E-ISSN : 2828-0903
P-ISSN : 2827-9077
IJESS | INDONESIAN JOURNAL OF EDUCATION AND SOCIAL STUDIES

Indonesian Journal of Education and Social Studies (IJESS)
Vol. 05, No. 01 (2026), p. 14-30
Available online at https://ejournal.unuja.ac.id/index.php/IJESS

Capable but Excluded: Unpacking the Systemic Barriers to Mathematics Education for Students with Blindness

Tsegaye Gerba Milki*, Belay Hagos Hailu, Abebe Yehualawork Male
Addis Ababa University, Ethiopia

*Corresponding Author: tsegayegerbamilki@gmail.com
http://doi.org/10.33650/ijess.v4i3.11898
Received: October 2025, Revised: December 2025, Accepted: January 2026

Abstract:

This study investigates the long-standing exclusion of students with blindness from mathematics education in Ethiopia, despite national commitments to inclusive learning and international frameworks supporting equitable access. Using a qualitative research design, the study gathered data from policymakers, regional education officials, disability advocates, and blind professionals to uncover structural, attitudinal, and pedagogical factors underpinning this exclusion. Data were collected through semi-structured interviews and analyzed thematically to identify patterns across institutional practices and lived experiences. Findings reveal a persistent misalignment between inclusive education policies and their implementation, driven by misconceptions that mathematics is inherently visual, insufficient teacher preparation, and the absence of adapted instructional tools. Testimonies from blind professionals further demonstrate that mathematical competence is attainable when accessible pedagogies are provided, highlighting that exclusion stems from systemic inaction rather than learner limitations. The study concludes that restoring mathematics education for blind learners requires challenging entrenched beliefs, strengthening teacher training, and ensuring institutional accountability. These insights contribute to broader debates on disability-inclusive education and emphasize the need for transformative reforms that honor the educational rights of students with blindness.

Key Words: *Blindness, Mathematics Education, Inclusive Policy, Disability Studies*

Please cite this article in APA style as:

Milki, T. G., Hailu, B. H., & Male, A. Y. (2026). Capable but Excluded: Unpacking the Systemic Barriers to Mathematics Education for Students with Blindness. *Indonesian Journal of Education and Social Studies*, *5*(1), 14-30.

INTRODUCTION

The exclusion of students with blindness from mathematics education represents a persistent and deeply rooted phenomenon that calls for critical scholarly attention (Chen & Horn, 2022; Hayes & Proulx, 2024; Tan et al., 2022). Existing theories on disability and learning emphasize that educational barriers rarely originate from impairments themselves, but from the social and institutional structures that determine who is deemed capable of accessing certain types of knowledge. Scholars within the social model of disability, such as Jóhannsdóttir et al. (2022), argue that disability arises within societal arrangements that fail to accommodate diverse ways of learning. Research on

mathematics accessibility further indicates that learners with visual impairments can develop strong competencies in abstract and symbolic reasoning when instructional tools and pedagogical methods are adapted appropriately (Ali et al., 2024; Ketema Dabi & Negassa Golga, 2024; Shoaib et al., 2023). Against this theoretical backdrop, the Ethiopian context presents a compelling case of how educational systems can reproduce marginalization through persistent misconceptions that mathematics is inherently visual. The phenomenon raises fundamental questions about how beliefs, pedagogical traditions, and institutional arrangements work together to deny blind learners access to a discipline that is essential for intellectual development and participation in everyday life.

Scholarly work on mathematics education for students with visual impairments has grown in the past decade, offering important insights into the pedagogical, technological, and institutional factors that shape learning opportunities. Recent studies highlight the effectiveness of tactile learning tools, braille-based mathematical notation, and multimodal instruction in improving conceptual understanding among blind learners (Kana & Hagos, 2025; Nahar et al., 2022; Shoaib et al., 2023). Teacher beliefs remain a central theme within this body of literature, with research consistently showing that negative assumptions about learner capability limit access to STEM subjects (Alam & Mohanty, 2023; Tenney et al., 2023; Wolf & Brown, 2023). Studies in inclusive education systems also reveal recurring challenges related to teacher preparedness, lack of accessible learning materials, and insufficient institutional support for differentiated instruction (Darwish et al., 2025; Gonzaga et al., 2024; Zelalem et al., 2022). Collectively, these themes indicate that successful mathematics learning for students with blindness depends on a combination of pedagogical adaptation, accessible materials, and positive expectations from educators.

Although this literature advances understanding of classroom-level and pedagogical barriers, it largely focuses on contexts where inclusive systems are already established. It rarely examines long-term, structural exclusion in national education systems, nor does it analyze how historical, political, and institutional trajectories interact to shape access to mathematics across generations of blind learners. This study fills these gaps by offering an in-depth qualitative account of the Ethiopian experience, where mathematics education for students with blindness once flourished under missionary-led schooling but later disappeared within mainstream public education. The novelty of this research lies in its multi-level analytical approach that integrates policy perspectives, institutional insights, and lived experiences to reveal how exclusion is produced, sustained, and justified across multiple layers of the education system.

Grounded in these gaps, the present study seeks to explore why students with blindness in Ethiopia have been systematically excluded from mathematics education despite theoretical and empirical evidence demonstrating their capacity to learn the subject. The study specifically seeks to: (1) examine

institutional interpretations and misinterpretations of inclusive education policy, (2) analyze how teacher preparation systems and school-level practices shape access to mathematics, (3) capture multi-generational experiences of blind individuals who either gained or were denied access to mathematics, and (4) identify structural, pedagogical, and attitudinal factors that perpetuate this long-standing exclusion. By integrating perspectives from policymakers, regional education authorities, advocacy organizations, and blind professionals, the study provides a comprehensive account of the systemic barriers embedded within Ethiopia's education landscape. These objectives allow the research to respond directly to the conceptual and empirical gaps identified earlier, while offering a grounded and contextually rich examination of exclusion.

This study contributes to broader discussions on inclusive education by emphasizing the importance of rethinking how mathematical learning is conceptualized for students with visual impairments. The findings underscore the need for teacher preparation systems that integrate inclusive pedagogies and for institutional cultures that challenge entrenched assumptions about blindness and mathematical capability. The historical and contemporary perspectives documented in this study provide a foundation for future research and policy reform, particularly in contexts where exclusion is normalized. The analysis also highlights the urgency of restoring mathematics as a fundamental right for blind learners and strengthening efforts to align inclusive education commitments with actual classroom practice.

RESEARCH METHOD

This study uses an exploratory qualitative design to deeply understand the factors that cause students with blindness to continue to be excluded from mathematics learning in Ethiopia (Antony et al., 2022; Steyn et al., 2022; Tebbs et al., 2021). This approach was chosen because the phenomenon studied cannot be reduced to numbers, but rather requires a contextual understanding of policy decisions, institutional practices, and the life experiences of professionals with blindness. By view Trupia et al. (2021), the study of complex social barriers requires an equally complex and flexible method of capturing the dynamics of reality that are not visible in formal documents. This research operates in the context of national education, involving actors from the Ministry of Education, regional and municipal education bureaus, organizations of persons with disabilities, and individuals who have experienced direct impact of policies. By its characteristics, the qualitative approach provides room for in-depth narratives, critical reflection, and unexpected findings—for example, the relationship between the scarcity of braille and poor teacher training—that cannot be obtained through structural surveys.

Data was collected through semi-structured in-depth interviews to explore the historical, political, and pedagogical reasons that lock in students' blind access to math. Interviews were conducted with policy makers, policy

implementers, education monitors and evaluators, as well as professionals with blindness who are living witnesses of changes in the education system from the missionary era to the modern regime. Informant selection using purposive sampling (Bouncken et al., 2025; Dosek, 2021; Pahwa et al., 2023), to select nine key officials who have a strategic role in the formulation and implementation of mathematics education policies as shown in table 1.

Table 1. Policy Informant & Education Practitioner

Institution	Role	Gender	Age	Years of Experience
Ministry of Education	Special Needs Expert	Male	48	19
Ministry of Education	Teacher Development Expert	Male	46	8
Addis Ababa Office	Special Needs Expert	Male	34	16
Addis Ababa Office	Teacher Development Expert	Male	47	21
Oromia Bureau	Special Needs Expert	Male	52	31
Oromia Bureau	Teacher Development Expert	Male	47	29
SNNP Bureau	Special Needs Expert	Male	53	33
SNNP Bureau	Teacher Development Expert	Male	51	30
ENAB	Advocacy Officer	Male	58	37

Meanwhile, snowball sampling was used to recruit six professionals with blindness who have a long range of educational and work experience, including roles as teachers, lecturers, inclusion activists, and social workers (Ng et al., 2024; Shafaghat et al., 2023; Zhou et al., 2023). Recruitment through chain recommendations was carried out because the themes studied touched sensitive experiences and required a high level of trust between participants. The complete profiles of the informants recruited through the snowball technique are presented as shown in Table 2.

Table 2. Profiles of professionals with Blindness

Institution	Role	Age	Gender	Years Working
Together for Inclusion	Officer	78	Male	48
Yemisirach Center	Advisor	72	Male	43
Former Primary School	Retired Teacher	79	Male	54
Former Primary School	Retired Teacher	66	Male	36
National Assoc. of the Blind	Inclusion Expert	57	Male	32
College of Teacher Education	Lecturer	53	Male	30

Data analysis in this study was carried out using thematic analysis to trace the patterns of meaning that emerged from in-depth interviews with fifteen informants, selected through purposive and snowball sampling (Lochmiller, 2021; Morgan, 2022; Naeem et al., 2024). All interview recordings were transcribed verbatim and read repeatedly to increase the researcher's familiarity with the data. The initial coding process was carried out by marking important statements related to policy implementation failures, misperceptions of the abilities of students with blindness, pedagogical barriers, and experiences of discrimination experienced across generations. The codes were then grouped

into broader categories before being developed into four main themes and three subthemes that reflect the relationship between policy structures, educational practices, and informants' life experiences. The credibility of the analysis is maintained through triangulation of sources, and reflective discussions between research teams to ensure that the resulting interpretations are in accordance with the reality conveyed (Heller, 2023; Janis, 2022; Kazu & Kuvvetli, 2023). This analytical approach allowed the research to uncover the systemic dynamics that perpetuate the exclusion of students with blindness from mathematics learning in Ethiopia.

RESULT AND DISCUSSION

Results

Mathematics and Students with Blindness

All informants from the Ministry of Education and regional/city administration Education bureaus were asked to share their opinions regarding the major goal of primary education and the Minimum Learning Competence required from students. They unanimously agreed that reading, writing, computing, and utilizing these skills in daily life are essential competencies to be achieved by students at this level. Furthermore, they emphasized that Mathematics and English are compulsory subjects due to their irreplaceable roles in students' futures.

However, all informants also noted a contradiction: students with blindness were being deprived of learning mathematics, which they believed adversely affected their ability to meet the intended educational goals. The experts acknowledged that there is no legal document explicitly prohibiting students with blindness from learning mathematics. However, they pointed out that a lack of knowledge among high-level educational leaders about the importance of mathematics for students with blindness, along with inadequate preparation for teachers, led to this exclusion.

One Special Needs Education (SNE) expert from the Ministry of Education stated: "I have searched repeatedly through the archives, but I have never found a written document that prohibits students with blindness from learning mathematics. However, the practical reality is different; students with blindness are not learning mathematics, and this contradicts the ministry's goals."

When asked about the capacity-building efforts for teachers in both pre-service and in-service training programs, all informants reported that no specific training had been provided to teachers to teach mathematics to students with blindness.

Institutional attempts to access Mathematics for students with blindness

The study explored the role of Ethiopian national Association of the Blind (ENAB) in creating accessible mathematics education for students with blindness. The advocacy officer of the association acknowledged that there were

insufficient advocacy on this issue. The officer furthermore explained that the sound of the association had not been heard by the high profile education leaders due to their beliefs that persons with blindness are incapable of learning mathematics; which contradicts with the experiences of the professionals with blindness. The study also explored the role of Inclusive Education Resource Centers (IERCs), established across Ethiopia. SNE experts indicated that these centers had not contributed to teaching mathematics to students with blindness. They explained that teachers had not received training on using the aids and equipment available at these centers. Besides, the experts added, the plan to establish IERCs didn't incorporate the issue of teaching mathematics and other natural sciences to students with blindness.

Special Needs Education (SNE) experts confirmed that while students with blindness are capable of learning mathematics and that the subject is essential to their academic and life success, institutional efforts have been weak. They cited historical precedent: in the 1950s to early 1970s, missionary-run schools allowed students with blindness to learn mathematics. This inclusive approach declined after the 1974 regime change, when students with blindness in regular schools were excluded from mathematics without clear justification.

A Special Needs expert from the Federal Ministry of Education explained: "In the 1950s, students with blindness had access to mathematics through schools run by missionaries. However, since the 1970s, after the fall of the imperial government, the opportunity to learn mathematics has been limited, especially for students integrated into regular schools. This has contributed to the ongoing exclusion of blind students from mathematics education."

Regional and City administration education bureaus also revealed that no efforts have been in place to access mathematics to students with blindness in their respective regions and city administration due to the failure of the overall education system to adapt to needs of these students.

All informant experts concurred that the current practice in the education institutions shows that the right of students with blindness to learn mathematics is deprived in defiance of the general principle of the United Nations Convention on the Rights Persons with Disabilities (CRPD, 2006) and international trends and pedagogical realities due to the reason that relevant institutions were not exercising their responsibilities. To clarify the dynamics of stakeholder perceptions regarding the ability of students with blindness to learn mathematics, these findings are presented in a concise manner as shown in Table 3.

Tabel 3. Institutional Efforts and Failures in Providing Access to Mathematics

Institutional Actor	Intended / Formal Role	Empirical Reality	Key Explanatory Factor	Analytical Insight
ENAB	Advocacy for the rights of persons with blindness	Advocacy insufficient;	Belief that blind students cannot	Ableist assumptions

		voice ignored by leaders	learn mathematics	weaken advocacy impact.
IERCs	Provide assistive tools and teacher support	No contribution to math learning; teachers untrained	Mathematics not included in IERC planning	Centers misaligned with subject-specific needs.
Ministry of Education	National policy leadership	Recognizes capability, but institutional support weak	Failure to institutionalize historical inclusive practices	Policy–practice gap remains wide.
Regional & City Education Bureaus	Implementation and supervision	No concrete efforts to provide access	System unable to adapt to blind learners' needs	Implementation vacuum reinforces exclusion.
CRPD and international norms	Ensure inclusive education and equal rights	Practices contradict CRPD principles	Weak monitoring and accountability	Rights remain symbolic rather than operational.

Table 3 shows that the exclusion of students with blindness from mathematics learning arises as a consequence of systemic failures at various institutional levels. ENAB is not pushing for meaningful change because some education leaders still maintain the erroneous assumption that blind students do not have the capacity to learn mathematics. IERCs do not work as originally designed. Their planning never included math, and teachers did not receive adequate training to take advantage of the tools available. The Ministry of Education has a policy framework that supports inclusion, but has not been able to re-instill inclusive practices that have been effective so that the gap between policy documents and implementation has widened. At the executive level, regional and municipal education bureaus have not shown concrete steps to expand access. This situation indicates the low adaptive ability of the system in meeting the learning needs of visually impaired students. Supervision of the application of CRPD principles is also weak so that the right to inclusive education only exists as a normative commitment.

Views of education leaders and Experts on the capability of students with blindness in learning Mathematics

When asked about the capability of students with blindness to learn mathematics, experts from the Teachers' Development and School Leadership program generally expressed doubts. They believed that visual media were essential for learning mathematics, and that students with blindness lacked the capacity to understand and use mathematical concepts. These beliefs were reflected in the teacher education curriculum, which did not include specialized training for teaching mathematics to students with blindness.

One expert stated:

"There is a deep-rooted misconception that students with blindness cannot learn mathematics. This belief has influenced the teacher education system, which fails to prepare teachers for the unique needs of students with blindness."

This statement highlights a core attitudinal barrier that shapes the entire educational ecosystem for students with blindness. The misconception that blind learners are inherently incapable of studying mathematics does not remain at the level of individual belief but becomes embedded within institutional structures, particularly the teacher education system. When such assumptions go unchallenged, they influence curriculum design, training priorities, and the types of competencies teachers are expected to develop. As a result, future educators enter classrooms without the pedagogical tools, adaptive strategies, or confidence needed to support blind students in learning mathematics. This creates a self-reinforcing cycle in which the absence of training sustains the belief that blind learners cannot learn the subject, and the belief itself justifies the lack of investment in inclusive teacher preparation. The testimony therefore reveals how ableist assumptions become institutionalized, transforming a misconception into a systemic barrier that restricts blind students' access to mathematical knowledge.

Experiences of professionals with blindness in learning and using Mathematics

The experiences of professionals with blindness revealed a range of perspectives on the inclusion of mathematics in their education. Six professionals shared their personal histories, and while one informant who began schooling under the military regime reported having no exposure to mathematics, the other five informants recalled their experiences of learning mathematics from grade 1 through grade 12.

One informant explained: "I learned mathematics up to grade six in a school for the blind, where missionary teachers introduced me to accessible tools like Braille and adaptive technology. This helped me succeed in mathematics. Later, when I moved to a regular school, I faced immense challenges because my teachers were not equipped to support me." Another informant, who had the opportunity to teach mathematics before retirement, stated: "The missionaries brought in valuable tools and methods for teaching mathematics to blind students. Thanks to their efforts, I was able to not only learn the subject but later teach it without significant difficulties."

These accounts illustrate how access to mathematics for students with blindness is closely tied to the availability of adapted instructional methods and teacher preparedness. The first informant's experience shows that when educators are equipped with braille materials, tactile tools, and adaptive technologies, blind learners can participate fully and succeed in mathematics. However, this success is jeopardized when learners transition into mainstream

schools where teachers lack both the skills and resources to provide appropriate support, revealing a sharp divide between specialized and regular school environments. The second informant reinforces this pattern by highlighting the pivotal role missionary educators once played in establishing effective pedagogical practices for blind students. Their adaptive methods not only enabled learners to master mathematical concepts but also empowered some to become mathematics teachers themselves. Together, these testimonies underscore that mathematical competence among blind learners is not an exception but a predictable outcome when inclusive tools and trained educators are present. They also reveal that the current barriers stem from systemic gaps in teacher preparation and the loss of historically inclusive practices.

Reasons for the exclusion of students with blindness from Mathematics lessons

Experts and professionals with blindness were asked why students with blindness were excluded from learning mathematics. All informants attributed this to entrenched negative attitudes among decision-makers and high-profile officials in the Ministry of Education and the regional /city administration education bureaus. They also pointed to the failure of the teacher education system to incorporate adaptive methods for teaching mathematics to students with blindness.

A professional with blindness shared: "When I joined a regular school after finishing grade six, I was forced to drop mathematics. The teacher simply told me that learning mathematics was impossible for someone like me. Despite my previous success, the teacher did not even consider my ability to learn." Another professional reflected on the historical context: "The missionaries who had been instrumental in educating blind students were expelled after the military regime took power. Their absence left a significant gap in how mathematics was taught to blind students."

The testimonies of professionals with blindness show that exclusion from mathematics learning is not rooted in individual ability, but in teachers' beliefs and historical changes that shape educational practice. The first statement asserts that the teacher's decision to exclude students from math classes was based on the assumption that blindness is synonymous with disability, even if the student had previously succeeded in the subject. This reflects a deficit mindset that ignores evidence of ability and places obstacles at the level of attitudes, rather than pedagogical needs. The second statement provides historical context that the expulsion of missionaries, who had previously provided adaptive mathematics learning methods and tools, created a huge gap in teaching competencies for blind students. The combination of teacher prejudice and the loss of inclusive pedagogical traditions confirms that exclusion occurs as a result of the interaction between discriminatory classroom decisions and long-lasting systemic collapse.

Effects of exclusion from Mathematics on the lives of persons with blindness

Informants with blindness shared their thoughts on the consequences of being excluded from learning mathematics. One informant noted that not learning mathematics limited future academic opportunities and professional choices, particularly in fields requiring mathematical knowledge.

One informant with blindness expressed: "During my time in graduate school, I struggled with statistical analysis in my thesis because my past education had not provided me with sufficient mathematical skills. I had to rely on my son, who was in grade 9, to help me with the math I needed for my research." Another professional added: "I feel less confident when interacting with friends who can calculate and discuss numerical issues casually. I sometimes feel incapable of meeting the professional demands that require mathematical understanding."

Conversely, those who had learned mathematics expressed more confidence. One informant, who had learned mathematics throughout the school years, stated: "I learnt mathematics from grade one through grade twelve during the regime of the emperor. I use mathematics daily in various tasks, like shopping or planning activities. It's just a normal part of life for me."

Measures to change the existing unlawful and traditional practices

The final section of the interview focused on measures to address the exclusion of students with blindness from mathematics education. Experts and professionals with blindness recommended several strategies to redress this issue. Teacher training must be strengthened so teachers can use adaptive and accommodative teaching methods to support students with blindness in learning mathematics. The issue of accessibility for students with blindness should be incorporated into both pre-service and in-service teacher training programs. Organizations of persons with disabilities, particularly the Ethiopian National Association of the Blind (ENAB), should raise awareness about the unlawfulness of excluding students with blindness from mathematics and advocate for their rights. The inclusion of Individual Education Plans (IEPs), assistive technologies, and inclusive ICT should become a standard part of mathematics education for students with blindness. A pilot program to showcase effective methods for teaching mathematics to students with blindness in inclusive schools could serve as an example for others to follow. To provide an overview of the steps to improve access to mathematics education for blind students in Ethiopia is as shown in figure 1.

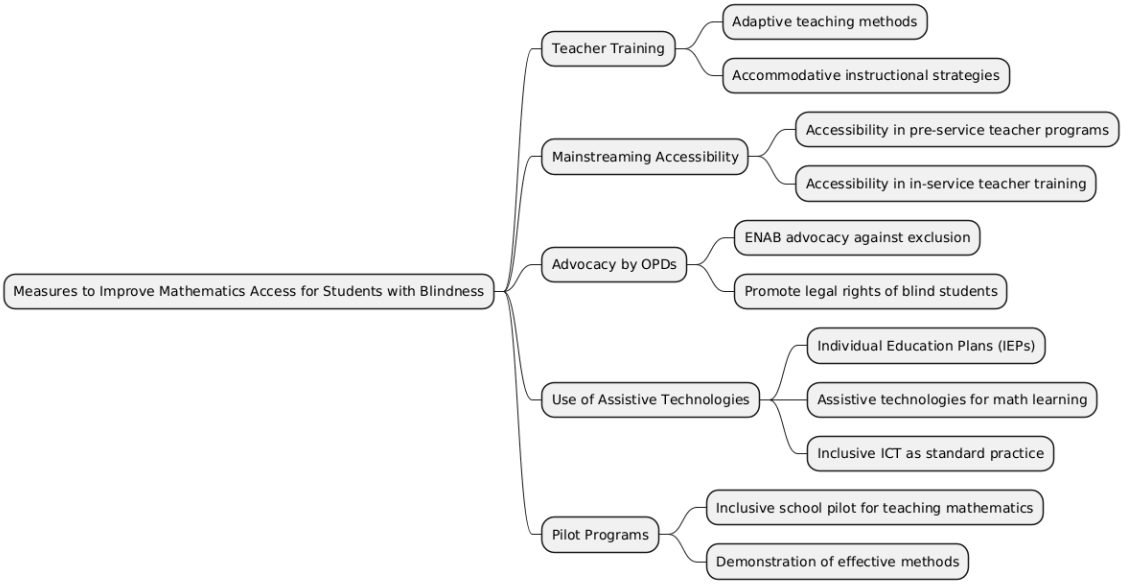

Figure 1. Key Measures Proposed to Improve Access to Mathematics Education for Students with Blindness in Ethiopia

The diagram summarizes five major strategies identified by experts and professionals with blindness to address the long-standing exclusion of blind students from mathematics education. These measures include strengthening teacher training, mainstreaming accessibility in teacher preparation programs, enhancing advocacy efforts by disability organizations such as ENAB, integrating assistive technologies and Individual Education Plans into mathematics instruction, and implementing pilot inclusive school programs. Together, these actions represent a systemic reform approach aimed at restoring the educational rights of students with blindness.

One expert concluded, "We need to invest in teacher training and make sure that all students, including those with blindness, have access to quality mathematics education. This is not just about teaching them a subject. It's about empowering them for life." These findings collectively underscore the urgent need for systemic reform to ensure that students with blindness in Ethiopia are afforded their full educational rights, including access to mathematics education.

Discussion

The findings of this study reveal a persistent and systemic exclusion of students with blindness from mathematics education in Ethiopia, despite the absence of any legal restrictions and the presence of national and international policy frameworks that mandate equitable learning opportunities. Interviews with Ministry of Education officials, regional education bureau experts, representatives of ENAB, and professionals with blindness consistently highlight a contradiction between policy intentions and classroom realities. Mathematics is universally acknowledged as a compulsory subject essential for meeting the

Minimum Learning Competencies (MLCs), yet blind students are routinely denied access due to entrenched beliefs that mathematics is inherently visual and therefore unsuitable for them. Institutional structures such as Inclusive Education Resource Centers remain underutilized, largely because teachers have not been trained in adaptive methods or in the use of tactile and assistive technologies. The testimonies of professionals with blindness who successfully learned mathematics during the missionary era demonstrate that capability is not the issue, but rather systemic neglect. Overall, the findings point to a multilayered barrier rooted in negative attitudes, insufficient teacher preparation, structural inaction, and a failure to implement inclusive education policies that Ethiopia has formally endorsed at national and global levels.

These findings contribute to the broader literature on inclusive education and mathematics learning for students with visual impairments by confirming and extending several key insights. Existing research, such as Hayes & Proulx (2024), identifies negative teacher beliefs as barriers to STEM participation among learners with blindness. This study supports that claim but expands the discourse by showing that such beliefs also influence institutional frameworks, teacher training curricula, and resource allocation practices. The historical discontinuity observed in Ethiopia—where missionary schools once provided effective mathematics instruction to blind learners—fills a significant gap in the literature, which often overlooks the role of political transitions in shaping inclusion trajectories. The findings also contrast with studies from countries where ICT tools and tactile aids have been shown to increase mathematics accessibility (Shoaib et al., 2023), highlighting Ethiopia's delayed adoption of such technologies. Furthermore, the study challenges an implicit assumption in previous literature that policy commitments naturally lead to inclusive practice, demonstrating instead that inclusion collapses without sustained institutional accountability. By documenting the mismatch between CRPD obligations and real educational practices, this study addresses a notable gap regarding how rights-based frameworks are operationalized in low-income countries, thereby offering a nuanced contribution to comparative inclusive education research.

Interpreting these findings through the lens of the social model of disability highlights how exclusion arises not from individual impairments but from institutional structures, cultural perceptions, and pedagogical barriers. The consistent belief among educational leaders that mathematics is inherently visual reflects what Bani Odeh & Lach (2024) describes as socially constructed disablement, where systemic attitudes—not functional abilities—create educational barriers. Applying sensemaking theory further clarifies how actors within the education system interpret disabilities through pre-existing assumptions. High-level officials and teacher educators make sense of blindness by associating it with incapacity, leading them to overlook or undervalue adaptive instructional methods. This sensemaking process sustains institutional inertia, explaining why policies mandating inclusive education fail to translate

into practice (Mizrahi-Shtelman, 2021). At the same time, testimonies from professionals with blindness disrupt these narratives by providing counter-sensemaking grounded in lived experience and historical precedent. Their accounts illustrate that mathematical competence is achievable when environmental barriers are removed, aligning with the core proposition of the social model. The findings thus contribute theoretically by showing how conflicting sensemaking patterns between policymakers, educators, and blind professionals shape the implementation of inclusive mathematics education, revealing tension points where reforms must intervene.

This research offers several significant contributions to the field of inclusive mathematics education, disability studies, and policy analysis. Empirically, the study documents a unique historical trajectory in Ethiopia, revealing how mathematics education for students with blindness shifted from earlier inclusive and effective missionary-led practices to prolonged systemic neglect following political transition. Such historical evidence is rarely captured in existing literature and therefore enriches the global understanding of how sociopolitical contexts shape inclusive education outcomes. Conceptually, the research challenges the dominant assumption that blindness inherently limits mathematical ability by demonstrating, through lived experiences, that exclusion results from institutional attitudes, not learner capacity. This advances the social model of disability by showing how culturally embedded beliefs within teacher education systems actively produce disadvantage. Methodologically, the study introduces a multi-level qualitative analytic framework that links policy discourse, institutional structures, and individual narratives, offering a model for future qualitative inquiries. Practically, the research provides a foundation for rethinking inclusive teacher preparation, demonstrating that meaningful reform must begin with reshaping beliefs and institutional accountability rather than merely supplying assistive tools. Together, these contributions strengthen theoretical discourse, expand comparative literature, and provide a roadmap for transforming mathematics education for learners with blindness.

This study underscores the urgent need to address the persistent exclusion of students with blindness from mathematics education in Ethiopia by revealing the deep misalignment between policy commitments and educational practice. Its contributions are both empirical and theoretical. Empirically, the study provides rare documentation of historical shifts from an inclusive missionary-led model to a post-1974 system characterized by systemic neglect, thereby offering new insights into the political-institutional determinants of inclusion. Conceptually, the findings advance the application of the social model of disability and sensemaking theory in understanding how deficit beliefs and institutional inertia shape pedagogical practices. By demonstrating that capability is not the barrier—systemic structures are—the study reframes the discourse on mathematics education for blind learners from one of perceived impossibility to one of institutional responsibility. The research also contributes

to global debates on CRPD implementation by exposing how rights frameworks remain symbolic without enforcement mechanisms. Ultimately, the study enriches scholarly understanding of inclusive mathematics education and provides a foundation for policy and practice reforms that can restore the educational rights of students with blindness and reshape the future of inclusive schooling in Ethiopia.

CONCLUSION

The exclusion of students with blindness from mathematics education in Ethiopia reflects a systemic challenge rooted in institutional beliefs, limited teacher preparation, and a persistent gap between policy commitments and classroom realities. Although national frameworks and international conventions guarantee equal access to mathematics, the findings reveal that misconceptions about the visual nature of the subject continue to shape educational decisions. Evidence from the experiences of professionals with blindness demonstrates that mathematical competence is attainable when appropriate supports, such as tactile tools and adapted pedagogy, are provided. These insights collectively show that the issue lies not in students' abilities but in structural conditions that restrict their participation.

The broader significance of these findings lies in their call for a shift in how inclusive education is enacted. Ensuring equitable access to mathematics requires dismantling entrenched attitudes, institutionalizing comprehensive teacher training, and translating policy promises into operational practices. The study offers a foundation for future research to explore effective instructional models, evaluate the role of assistive technologies, and understand long-term outcomes for learners who gain access to mathematics. Moving forward, meaningful progress depends on an institutional commitment to recognize mathematics education as an essential right and to redesign the educational environment so that students with blindness can participate fully and succeed.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to all participants who generously shared their experiences and insights, including policymakers, education bureau experts, and professionals with blindness. Special thanks are given to Addis Ababa University for providing academic guidance and an enabling research environment.

REFERENCES

Alam, A., & Mohanty, A. (2023). Cultural Beliefs and Equity in Educational Institutions: Exploring the Social and Philosophical Notions of Ability Groupings in Teaching and Learning of Mathematics. *International Journal of Adolescence and Youth, 28*(1), 2270662. https://doi.org/10.1080/02673843.2023.2270662

Ali, A., Khusro, S., & Alahmadi, T. J. (2024). Accessible Interactive Learning of Mathematical Expressions for School Students With Visual Disabilities. *PeerJ Computer Science, 10*, e2599. https://doi.org/10.7717/peerj-cs.2599

Antony, J., McDermott, O., & Sony, M. (2022). Quality 4.0 Conceptualisation and Theoretical Understanding: A Global Exploratory Qualitative Study. *The TQM Journal, 34*(5), 1169–1188. https://doi.org/10.1108/TQM-07-2021-0215

Bani Odeh, K., & Lach, L. M. (2024). Barriers to, and Facilitators of, Education for Children With Disabilities Worldwide: A Descriptive Review. *Frontiers in Public Health, 11*, 1294849. https://doi.org/10.3389/fpubh.2023.1294849

Bouncken, R. B., Czakon, W., & Schmitt, F. (2025). Purposeful Sampling and Saturation in Qualitative Research Methodologies: Recommendations and Review. *Review of Managerial Science*, 1–37. https://doi.org/10.1007/s11846-025-00881-2

Chen, G. A., & Horn, I. S. (2022). A Call for Critical Bifocality: Research on Marginalization in Mathematics Education. *Review of Educational Research, 92*(5), 786–828. https://doi.org/10.3102/00346543211070050

Darwish, S., Alodat, A., Al-Hendawi, M., & Ianniello, A. (2025). General Education Teachers' Perspectives on Challenges to the Inclusion of Students With Intellectual Disabilities in Qatar. *Education Sciences, 15*(7), 908. https://doi.org/10.3390/educsci15070908

Dosek, T. (2021). Snowball Sampling and Facebook: How Social Media Can Help Access Hard-to-Reach Populations. *PS: Political Science & Politics, 54*(4), 651–655. https://doi.org/10.1017/S104909652100041X

Gonzaga, N. G., Plan, L. D., & Aguipo, M. M. (2024). Readiness and Challenges of General Education Teachers on the Implementation of Inclusive Education. *Russian Law Journal, 12*(1), 8–26.

Hayes, C., & Proulx, M. J. (2024). Turning a Blind Eye? Removing Barriers to Science and Mathematics Education for Students With Visual Impairments. *British Journal of Visual Impairment, 42*(2), 544–556. https://doi.org/10.1177/02646196221149561

Heller, M. (2023). Rethinking Historical Methods in Organization Studies: Organizational Source Criticism. *Organization Studies, 44*(6), 987–1002. https://doi.org/10.1177/01708406231156978

Janis, I. (2022). Strategies for Establishing Dependability Between Two Qualitative Intrinsic Case Studies: A Reflexive Thematic Analysis. *Field Methods, 34*(3), 240–255. https://doi.org/10.1177/1525822X211069636

Jóhannsdóttir, Á., Egilson, S. Þ., & Haraldsdóttir, F. (2022). Implications of Internalised Ableism for the Health and Wellbeing of Disabled Young People. *Sociology of Health & Illness*, *44*(2), 360–376. https://doi.org/10.1111/1467-9566.13425

Kana, F. Y., & Hagos, A. T. (2025). Factors Hindering the Use of Braille for Instruction and Assessment of Students With Visual Impairments: A Systematic Review. *British Journal of Visual Impairment, 43*(2), 396–406. https://doi.org/10.1177/02646196241239173

Kazu, İ. Y., & Kuvvetli, M. (2023). A Triangulation Method on the Effectiveness of Digital Game-Based Language Learning for Vocabulary Acquisition. *Education and Information Technologies, 28*(10), 13541–13567. https://doi.org/10.1007/s10639-023-11756-y

Ketema Dabi, G., & Negassa Golga, D. (2024). The Role of Assistive Technology in Supporting the Engagement of Students With Visual Impairment in Learning Mathematics: An Integrative Literature Review. *British Journal of Visual Impairment, 42*(3), 674–687. https://doi.org/10.1177/02646196231158922

Lochmiller, C. R. (2021). Conducting Thematic Analysis With Qualitative Data. *The Qualitative Report, 26*(6), 2029–2044. https://doi.org/10.46743/2160-3715/2021.5008

Mizrahi-Shtelman, R. (2021). Role Identity and Sensemaking as Institutional Mechanisms for Policy Translation: The Case of School Principals and Education Reforms in Israel. *Leadership and Policy in Schools, 20*(2), 203–221. https://doi.org/10.1080/15700763.2019.1638422

Morgan, H. (2022). Understanding Thematic Analysis and the Debates Involving Its Use. *The Qualitative Report, 27*(10), 2079–2091. https://doi.org/10.46743/2160-3715/2022.5912

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2024). Demystification and Actualisation of Data Saturation in Qualitative Research Through Thematic Analysis. *International Journal of Qualitative Methods, 23*, 16094069241229776. https://doi.org/10.1177/16094069241229777

Nahar, L., Sulaiman, R., & Jaafar, A. (2022). An Interactive Math Braille Learning Application to Assist Blind Students in Bangladesh. *Assistive Technology, 34*(2), 157–169. https://doi.org/10.1080/10400435.2020.1734112

Ng, R., Indran, N., & Liu, L. (2024). Social Media Discourse on Ageism, Sexism, and Racism: Analysis of 150 Million Tweets Over 15 Years. *Journal of the American Geriatrics Society, 72*(10), 3149–3155. https://doi.org/10.1111/jgs.19047

Pahwa, M., Cavanagh, A., & Vanstone, M. (2023). Key Informants in Applied Qualitative Health Research. *Qualitative Health Research, 33*(14), 1251–1261. https://doi.org/10.1177/10497323231198796

Shafaghat, T., Zarchi, M. K. R., Mousavi, S. M., Askari, R., Ranjbar, M., & Ebadi, F. (2023). Iranian Health System Response to the COVID-19 Pandemic.

International Journal of Preventive Medicine, *14*(1), 52. https://doi.org/10.4103/ijpvm.ijpvm_359_21

Shoaib, M., Fitzpatrick, D., & Pitt, I. (2023). Assistive Technology-Based Solutions in Learning Mathematics for Visually-Impaired People: Exploring Issues, Challenges and Opportunities. *Multimedia Tools and Applications*, *82*(29), 46153–46184. https://doi.org/10.1007/s11042-023-17409-z

Steyn, L., Mash, R. J., & Hendricks, G. (2022). Use of the Vula App to Refer Patients in the West Coast District: A Descriptive Exploratory Qualitative Study. *South African Family Practice*, *64*(1), 5491. https://doi.org/10.4102/safp.v64i1.5491

Tan, P., Padilla, A., & Lambert, R. (2022). A Critical Review of Educator and Disability Research in Mathematics Education: A Decade of Dehumanizing Waves and Humanizing Wakes. *Review of Educational Research*, *92*(6), 871–910. https://doi.org/10.3102/00346543221081874

Tebbs, O., Hutchinson, A., Lau, R., & Botti, M. (2021). Evaluation of a Blended Learning Approach to Developing Specialty-Nursing Practice: An Exploratory Descriptive Qualitative Study. *Nurse Education Today*, *98*, 104663. https://doi.org/10.1016/j.nedt.2020.104663

Tenney, K., Stringer, B. P., LaTona-Tequida, T., & White, I. (2023). Conceptualizations and Limitations of STEM Literacy Across Learning Theories. *Journal of Microbiology & Biology Education*, *24*(1), e00168-22. https://doi.org/10.1128/jmbe.00168-22

Trupia, D. V., Mathieu-Fritz, A., & Duong, T. A. (2021). The Sociological Perspective of Users' Invisible Work: A Qualitative Research Framework for Studying Digital Health Innovations Integration. *Journal of Medical Internet Research*, *23*(11), e25159. https://doi.org/10.2196/25159

Wolf, S., & Brown, A. (2023). Teacher Beliefs and Student Learning. *Human Development*, *67*(1), 37–54. https://doi.org/10.1159/000529450

Zelalem, A., Melesse, S., & Seifu, A. (2022). Teacher Educators' Self-Efficacy and Perceived Practices of Differentiated Instruction in Ethiopian Primary Teacher Education Programs: Teacher Education Colleges in Amhara Regional State in Focus. *Cogent Education*, *9*(1), 2018909. https://doi.org/10.1080/2331186X.2021.2018909

Zhou, J., Chen, S.-L. P., Shi, W. W., Kanrak, M., & Ge, J. (2023). The Impacts of COVID-19 on the Cruise Industry Based on an Empirical Study in China. *Marine Policy*, *153*, 105631. https://doi.org/10.1016/j.marpol.2023.105631