



Embodied Learning and Cognitive Experiences Amongst Visually Impaired Students: A Patchwork Ethnographic Study in Odisha, India

Satyabrata Sahoo; K.R. Rama Mohan

Sikkim University, India

Corresponding author: ssahoo.24pdan03@sikkimuniversity.ac.in

DOI: 10.47814/ijssrr.v9i10.3576

Abstract

This article examines embodied learning among visually impaired (VI) students attending residential Schools for the Blind in Odisha, India. Grounding in patchwork ethnographic fieldwork across three institutions, the School for the Blind at Banpur NAC, Bhima Bhoi School for the Blind, and Louis Braille School for the Blind in Bhubaneswar, the study challenges the ocularcentrist assumption that vision plays a primary role in formal education. Drawing from extended classroom observations, the research explores how students engage with language, geography, and mathematics through multiple senses involving touch, sound and spatial memory. The insights from embodied cognition theory, phenomenology of the lived body and sociocultural framework of cognition help to argue that cognition is not just a brain-bound process but rather emerges through dynamic engagements between bodies, environments and practice. Braille learning kits, tactile maps and tactile geometry kits are examined not only as assistive devices but also as generative epistemic tools that construct alternative forms of knowledge. The findings help to reframe visual impairment as a perceptual and cognitive reorganization rather than a deficit, contributing to disability studies scholarship by foregrounding the ontological richness of non-visual knowing. Lastly, it discusses implications for inclusive pedagogy, curriculum design, and educational policy in the Indian context.

Keywords: *Embodied Cognition; Visual Impairment; Disability Studies; Inclusive Education; Multisensory Learning; Braille Literacy; Odisha; Ethnography*

Introduction

Historically, the educational systems around the world have been constructed around vision (Michalko, 1998). Reading involves seeing printed text; geography requires interpreting visual maps; mathematics relies on diagrams, graphs, and symbolic notation. This orientation is described as 'ocularcentrism' (Kavanagh, 2002), privileging the vision as the normative and superior pathway through which humans come to know and understand the world. Within this framework, the visually impaired students have typically been positioned as learners who must compensate for a missing modality, requiring specialized accommodations and assistive technologies to access a curriculum fundamentally designed for sighted ones.

However, ethnographic observation in schools for the blind in Odisha, one of India's eastern states, offers a different picture. Rather than functioning as sites of adjustment, these schools show that alternative practices are not merely substituted for visual ones but are actively cultivated and transmitted through non-visual media. Visually impaired students in these schools navigate language, geography, and mathematics through tactile and auditory modalities that are not residual or second-order forms of knowing, but constitute an epistemic framework in their own right. This paper presents findings from ethnographic fieldwork conducted across three institutions in Khordha District, Odisha. The choice of Khordha is significant as it is the district where the capital is present and has a documented history of special education for visual impairment. This paper seeks to contribute to a more geographically diverse understanding of disability and learning.

The article is organized as follows. Following the introduction, a theoretical section outlines the conceptual framework integrating embodied cognition, phenomenology and sociocultural learning theory. Then, the empirical sections include the fieldwork observations of embodied learning practices in language, geography and mathematics respectively. The final section addresses the roles of memory and rhythm as foundational cognitive

resources for the students. And the paper concludes with a discussion of implications for educational theory, disability studies, and inclusive pedagogical practice in the Indian context.

Theoretical Frameworks

The theoretical ideation of this article rests on three interconnected intellectual traditions. The first is embodied cognition theory. Varela, Thompson and Rosch (1991), in 'The Embodied Mind,' argue that cognition cannot be understood as the manipulation of abstract symbols in a disembodied system. Rather, cognitive processes are 'enacted' through the coupling between the organism and its environment, which is shaped by the organism's engagement with the world. It means we are not simply observing the environment like a computer. Rather, we use our perception and action at the exact time to understand and create experience. For example, traditionally, we look at the road while driving, process the ongoing traffic, then move our foot towards the brake. But in enacted view, the vehicle becomes a physical extension that responds to the flow of traffic.

The second is Merleau-Ponty's phenomenology of the lived body (1962). For Merleau-Ponty, perception is not a passive reception of sensory data by a detached subject but an active, intentional engagement with the world conducted through the body. He rejects Descartes' idea of body-mind dualism. The body, according to him, is not merely an object in the world; it is the very medium through which a subject has a world at all. His concept of the 'body schema,' i.e., the pre-reflective, habitual understanding of one's own body and its capacities for movement within an environment, is particularly relevant for understanding the observations.

The third framework is Vygotsky's sociocultural theory of cognitive development (1978). Vygotsky's central argument is that children's minds develop not through isolated activities but through social interactions, in which higher mental functions are first formed and later internalized by individuals. First, the child develops Elementary mental Functions through attention, perception and memory; then, through social interaction, it develops higher mental functions. For example, a child in a farming community physically sees the different crops grown in each season and, through social interaction, understands the agricultural seasons in which various crops are grown. The journey toward understanding the transition from elementary to higher mental functions is known as the Zone of Proximal Development (ZPD), i.e., the distance between a learner's current understanding and their ability to perform a task independently. To cover this distance, they need temporary support from More Knowledgeable Others (MKO) through scaffolding. For instance, as discussed above, the rural child learns about the agricultural seasons from his parents and comes to understand the seasons on his own. Here, the learning of the agricultural season to understand it on its own is in the ZPD; the parents become MKO, while the knowledge of understanding is scaffolding. Together, these three frameworks provide a theoretical lens for making sense of the empirical material presented in this paper.

Methodology

The observations on which the paper is based were conducted over multiple visits to the Schools for the Blind. The methodologies involved are Patchwork Ethnography for collecting data and situational analysis for analyzing a particular situation. Patchwork ethnography advocates by stitching together short-term field works to collect fragmented data and make it understandable as a whole, like the long-term fieldwork by maintaining a relationship with the community (Günel & Watanabe, 2024). Situational Analysis extends grounded theory by shifting the focus of research from a single central human process to the entire situation as the unit of analysis (Clarke, 2016).

Together, these Observations were recorded in field notes written up immediately after each visit, capturing as much sensory detail as possible, i.e., the sounds of screen readers, the physical arrangements of students around tactile materials, the spatial organization of classrooms, and the nature of teacher-student interactions from three institutions, the School for the Blind at Banpur NAC, Bhima Bhoi School for the Blind, and Louis Braille School for the Blind in Bhubaneswar.

In the interest of methodological transparency and in accordance with emerging norms in disability research and the social sciences regarding the use of artificial intelligence (AI) tools, the author discloses that Grammarly is employed as a writing assistant during the drafting and revision of this manuscript. The use of AI for this purpose was limited to structural and organizational tasks; no analytical interpretations, theoretical framings, or empirical claims in this paper were generated or substantially altered by the AI system. The authors acknowledge that the use of AI tools in academic research raises important ethical and epistemological questions, particularly in disability studies, where questions of representation, voice, and authentic knowing are central.

Reflexivity is an important consideration in this research. As researchers with personal familiarity with visual impairment, the authors bring to this work both situated knowledge and particular interpretive commitments that necessarily shape the observations they make and the analyses they advance. The authors have tried to be

transparent about these interpretive commitments throughout this paper, while also recognizing that they represent a form of epistemological positioning rather than a methodological limitation to be overcome.

Language Learning as Multisensory Embodied Literacy

Language learning for visually impaired students challenges some of the most deeply held assumptions about what literacy is and how it develops. In mainstream educational discourse, influenced by decades of cognitive science and reading research largely conducted with sighted populations (Bendy and Saxe, 2012), literacy is routinely conceptualized as a visual-linguistic activity, i.e., learning to read means learning to decode written symbols perceived through the eye. The observations reported here substantially complicate this account.

In the computer laboratories of the schools visited, students learn to type using desktop computers equipped with NVDA (Non-Visual Desktop Access) screen readers. What is immediately striking to the observational eye or, more precisely, to the observational ear and ethnographic attention is the intricate sensorimotor choreography involved in this activity. Students locate keys through tactile memory, pressing raised Braille markers on keycaps to orient their fingers. Each keystroke is followed almost instantaneously by auditory confirmation from the NVDA software, which reads back the character, word, or navigation action performed. The student pauses, listens, confirms, and proceeds. Writing thus becomes a recursive, dialogic process, i.e., a conversation among the learner's body, the keyboard as a material artifact, and the auditory feedback generated by assistive software. These pauses, which an observer unfamiliar with learning practices might initially interpret as hesitations or difficulties, are in fact moments of active cognitive work.

Observations of the Hexis Braille Reader, a device that presents text through an array of tactile Braille cells, reveal a different rhythm of literary engagement but an equally embodied one. Students move their fingertips across the cells with deliberate, exploratory movements that closely resemble Merleau-Ponty's description of the body schema (1962). The device is not experienced as external technology but as a prosthetic extension of the learner's haptic sensory apparatus. Reading through the Hexis device is slow, recursive, and intensely physical. Students frequently return to previously read cells, re-tracing familiar patterns to consolidate emerging meanings. Reading is thus not a linear extraction of information but a spatiotemporal construction of meaning through cumulative bodily engagement with a tactile text.

Perhaps the most striking classroom observation involved a blind teacher with limited mobility instructing young students in foundational Braille literacy. This teacher, whose direct experience of visual impairment gave her a distinctly embodied pedagogical authority, guided students through a sequence that inverted the typical progression of visual literacy learning. Rather than presenting written text visually and asking students to decode it, she began with the auditory presentation of phonological units through spoken syllables and words, before transitioning to tactile activities involving pegs and Braille frames, and finally to students producing Braille writing themselves. This sequence embodied a fundamentally different theory of how literacy is acquired: from sound to touch to text, rather than from text to sound.

From a Vygotskian perspective, this pedagogical sequence is notable for the way in which the teacher's verbal instruction and physical guidance mediated students' appropriation of literacy tools. The Braille frame, the pegs, the spoken phonological units: all of these function as what Vygotsky called 'psychological tools,' i.e., culturally developed mediating artifacts that transform natural perceptual processes into culturally organized cognitive ones. The classroom is a community of practice in which literacy is not transmitted but co-constructed through joint, mediated, embodied activity.

These observations suggest that reading and writing, far from being exclusively visual-linguistic activities, are fundamentally multimodal and corporeal practices whose visual instantiation in mainstream schooling represents one culturally specific realization of a more general capacity for embodied symbolic engagement. Students do not access literacy despite lacking vision; they participate in a form of literacy constituted through various bodily engagements with material artifacts, and it makes different but equally complex cognitive demands.

Geography Learning Through Tactile Exploration and Spatial Memory

Among the academic subjects in which ocularcentrist assumptions are most deeply embedded, geography occupies a central place. The discipline's reliance on maps, visual representations of spatial relationships rendered in two-dimensional cartographic form, seems to presuppose a sighted learner as its normative subject. Tactile maps, in this conventional framing, appear as compensatory substitutes, translations of visual information into haptic form for those who cannot access the original. The observations reported here challenge this compensatory narrative and suggest a more generative account.

During a geography lesson at one of the schools, a student was observed engaging with a tactile political map of Odisha, a raised-surface map on which district boundaries and coastlines are represented by differently textured ridges and surfaces, with Braille labels. The student's engagement with this map was strikingly different from the glance-and-grasp mode of reading visual maps. She began at the coast, running her fingertips slowly along the textured line representing the Bay of Bengal, establishing a reference boundary before moving inward. Her fingers traced district boundaries with exploratory, recursive movements, frequently backtracking to known positions before advancing into unfamiliar areas. She worked systematically from south to north, integrating Braille labels, which she read by touch while maintaining spatial context with the other hand, into an emerging mental model of the state's administrative geography.

This observation reveals that tactile map reading is not a degraded or slower version of visual map reading but a distinct cognitive practice with its own internal logic and epistemic virtues. Visual map reading typically proceeds through a gestalt-like simultaneous apprehension of spatial relationships, with sequential inspection of details following an initial holistic orientation. Tactile map reading, by contrast, is necessarily sequential and exploratory, i.e., knowledge of the whole emerges from the accumulation of part-by-part tactile encounters over time. This gives rise to what might be described as a temporally distributed form of spatial cognition, in which the map is understood not as a static visual object but as a dynamic sequence of embodied spatial encounters.

Merleau-Ponty's analysis of the phenomenology of the lived body is relevant here. For Merleau-Ponty (1962), the space is not defined by how the mind perceives the body, but a lived, perspectival space organized around the body's own capacities for movement and orientation. The student's progressive construction of a mental map of Odisha through fingertip exploration is an instance of this lived spatiality: a geographical understanding that is not stored as a visual image but constituted through a history of bodily movements and tactile encounters.

Memory's role in this process deserves particular attention. Repeated tactile map exploration does not merely refresh pre-existing visual memories but generates new tactile-kinaesthetic memory traces organized around movement sequences and spatial rhythms. Students who repeatedly engaged with a particular map could navigate it with increasing fluency and confidence, suggesting that spatial memory is constituted by embodied procedural knowledge, i.e., knowledge of how to move through a tactile space rather than by declarative visual imagery.

Morning assembly practices observed across the schools offered a further dimension of geographical knowing. Students collectively recited the names of Indian states and their capitals, principal rivers, mountain ranges, and political leaders in a rhythmic call-and-response format. These recitations function as what might be called 'auditory maps': organized sequences of geographical information encoded in rhythm and collective vocal performance, and recoverable through the embodied memory of participation in repeated communal practice. Geography, in these assembly settings, is not represented spatially but enacted temporally, through the rhythmic, coordinated bodies of students engaged in collective vocal performance.

The convergence of these observations points toward a fundamentally spatial but non-visual form of geographical knowing, constituted through the integration of tactile map exploration, bodily movement, rhythmic memory, and social recitation. This form of knowing is not lesser than visual geographical knowledge; it is differently constituted, organized around different bodily and social practices, and possesses its own forms of reliability, complexity, and epistemic depth.

Mathematical Learning Through Touch, Spatial Reasoning, and Collaborative Verification

Mathematics presents particular challenges for students with visual impairments because much of mathematical culture, such as its notation systems, diagrams, and spatial representations, is organized visually. Equations, graphs, geometric figures, and number lines are all visual artifacts that presuppose a sighted reader. Yet observations in mathematics classrooms across the Schools reveal that mathematical thinking can not only survive but flourish through alternative embodied practices.

Geometry classrooms provided some of the richest observational material. Students were equipped with tactile geometry kits containing Braille rulers and protractors, compasses, pins, rubber bands, and raised pegboards. When constructing geometric figures, the observed lesson focused on equilateral triangles; students worked through a sequence of physical actions rather than visual inspections. To construct an equilateral triangle with side length a , a student first established one vertex with a pin, then measured a distance along one axis using the Braille ruler, placed a second pin, measured the same distance along another axis from the first pin, placed a third pin, and then connected the three pins with rubber bands, checking alignment and symmetry through touch. The geometric property $a = b = c$ was not memorized as a verbal formula but confirmed through bodily action: the student could feel that the three sides were equal because she had measured each of them with the same physical procedure.

This observation illustrates what the embodied cognition literature describes as 'grounded mathematics' (Lakoff & Núñez, 2000): the thesis that even the most abstract mathematical concepts are ultimately grounded in bodily experiences of space, movement, and manipulation. For students, this grounding is not metaphorical but literal: the abstract concept of an equilateral triangle is understood through the physical experience of constructing one, measuring and confirming equal distances by touch, and feeling the symmetry of the completed figure. Mathematical understanding is constituted through physical action, not merely illustrated by it.

Arithmetic instruction using Taylor's Mathematical Frame offered a different but equally compelling instance of embodied mathematical cognition. The Taylor Frame is a grid-based tactile device in which numerical values are represented by the placement of pegs in specific positions, allowing students to represent and manipulate numbers and arithmetic operations through physical arrangement. In the observed lessons, students placed and moved pegs under teachers' verbal instruction, constructing representations of arithmetic operations and then verifying the results by touch. The physical arrangement of pegs was not a representation of a prior mental calculation but the calculation itself: thinking occurred in the manipulation of artifacts, not as a preparatory step to it.

From a sociocultural perspective, the collaborative dimensions of mathematics classrooms are significant. Students frequently consulted each other during problem-solving activities, describing their peg arrangements verbally, requesting tactile confirmation from peers, and negotiating interpretations of ambiguous tactile configurations. This collaborative practice is not a pedagogical luxury but a cognitive necessity. The verification of mathematical results through social consensus, through multiple bodies confirming the same tactile arrangement, performs functions in mathematical practice that visual inspection performs for sighted students. The reliability of mathematical knowledge is established socially and physically, through the convergence of multiple sensory checks, rather than through the individual visual inspection of a written answer.

Teachers in mathematics classrooms played a scaffolding role that went beyond verbal instruction. Experienced teachers physically guided students' hands to correct positions, modeled procedures through shared tactile demonstrations, and provided running verbal commentary that served as an organizational scaffold for students' tactile explorations. This constitutes what Rogoff (1990) has described as 'guided participation,' a form of apprenticeship in which novices are gradually inducted into the embodied practices of a community of experts through joint activity rather than explicit instruction alone.

Memory, Rhythm, and the Temporal Architecture of Embodied Knowledge

Cutting across the domain-specific analyses presented above are a pair of cognitive resources that appear fundamental to embodied learning among students, i.e., memory and rhythm. Both have important theoretical implications for how we understand cognition in the absence of vision, and both point toward the temporal dimension of knowing as an undertheorized aspect of educational and cognitive science.

Memory, as observed, operates very differently from the visual-declarative model that dominates cognitive psychology. In mainstream cognitive science, memory is often conceptualized as the storage and retrieval of visual or propositional representations, such as mental images, facts, and rules, by an individual cognitive system. The observations reported here suggest that memory in visually impaired students is better understood as procedural, distributed, and embodied, which is organized around sequences of movement, the sensorimotor routines required to navigate familiar artifacts, and the kinaesthetic traces left by repeated physical engagements with specific materials.

Students remember keyboard layouts not as visual images of keyboards but as networks of finger movements, each key location encoded as a specific motor pattern relative to reference points established by raised markers. They remember tactile maps not as static spatial images but as procedural sequences, i.e., start from the coast, move to find borders and braille labels. They remember arithmetic procedures not as visual algorithms but as kinaesthetic routines for manipulating pegs on the Taylor Frame. This procedural, embodied form of memory is not inferior to visual-declarative memory; it may, in fact, be more robust in certain respects, since motor memories are often more resistant to forgetting than visual-declarative ones.

Rhythm emerges as a second crucial cognitive resource across all three domains observed. In language learning, the rhythmic structure of Braille reading, i.e., the measured pace of fingertip movement across cells, the regular cadence of auditory feedback from screen readers, provides a temporal scaffold that organizes attention and enables the integration of information across time. In geography, the rhythmic collective recitations of morning assemblies encode spatial information in temporal form, transforming geographical knowledge from a visual representation into an embodied temporal performance. In mathematics, the rhythmic handling of pegs, the

counting rhythms that accompany arithmetic operations, and the measured sequences of tactile geometry construction all provide temporal structures that organize cognitive activity.

These observations suggest that the temporal dimension of cognition, such as the role of rhythm, timing, sequencing, and temporal structure in organizing mental activity, deserves much greater attention in both cognitive science and educational research than it has typically received. For students with visual impairments, temporal structures may serve organizing functions that spatial-visual structures serve for sighted learners, suggesting a fundamental equivalence between different forms of cognitive organization that subverts the assumption of visual cognitive superiority.

Implications for Educational Theory and Disability Studies

The findings presented in this paper have implications across several intellectual domains. In educational theory, they challenge the visual-linguistic norms that dominate mainstream curricula and pedagogical practice. The experiences of students in Odisha demonstrate that complex academic content, including content as visually organized as geography and mathematics, can be fully and rigorously engaged through non-visual embodied practices. This suggests that the visual organization of mainstream curricula reflects not a cognitive necessity but a cultural and historical contingency: the institutionalization of educational practices developed by and for sighted majorities.

The implications for inclusive education policy in India are particularly significant. The Rights of Persons with Disabilities Act 2016 (RPwD Act) and the National Education Policy 2020 (NEP) both articulate commitments to inclusive education for students with disabilities, including those with visual impairment. However, inclusive education policy in practice often defaults to a model of integration, i.e., placing visually impaired students in mainstream classrooms with access to assistive technology, without adequately addressing the deeper question of whether mainstream pedagogical practices are epistemologically inclusive. The findings of this study suggest that truly inclusive education would require not merely the provision of assistive devices but a fundamental rethinking of curriculum design, teaching methods, and assessment practices to accommodate and valorize diverse embodied forms of knowing.

For disability studies, the findings reinforce and extend the social model of disability (Oliver, 1990), while adding a specifically epistemic dimension that the social model has not always foregrounded. The social model argues that disability is produced not by impairment but by social and architectural environments that are organized around the needs of non-disabled majorities. This study extends this argument into the domain of epistemology, such that it is not merely the physical environment, but the epistemic environment, i.e., the assumption that knowledge is fundamentally visual, that has historically marginalized non-visual ways of knowing.

At the same time, the findings resist a simple inversion of this hierarchy. It would be mistaken, and a disservice to the students whose practices are described here, to romanticize non-visual cognition or to suggest that visual impairment is an uncomplicated epistemic advantage. The students in this study work hard, employ sophisticated strategies, and navigate genuine challenges. The argument is not that non-visual knowing is better than visual knowing but that it is genuinely knowing a legitimate, complex, socially organized form of epistemic engagement with the world that deserves recognition, study, and institutional support.

The presence of blind and visually impaired teachers in the schools observed is worth commenting on specifically. These teachers bring to their pedagogical practice an embodied authority that sighted teachers, however well-trained, cannot fully replicate. They teach from direct experience of the cognitive practices they are guiding students to develop. This suggests that the recruitment, training, and professional development of teachers with visual impairment should be a priority for inclusive education policy, not merely as a matter of workforce diversity but as a pedagogical asset for students.

The findings also speak to broader debates within disability studies about the relationship between knowledge production and disability identity. Emancipatory disability research (Barnes & Mercer, 1997) has argued for research paradigms in which disabled people are not merely objects of study but active participants in the production of knowledge about their own lives and experiences. The schools for the blind in Odisha are institutional spaces in which this emancipatory potential is partially realized, i.e., teachers transmit embodied knowledge to students, creating intergenerational communities of epistemic practice that do not depend on sighted intermediaries for their reproduction. Scholarship that documents and theorizes these practices, as this paper attempts to do, serves the broader goal of making non-visual epistemic practices visible and legible within academic discourse.

It is also worth considering the implications of these findings for the design and evaluation of assistive technologies. Assistive technology research and development is often driven by a logic of visual simulation, i.e., technologies aim to provide visually impaired individuals with information that approximates what sighted users

would obtain visually, through text-to-speech and tactile graphics. While such technologies are undeniably valuable, the observations reported here suggest that a complementary design logic might also be productive, one that starts from the distinctive cognitive practices and asks how technology can support and extend those practices, rather than beginning from a sighted norm and asking how to translate visual information into non-visual form. The Hexis Braille Reader and Taylor's Mathematical Frame are examples of technologies that, at their best, embody this alternative logic, i.e., they are not visual-to-tactile translators but tools specifically designed to afford the kinds of sequential, exploratory, physically grounded cognitive practices through which students build knowledge.

Finally, the methodological dimension of this research invites reflection on what it means to conduct ethnographic fieldwork in settings where the researcher's sensory experience differs fundamentally from participants'. Ethnography depends on participation and observation, but in classrooms for VI students, the most important forms of participation and observation are tactile and auditory rather than visual. A partially sighted researcher's visual field observations are inevitably limited; they capture external bodily movements and artifact configurations but cannot access the tactile and auditory experiences that constitute the cognitive substance of the artifact. This limitation has been mitigated, but not eliminated, through extended fieldwork, repeated observation, informal conversations with students and teachers, and sustained attention to verbal accounts of cognitive experience.

Conclusion

This paper has argued, on the basis of ethnographic fieldwork in schools for the blind in Odisha, India, that learning among visually impaired students is constituted through rich, complex, socially organized embodied practices that challenge the ocularcentrist assumptions of mainstream educational theory. In language learning, literacy emerges through the interplay of touch, sound, memory, and social interaction, mediated by artifacts such as Braille frames, screen readers, and tactile keyboards. In geography, spatial knowledge is constructed through sequential tactile map exploration, kinaesthetic bodily memory, and collective rhythmic recitation. In mathematics, abstract concepts are grounded in physical manipulation of tactile artifacts, verified through collaborative social practice, and scaffolded by the guided participation of expert teachers.

These practices do not represent mere compensation for the absence of vision. They are positive, culturally elaborated forms of epistemic engagement with the world, organized around different but equally legitimate bodily capacities, cultural tools, and social practices. They demonstrate that the association of genuine knowing with vision is a cultural assumption, not a cognitive necessity, and that education organized around this assumption systematically undervalues and fails to cultivate the distinctive epistemic capacities of students.

The theoretical frameworks employed in this paper, such as embodied cognition, phenomenology, and sociocultural learning theory, converge on a view of knowledge as an active, relational, and corporeal achievement rather than a passive, individual, and mental one. The experiences of students in Odisha powerfully illustrate and extend this view, demonstrating that the body's engagement with the world takes many forms and that each can generate genuine, complex, and socially valuable knowledge.

Future research in this area might examine in greater depth the specific social and institutional conditions that support the development of rich embodied learning practices in schools for the blind; the ways in which digital technologies are transforming these practices; and the possibilities for mutual learning between mainstream and specialist educational settings. The students whose experiences are described in this paper are not simply adapting to disability; they are showing us new possibilities for human cognition, new ways of engaging with language, space, and number that enrich our collective understanding of what it means to know.

A particularly promising avenue for future investigation concerns the longitudinal trajectories of students as they transition from special schools for the blind into mainstream higher education or employment contexts. The embodied cognitive practices they develop, i.e., tactile literacy, spatial memory, rhythmic knowledge organization, and collaborative verification, may transfer in complex and non-obvious ways to new contexts, and their adaptability and resilience may represent underrecognized graduate competencies that are relevant well beyond the domain of disability studies. Research that follows students through these transitions, attending to both the affordances and the constraints of their embodied cognitive repertoires across different institutional settings, would make an important contribution to our understanding of both disability and cognition.

The geographic specificity of this research, its situatedness in Odisha, in institutions that have developed their practices in the particular historical, cultural, and policy context of post-independence India, is both a limitation and a strength. It is a limitation because it precludes straightforward generalization to educational contexts elsewhere. It is a strength because it insists on the cultural and institutional embeddedness of cognitive practices,

resisting the tendency of cognitive science to treat cognitive processes as universal, culture-free, and context-independent. The embodied learning practices documented here are not simply the expression of universal human cognitive capacities freed from visual constraint; they are culturally specific achievements, shaped by particular institutional histories, pedagogical traditions, assistive technology ecosystems, and social relations. Understanding them fully requires attending to these contextual dimensions rather than abstracting from them. This is one of the most important contributions that ethnographic methods can make to the study of cognition, and it is a contribution that disability studies, with its tradition of situating disability in social and political context, is particularly well placed to appreciate and extend.

This paper has sought to demonstrate that the schools for the blind in Odisha are not spaces of educational deficit but sites of genuine epistemic innovation, i.e., places where alternative ways of knowing are cultivated, transmitted, and refined across generations of visually impaired learners and teachers. Taking their practices seriously, as this paper has attempted to do, is not merely an act of scholarly inclusion. It is an act of epistemic justice, a recognition that the human capacity for learning and knowing is richer, more varied, and more resilient than ocularcentrist educational systems have allowed us to see.

Declaration of interest

There is no conflict of interest.

References

- Barnes, C., & Mercer, G. (1997). *Doing disability research*. The Disability Press.
- Bedny, M., & Saxe, R. (2012). Insights into the origins of knowledge from the Cognitive Neuroscience of Blindness. *Cognitive Neuropsychology*, 29(1–2), 56–84. <https://doi.org/10.1080/02643294.2012.713342>
- Clarke, A. E. (2016). Situational analysis. *The Blackwell Encyclopedia of Sociology*. <https://doi.org/10.1002/9781405165518.wbeos0777>
- Günel, G., & Watanabe, C. (2023). Patchwork ethnography. *American Ethnologist*, 51(1), 131–139. <https://doi.org/10.1111/amet.13243>
- Kavanagh, D. (2004). Ocularcentrism and its others: A framework for metatheoretical analysis. *Organization Studies*, 25(3), 445–464. <https://doi.org/10.1177/0170840604040672>
- Lakoff, G., & Núñez, R. (2000). *Where mathematics comes from: How the embodied mind brings mathematics into being*. Basic Books.
- Merleau-Ponty, M. (1962). *Phenomenology of perception* (C. Smith, Trans.). Routledge & Kegan Paul.
- Michalko, R. (1998). *The mystery of the eye and the shadow of blindness*. University of Toronto Press.
- Ministry of Education, Government of India. (2020). *National Education Policy 2020*. Government of India.
- Ministry of Law and Justice, Government of India. (2016). *The Rights of Persons with Disabilities Act, 2016*. Gazette of India.
- Oliver, M. (1990). *The politics of disablement*. Macmillan.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. Oxford University Press.
- Varela, F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience*. MIT Press.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner & E. Souberman, Eds. & Trans.). Harvard University Press.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal. This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (CC BY 4.0).