaf people recognize each other and are recognized as members of a unique community" (Rodrigues, 2015, p. 25). From the perspective that quality education, respecting differences and customs, in regular classes should be guaranteed to all students, it is necessary to consider that "contemporary schools were designed to serve a specific student profile, however, today, the demand is different: we have very diverse students" (Silva Neto *et al.*, 2018, p.80). According to the authors, this "demand requires schools to reformulate and innovate their entire system, with teaching strategies that enable them to serve all individuals" (Silva Neto *et al.*, 2018, p. 80).

With these ideas presented by way of introduction, the theoretical references that underpinned the research are presented below: overlaps between deaf studies and the field of Ethnomathematics, as described by Knijnik *et al*. (2019).

2 Theoretical framework: overlaps between deaf studies and the field of Ethnomathematics

Brazilian Sign Language (Libras), used by deaf teachers in regular classrooms, is a

mandatory subject in teacher training in all segments of education, as determined by Decree n. 5,626 of December 24, 2005:

> Art. 3 *Libras must be included as a compulsory subject in teacher training courses for secondary and higher education*, and in speech therapy courses, in public and private educational institutions, in the federal education system and in state education systems (Brasil, 2005, digital text, emphasis added).

Given the mandatory inclusion of Libras in all curricula involving teaching and health courses, it is worth noting that the aforementioned decree recognizes Libras as a legal means of communication and expression for the Brazilian deaf community. Thus, one of the fundamental aspects for the interaction of deaf teachers in regular classrooms with hearing students is respect for their culture.

Added to this is the Federal Constitution, which establishes the right of people with special needs, including the deaf, to receive education, preferably in the regular school system (item III of Art. 208[1]). In line with this, the Law of Guidelines and Bases (LDB) of 1996 states in its Article 58 that "for the purposes of this Law, special education is understood to be the type of school education offered preferably in the regular school system for students with special needs" Additionally,

> Brazilian Sign Language (Libras) is understood as a form of communication and expression in which the visual-motor linguistic system, with its own grammatical structure, constitutes a linguistic system for transmitting ideas and facts originating from communities of deaf people in Brasil (Brasil, Law No. 10,436, 2002).

Perlin (2016) reports that deaf people have been creating and innovating their own language from generation to generation, whose mode of reception and production is visual-gestural. To support this idea, the author states that "deaf people are deaf in relation to visual experience and far from auditory experience" (Perlin, 2016, p. 54). From this perspective, "the deaf person has a difference, not a disability" (Perlin, 2001, p. 56).

Corroborating this perspective, Zilio (2019, p. 36) expresses that this difference in deaf individuals "is what makes us recognize not deafness, which looks first at hearing impairment, but deaf culture, which sees first the difference in the language spoken by this individual, the deaf individual". Kraemer (2019, p. 150) points out that

> sign language is an important operator in the constitution of deaf identity. It is through visual practices that significant elements are constituted in the development of subjects and in their interactions. In this form of interaction with the world, the condition of deafness is not presented as a pathology, a problem to be solved and/or corrected. Being deaf means experiencing personal experiences in other ways. Being deaf, from a cultural context, means dialoguing with individuals using another language: sign language.

That said, it is advisable to adapt the school curriculum to the students' context and link it to the school's Pedagogical Political Project (PPP). In fact, this is fundamental to the teaching and learning processes, especially in inclusive classes, which inclu ly students with deafness. In this way, it "plays a key role in the education of the individuals we want to educate" (Kipper,

[1] Available in https://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm.

2015, p. 96).

In addition to pedagogical resources, such as the PPP, which guides work with deaf and hearing students, human resources dedicated to serving deaf students are also important. These resources include

> teachers in the special education sector and regular classrooms, secondary school instructors or teachers of Brazilian Sign Language (Libras) with higher education degrees, Libras translators/interpreters, principals, coordinators, counselors, educational supervisors, and teacher-interpreters (Alves, 2016, p. 100).

Among the professionals mentioned by the author, the presence of deaf teachers in inclusive classrooms and schools stands out, as it guarantees the right to the constitution of deaf identity and culture. Alves (2016, p. 38) adds that "it is indicated that there should be deaf professionals in schools as a reference for deaf children, as they perform the main function of Libras in the school context".

That said, it is possible to affirm that deaf teachers, when teaching their classes with the presence of a sign language interpreter in a regular classroom, will use sign language with deaf and hearing students, as they are part of a specific cultural group. Hoffmeister (2009) points out that deaf people have a different way of operating in the world compared to hearing people. For example, they are people who use their vision more intensely. The author also highlights visual-gestural communication as a way of opposing the notion of disability, recognizing deafness primarily as a cultural difference.

Alves (2016) emphasizes that services for deaf students should be structured around three axes: educational infrastructure, pedagogy, and human resources. The first, educational infrastructure, concerns the laws provided for in Brazilian education policy; that is, support for deaf students who use Libras, ensuring their inclusion in regular classrooms. As for pedagogical resources,

> the documents determined that there should be equal access to the benefits of supplementary social programs to meet special educational needs, enrollment, Political-Pedagogical Project (PPP), changes in the curriculum, specific structuring for each school, methods, techniques, educational resources, adapted assessment, and human resources training (Alves, 2016, p. 100).

In addition to pedagogical resources, such as the PPP, which guides work with students, both deaf and hearing, there are also human resources dedicated to serving the deaf. These professionals include "teachers in the special education sector and regular classrooms, secondary school instructors or teachers of Brazilian Sign Language (Libras) with higher education degrees, Libras translators/interpreters, principals, coordinators, counselors, educational supervisors, and teacher-interpreters" (Alves, 2016, p. 100).

Among the professionals mentioned by the author, the presence of deaf teachers in inclusive classrooms stands out, guaranteeing the right to build deaf identity and culture, reiterating that "it is indicated that there should be deaf professionals in schools as a reference for deaf children, as they perform the main function of Libras in the school context" (Alves, 2016, p. 38).

These ideas can also be associated with the field of Ethnomathematics, since, according to D'Ambrosio (2008, p. 7), the "main objective of the Ethnomathematics program is to give

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meaning to ways of knowing and doing Mathematics in various cultures". For him, *ethno* is "something very broad, referring to the cultural context, and therefore includes considerations such as language, jargon, codes of behavior, myths, and symbols"; *matema* "is a difficult root, which goes in the direction of explaining, of knowing, of understanding; and *tics* undoubtedly comes from *techne*, which is the same root as art and technique" (D'Ambrosio, 1999, p. 5). Finally, "we could say that Ethnomathematics is the art or technique of explaining, knowing, and understanding in different cultural contexts" (D'Ambrosio, 1999, p. 5).

From the perspective of an inclusive classroom, ideas related to Ethnomathematics can dialogue with those related to deaf studies, since Mathematics, in this sense, is understood as that "practiced by cultural groups, such as urban and rural communities, groups of workers, professional classes, children of a certain age group, indigenous societies, and many other groups that identify themselves by objectives and traditions common to the groups" (D'Ambrosio, 2013, p. 10).

Thus, it is possible to allude that deaf subjects are an integral part of a group that identifies itself through traditions and codes, among them, Libras. As discussed in Agapito, Giongo and Hattge (2019, p. 184), in a logic of sharing ideas and values, "subjects allow themselves to construct a system that integrates into their way of life". The authors continue their argument by stating that "in line with this premise, we have language, behavior, and other commonalities that demarcate specific groups, such as the deaf, who have visual experience and, immersed in it, deaf culture and sign language" (Agapito, Giongo and Hattge, 2019, p. 184). In this sense, a close relationship can be considered between deaf studies and ideas in the field of Ethnomathematics, especially with regard to the specific ways of doing Mathematics.

Among the multiple perspectives alluding to the field are the studies by Knijnik *et al.* (2019). In fact, Knijnik (2014, p. 122) attests that the research group she coordinated had, among its purposes, "to offer theoretical tools that allow us to question what in our society we often take as unquestionable truths of and about Mathematics Education".

In this sense, the definition of Ethnomathematics intersects the ideas of two philosophers. Those of the first, Michel Foucault, are central, "mainly because of their refusal to take as 'natural' the objectives and narratives that make up the thinking of Modernity" (Knijnik, 2014, p. 121), given that,

> for the philosopher, the production of 'truth' is not unrelated to the power relations that incite and support it, being closely linked to the positivity of discourse. He states that it is in fact "the set of rules according to which the true is distinguished from the false and attributes specific effects of power to the true" (Foucault, 2002, p. 13 *apud* Wanderer and Knijnik, 2014, p. 122).

The second philosopher, Ludwig Wittgenstein, puts forward powerful ideas about ways of life, usage, and family resemblances, concepts that allow us to deconstruct the idea of the existence of a supposed universal Mathematics that could be *applied* in a wide variety of contexts. It is relevant that, during math classes, teachers of inclusive classes can "address the cultural specificities of the students in question regarding some content during math classes, and also felt the need to respond to questions that came from the teachers" (Agapito (2020, p. 22). Thus, the author clarifies that

> Libras enters the discussions, first, because it is the natural language of these subjects, is part of their cultural group, and is considered fundamental to the constitution of their mathematical thinking; and, second, because it constitutes a language game practiced by students in the form of life in which they are

> immersed (Agapito, 2020, p. 36).

In Agapito (2020), it is argued that "the way of life is the basis for a particular language game to make sense" (p. 107). In this case, the ways of life of deaf students are added to "these language games, which may present family similarities, meaning that it is possible to establish analogies or kinships between them" (Agapito, 2020, p. 108). This fact, when compared to members of a family, generates a degree of kinship, as Wittgenstein (2018) reports:

> Consider, for example, the processes we call '*games*'. I mean board games, card games, ball games, combat games, and so on. What do they all have in common? — Don't say, 'There *must* be something in common for them, otherwise they wouldn't be called *games*' — but *see* if all things are common to them. — For if you examine them, you will not see, in reality, something that *they all* have in common, but similarities, kinships, and, in reality, a whole series of these things. As has been said: don't think, see! — Examine, for example, board games with their multiple relationships (p. 55).

These reflections on language games, similarities and deaf identities, relate to one of the activities analyzed in Agapito (2020).: the development, by a group of deaf students from a bilingual school in Imperatriz, MA, of a task involving division by one and two digits. Among the various experiences that the author observed and recorded in her thesis is the calculation of division with the help of the multiplication table in E.V.A. In the field diary, it is noted that

> the multiplication table in E.V.A. was used to mediate the content of division by one or two digits. This material has spaces for fitting the digits referring to the results. Thus, at the beginning of the class, the teacher reviewed multiplication according to the table distributed to each student, asking them to first assemble the table with the respective results. She then moved on to the content of division with one digit, explaining how to proceed with the calculations using the multiplication table, using it as an additional tool to mediate the teaching of division calculations expressed on the whiteboard. (Agapito, 2020, p. 140)

From this perspective of analogies between games, what the pieces have in common, as well as the board, refers to those that constitute the Deaf Group, for example, when they gather for a party or communicate via videoconference, using Libras. This dialogues with the ideas of Perlin (2016, p. 63), based on the testimony of one of her research participants: "Being with a group of deaf people is feeling that you have this kinship. It is a virtual kinship. This is because we reach the depth of our relationships of similarities".

Based on these references, the next section will address issues related to methodology and data production for analysis.

3 The locus and participants

The research was conducted in two public schools located in the municipalities of Guarantã do Norte and Sinop, in the state of Mato Grosso, Brazil, with the participation of seven teachers, including two deaf and five hearing teachers, who worked with deaf students in the early years in inclusive classes.

The first stage of the research took place in 2021, in a public school in the city of Guarantã do Norte, with the implementation of Spatial Geometry activities, using GeoGebra as assistive technology, in a 4th-grade class of Elementary School. ly, in 2022, the research was

conducted in a public school in Sinop, Mato Grosso, with a 3rd-grade class. At the end, in 2023, the study group returned to the first school investigated and concluded the activities in a 5th-grade class. It should be noted that there were deaf students in all the classrooms investigated.

It should be noted that all the precepts of Research Ethics were respected. Initially, the research was submitted to the Research Ethics Council of the institution that hosts the Graduate Program. In this regard, the Free and Informed Consent Forms were signed by the parents or guardians of the students and by the teachers participating in the investigation. The former, in turn, signed the Free and Informed Consent Form, agreeing to participate in the research after their questions had been clarified.

The methodology chosen to support the training refers to the ideas of Classroom Studies. According to Blanco-Álvarez and Castellanos (2017, p. 16, our translation), "Collaborative group work enriches the program of activities with the experience of each member, discussing the difficulties encountered and leading to solutions. This allows them to think of teaching as a collective rather than an individual task". In fact, the Study Group aimed to discuss, design, carry out, develop, evaluate/reflect on, and redesign/apply Spatial Geometry tasks using GeoGebra, resulting in a teaching sequence that, according to Lima (2018, p. 151), "is a set of activities, strategies, and interventions planned step by step by the teacher so that students can understand the proposed content or theme". Another important decision concerns the choice of descriptive research, with the central premise being,

> the description of the characteristics of a given population or phenomenon, or the establishment of relationships between variables. There are countless studies that can be classified under this title, and one of their most significant characteristics is the use of standardized data collection techniques, such as [...] systematic observation [...] which aim to study the characteristics of a group (Gil, 2002, p. 42).

In this sense, Gil points out that, in field research, the researcher intends to describe the characteristics, using data collection instruments to generate data. In addition to the concern with description, in field studies, according to Gil (2002, p. 131), emphasis is placed on "depth rather than [...] accuracy, leading the researcher to prefer the use of testimonials". Furthermore, "among descriptive research studies, those that aim to study the characteristics of a group stand out: its distribution by age, gender, origin, level of education, physical and mental health status, etc." (Gil, 2002, p. 42).

The research materials that emerged consisted of footage, field notes, materials produced by teachers and students, and participant observation. Field notes are an indispensable tool for researchers who use qualitative research, as they can be used to record all their notes and reflections, organizing them in the way that feels most comfortable. According to Yin (2016, p. 186), "in your notes, you can leave large margins, write in one column, leave a second column blank on each page, or use any other pattern that suits you." In this vein, "the field diary allows researchers to describe people, objects, places, events, activities, and conversations, as well as their ideas, strategies, reflections, and guesses" (Afonso *et al.*, 2015, p. 133).

Throughout the research process, "participant observation" was used, which "consists of the researcher's actual participation with the community or group. He or she becomes part of the group, blending in with it. He or she becomes as close as a member of the group being studied and participates in its normal activities" (Marconi and Lakatos, 2002, p. 90). From this perspective, Marques (2016) argues that this observation is a valuable tool for understanding different groups, including in schools, and relates theory to practice, aiming to construct theoretical and methodological procedures in the studies to be investigated. It is important to

remember that, in the course of the research, the researcher/participant needs to know what to ask, when to ask it, and what questions can be asked (Marques, 2016).

The use of filming in qualitative research aims to record different perspectives at all stages of the investigation. This creates opportunities for the researcher to subsequently carry out more in-depth analyses, reviewing the videos as many times as necessary, thus avoiding the loss of information considered important for the research (Loizos, 2002). Consequently, filming, participant observation, and field notes were used during the project, following the room layout illustrated in Figure 1.

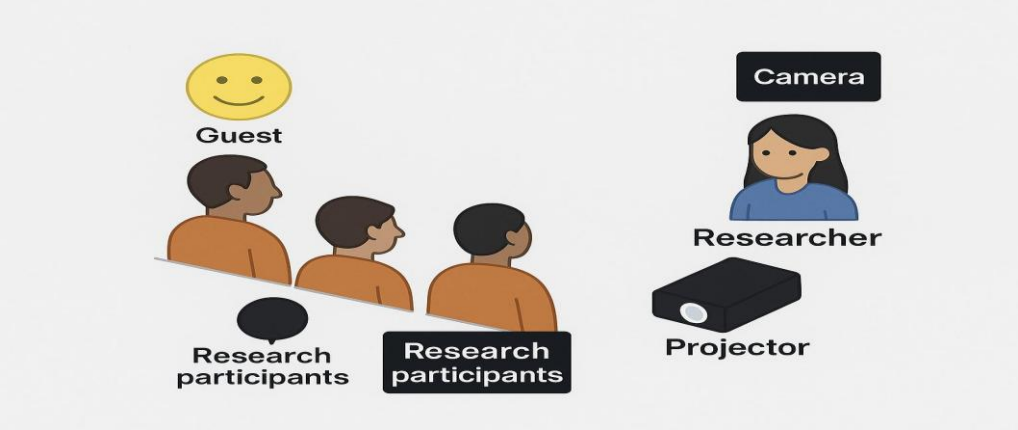

Figure 1: Organization of the filming room. (Own elaboration, 2023)

The participants in the first stage of the research were the teachers in charge of the 3rd and 4th grade classes of Elementary School, the Libras translator-interpreter, and the teacher of the Multifunctional Resource Room of a state school in the municipality of Guarantã do Norte, Mato Grosso. They continued studying with those in the second stage, at a public school in Sinop, Mato Grosso, where the Multifunctional Resource Room teacher and two deaf teachers worked, one of whom was a guest.

In all stages, the group developed, redesigned, and evaluated spatial geometry activities, using GeoGebra as an assistive technology. The classes chosen to develop and reapply the tasks were the 4th grade class in Guarantã do Norte and the 3rd grade class in Sinop, Mato Grosso. Finally, the group returned to the first school investigated to work with a 5th grade class, which, like the previous ones, had a deaf student.

Next, the tasks were reviewed by the Study Group for analysis, and were refined or recreated with the aim of developing them in the next stage by teachers in the classroom, with deaf students included in regular education. Aware of these premises, Nvivo[2] was used, as this *software* contributed to the processing of the data transcribed at each meeting of the Study Group, as well as to the development of classroom tasks, both consisting of testimonials, videos, and photographs that marked the course of the investigation.

Thus, the program filtered the findings during the stages of analysis from "the deconstruction of the corpus, giving rise to the nodes that constitute the US [units of meaning], to the approximation and establishment of relationships between them (the nodes), forming the initial, intermediate, and final categories" (Andrade; Schmidt; Montiel, 2020, p. 969).

Montiel (2019, p. 148) explains that NVivo *software* assists

[2] "NVivo is software that helps you easily organize and analyze unstructured information so you can always make the best decisions. Whatever your material, field, or approach, NVivo provides a workspace to help you through every stage of your project—from organizing your material to analyzing it, then sharing and reporting on it" (Nvivo, 2014, available at https://lumivero.com/products/nvivo).

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> in organizing our data, analyzing it, and obtaining information from the observations made. The program facilitates the analysis of information and more appropriate decision-making in relation to the data that appears to us in an un d, unstructured form. The NVivo program contributed effectively to the systematization of our data and the achievement of the results of this study.

It should be noted that NVivo, by itself, does not perform data analysis; it only helps the researcher organize them in a single space, enabling new perspectives on their findings. The process involved in descriptive research, from the execution and separation of data in the program during the analysis process, depends exclusively on the rigor of the researcher, implying their relationship with the theme and object of study (Andrade; Schmidt; Montiel, 2020). In fact, the *software* can assist "in responding to dilemmas and challenges in research with large amounts of data. [...] its main function is to assist in the categorization and correlation of data, ensuring greater scientific rigor in the analyses" (Fick *et al.*, 2021, p. 55).

The next section discusses the results and evidence regarding the project map: inclusion and the curriculum.

4 One result: the deaf teacher in a regular classroom

The analysis of the research materials — field diary, footage, participant observation, printed tasks, and, *a posteriori*, the transcription of these data involving the participants — allowed, among other aspects, the emergence of the project map entitled *Inclusion and the curriculum*, as shown in Figure 2.

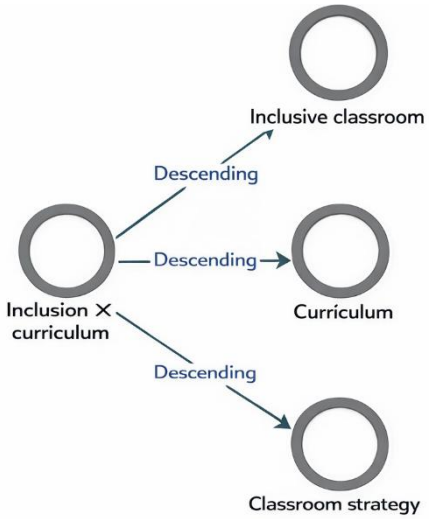

Figure 2: Project map *Inclusion and the curriculum* (Own elaboration using Nvivo (2023)

As shown in Figure 2, the project map *Inclusion and the Curriculum* dialogues with its descendants (inclusive classroom; curriculum; classroom strategy). Thus, it was observed that deaf teachers can act as conductors in regular classrooms, just like hearing teachers. In other words, regardless of the subject, deaf teachers can teach in regular classes, provided they have training in the area of knowledge and have the support of a sign language interpreter, such as Brazilian Sign Language (Libras).

To support this finding, in the Study Group, the deaf teachers participating in the research acted as conductors in early grade classes (3rd and 5th grades), with deaf and hearing students, in the two schools investigated. Teacher 3 stated in his testimony: *"I think it's great for the deaf community/teacher to be very present in the activities, together with deaf/hearing students, in regular classrooms and with an interpreter alongside the deaf teacher*".

The inclusion of deaf teachers in regular classrooms is in line with the principles of Ethnomathematics, as evidenced by Teacher 7's statement: *"The strategy of including a deaf teacher in the second stage of the investigation strengthened respect for deaf culture, especially the use of Libras in the classroom"*. In this context, Ethnomathematics contributes to the recognition of cultural issues and school practices linked to deaf identity.

Based on the data analyzed, from the beginning of the investigation, the hypothesis was that respect for deaf culture could give meaning to the teaching of Mathematics and favor the inclusion of deaf teachers in regular classrooms, both for deaf and hearing students, as illustrated in Figure 3.

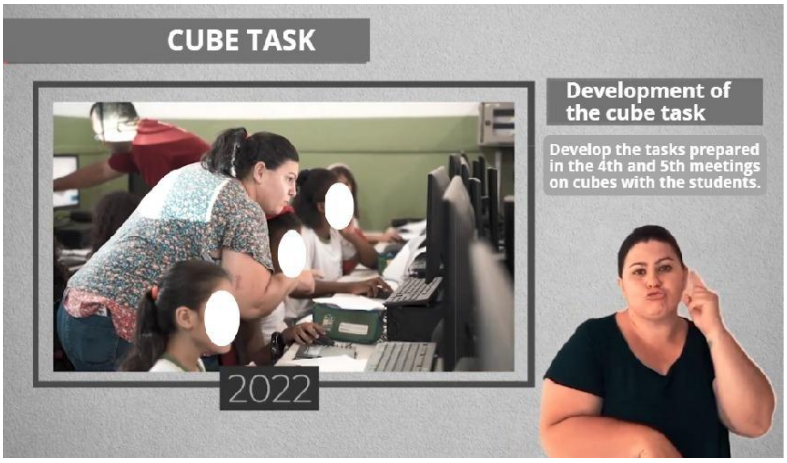

Figure 3: Deaf teacher guides hearing students (Research collection, 2023)

Figure 3 shows the moment when the deaf teacher guides hearing students in a 3rd-grade class during an activity using GeoGebra as an AT. The use of elements specific to deaf culture, such as the use of hands and visual perception, especially in interaction with the computer screen, is noteworthy.

In this sense, Alberton and Karnopp (2022, p. 3) state that,

> deaf Education and Ethnomathematics are intertwined and complement each other, valuing the deaf community, sign language, deaf difference, and their visual experience. By bringing together the Ethnomathematics perspective and Deaf Education, it is clear that knowledge acquired through visual experience is better understood and learned, while the acquisition of sign language is internalized through visualization.

Agreeing with the authors, Teacher 7 stated that, *"Certainly, little by little, Débora*[3] *worked in the regular classroom with hearing students, interacting with everyone, and then she understood the process. When questions arose, she asked the sign language interpreter"*. To reinforce this idea, the teacher added: *"I heard from a hearing student, 'Wow, she has the same ability as the hearing teacher to work in the classroom with us. I was amazed!'"*.

Teacher 2 adds that the deaf teacher "acted with confidence and mastery of the proposed content, organizing the materials and conducting the activity with clarity." He also reports that the students showed involvement and respect in their interactions with the teacher and in the mediation carried out by the Libras interpreter.

These testimonials show that the classroom experience was not only positive but also reaffirmed the deaf teacher's ability to fully perform her role in an inclusive context.

[3] Refers to the deaf teacher — who consented to have her name included in the investigation — in the regular classroom.

> *In addition to guiding students on the issue of solving spatial geometry math problems, there was also the issue of breaking paradigms regarding the inclusion of deaf teachers in regular classrooms when teaching math. Not only hearing teachers can teach math, but deaf teachers can too. This did not happen only today, but also in last year's activities.*

To affirm the inclusion of deaf teachers as classroom leaders in regular classrooms, another moment in the investigation is presented that expresses the interaction of the deaf teacher with hearing students, with the help of GeoGebra.

Figure 4: Deaf teacher working in the classroom (Research collection, 2023)

As illustrated in Figure 4, the deaf teacher teaches spatial geometry using GeoGebra as assistive technology, aimed at third-grade students in a regular classroom. From this perspective, "Libras is the sign language used by deaf Brazilians, and each country uses a different sign language: in Argentina, Argentine sign language; in Bolivia, Bolivian sign language; in Ecuador, Ecuadorian sign language" (Zilio, 2019, p. 37). Given this, even though each country has its own grammatical rules for sign language, these languages establish dialogues with each other in the following aspects:

> [...] sign language is an important operator in the constitution of deaf identity. It is through visual practices that significant elements are constituted in the development of subjects and their interactions. In this form of interaction with the world, deafness is not presented as a pathology, a problem to be solved and/or corrected. Being deaf means experiencing personal experiences in other ways. Being deaf, from a cultural context, means dialoguing with individuals using another language: sign language (Kraemer, 2019, p. 150).

The research results highlighted the ability of deaf teachers to act as conductors in teaching Mathematics to students, both hearing and deaf, as long as their different ways of operating with school Mathematics are respected, which is in line with the principles of Ethnomathematics. In this context, another deaf teacher also taught classes to deaf and hearing students, as illustrated in Figure 5.

In the image in Figure 5, hearing students interact with the GeoGebra *software*. It is also worth mentioning that there were rare moments in the classroom when the Libras translator-interpreter collaborated with the deaf teacher. However, the presence of this professional in regular classrooms is indispensable, except in Sign Language classes. In this sense, Wortmann (2002, p. 81) points out that "languages are central to meaning and culture, as they are the key repertoires of values and codes that underpin dialogues".

Figure 5: Deaf teacher in a regular classroom (Research collection, 2023)

Next, in the last section of this paper, we present some reflections by way of final considerations, as well as proposals for further research.

5 Final considerations: implications of the results

This paper sought to address the presence of deaf teachers in regular classrooms, teaching Mathematics, while respecting deaf culture. To discuss this objective, continuing education was developed through study groups with teachers, five hearing and two deaf, who worked with deaf and hearing students in the early grades at two public schools, both located in Mato Grosso, Brazil.

For this investigation, we used a methodology called Lesson Study, with spatial geometry as the teaching content, and GeoGebra as assistive technology for teaching deaf students, as well as to enhance the learning of hearing students. Likewise, the idea of interrelation with the field of Ethnomathematics was applied throughout the research process, through the valorization of the culture of the deaf group. In this process, the different ways of working with Mathematics among hearing students were also respected.

Using these elements and analyzing the data through Nvivo, the project map emerged: *Inclusion and the curriculum*. As a result, the study group recognized the potential of deaf teachers teaching spatial geometry activities to hearing and deaf students in regular classrooms, together with a sign language interpreter. The other participants in the group acted as observers in the classroom, according to the guidelines of the Classroom Studies methodology.

Given this, it was understood to be pertinent to emphasize the inclusion of deaf teachers in the classroom to teach Mathematics, proving that they can perform this function just like their hearing colleagues. This fact represented a paradigm shift in almost all meetings. To corroborate this perception, here is a quote from the field diary: *"The students got up from their chairs to attend the deaf teacher's class several times".* This way of working can be considered an unprecedented event, different from what is usually experienced in schools with deaf teachers. Thus, we understand the power of provoking these actions in the classroom, so that hearing students understand that deaf people can be teachers of any subject. Therefore, it is not enough to discuss inclusion, it must be practiced. The development of the research showed that some concrete actions are necessary.

To reinforce the idea of using Libras in the regular classroom, Teacher 3 proposed: *"I think it's cool for the deaf community to be very present in activities with deaf students in the classroom"*. This suggestion, presented in the first stage, contributed greatly to the inclusion of

two deaf teachers in the group, who, in addition to participating in meetings with their hearing colleagues and deaf students, performed the role of conductors, developing geometry tasks in the inclusive classroom. In fact, *"The teacher handled the class very well, which means that deaf teachers have the right to be conductors in inclusive* classrooms*"* (Teacher 7).

It is understood that it is essential to start with discussions in teacher training courses, considering the need to promote actions that effectively include deaf teacher trainees. In particular, when participating in programs such as *Programa Institucional de Bolsas de Iniciação à Docência* [Institutional Scholarship Program for Initiation into Teaching — PIBID] and/or carrying out pedagogical practices in internships, the teacher trainee, accompanied by a Libras translator-interpreter, would be led to teach classes in regular classes. Another productive action is based on the idea of promoting continuing education for teachers based on the premise of collaboration and research on their own practice, as proposed in this study. These initiatives could highlight, in school and non-school environments, the power of having these professionals in schools and universities.

Acknowledgments

We would like to thank the National Council for Scientific and Technological Development (CNPq) and the Rio Grande do Sul State Research Support Foundation (FAPERGS) for their financial support for the development of this research.

Conflicts of Interest

The authors declare that there are no conflicts of interest that could influence the results of the research presented in this paper.

Data Availability Statement

The data produced and analyzed in this article will be made available to the authors upon request.

Note

The translation of this paper from Portuguese into English was funded by the Minas Gerais State Research Foundation (Fapemig — Fundação de Amparo à Pesquisa do Estado de Minas Gerais), under Call for Proposals 8/2023.

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