International Electronic Journal of Mathematics Education
2026, 21(1), em0870
e-ISSN: 1306-3030
https://www.iejme.com

MODESTUM

Research Article

OPEN ACCESS

Mathematics teaching practices in a special school for blind students

César Lizárraga-Ojeda [1], Juan Luis Piñeiro [1]*

[1] Universidad Metropolitana de Ciencias de la Educación, Santiago, CHILE
*Corresponding Author: juanluis.pineiro@umce.cl

Citation: Lizárraga-Ojeda, C., & Piñeiro, J. L. (2026). Mathematics teaching practices in a special school for blind students. *International Electronic Journal of Mathematics Education, 21*(1), em0870. https://doi.org/10.29333/iejme/17914

ARTICLE INFO

Received: 04 Dec. 2025

Accepted: 22 Jan. 2026

ABSTRACT

The relationship between mathematics education and visual impairment has historically fallen short in providing learners with meaningful access to mathematical understanding, often relying on practices that limit students' agency. This study analyzes the work of three teachers at a Chilean special school for blind students. Their lessons were recorded, transcribed, and examined using the NCTM's eight effective teaching practices as the analytical framework. The findings reveal a persistent emphasis on memorization and procedural reproduction, with few opportunities for reflection, reasoning, or engagement with multiple representations. These instructional patterns constrain students' access to a full mathematics education and highlight structural tensions that warrant attention.

Keywords: school for blind students, special education teacher, mathematics teaching practices

INTRODUCTION

The relationship between mathematics and disability has long been marked by tension. In many educational settings, students with disabilities have historically been assumed to possess diminished intellectual capacity, a view that has shaped—and often limited—their access to learning opportunities (Tan et al., 2019). This bias is particularly strong in mathematics, a subject often seen as reliant on supposedly "innate" abilities (Lambert, 2018). As Padilla et al. (2024) argue, such assumptions lead to a narrow and impoverished approach to mathematics education for students with disabilities—one focused on remediation rather than fostering genuine mathematical understanding. Beyond academic achievement, these beliefs reinforce low expectations and restrict future opportunities, perpetuating exclusion that goes far beyond the classroom.

Recently, scholarship has sought to challenge these deficit-based views, advocating for the humanization of mathematics education. This perspective emphasizes that all learners, regardless of their characteristics, should be recognized as capable mathematical thinkers, entitled to engage with the subject in meaningful and dignified ways (Tan et al., 2019). Disability, in this view, is not an obstacle to mathematical reasoning but a reminder of the diverse ways individuals can participate in mathematical activity. Such research has highlighted classroom practices that marginalize students and the absence of pedagogical adaptations needed to support full engagement in mathematics (Padilla et al., 2024).

Research in mathematics education on visual impairment (VI) shows that blind students can reach levels of mathematical understanding and performance comparable to those of sighted peers, provided that no additional cognitive disabilities are present and that instruction accounts for sensory diversity in learning (Andreou & Kotsis, 2005; Klingenberg et al., 2019). Vision is therefore not a prerequisite for abstract mathematical thinking, as core mathematical ideas—including number, measurement, comparison, geometry, and functions—can be developed through embodied, tactile, and functional experiences in which action and language are central. In some areas, particularly measurement, blind students may even demonstrate conceptual advantages, relying more on direct quantification and logical reasoning than on visually based perceptual cues (Andreou & Kotsis, 2005).

The literature further suggests that blind students' mathematical learning unfolds through distinctive sensory, semiotic, and embodied pathways, involving systematic tactile exploration, the use of gestures and movement, verbal mediation, and perceptual-motor coordination (Figueiras & Arcavi, 2014, 2015; Healy & Fernandes, 2011; Healy et al., 2016). Instructional tools such as the abacus, mathematical Braille, tactile graphics, and concrete materials support understanding only when embedded within carefully designed teaching approaches that guide action and foster the articulation of mathematical meaning (Brawand & Johnson, 2016; Klingenberg et al., 2019). By contrast, critical reviews note that many traditional practices have relied on pedagogical intuition or diluted adaptations with limited empirical grounding, thereby constraining opportunities for meaningful mathematical learning (Contreras-Urra et al., 2023; Ferrell, 2006). Taken together, these findings point to the need for a reconceptualization of both mathematical ideas and classroom practices grounded in a sensorially plural epistemology, in which learning is understood as embodied, situated, and multimodal rather than as a deficient translation of visual representations (Figueiras & Arcavi, 2014; Healy et al., 2016).

Many of these challenges stem from the fact that special education teachers, who are typically responsible for teaching mathematics to blind students, receive limited training in mathematics education during their initial preparation (Piñeiro & Calle, 2023). Consequently, special education teachers are often expected to teach content for which they lack both disciplinary and pedagogical specialization. This gap in preparation highlights a critical gap in the literature: while numerous studies have examined inclusive education in mainstream schools, far less is known about special education settings, where demands, resources, and constraints are markedly different. This gap raises the central research question of this study: What mathematics teaching practices are enacted in a special school serving blind students? To address this question, we investigate the mathematics teaching practices implemented in a Chilean special school for blind learners. In doing so, we aim to expand current understandings of the knowledge required for inclusive mathematics instruction and offer insights relevant to both initial teacher preparation and professional development, ultimately contributing to a more equitable educational landscape.

MATHEMATICS TEACHING PRACTICES

NCTM (2014) outlines eight teaching practices designed to foster meaningful mathematical learning. These practices rest on pedagogical principles that emphasize how students organize knowledge, the social nature of learning, and the importance of feedback and metacognitive engagement. Taken together, they offer a structured yet flexible framework that helps teachers design learning experiences aimed at developing deep understanding and robust mathematical reasoning. Below, we provide a brief overview of these eight practices.

Establish Mathematics Goals to Focus Learning

An effective mathematics lesson begins with goals that are not merely procedural checkpoints but genuine invitations to mathematical thinking. These goals should anchor new content in what students already know while opening space for deeper, more complex ideas to emerge. As NCTM (2014) notes, well-crafted objectives help clarify essential questions—What mathematics is being learned? Why is it important? How does it build on previous experiences? Making these aims visible to students allows them to understand the purpose of the lesson and to reflect on their learning as it unfolds.

Implement Tasks That Promote Reasoning and Problem-Solving

This practice underscores the importance of selecting tasks that challenge students intellectually and encourage them to make sense of mathematical ideas rather than simply perform routine procedures. Teachers play a crucial role in sustaining the cognitive demand of these tasks by inviting multiple solution strategies and representational forms. As NCTM (2014) argues, such tasks help nurture advanced forms of reasoning and guard against reducing mathematics to rote behavior. Stein and Smith's (1998) well-known taxonomy—memorization, procedures without connection, procedures with connection, and doing mathematics—offers a useful lens here, with the latter representing the richest opportunities for genuine mathematical engagement.

Use and Connect Mathematical Representations

Another central pillar involves supporting students in working across different representational forms and understanding how these representations relate to one another. Following a widely used classification, this study considers three modes—concrete, pictorial, and symbolic. Concrete representations draw on manipulatives; pictorial ones include drawings, diagrams, and other visual displays; and symbolic representations rely on conventional notation. Purposefully navigating among these modes enables students to develop more flexible, interconnected understandings of mathematical ideas.

Facilitate Meaningful Mathematical Discourse

Mathematical learning is deeply social, and this practice centers on cultivating classroom discourse that allows students to articulate, question, and refine their thinking. NCTM (2014) suggests anticipating likely student responses, selecting contributors deliberately, and structuring whole-class discussions in ways that help ideas build on one another. When discourse is intentionally planned, students become active authors of mathematical meaning, and learning emerges from shared examination of strategies and arguments.

Pose Purposeful Questions

Intentional questioning is a powerful means for cultivating mathematical thinking. NCTM (2014) differentiates among questions aimed at gathering information, probing thinking, making the mathematics visible, and encouraging reflection and justification. The document also describes several interaction patterns through which such questions can be used:

(a) the initiate-response-evaluate pattern, which often limits reflection,

(b) funneling, which channels students toward a single procedure, and

(c) focusing, which draws on students' varied ideas and strategies to support deeper reasoning.

Ultimately, both the types of questions posed and the manner in which they are enacted shape the quality of students' reasoning and the construction of mathematical meaning in the classroom.

Build Procedural Fluency From Conceptual Understanding

This practice emphasizes developing procedural fluency in tandem with a robust grasp of underlying concepts (NCTM, 2014). Rather than reproducing algorithms mechanically, students are encouraged to select and justify solution strategies that are mathematically grounded. Such flexibility rests on strong conceptual understanding, underscoring the importance of instructional environments that promote exploration, comparison of alternative procedures, and reflection on the efficiency and appropriateness of different approaches.

Support Productive Struggle in Learning Mathematics

NCTM (2014) stresses that error and frustration are natural components of mathematical learning rather than obstacles to be avoided. Supporting productive struggle entails designing tasks that are appropriately challenging while offering guidance that helps students persist without removing the inherent cognitive demand. The goal is to center reasoning—not speed or correctness—as the primary value in the learning process. Experiences with manipulatives and structured collective discussions further strengthen persistence. As Townsend et al. (2018) demonstrate, when this process is intentionally supported, students gain access to mathematical experiences that are simultaneously rigorous and motivating.

Elicit and Use Evidence of Student Thinking

Effective mathematics instruction also requires teachers to intentionally gather and interpret evidence of students' thinking to inform feedback and guide subsequent instruction. According to NCTM (2014), this involves identifying recurring reasoning patterns, common difficulties, and characteristic errors through systematic formative assessment. High-level tasks and focusing questions are especially powerful tools for eliciting insights into students' understanding. What matters most is how teachers use this evidence—to deepen conceptual understanding and to strengthen students' procedural fluency.

The eight practices outlined by NCTM (2014) constitute an integrated framework for teaching mathematics that foregrounds conceptual understanding, problem-solving, meaningful communication, and metacognitive reflection. Through clear goals, cognitively demanding tasks, multiple representations, and purposeful questioning, teachers can support the development of mathematical thinking that is both deep and flexible. Likewise, the emphasis on productive struggle and sustained formative feedback helps ensure that learning extends beyond procedural performance and becomes a meaningful experience—one with the potential to transform how mathematics is taught and learned.

RESEARCH DESIGN

Study Context

This study was conducted in Chile, where special education has gradually shifted from a medical-clinical orientation toward an inclusive paradigm, leading to substantive changes in both policy and institutional practice. In practical terms, this transition has resulted in most students with disabilities or special educational needs being enrolled in mainstream schools, with a smaller proportion attending special schools. Although these specialized schools are organized according to disability type, the enactment of new policies (Ministerio de Educación, 2015) requires them to implement the same national curriculum used across the country, thereby eliminating the former disability-specific content guidelines (e.g., curriculum for blind or deaf students).

In both mainstream and special school settings, special education teachers are responsible for supporting students with disabilities or special educational needs. In mainstream schools, they primarily engage in curriculum adaptation and diversity-oriented instructional support, often through co-teaching. In special schools, by contrast, special education teachers assume autonomous responsibility for teaching the full curriculum while adapting it to each learner's needs. This latter role has generated ongoing tensions, as professional preparation in Chile has historically prioritized diagnostic assessment over the teaching of specific subject matter (Inostroza, 2020). Such conditions may help explain performance differences observed in standardized tests among students with disabilities—such as students with VIs—across special and mainstream schools (Agencia de Calidad de la Educación [ACE], 2024).

More specifically, the present study was conducted in a special school serving students with VIs in central Chile. Class sizes in this type of institution are typically small, with around eight students per class, and instruction follows the national curriculum. The cases analyzed correspond to three female special education teachers specializing in VI. In Chile, this university degree qualifies teachers to work with students with VIs in both special and mainstream schools. At the time of the study, these teachers were responsible for teaching mathematics in first, third, and sixth grade (T1, T3, and T6) and had between 5 and 10 years of teaching experience. . One of these teachers (T6) also held an additional qualification in mathematics. Participant confidentiality was safeguarded by the use of coded identifiers and the omission of personal information (ethics report no. 180/2024).

Methods and Data Sources

This study is set within a qualitative framework with an interpretive, meaning-focused approach—one that considers reality as something constructed through social practices and the meanings attributed to them by participants (McMillan & Schumacher, 2005). The research adopts a multiple-case study design (Stake, 1999) to examine the mathematics teaching practices of several special education teachers at a special school, aiming to identify patterns that go beyond individual differences. Working with multiple cases allows for comparison, contrast, and the identification of common features across different contexts, resulting in a stronger evidentiary foundation than a single-case study.

Table 1. Deductive analysis categories: Mathematics teaching practices (NCTM, 2014, p. 10)

Practice	Description
Establish mathematics goals to focus learning	Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates these goals within learning progressions, and uses them to guide instructional decisions.
Implement tasks that promote reasoning and problem-solving	Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem-solving, allowing multiple entry points and varied solution strategies.
Use and connect mathematical representations	Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures, and as tools for problem-solving.
Facilitate meaningful mathematical discourse	Effective teaching of mathematics facilitates discourse among students to build a shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.
Pose purposeful questions	Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense-making about important mathematical ideas and relationships.
Build procedural fluency from conceptual understanding	Effective teaching of mathematics fosters fluency with procedures on a foundation of conceptual understanding, enabling students to become skillful in using procedures flexibly as they solve contextual and mathematical problems over time.
Support productive struggle in learning mathematics	Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and support to engage in productive struggle as they grapple with mathematical ideas and relationships.
Elicit and use evidence of student thinking	Effective teaching of mathematics utilizes evidence of student thinking to assess progress toward mathematical understanding and continually adjust instruction in ways that support and extend learning.

Table 2. Frequencies for the category: Establish mathematics goals to focus learning

	T1	T3	T6
Focus on mathematics to be learned	1	2	1
Focus on the value of mathematics	7	3	-

Note. The symbol "–" indicates that this practice was not observed in the analyzed class

The data set was composed of audiovisual recordings of mathematics lessons, collected using 360° panoramic cameras and individual microphones. This setup allowed for a rich capture of classroom interaction, including both teacher discourse and student responses. In total, eleven sessions were recorded from which three—one per grade level—were selected for analysis. Each session lasted roughly 90 minutes of effective instruction. The researchers employed a non-participatory observation approach, remaining present in the classroom while avoiding any influence on how the lessons unfolded.

The analysis began with the transcription of each lesson, guided by criteria of clarity, usability, and participant anonymity. Once transcribed, the classroom dialogue was broken into smaller sub-episodes using turns of talk as the segmentation unit (Rodríguez et al., 1999). This procedure made it possible to distinguish broader instructional patterns as well as practices targeted toward individual students.

The units of analysis were defined at two levels:

(a) the teachers' verbal statements, which were directly linked to specific instructional practices (Bardin, 1996) and

(b) the broader classroom context in which those practices unfolded, allowing for a more holistic interpretation.

The analytic process followed a sequential content analysis approach (Kuckartz, 2019) carried out in two stages. First, a deductive phase involved an initial categorization based on the framework of the eight effective mathematics teaching practices (NCTM, 2014), presented in **Table 1**. This was followed by an inductive phase, in which each category was refined to identify subcategories and emerging patterns. The analysis also applied the rule of numeration (Bardin, 1996), documenting the presence or absence of subcategories and their relative frequency in each lesson to identify emphasis. Finally, a cross-case comparison was conducted (Miles & Huberman, 1994), enabling the identification of meaningful similarities and differences and supporting more generalizable claims. All categorizations were developed through ongoing joint review by both authors to minimize subjectivity.

RESULTS

This section presents the findings for each mathematics-teaching practice, highlighting the subcategories identified, along with illustrative examples.

Establish Mathematics Goals to Focus Learning

In this category, we grouped all the sub-episodes in which teachers clearly stated the mathematical goal, linked prior knowledge with new content, or connected the current material to a specific learning target. Along these lines, we identified two subcategories: focus on mathematics to be learned and focus on the value of mathematics. **Table 2** shows how often these subcategories appear across the observed lessons. Notably, the first subcategory occurs at least once in every lesson. Additionally, the second subcategory is highly present in T1, but its frequency drops in T3 and is completely absent in T6's session.

The first subcategory, which we label focus on mathematics to be learned, refers to the sub-episodes in which teachers explicitly introduce the content that will be addressed during the lesson, that is, when they clearly articulate the learning goals for

Table 3. Frequencies for the category: Implement tasks that promote reasoning and problem-solving

	T1	T3	T6
Memorization/execution	3	9	-
Procedures without connections	-	-	3
Procedures with connections	-	-	1

Note. The symbol "–" indicates that this practice was not observed in the analyzed class

the session. For instance, in the following excerpt, the teacher states outright the mathematical ideas and procedures that students will be working on:

> Teacher: … so today we're going to review a few things. And as part of that review, we'll go back over units, the place value of tens and ones, and we'll also work through some addition, right?

The second subcategory, focus on the value of mathematics, refers to the sub-episodes when teachers frame mathematical ideas as purposeful and useful. In the excerpt below, the teacher uses guiding questions to prompt students to consider the role of numbers in everyday life.

> Teacher: Very good. And why do you think we learn numbers? … Suppose I need to go, for instance, to the municipality of Puente Alto and I have to catch a bus …

Implement Tasks That Promote Reasoning and Problem-Solving

This category encompasses all sub-episodes in which teachers assign mathematical tasks to students. Our analysis revealed three subcategories, which we labeled as memorization or execution tasks, procedures without connections, and procedures with connections. **Table 3** summarizes their frequency across the observed lessons. As shown, memorization tasks dominate in T1 and T3, whereas T6 more often employs procedures without connections and, on one occasion, tasks that involve connected procedures.

The first subcategory—tasks focused on memorization or execution—refers to activities that demand little cognitive effort from students. These tasks usually have only one correct solution, and answers are judged as right or wrong. In the example that follows, the teacher introduces an activity on quantity using concrete materials; however, the process leaves no room for exploration, as the outcome is essentially set once the materials are handed out. Additionally, the repetitive act of stacking cubes ends up overshadowing any genuine intellectual engagement the task might have previously offered.

> Teacher: I'd like you to build a tower with those cubes—just one tower—and then tell me how many cubes you end up with.

This second subcategory refers to tasks that rely on procedures with no meaningful connections. These tasks were identified by their algorithmic nature: students know exactly which steps to follow, and the main challenge lies in executing the procedure rather than thinking it through. In this context, the accuracy of the final answer takes priority over any strategic considerations. The following excerpt illustrates this, as the teacher prompts students to solve a specific calculation after providing all the necessary information.

> Teacher: Look, H—here's the question: Calculate the difference between the plastic and the glass. You have 425 kilograms of plastic and 280 kilograms of glass.

Finally, the third subcategory involves tasks that require procedures with connections, demanding a higher level of cognitive engagement. In the example, the teacher asks students to create an operation using data previously discussed in class. Here, learners are not given a set path to follow; instead, they must decide how to relate the available information to formulate their own problem. In this sense, memorization and repetition become less important, making room for genuine construction through flexible use of the provided elements.

> Teacher: … Now, with the data you have here, you need to create a question for me that requires using subtraction.

Use and Connect Mathematical Representations

This category encompasses all sub-episodes that address how mathematical ideas are represented in the classroom. Three subcategories were identified and labeled as concrete, symbolic, and mixed representations. The last of these—mixed representation—emerged during the analysis and refers to instances in which the boundaries between one type of representation and another are not clearly distinguishable.

Table 4 presents the frequencies of these subcategories across all observed lessons. Overall, the three participants made extensive use of this instructional practice, except for pictorial representation, which was not observed in the analyzed lessons. A general preference for concrete representations is also evident. Notably, T1's lessons show a considerable—and uniquely prominent—use of symbolic representations, particularly through Braille.

The subcategory concerning concrete representation was observed across all lessons. At times, this involved the use of unstructured materials—such as beans—and, in others, structured materials, including base-ten blocks and a range of resources specifically designed for mathematics teaching and learning. The following example shows the teacher employing a concrete representation to introduce the concept of place value.

Table 4. Frequencies for the category: Use and connect mathematical representations

	T1	T3	T6
Concrete representation	7	31	11
Symbolic representation	28	-	-
Mixed concrete-symbolic representation	16	-	19

Note. The symbol "–" indicates that this practice was not observed in the analyzed class

Table 5. Frequency of the category: Facilitate meaningful mathematical discourse

	T1	T3	T6
Discussing the task	7	7	10
Sharing materials	-	3	-
Comparing results	-	2	-

Note. The symbol "–" indicates that this practice was not observed in the analyzed class

> Teacher: Let's switch trays. Now, touch the tens on the top. The top is here. Good. So, I want you to show me where the tens are and where the ones are …

Within the subcategory of symbolic representation, the use of Braille stands out as the primary resource for reading and writing numbers and operations. The following example illustrates this point, showing how Braille becomes an integral part of mathematics lessons. In this instance, the teacher provides the student with a card printed in Braille with a number on it; the purpose of the task was to identify the numbers and represent them accordingly.

> Teacher: No, feel it carefully. Look, number sign—now feel it properly. Go on, feel it well.

Finally, the subcategory corresponding to mixed representation emerges when a manipulative—typically classified as a concrete representation—is used as a bridge to construct a symbolic one. Examples include cubarithms or macro-braille cells. In the excerpt below, we observe an interaction between the teacher and a student who is learning Braille using macro-braille cells. This episode exemplifies a mixed representation: the student manipulates a concrete material (the raised points) to assemble the corresponding symbol (a Braille character).

> Teacher: Number sign, good. A … now I have the other cell right here, the next one, and with this one we're going to build the number, okay?

Facilitate Meaningful Mathematical Discourse

In this category, we group all sub-episodes in which teachers create opportunities for students to share and discuss mathematical ideas. Three subcategories emerged from this set of practices: discussing the task, sharing materials, and comparing results. **Table 5** presents the frequencies of these subcategories. As shown, the practice of discussing the task appears consistently and repeatedly across the lessons taught by all three teachers. In contrast, the other two subcategories occur far less frequently and were identified only in T3's classroom interactions.

In the subcategory related to discussing the task, students are invited at several points throughout the lesson to articulate hypotheses about how a given challenge might be solved, pose general monitoring questions, or contribute during the closing stage of the activity. The following excerpt illustrates how the teacher opens a space for dialogue, encouraging students to voice the mathematical ideas that emerge when she prompts them with a question connected to the task at hand.

> Teacher: To figure out how many more cans they recycled than paper, what operation do you need to use? What options do we have? … Wait—don't you know which operation that would be.

The second subcategory appears as a complementary step where teachers often encourage students to describe or characterize the material for various purposes. This usually involves guiding their observations so that the discussion gradually links to the mathematical ideas that will be developed in the lesson. In the following excerpt, for example, the teacher prompts students to explore the object, describe it, and consider which features might become relevant for the upcoming mathematical work.

> Teacher: All right, this is something new. Explore it—touch it—and tell me what might make it different from an ordinary plastic rod. What does it have? What can I recognize in this piece? And yes, it's orange. Touch it. Explore it. What could it have? Think … what could it be, like a post? Now, what would you do with this little piece? What comes to mind?

The third subcategory, which we label comparing students' responses, appears during task closure. Here, the teacher opens space for students to share and contrast their answers, allowing the class to collectively review the different solutions generated. In the excerpt below, the teacher gives students the floor so they can compare their results.

> Teacher: Okay, student says it's a ten. What do you think, student?

> Student: A ten.

Table 6. Frequencies of the category: Pose purposeful questions

	T1	T3	T6
Gathering information	44	38	41
Probing reasoning	22	15	26
Making the mathematics visible	2	3	3

Table 7. Frequency of the category: Build procedural fluency from conceptual understanding

	T1	T3	T6
Making the procedure explicit	14	9	32
Offering procedural support	6	2	3
Justifying the procedure	-	4	4
Socializing the procedure	-	-	2

Note. The symbol "–" indicates that this practice was not observed in the analyzed class

Throughout this subcategory, teachers mainly concentrate on students' final answers rather than on the strategies that led to them. In the example below, the teacher facilitates a whole-class discussion about the outcome of the task; however, when a student offers an incorrect response, the teacher moves directly to correction rather than exploring the reasoning behind it.

> Teacher: A ten. What does student think?
>
> Student: Ten tens.
>
> Teacher: Student says ten tens. It's one ten.

Pose Purposeful Questions

This category brings together all the sub-episodes in which teachers' questioning was evident throughout the lesson. The resulting subcategories align with those proposed in the conceptual framework—*gathering information*, *probing reasoning*, and *making the mathematics visible*. **Table 6** illustrates the frequency with which each subcategory appeared across the teachers' lessons. Overall, this practice was consistently present at all grade levels, with *gathering information* and *probing reasoning* emerging as the most prevalent forms.

The first subcategory, gathering information, involves questions that don't require complex mathematical thinking. Instead, students are simply expected to respond to the prompt given to them. In the following example, the teacher uses a question aimed solely at eliciting a direct answer from the student.

> Teacher: Now, the number of points changes here. Look—how many points do you have here? (as she asks, she takes An's fingers and guides them across the large box).

The second subcategory, exploring reasoning, refers to questions aimed at prompting students to explain the thinking behind their answers. These questions appear when the teacher seeks to understand how students comprehend and apply a given concept. In the excerpt below, the teacher uses a question to probe the student's conceptual and procedural grasp while performing a subtraction.

> Teacher: So, why do we start with 1425 to do this subtraction?
>
> Student: Because it's the base number.
>
> Teacher: Because it's the base number—the larger number.

The final subcategory, making mathematics visible, includes questions that encourage students to connect their ideas with the mathematical ideas being discussed or that require higher cognitive demand. In the example below, the teacher prompts the student to draw on their understanding and interests to apply mathematical ideas creatively.

> Teacher: What could you propose—what could you tell me—to help you solve something using a subtraction? What would you like to know?

Build Procedural Fluency From Conceptual Understanding

This category encompasses all the sub-episodes in which teachers engage directly with the mathematical procedures being carried out. Four subcategories were identified: making the procedure explicit, offering procedural support, justifying the procedure, and socializing procedures with the class. **Table 7** presents their frequency across lessons, highlighting that all three teachers frequently made procedures explicit and offered procedural support, whereas socializing procedures occurred only a few times and exclusively in P6's lessons.

The first subcategory, making the procedure explicit, refers to the sub-episodes when teachers lay out the steps needed to solve a task. In the following example, the teacher carefully verbalizes each part of the solution process so that the student can later reproduce it. This episode takes place during an activity designed to help students learn Braille numbers using enlarged

Table 8. Frequency of the category: Support productive struggle in learning mathematics

	T1	T3	T6
Praise/encourage	22	5	8
Diversify	2	10	4
Support	15	2	6
Provide the answer	7	4	9
Error	8	6	1

Braille cells. The task required the student to touch a sample Braille cell—where the number was already arranged, identify the position of the dots, and then recreate the same configuration on her own board. As the example shows, when the student has trouble carrying out the task, the teacher chooses to work through it alongside her, even completing it if necessary, articulating each step the student needs to follow to arrive at the correct answer.

> Teacher: No—so you have: one, four, five. Now you. Do it yourself. One, four, five …

In the second subcategory, the teachers focus on offering procedural support. Rather than solving the task for the student, they provide the tools the student needs to work through the procedure independently. In the example below, the teacher encourages the class to analyze each possible mathematical operation, while letting the students decide which one is most suitable. In this episode, the entire class struggles with a calculation activity—especially with choosing the operation that best fits the task. Instead of immediately providing the solution, the teacher prompts them to share their ideas and think through the mathematics involved.

> Teacher: So, will we need division for this one? … To answer it?

The third subcategory includes those sub-episodes in which, after students carry out a mathematical procedure, some teachers prompt them to engage in metacognitive reflection by asking questions that require them to justify their actions. In the following example, the teacher highlights a central question: *How did you carry out that procedure?*

> Teacher: Did he count it? How did F count it? Really? How did he count it? Show me.

However, this subcategory requires some nuance. In the previous example, even though the teacher asks the student to explain the procedure, the broader context suggests that her intention is not to strengthen the student's procedural fluency. Instead, her questions seem to reflect a concern about whether the student solved the task independently or simply copied a peer's work.

A second consideration is that, in some cases, it is the teachers—not the students—who end up providing the justification for the procedures. For example:

> Teacher: All right. So … 11, 3. Three minus two … This one was four and you changed it to three, okay. Then you ended up with 2, 1, and then 1 minus 1 is 0. So your final answer would be …

Here, the teacher walks through the steps she sees in the student's notebook, while asking the student to speak only to provide the result of the calculation. Another example can be seen below:

> Teacher: No, because once we went through all those earlier steps, we were able to understand that this little bar represented a ten.

In this excerpt, the teacher offers a brief reflection on the conceptual dimension of the task, pointing out that ten single units make up one ten.

Finally, the last subcategory includes those sub-episodes in which teachers aim to *socialize the procedure*; they create opportunities for students to share their strategies and ways of approaching the tasks during class, as shown in the following example:

> Teacher: Let's see—those of you working in Braille, where are you going to start when you do the operation?

Support Productive Struggle in Learning Mathematics

This category encompasses the sub-episodes in which teachers engaged in various practices that fostered productive struggle in mathematics lessons. Five subcategories were identified. The first includes moments in which the teacher praised and encouraged students. A second subcategory involves diversifying both the materials and the level of challenge embedded in the tasks. A third refers to instances where the teacher supported students' task development by helping them make connections between ideas and guiding their thinking. In addition, one subcategory captures moments when the teacher provided students with the correct answer to the task they were completing. Finally, the "error responses" subcategory encompasses the different ways in which teachers addressed students' mistakes. **Table 8** presents the frequency of each subcategory across the lessons analyzed, highlighting the variation observed according to the teacher and the grade level. For example, in T1's lessons, praise appears frequently; in T3's lessons, greater emphasis is placed on task diversification; and in T6's lessons, the distribution centers primarily on instances of praise and on moments when the teacher provides the answers to the tasks being completed.

The first subcategory captures all the sub-episodes in which teachers offer positive reinforcement to their students—an interactional move that appears frequently throughout the lessons. In the next excerpt, the teacher acknowledges a student's correct answer, a form of praise that stands out as the most common type of motivational response across all observed classes. Notably, this subcategory emerges almost exclusively when students provide correct answers to the tasks or questions posed in class.

> Student: Teacher, it was number three.
>
> Teacher: Great, student! Excellent. Let's keep these numbers here—take them, yes, right there. And we'll put the others away.

Within this subcategory, we include the ways teachers motivate their students. This type of motivation becomes visible in the instructional decisions teachers make to connect with students' interests. In the following example, a teacher chooses a task that, based on her prior experience, she knows will engage the class. To work with the material and support understanding, she frames the activity with a purpose designed to motivate students and draw them into the learning process.

> Teacher: ... And then we're going to play "supermarket" using these little bars.

This subcategory encompasses all the sub-episodes related to diversification. Diversifying is a way of fostering productive effort, as it allows students to engage and progress using their own strategies by considering their existing knowledge and skills. In the example below, the teacher adjusts the task based on the student's conceptual understanding, modifying both the numbers involved and the materials available for solving the activity.

> Teacher: (…) Student, you're going to work on the same question, but the numerical range we're using may change, okay? And you will work like this … See here how the teacher prepared a little table for you so that we could work, and in this section up here we're going to place, for example, the materials you will be using, alright?(…)

This subcategory brought together the sub-episodes that involved offering procedural support, viewed from the perspective of how such support enhances productive effort. In the following excerpt, a student has difficulty identifying the Braille code on a sheet. The teacher responds by modelling the conventional reading process and by guiding the student's reasoning as she articulates her own hypotheses.

> Teacher: (The teacher takes her hands and points to a part of the card) (Student examines the card for a while)
>
> Student: It's like a four.
>
> Teacher: Are you sure it's a four?

This subcategory encompasses all the sub-episodes in which teachers decide to provide the solution path for students once they notice that they have become stuck. This type of intervention appeared more than once across all observed lessons. In the example below, the teacher chooses to lay out the procedure step by step, thereby reducing the amount of productive effort the student needs to invest in solving the task. Although the teacher does not provide the result for 'four hundred and twenty-five minus two hundred and eighty,' the task itself focused on selecting an appropriate way of organizing the numbers to carry out the operation.

> Teacher: Subtract. So, at the beginning here, you're going to put 425, and then you'll put two hundred e … ighty. First, 425. Enter that amount.

Finally, the subcategory labeled 'error' brings together the sub-episodes that illustrate how teachers respond when students make mistakes. In the following excerpt, it is the teacher who detects the error and takes the lead in correcting it, thereby positioning herself at the center of the resolution process.

> Teacher: 1,200?! You have 200 and 10. 200 plus 10, how much would that be?
>
> Student: thou … sand
>
> Teacher: There's no thousand there.
>
> Student: I don't know.
>
> Teacher: 200 what?
>
> Student: I can't think of it
>
> Teacher: Two hundred …

Table 9. Frequency of the category: Elicit and use evidence of student thinking

	T1	T3	T6
Identifying indicators of thinking	3	6	1
Making decisions	-	1	1

Note. The symbol "–" indicates that this practice was not observed in the analyzed class

Elicit and Use Evidence of Student Thinking

In this final category, we group all the sub-episodes that involve actions in which teachers inquire about difficulties, ask metacognitive questions, or even make explicit the decisions they will take in upcoming sessions based on students' interests or concerns, which suggests an evaluative purpose. Specifically, we identified two subcategories, labeled as *identifying indicators of thinking* and *making decisions based on students' ideas*. **Table 9** shows the frequency with which these subcategories appear in the classes. It can also be seen that the first subcategory, *identifying indicators of thinking*, is applied by all three teachers, with T3 standing out. However, *making decisions* appears only rarely and exclusively with T3 and T6.

The first subcategory includes those sub-episodes in which teachers seek to identify indicators of students' thinking. This typically occurs during the closing moments of a lesson, when teachers create a space for students to articulate what they learned and what they found difficult. In the following example, the teacher uses a metacognitive question to surface the most salient mathematical ideas that emerged during the session.

> Teacher: Alright, then. To finish, let's review what we did. What did we work on today?

The second subcategory encompasses sub-episodes in which teachers make instructional decisions based on students' ideas. This occurred when a teacher explicitly stated that she would adjust to upcoming lessons in response to the interests, concerns, or understandings expressed by the class. The following example illustrates this: after receiving a student's comment, the teacher spontaneously decides to act on it.

> Student: I really liked this material.
>
> Teacher: Great, because we're going to start using it now.

DISCUSSION

The purpose of this study was to address the following question: *How are mathematics teaching practices implemented in a special school for visually impaired students in Chile?* To explore this, we have conducted a fine-grain analysis of the mathematical teaching practices of three special education teachers.

The first key finding relates to the practice of setting learning-oriented goals, which appeared only in an incipient form at the start of lessons, typically when the session objectives were introduced. Although these goals were occasionally linked to students' everyday experiences, there was no systematic effort to connect them to prior learning or to articulate how they would contribute to longer-term mathematical development. This lack of rigorous planning echoes the insights of Contreras-Urra et al. (2023) and Ferrell (2006), who observe that mathematics instruction for students with VIs often relies on improvisation or common-sense approaches rather than on research-informed pedagogical design. This gap has important implications: when goals are not explicitly connected to the progressive development of mathematical thinking, opportunities for coherent and meaningful learning become limited. As a consequence, even when immediate lesson objectives are met, teaching often fails to establish learning trajectories that support sustained academic progress or to integrate classroom elements in ways essential for learning (Brawand & Johnson, 2016).

A second major finding concerns the cognitive demand of classroom tasks. Most activities were situated at low levels of demand, emphasizing memorization or the repetition of procedures with little conceptual depth. This pattern reflects the arguments of Tan et al. (2019), who contend that students with disabilities are often offered a "remedial" version of mathematics focused on functionality and everyday basics. Consistently, Oyebanji et al. (2021) note that Braille-using students are less likely to access advanced mathematics precisely because classroom practices privilege mechanical repetition over the development of abstract reasoning. The present findings reinforce this trend and suggest that restricted access to cognitively challenging tasks may help explain why, at a system level, students with VIs exhibit lower performance in standardized assessments or face higher dropout rates in scientific fields (García et al., 2021).

A third critical dimension involves the use of mathematical representations. While Braille and concrete materials such as cubes or base-10 blocks were regularly employed, pictorial representations and deliberate transitions between representational registers were largely absent. As emphasized by the NCTM (2014), moving across representations is essential for meaningful learning because it allows students to connect concrete experiences with abstract ideas. Moreover, traditional tactile representations may impoverish cognitive activity (Abrahamson et al., 2019), particularly when they are not coherently integrated into instructional designs (Brawand & Johnson, 2016). Without pictorial or graphical supports, students' development of core mathematical skills remains constrained. Brawand and Johnson (2016) highlight that, in addition to tactile materials, tools such as the abacus or tactile graphics are vital for enabling visually impaired students to access the full mathematical curriculum. The limited use of these resources in the observed lessons may stem from teacher conceptions that treat concrete materials primarily as compensatory aids rather than as tools for deepening conceptual understanding. This reductive perspective diminishes the pedagogical potential of representations, turning support into mere substitutes for vision instead of mediators of mathematical reasoning.

Mathematical discourse also emerges as a problematic area. Classroom interaction tended to focus on task completion rather than on making students' mathematical reasoning explicit. Communication was often reduced to confirming whether answers were correct or incorrect, leaving little room for argumentation or the justification of procedures. Similar patterns were documented by Contreras-Urra et al. (2023), who report that mathematical dialogue remains superficial in mainstream schools involving visually impaired students. This contrasts with Oyebanji (2021), who argues that an inclusive mathematics curriculum must embrace the social dimensions of learning, actively encouraging students to discuss, argue, and reflect on mathematical ideas. Without such opportunities, students' development of communicative and reasoning competencies—central to mathematical literacy—is significantly constrained.

Regarding deliberate questioning, the findings indicate that teachers relied predominantly on closed, direct questions aimed at eliciting immediate answers. Questions that stimulate reflection, invite alternative strategies, or prompt conceptual connections were largely absent. This pattern aligns with Contreras-Urra et al. (2023), who note that questioning in similar contexts often functions more as a form of classroom control than as a pedagogical strategy. Consequently, the classroom operates more as a space for verification than for inquiry, limiting students' opportunities to develop autonomy and flexibility in their mathematical thinking. In this line of work, mathematical meanings are constructed through tactile exploration, gestures, and embodied action (Healy et al., 2016); however, such exploration needs to be discussed in relation to the mathematical elements involved. In terms of procedural fluency, teachers tended to emphasize predefined solution methods, offering limited opportunities for students to propose their own strategies. This stands in contrast to the work of Andreou and Kotsis (2005), who demonstrate that visually impaired students develop strong estimation and comparison skills when encouraged to explore and draw on their own lived experiences to solve problems. The lack of flexibility observed in the present study is likely tied to the routine, low-demand nature of the tasks: when activities do not invite cognitive engagement, diverse strategies seldom have the opportunity to emerge. This reinforces the view that the primary barriers faced by blind students are didactic and related to access, rather than cognitive in nature (Klingenberg et al., 2019). With respect to productive struggle, teacher feedback largely centered on validating correct answers rather than acknowledging students' processes or efforts. This narrow focus contrasts with the recommendations of Townsend et al. (2018), who emphasize that recognizing frustration and error as integral to learning is essential for creating mathematically rich and challenging experiences. The avoidance of frustration may reflect teacher beliefs that frame error as something negative to be minimized, rather than as a key opportunity to deepen conceptual understanding.

Finally, the collection of evidence about students' thinking occurred only marginally and without planning—an unsurprising result given the low complexity of tasks and limited opportunities for discussion. The NCTM (2014) highlights that the intentional gathering of evidence through formative assessment is fundamental for guiding instruction, yet this practice was not systematically embedded in the observed lessons. As a result, opportunities to provide targeted feedback and to adjust instruction to students' actual needs were largely missed.

CONCLUSIONS

When viewed collectively, the findings reveal a clear and consistent pattern: mathematics instruction in the special school studied reproduces dynamics widely documented in both international and national research. Students with VIs receive a reduced version of mathematics—one shaped by low-demand tasks, limited opportunities for reasoning, and a narrow range of representations—which ultimately restricts their right to a robust mathematical education. Although these results should be understood as preliminary, this observation aligns with concerns raised by Tan et al. (2019), who argue that teaching mathematics for students with disabilities often becomes disempowering, as it fails to recognize their inherent capacity to think and engage mathematically fully.

Nevertheless, these findings must be interpreted with caution due to certain limitations. While the inclusion of multiple grade levels may be considered a strength in terms of the range of practices observed, it may also have shaped the instructional strategies employed, as participating teachers likely adapted their approaches to the ages of their students. For this reason, future research should examine mathematics instruction in greater depth at specific grade levels. In addition, further lines of inquiry should explore the role of technological tools that support learning for blind students, particularly in light of the challenges related to representations identified in this study.

The implications of these results are far-reaching. In the domain of teacher preparation, the study underscores the pressing need for future special education teachers to develop mathematical knowledge for teaching. This area remains critically underdeveloped in current programs (Piñeiro & Calle, 2023). The fine-grain analysis in this paper provides specific examples that can be used to review current training in mathematical knowledge for special education teachers.

At the level of public policy, the findings call for a thorough re-examination of the working conditions and professional recognition afforded to special education teachers in Chile, who are tasked with teaching discipline-specific content without specialized preparation or adequate financial incentives.

Addressing the research question leads us to conclude that the mathematics teaching practices observed are predominantly oriented toward memorization and the production of correct answers, with limited space for reflection, argumentation, or the development of independent problem-solving strategies. Consequently, students with VIs are not granted access to meaningful mathematical learning, which in turn constrains their opportunities for full social participation and continuation into higher education. The primary contribution of this study lies in bringing these practices to light and situating them within the broader scholarly conversation, demonstrating that the issues identified are not attributable to individual teachers but are symptoms of a systemic problem spanning initial teacher education, public policy, and the structural conditions that shape special education in Chile.

Author contributions: Both authors actively participated in the all-research process, reviewing and approving the final version of the text

Funding: This study was funded by under Fondecyt Iniciación 11240835 and DIUMCE 13-2024 EFA.

Acknowledgments: The authors would like to thank the teachers and students who participated in this study.

Ethical statement: The authors stated that the study was approved by the Scientific Ethics Committee at Universidad Santiago de Chile on 2 April 2024 with approval number 082/2021. Written informed consents were obtained from the participants.

AI statement: The authors stated that no generative AI or AI-based tools were used during the analysis, writing, and editing of this article.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

Abrahamson, D., Flood, V. J., Miele, J., & Siu, Y.-T. (2018). Enactivism and ethnomethodological conversation analysis as tools for expanding Universal Design for Learning: the case of visually impaired mathematics students. *ZDM Mathematics Education, 51*, 291-303. https://doi.org/10.1007/s11858-018-0998-1

ACE. (2024). Informe de resultados nacionales. Estudiantes en situación de discapacidad sensorial [National results report. Students with sensory disabilities]. *Agencia de Calidad de la Educación*. https://s3.amazonaws.com/archivos.agenciaeducacion.cl/Informe+Estudiantes+en+Situaci%C3%B3n+de+Discapacidad+4%C2%B0+b%C3%A1sico+y+II+medio+(final).pdf

Andreou, Y., & Kotsis, K. T. (2005). Mathematical concept development in blind and sight children. *International Journal of Learning, 12*(7), 255-260. https://doi.org/10.18848/1447-9494/CGP/v12i07/47920

Bardin, L. (1996). *Análisis de contenido* [Content analysis] (2nd ed.). Akal.

Brawand, A., & Johnson, N. (2016). Effective methods for delivering mathematics instruction to students with visual impairments. *Journal of Blindness Innovation and Research, 6*(1). https://doi.org/10.5241/6-86

Contreras-Urra, F., Pailamilla-Rojas, L., & Piñeiro, J. L. (2023). Estrategias docentes para enseñar matemáticas: Trabajo colaborativo entre profesionales del área de matemáticas y educación diferencial [Teaching strategies for teaching mathematics: Collaborative work between professionals in the field of mathematics and special education]. *Revista de Estudios y Experiencias en Educación, 23*(51), 68-91. https://doi.org/10.21703/rexe.v23i51.2215

Ferrell, K. A. (2006). Evidence-based practices for students with visual disabilities. *Communication Disorders Quarterly, 28*(1), 42-48. https://doi.org/10.1177/15257401060280010701

Figueiras, L., & Arcavi, A. (2014). A touch of mathematics: Coming to our senses with the blind. *ZDM Mathematics Education, 46*, 123-133. https://doi.org/10.1007/s11858-013-0555-x

Figueiras, L., & Arcavi, A. (2015). Learning to see: The viewpoint of the blind. In S. J. Cho (Ed.), *Selected regular lectures from the 12th International Congress on Mathematical Education* (pp. 175-186). Springer. https://doi.org/10.1007/978-3-319-17187-6_10

García, C., Farías, J., Reyes, D., & Vásquez, A. (2021). Análisis de la participación académica de los y las estudiantes con discapacidad sensorial de la Pontificia Universidad Católica de Chile [Analysis of the academic participation of students with sensory disabilities at the Pontifical Catholic University of Chile]. *Revista Latinoamericana de Educación Inclusiva, 15*(1), 117-137. https://doi.org/10.4067/s0718-73782021000100117

Healy, L., & Fernandes, S. (2011). Multimodality and mathematical meaning-making in the context of blind learners. *Educational Studies in Mathematics, 77*, 157-174. https://doi.org/10.1007/s10649-010-9290-1

Healy, L., Becerra Ramos, E., Hassan Ahmad, S., Fernades, A., & Lindote, J. (2016). Mathematics in the hands of deaf learners and blind learners: Visual-gestural-somatic means of doing and expressing mathematics. In R. Barwell, P. Clarkson, A. Halai, M. Kazima, J. Moschkovich, N. Planas, M. Setati Phakeng, P. Valero, & M. Villavicencio (Eds.), *Mathematics education and language diversity. The 21st ICMI study* (pp. 141-162). Springer.

Inostroza, F. (2020). *La puesta en práctica de las políticas de inclusión escolar desde la perspectiva de las educadoras diferenciales* [The implementation of school inclusion policies from the perspective of special education teachers] [PhD thesis, Universidad Alberto Hurtado]. https://doctoradoeducacion.cl/wp-content/uploads/2018/08/2020.Tesis_Fabian.pdf

Klingenberg, O. G., Holkesvik, A. H., & Augestad, L. B. (2019). Research evidence for mathematics education for students with visual impairment: A systematic review. *Cogent Education, 6*, Article 1626322. https://doi.org/10.1080/2331186X.2019.1626322

Kuckartz, U. (2019). Qualitative text analysis: A systematic approach. In G. Kaiser, & N. Presmeg (Eds.), *Compendium for early career researchers in mathematics education* (pp. 181-198). Springer. https://doi.org/10.1007/978-3-030-15636-7_8

Lambert, R. (2018). "Indefensible, illogical, and unsupported"; countering deficit mythologies about the potential of students with learning disabilities in mathematics. *Education Sciences, 8*(2), Article 72. https://doi.org/10.3390/EDUCSCI8020072

McMillan, J. H., & Schumacher, S. (2005). *Investigación educativa: Una introducción conceptual* [Educational research: A conceptual introduction] (5th ed.). Pearson.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. SAGE.

Ministerio de Educación. (2015). *Decreto N°83/2015. Aprueba criterios y orientaciones de adecuación curricular para estudiantes con necesidades educativas especiales de educación parvularia y educación básica* [Decree no. 83/2015. Approves criteria and guidelines for curricular adaptation for students with special educational needs in early childhood education and basic education]. División de Educación General y Unidad Educación Especial.

NCTM. (2014). *Principles to actions: Ensuring mathematical success for all*. National Council of Teachers of Mathematics.

Oyebanji, M. S., & Idiong, U. S. (2021). Challenges of teaching mathematics to students with visual impairment. *Malikussaleh Journal of Mathematics Learning, 4*(1), 1-6. https://doi.org/10.29103/mjml.v4i1.2538

Padilla, A., Lambert, R., Tan, P., & White-Smith, K. (2024). Conceptualizing political knowledges needed to teach inclusive mathematics: Theorizing through counterstories. *ZDM Mathematics Education, 56*, 461-472. https://doi.org/10.1007/s11858-024-01598-4

Piñeiro, J. L., & Calle, J. P. (2023). Mathematical knowledge for teaching in the initial education of special education teachers. *Acta Scientiae, 25*(5), 118-143. https://doi.org/10.17648/acta.scientiae.7504

Rodríguez, G., Gil, J., & García, E. (1999). *Metodología de la investigación cualitativa* [Qualitative research methodology]. Aljibe.

Stake, R. E. (1999). *Investigación con estudio de casos* [Case study research]. Morata.

Stein, M. K., & Smith, M. S. (1998). Mathematical tasks as a framework for reflection: From research to practice. *Mathematics Teaching in the Middle School, 3*(4), 268-275. https://doi.org/10.5951/MTMS.3.4.0268

Tan, P., Padilla, A., Mason, E. N., & Sheldon, J. (2019). *Humanizing disability in mathematics education*. National Council of Teachers of Mathematics.

Townsend, C., Slavit, D., & McDuffie, A. (2018). Supporting all learners in productive struggle. *Mathematics Teaching in the Middle School, 23*(4), 216-224. https://doi.org/10.5951/mathteacmiddscho.23.4.0216