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EMBODIED KNOWLEDGE AND MOVEMENT SCIENCE IN ASSAM'S SATTRA TRADITION: MATI AKHORA, GURU- SISHYA PARAMPARA, AND NATURAL SCIENCE INTEGRATION FOR INTANGIBLE CULTURAL HERITAGE

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ABSTRACT

Assam's Sattra tradition, founded by the Vaishnav saint-scholar Srimanta Sankardeva (1449–1568), represents one of the most coherent and historically continuous systems of integrated artistic, spiritual, and pedagogical knowledge in Northeast India. The tradition sustains four principal art forms: Sattriya classical dance, Ankiya Nat devotional theatre, Borgeet sacred music, and Putala Nach puppetry through an unbroken chain of teacher-disciple transmission across more than five centuries. Central to this system is Mati Akhora, the foundational movement grammar of Sattriya dance, which encodes a verifiable body of somatic knowledge whose biomechanical, physiological, and cognitive dimensions have received no systematic scientific examination to date. This ethnographic and analytical study applies an interdisciplinary framework combining movement science, cognitive psychology, and cultural documentation to examine Mati Akhora training and the Guru-Sishya Parampara (teacher-disciple transmission system) across three principal Sattra centres: Majuli, Bordowa, and Barpeta. Ethnographic fieldwork comprising twenty-seven practitioner interviews and extended participant observation reveals that selected Mati Akhora forms exhibit precise structural convergences with classical yogic postures codified in Yoga Shastra, which Sankardeva is documented to have studied, confirming that the training system represents deliberate application of established somatic science to performative pedagogy. Biomechanical principles embedded in these forms including postural alignment, neuromuscular sequencing, joint stabilisation, and energy-efficient movement patterning align with contemporary findings from kinesiology, exercise physiology, and movement therapy. The Guru-Sishya Parampara, examined through Rudolf Laban's Movement Analysis, Emile Jaques-Dalcroze's eurhythmics, and Carl Jung's theory of the collective unconscious, exhibits structural features that correspond to modern theories of embodied cognition, mirror neuron activation, experiential learning, and intrinsic motivational psychology. The study argues that systematic integration of natural science methodologies with this tradition through kinematic analysis, physiological assessment, and digital archiving constitutes a viable and urgent pathway for preserving, validating, and extending the contemporary relevance of Assam's intangible cultural heritage, with significant implications for Indian Knowledge Systems (IKS) research, cultural sustainability, and interdisciplinary wellness science.

1. INTRODUCTION

The performing traditions of India carry within them centuries of systematically accumulated knowledge about the human body, its somatic capacities, its relationship to rhythm, narrative, and communal practice, and its cultivation through structured, long-term discipline. These traditions are not merely aesthetic achievements; they are knowledge systems whose empirical dimensions, their biomechanical architecture, physiological outcomes, cognitive effects, and pedagogical design have only begun to receive scientific attention. Within the growing field of Indian Knowledge Systems (IKS) research, which the Ministry of Education, Government of India, has prioritised as a domain of national scholarship, the documentation and scientific validation of traditional performing arts constitutes both an intellectual imperative and a policy priority (Gogoi, 2023).

Assam's *Sattriya* tradition occupies a distinctive position within this scholarly landscape. Although *Sattriya* has been recognised since 2000 as one of India's eight classical dance forms, its natural science dimensions remain substantially underdocumented in comparison with traditions such as *Bharatanatyam* and *Kathak*, for which biomechanical and physiological research has been conducted over the past two decades (Mukherjee, 2015; Medhi and Choudhury, 2019). This disparity is not a reflection of the tradition's scientific depth but of the relative neglect of Northeast Indian cultural traditions within the mainstream of Indian performing arts scholarship. The present study seeks to redress this imbalance by bringing movement science, cognitive psychology, and cultural ethnography into sustained dialogue with the somatic and pedagogical knowledge embedded in the *Sattria* system.

The *Sattria* institutions, established by the Vaishnav saint-scholar Srimanta Sankardeva (1449–1568) and proliferating across Assam from the seventeenth century onwards, number more than nine hundred today, distributed across the Brahmaputra valley and its tributaries (Das, 2018). They function simultaneously as monastic centres, schools of performing arts, community organisations, and repositories of manuscript knowledge, all unified by the devotional framework of *eka sharana nama dharma* the Neo-Vaishnavite path of singular devotion to *Krishna*. The arts they sustain *Sattriya* dance, *Ankiya Nat* one-act theatre, *Borgeet* devotional song, and *Putala Nach* puppetry constitute an integrated corpus of intangible knowledge whose transmission across five centuries through the *Guru-Sishya Parampara* represents one of the most durable instances of

embodied knowledge preservation in the Indian subcontinent (Neog, 1980; Barua, 2009).

Three sites were selected for fieldwork based on their historical significance, institutional diversity, and representativeness of different facets of the *Sattria* tradition. Majuli, the world's largest inhabited river island and home to sixty-four *Sattras*, is the most celebrated centre of *Sattriya* performing arts and manuscript preservation in Assam and has been the subject of several cultural and ecological studies (Goswami, 2021; Sharma, 2020). Bordowa, the birthplace of Sankardeva himself, houses the Bordowa *Thaan* established by Sankardeva and the Narowa *Sattria*, both significant sites of Vaishnavite learning and philosophical discourse (Baruah, 2017; Bhattacharya, 2022). Barpeta, with over seventy *Sattras* including the historically paramount Barpeta *Sattria* founded by Madhavdeva, Sankardeva's principal disciple, is a major centre for the preservation of the *Guru-Sishya Parampara* and *Sattriya* performance traditions (Kalita, 2018). Together these three sites encompass the full geographic, institutional, and stylistic range of the *Sattria* tradition, making them an ideal basis for a study that seeks to document this tradition's natural science dimensions.

The study is organised as follows. Section 2 examines *Mati Akhora* as a movement system, addressing its structural taxonomy, its convergences with *Yoga Shastra*, and its biomechanical principles. Section 3 analyses the *Guru-Sishya Parampara* through cognitive neuroscience, movement theory, and depth psychology frameworks. Section 4 addresses the integration of natural science frameworks with the tradition's knowledge. Section 5 describes the study's methodology. Section 6 presents discussion and Section 7 conclude with implications and future directions.

2. MATI AKHORA: THE MOVEMENT GRAMMAR OF SATTRIYA DANCE

2.1 Definition, Structure and Taxonomy

The Assamese compound *mati akhora* translates literally as exercises performed on the ground. Within the pedagogical architecture of *Sattriya* dance, however, the term carries a more precise technical meaning: it designates the complete foundational vocabulary and the structural grammar upon which all subsequent choreographic elaboration is built. As Barua (2009) documents, no student of *Sattriya* dance is introduced to individual dance compositions until the full *Mati Akhora* repertoire has been internalised through sustained, supervised practice. The *Mati Akhoras* thus function analogously to the *adavus* of

Bharatanatyam not as preparatory warm-up exercises but as the constitutive grammatical units of a movement language, the mastery of which is prerequisite to any further expressive development. Sixty-four named *Mati Akhora* forms are documented in the tradition, each assigned a specific functional context within the pedagogical system (see Appendix, Table A1). This internal differentiation reveals a deliberately designed curriculum architecture that distinguishes three categories of movement practice. The first category comprises pure conditioning exercises forms such as *Khasaka* (the salutatory opening exercise, combining physical warm-up with devotional salutation to the *Guru*), *Kachabandh*, *Morai pani khowa*, *Kachai pani khowa*, *Udha lon*, *Thiyo lon*, *Teltupi*, *Zor-Kamitona*, and *Kamitona*. These forms are not directly incorporated into choreographic performance but build the somatic foundations spinal flexibility, hip mobility, core stability, lower limb strength, and proprioceptive awareness upon which performative competence depends. The second category comprises forms that function simultaneously as conditioning exercises and as choreographic elements applicable in dance compositions: *Orat baha-utha*, *Beng jap* (*Bhekola jap*), *Hatpakowa*, *Gerowa-sowa*, *Chatrawali*, *Harbhanga*, *Pani-sisha*, and *Buku chuwa*. The third category comprises forms designated exclusively as choreographic elements, including the extensive range of *pak* (spinning) forms *Purush pak*, *Prakriti pak*, *Akal pak*, *Uor pak*, *Pithi pak*, *Thita pak*, *Cereki pak*, and their variants along with *Moropa*, *Muruka*, *Citika*, *Jalak*, *Sigha jalak*, and numerous others.

This tripartite taxonomy is not merely classificatory. It reflects an understanding of physical development as a staged process requiring the systematic establishment of somatic foundations before expressive elaboration is introduced a principle that contemporary exercise science terms periodisation, and which sports medicine identifies as essential for both performance optimisation and injury prevention (Mukherjee, 2015). That such a principle should be embedded in a sixteenth-century performative training system is itself a significant IKS finding, indicating that the architects of *Sattriya* pedagogy possessed a functional understanding of somatic development that anticipates modern exercise science by several centuries.

2.2 Convergences with Yoga Shastra

Among the most scientifically significant findings of this study is the systematic correspondence between specific *Mati Akhora* forms and classical yogic postures as codified in *Yoga Shastra*. This

correspondence is not incidental. Neog (1980) documents that Srimanta Sankardeva was not merely an artist and religious reformer but a practitioner and scholar of yoga who had studied *Yoga Shastra* thoroughly. The integration of yogic principles into the *Sattriya* training system thus reflects deliberate pedagogical design: the application of an established somatic science to the specific physical demands of a performative tradition.

Two correspondences are particularly well attested through ethnographic investigation and scientifically significant in their biomechanical implications. The *Thiyo-Lon* of *Mati Akhora* is structurally homologous with *Chakrasana*, the wheel pose of classical *yoga*. Both postures demand sustained thoracic and lumbar spinal hyperextension, continuous engagement of the deep paraspinal and multifidus musculature to maintain the arch, full shoulder girdle mobility with active scapular retraction, and sustained quadriceps engagement to stabilise the extended knee. Practitioners across all three field sites report consistently and in detail that regular *Thiyo-Lon* practice produces increased spinal flexibility, reduced sensation of muscular load during sustained performance, and improved ease of recovery from the exertional phases of *Sattriya* choreography. These reported outcomes correspond precisely to the documented physiological effects of *Chakrasana* practice on thoracic mobility, paraspinal muscular endurance, and spinal extension capacity (Chopra, 2015). Senior *gurus* at Majuli and Barpeta further note that *Thiyo-Lon* is identified in the tradition as essential preparation for the sustained elevated backbend postures that appear in several *Sattriya* dance numbers a functional relationship that demonstrates awareness, within the tradition itself, of the form's conditioning role.

The *Jur-Kamitona* form parallels *Dhanurasana*, the bow pose. Both engage the anterior kinetic chain comprehensively: the hip flexors and quadriceps contract to maintain the lower limb position while the thoracic spine extends into a sustained backward arch, requiring simultaneous engagement of the thoracic extensors and passive stretching of the anterior thoracic structures. This form is identified by senior *gurus* across all field sites as particularly important for developing the abdominal strength and anterior chain flexibility required to sustain the *Ora* position the characteristic deep-knee-bend standing stance, performed in both the outwardly rotated *purush* (male) and inwardly oriented *prakriti* (female) variants throughout extended performance sequences. The *Ora* position, which is the foundational stance of *Sattriya* performance, places

sustained demands on the knee extensors, hip external rotators, and lumbar stabilisers; the *Jur-Kamitona's* conditioning of the anterior chain directly prepares these structures for this demand (Medhi and Choudhury, 2019).

Beyond these two primary correspondences, practitioners and gurus identify numerous other *Mati Akhora* forms as possessing what they consistently describe as 'yogic qualities': a quality of sustained, breath-integrated, whole-body engagement that distinguishes them from purely mechanical exercises. This practitioner testimony is consistent with the hypothesis that the full *Mati Akhora* curriculum was designed with reference to yogic principles of somatic development, and that the tradition embodies an applied somatic science rooted in Yoga Shastra but adapted to the specific physical demands of *Sattriya* performance.

2.3 Biomechanical Principles

Movement observation analysis of *Mati Akhora* forms, conducted across the three field sites in consultation with senior practitioners, identifies several biomechanical principles whose contemporary scientific relevance extends well beyond the performative context of *Sattriya* dance. Three principles merit particular attention.

First, the *Mati Akhora* curriculum employs a systematic progression of joint-loading complexity. Early forms in the conditioning category engage smaller, more stable joint complexes the wrist, the ankle, the cervical spine before advancing to compound movements that load the knee, hip, and lumbar spine simultaneously under the additional demands of dynamic balance and directional momentum. This progression directly mirrors the joint-preparation and graduated-loading principles that contemporary sports medicine identifies as essential for musculoskeletal injury prevention and long-term training sustainability (Mukherjee, 2015). The tradition's implicit understanding that peripheral joint preparation must precede central joint loading demonstrates a functional biomechanical intelligence that has significant implications for the design of contemporary dance training programmes.

Second, the characteristic turned-out hip position required by the *Ora* stance sustained bilateral external rotation of the hip joints against gravity and the resistance of the practitioner's own body weight systematically develops the deep external rotator group of the hip, including the piriformis, obturator internus and externus, gemelli, and quadratus femoris. This development is not merely a

performative requirement; it produces functional stabilisation of the hip joint under dynamic load that has been shown in the broader dance medicine literature to protect the medial knee structures the medial collateral ligament and medial meniscus against the valgus strain injuries that are among the most common and debilitating in dance medicine (Medhi and Choudhury, 2019). That a sixteenth-century training system should have arrived at a training posture that contemporary biomechanics validates as protective of the medial knee is a finding of both historical and practical significance.

Third, and perhaps most distinctively, the *Mati Akhora* system integrates breath co-ordination into its movement patterns in a manner that reflects advanced respiratory physiology. Exhalation is consistently co-ordinated with the effort phase of each movement the phase of maximal muscular contraction and force production while inhalation is reserved for the recovery phase. This pattern, which mirrors the *pranayama* informed breathing discipline that Sankardeva's *yoga* training would have provided, produces several physiological benefits that contemporary exercise science has documented: enhanced intra-abdominal pressure during effort phases, which provides spinal stabilisation; reduced oxygen cost per unit of work through more efficient respiratory mechanics; and lower cardiovascular demand at given exercise intensities, supporting greater endurance (Capra, 2010). The integration of this principle into a performative training system rather than into a purely meditative or therapeutic context demonstrates the *Sattriya* tradition's sophisticated understanding of the relationship between breath, movement, and physical endurance.

3. THE GURU-SISHYA PARAMPARA: PEDAGOGY AS EMBODIED SCIENCE

3.1 Historical and Structural Context

The *Guru-Sishya Parampara* from Sanskrit guru (teacher), *shishya* (disciple), and *parampara* (uninterrupted succession) constitutes the educational infrastructure through which the *Sattriya* system's artistic and spiritual knowledge is transmitted across generations. Its roots in the Upanishadic tradition are well established: the *Chandogya* and *Brihadaranyaka* Upanishads describe the residential apprenticeship model that became the template for systematic learning across disciplines in ancient India, from Vedic recitation and Ayurvedic medicine to martial arts and fine arts (Radhakrishnan, 1953). Sankardeva adopted and systematised this model as the institutional backbone of his cultural and spiritual movement, ensuring that

the arts complex he developed would be transmitted with structural fidelity across generations through a chain of masters who each bore personal responsibility for their disciples' development (Subramanian, 2007).

Within the *Sattra* context, the *Parampara* operates simultaneously at two analytically distinguishable but practically inseparable levels. The formal level concerns the transmission of specific technical knowledge: the sequences of *Mati Akhora* forms, the choreographic vocabulary and compositions of *Sattriya* dance, the textual and melodic content of *Borgeet*, and the theatrical conventions of *Ankiya Nat* performance. The dispositional level concerns the transmission of the cultivated attitudes, values, and modes of attention that constitute the Vaishnavite ethos within which the arts are embedded: devotional attentiveness, aesthetic discrimination, disciplined self-regulation, and communal responsibility. These two levels are inseparable in practice because, within the *Sattra* system, artistic knowledge is understood not as technical skill separable from its meaning but as a form of devotional practice in which technical mastery and spiritual cultivation are simultaneously pursued. The student learns not only how to perform the *Thiyo-Lon* but why that form matters what relationship it bears to the practitioner's physical, spiritual, and communal life (Neog, 1980).

3.2 Neurological and Cognitive Mechanisms

Contemporary cognitive neuroscience provides a productive set of frameworks for understanding why the *Guru-Sishya Parampara* achieves the remarkable retention rates that ethnographic observation consistently records among its practitioners, and why the knowledge it transmits appears to be so durable and so deeply embodied. Three mechanisms are particularly relevant.

The discovery of mirror neurons motor neurons that fire both when an individual executes a movement and when the same individual observes another executing the same movement provides a neurological basis for understanding the efficiency of observation-based learning as practised in the *Parampara* (Jung, 1981; Aiyar, 2013). When a student of *Sattriya* watches a senior guru execute a *Mati Akhora* sequence, the student's motor cortex activates in patterns that partially simulate the execution of the observed movement, creating what researchers term motor simulation or neural resonance between teacher and student. This simulation is not merely cognitive; it is neuromotor, meaning that observation alone produces partial motor learning. The guru's

subsequent tactile correction of the student's replication attempt activates proprioceptive and somatosensory neural pathways, consolidating the motor memory through multiple sensory channels simultaneously visual, kinaesthetic, proprioceptive, and tactile in a manner that no single-channel learning mode can replicate. The *Parampara's* instructional sequence expert demonstration, guided replication, immediate embodied correction thus constitutes a multi-channel neuromotor learning protocol whose effectiveness contemporary neuroscience validates.

The rhythmic structure of *Mati Akhora* training provides a second mechanism of cognitive effectiveness. All *Mati Akhora* sequences are practised in co-ordination with the *taal* (rhythmic cycle) marked by the *khol* drum, ensuring that movement learning is always simultaneously musical learning. This integrated music-movement training engages the cerebellar and basal ganglia circuits responsible for rhythmic motor sequencing, which are distinct from the cortical circuits that govern deliberate, attention-demanding movement control. Sustained practice under rhythmic structure produces what movement scientists' term automatization the transfer of motor control from attention-demanding cortical systems to more automatic subcortical systems which is the neurological signature of expert performance and the precondition for the expressive freedom that characterises master *Sattriya* dancers. Emile Jaques-Dalcroze's eurhythmics principle that musical understanding is fundamentally a bodily achievement requiring kinesthetic embodiment rather than cognitive abstraction (Aiyar, 2013) is structurally instantiated in *Sattriya* pedagogy centuries before Dalcroze articulated it, representing an independent indigenous formulation of the same pedagogical insight.

Rudolf Laban's Movement Analysis framework provides a third analytical lens. Laban's four-component model Body, Effort, Space, Shape enables precise description of the qualitative structure of *Mati Akhora's* pedagogical progression (Mukherjee, 2015). Early conditioning forms are characterised by Laban's 'sustained' and 'bound' Effort qualities: movements are slow, controlled, and heavily weighted, building kinesthetic awareness, proprioceptive sensitivity, and muscular endurance in the practitioner. As the curriculum advances through the intermediate forms to the choreographic elements, the Effort qualities shift progressively toward 'free', 'quick', and 'light' qualities, enabling the expressive range that performative contexts require. This systematic progression from controlled

conditioning to free expression maps precisely onto contemporary periodisation models in sports training models that are considered foundational to modern athletic preparation confirming that the *Mati Akhora* curriculum embodies a scientifically sophisticated understanding of physical development.

3.3 Jungian and Psychological Dimensions

Carl Jung's theory of the collective unconscious the layer of the psyche containing universal archetypal images inherited from the accumulated symbolic experience of humanity provides a framework for understanding dimensions of *Sattriya* training that purely somatic or cognitive analyses cannot fully account for (Jung, 1981). The mythological figures who populate *Sattriya* narrative *Krishna* in his multiple forms, Radha in her devotional longing, the demon-vanquisher *Vishnu*, the devoted *Gopi* community are not merely cultural characters specific to the Vaishnavite tradition. They are, in Jungian terms, archetypal configurations whose psychological resonance extends beyond their specific cultural context to engage universal patterns of human meaning-making: the divine-human encounter, the transformative power of devotion, the tension between worldly and transcendent life. When practitioners embody these figures through sustained, long-term performance training, they engage their own psychological relationship to these archetypal contents, producing the deep identification, motivational sustenance, and sense of participating in something larger than individual technical achievement that ethnographic observation records among senior *Sattriya* practitioners at all field sites.

This Jungian dimension does not displace biomechanical or cognitive analysis but enriches it. It explains why the affective and devotional dimensions of *Sattriya* training appear to be integral rather than incidental to its physical and cognitive effectiveness: the practitioner who is deeply motivated by devotional meaning will sustain the years of disciplined practice that *Sattriya* mastery requires more readily than one motivated by aesthetic or competitive goals alone. The Parampara's embedding of technical training within a devotional and communal framework is thus not merely culturally distinctive but pedagogically functional a structural feature whose psychological intelligence the Jungian framework helps to articulate.

4. INTEGRATING NATURAL SCIENCE WITH INTANGIBLE CULTURAL HERITAGE

The convergence between Assam's performative traditions and contemporary natural science is not a projection of modern categories onto pre-modern practice. The traditions themselves embody systematic empirical knowledge of the human body developed through centuries of observation, practice, and pedagogical codification within the *Sattra* system. What contemporary natural science offers is not a replacement for this knowledge but an additional and complementary vocabulary for articulating, validating, and extending it into contemporary contexts of application.

The IKS research framework, as articulated by the IKS Division, Ministry of Education, Government of India, identifies several specific domains in which traditional Indian knowledge systems carry contemporary relevance: wellness and preventive medicine, educational design, environmental knowledge, and cultural sustainability (Gogoi, 2023). The *Mati Akhora* system addresses the first two of these directly. As a structured physical training system with demonstrated biomechanical intelligence, it has potential applications in wellness programming, rehabilitation medicine, and preventive health care that extend well beyond its original performative context. Its systematic development of spinal flexibility, hip stability, respiratory efficiency, and neuromuscular co-ordination positions it as a traditional movement modality comparable in its health benefits to Tai Chi, which has achieved significant recognition in contemporary preventive medicine and rehabilitation research (Capra, 2010). As a pedagogical model, the *Guru-Sishya Parampara*'s integration of embodied learning, rhythmic co-ordination, intrinsic motivation, and individualised instruction provides design principles for contemporary educational programmes that current neuroscience and learning theory validates as optimal (Subramanian, 2007; Aiyar, 2013).

Digital technology and AI-based tools further expand the possibilities for integrating natural science with this tradition. Three-dimensional motion capture and kinematic analysis can document the full *Mati Akhora* movement vocabulary with a precision that written description and video recording alone cannot achieve, creating a permanent, computationally analysable archive of embodied knowledge. AI-driven movement analysis can identify biomechanical patterns in practitioner movement that are invisible to unaided observation, potentially revealing subtleties of technique that

even experienced gurus struggle to articulate verbally. Virtual and augmented reality environments can create immersive training simulations that extend the *Guru-Sishya Parampara's* observational learning model into digital spaces, making *Sattriya* training accessible to students who cannot undertake residential apprenticeship in the

traditional manner (Goswami, 2021). These technological possibilities are not in tension with the tradition's integrity; they are, rather, new instruments for the same purpose the tradition have always served: the accurate transmission of embodied knowledge across generations.

Table 1. Scientific dimensions and contemporary applications of Assam's Sattra artistic traditions.

Artistic Tradition	Natural Science Dimensions	Contemporary Applications
<i>Sattra</i> Tradition (<i>Sattriya</i> , <i>Ankiya Nat</i> , <i>Borgeet</i>)	Neuromuscular coordination; respiratory control; cardiovascular conditioning; cognitive memory and narrative processing	Holistic education integrating arts and neuroscience; movement-based physiotherapy; cognitive enhancement programmes; sound-based therapeutic interventions
<i>Mati Akhora</i> (foundational movement grammar)	Biomechanical motion efficiency; postural control and spinal stability; energy-efficient movement; proprioceptive development; <i>Yoga Shastra</i> convergences	Athlete training and rehabilitation; sports science; AI-driven motion analysis; elderly mobility; physiotherapy for musculoskeletal conditions
<i>Guru-Sishya Parampara</i> (teacher-disciple transmission)	Mirror neuron activation; embodied cognitive conditioning; stress regulation through devotional rhythm; motor memory consolidation through multi-channel learning	Personalised AI-assisted education; experiential learning curriculum design; mental resilience and mindfulness training; intergenerational knowledge frameworks

5. METHODOLOGY

This study employs a mixed-methods interdisciplinary design that integrates ethnographic fieldwork with movement

observation analysis and systematic review of physiological and cognitive science literature relevant to traditional movement systems. The choice of mixed methods reflects the nature of the

subject matter: *Mati Akhora* and the *Guru-Sishya Parampara* are simultaneously cultural, somatic, and cognitive phenomena, each dimension of which requires appropriate methodological tools. Ethnographic fieldwork was conducted across Majuli, Bordowa, and Barpeta over multiple research phases, encompassing a total of fourteen weeks of immersive engagement at the three sites. Data collection methods included: extended participant observation at *Sattra* training sessions, formal performance events, initiation ceremonies, and daily communal activities; semi-structured and structured interviews with twenty-seven participants purposively selected to include senior *Sattriya* gurus with more than twenty years of teaching experience, *satradhikars* (*Sattra* administrators), practising dancers at three levels of training (beginner, intermediate, and advanced), and cultural historians with specialist knowledge of the *Sattra* tradition; and archival examination of manuscript collections at the Bordowa *Thaan* and Barpeta *Sattra*, as well as published historical documentation of *Sattriya* training methodology.

Movement observation analysis applied Rudolf Laban's Movement Analysis framework to document the qualitative structure of selected *Mati Akhora* forms as performed by senior practitioners at each site, systematically recording Body, Effort, Space, and Shape dimensions for each form. This framework was selected because it provides a scientifically recognised and inter-rater reliable method for describing movement qualities that bridges aesthetic and biomechanical discourse, enabling comparison across traditions and facilitating the design of future quantitative studies. Physiological and biomechanical evidence was drawn from a systematic review of published research on Indian classical dance (Mukherjee, 2015; Medhi and Choudhury, 2019) and closely related traditional movement systems including yoga, Tai Chi, and other Indian martial arts (Capra, 2010; Chopra, 2015), applied by structured analogy to the documented movement characteristics of *Mati Akhora* forms. Cognitive and psychological dimensions were examined through a narrative review of relevant neuroscience, cognitive psychology, and educational psychology literature (Jung, 1981; Subramanian, 2007; Aiyar, 2013), systematically related to the ethnographic findings from practitioner interviews.

Ethical clearance for the ethnographic component was obtained from the Institutional Ethics Committee of The Assam Royal Global University

prior to fieldwork commencement. Informed consent was obtained from all participants; practitioner testimony is reported anonymously throughout except where individuals explicitly consented to identification. Data collection, storage, and analysis followed institutional ethical guidelines for research involving human participants.

6. DISCUSSION

The analysis presented in the preceding sections establishes that Assam's *Sattra* tradition specifically the *Mati Akhora* training system and the *Guru-Sishya Parampara* constitutes an integrated system of embodied knowledge whose natural science dimensions are verifiable, significant, and practically applicable in contemporary contexts. Several findings carry implications for IKS research, cultural heritage science, and natural science scholarship.

The structural convergences between *Mati Akhora* forms and *Yoga Shastra* postures most clearly demonstrated in the *Thiyo-Lon* and *Chakrasana* correspondence and the *Jur-Kamitona* and *Dhanurasan* correspondence establish that the *Mati Akhora* system represents a deliberate application of established somatic science to performative training. This finding carries a significant epistemological implication: it challenges the dichotomy between 'traditional knowledge' and 'scientific knowledge' that continues to structure much heritage discourse. The *Sattra* tradition did not develop *Mati Akhora* through cultural intuition or spiritual revelation alone; it applied a systematically codified understanding of human somatic development *Yoga Shastra* to a new practical domain. This is, by any definition, scientific reasoning, and recognising it as such has implications for how IKS scholarship conceptualises the relationship between traditional and modern knowledge systems.

The *Guru-Sishya Parampara's* correspondence with contemporary theories of optimal motor learning through mirror neuron activation, multi-channel sensory learning, rhythmic automatising, and intrinsic motivational structure supports the argument that this system's pedagogical effectiveness is not culturally idiosyncratic but grounded in general features of human neurocognitive architecture. This correspondence suggests that the *Parampara's* design principles could be productively applied in contemporary educational contexts beyond the *Sattra* in training programmes for other performing arts traditions, in

sports coaching, in professional skills development, and in the design of AI-assisted personalised learning systems. The tradition thus carries relevance not only as a subject of cultural heritage research but as a source of design principles for contemporary educational innovation.

The challenges facing the *Sattra* tradition declining patronage, urbanisation, reduced availability for residential apprenticeship, and competition from globalised entertainment forms are real, documented, and consequential (Sharma, 2014; Das, 2018). However, the study's findings suggest that these challenges are not insuperable, and that scientific documentation and validation constitute an important component of any strategy for the tradition's sustainability. When a traditional practice can be shown to produce measurable physical and cognitive benefits that are relevant to contemporary wellness and educational contexts, it acquires institutional advocates beyond the community of cultural heritage scholars: sports scientists, physiotherapists, rehabilitation specialists, and educational technologists who can support the tradition's survival from a perspective of professional self-interest as well as cultural appreciation. Scientific validation thus serves not only the epistemological project of IKS scholarship but the practical project of cultural sustainability (Gogoi, 2023; Bhattacharya, 2022).

7. CONCLUSION

This study has examined Assam's *Sattra* tradition – specifically *Mati Akhora* and the *Guru-Sishya Parampara* through the lens of natural science and movement science, demonstrating that these traditions encode a systematic somatic and pedagogical knowledge whose scientific dimensions are both empirically verifiable and practically applicable in contemporary contexts of wellness, rehabilitation, and education. The biomechanical architecture of *Mati Akhora*, rooted in Sankardeva's deliberate integration of *Yoga Shastra* with performative training, aligns with contemporary principles of exercise science, kinesiology, and injury prevention in ways that are specific, documented, and significant. The *Guru-Sishya Parampara's* structural features embodied demonstration, multi-channel sensory correction, rhythmic automatization, devotional motivational embedding, and individualised progressive instruction correspond to neuroscientific and cognitive psychological findings on optimal

conditions for complex motor learning and long-term knowledge retention.

These findings collectively support the characterisation of these traditions as living knowledge systems requiring scientific engagement rather than cultural artefacts requiring only preservation and display. Positioned within the IKS research framework mandated by the Ministry of Education, Government of India, this study contributes empirical and analytical substance to the argument that India's traditional performative traditions are resources for contemporary innovation in health, education, and cultural sustainability not merely testimonies to historical achievement. The urgency of systematic scientific documentation cannot be overstated: the senior practitioners who hold the complete embodied knowledge of the *Mati Akhora* repertoire represent a dwindling community whose passing would constitute irreversible epistemological loss.

Future research directions include: longitudinal biomechanical studies tracking practitioners from early training through advanced performance levels, establishing developmental norms and enabling evidence-based curriculum design; randomised controlled trials examining the therapeutic potential of *Mati Akhora* for specific clinical populations, including older adults at risk of falls and individuals in post-surgical or neurological rehabilitation; comparative analysis of *Mati Akhora* with the training systems of other Indian classical dance forms and with non-Indian traditional movement systems such as Tai Chi and Butoh; and development of AI-assisted motion capture and analysis tools that can extend the *Guru-Sishya Parampara's* corrective function into digital learning environments. The present study provides the conceptual, ethnographic, and analytical foundations upon which these empirical research programmes can be built.

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APPENDIX: MATI AKHORA FORMS INVENTORY

Table A1. Sixty-four named *Mati Akhora* forms and their functional contexts in *Sattriya* dance pedagogy.

No.	Name	Functional Context
1	<i>Khasaka</i>	Conditioning exercise; salutation to the Guru
2	<i>Ora (Purush / Prakriti)</i>	Initial standing position – male and female dance styles
3	<i>Orat baha-utha</i>	Conditioning and choreographic element
4	<i>Harbhanga</i>	Conditioning exercise; applicable in dance
5	<i>Pani-sisha</i>	Conditioning exercise; applicable in dance
6	<i>Saman ora</i>	Dance pose
7	<i>Udha-chota</i>	Dance element
8	<i>Baha chota</i>	Dance element
9	<i>Ora chota</i>	Dance element
10	<i>Samukhalai chota</i>	Dance element
11	<i>Kati chota</i>	Dance element
12	<i>Etiya chota</i>	Dance element
13	<i>Gerowa-sowa</i>	Conditioning exercise; applicable in dance
14	<i>Orat jap</i>	Dance element
15	<i>Bagh jap</i>	Dance element
16	<i>Beng jap (Bhekola jap)</i>	Conditioning and choreographic element
17	<i>Samukhaloi jap</i>	Dance element
18	<i>Kachabandh</i>	Conditioning exercise
19	<i>Hatpakowa</i>	Conditioning exercise; applicable in dance
20	<i>Moropa</i>	Dance element
21	<i>Muruka</i>	Dance element
22	<i>Bahamuruka</i>	Dance element
23	<i>Thiyo muruka</i>	Dance element
24	<i>Hat salowa</i>	Dance element
25	<i>Citika</i>	Dance element
26	<i>Ketela</i>	Dance element
27	<i>Jalak</i>	Dance element
28	<i>Sigha jalak</i>	Dance element
29	<i>Tewai</i>	Dance element
30	<i>Kakilakhosa</i>	Dance element
31	<i>Khahaki</i>	Dance element

No.	Name	Functional Context
32	<i>Jatoni</i>	Dance element
33	<i>Athuwa</i>	Dance element
34	<i>Kati khar</i>	Dance element
35	<i>Cit khar</i>	Dance element
36	<i>Luti khar</i>	Dance element
37	<i>Olata khar</i>	Conditioning exercise
38	<i>Chatrawali</i>	Conditioning and choreographic element
39	<i>Morai pani khowa</i>	Conditioning exercise
40	<i>Kachai pani khowa</i>	Conditioning exercise
41	<i>Udha lon</i>	Conditioning exercise
42	<i>Thiyo lon</i>	Conditioning exercise; used in Natuwa Nach
43	<i>Athu lon</i>	Conditioning exercise; used in Natuwa Nach
44	<i>Tamal muchora</i>	Conditioning exercise
45	<i>Buku chuwa</i>	Conditioning and choreographic element
46	<i>Purush pak</i>	Dance element
47	<i>Prakriti pak</i>	Dance element
48	<i>Akal pak</i>	Dance element
49	<i>Uor pak</i>	Dance element
50	<i>Pithi pak</i>	Dance element
51	<i>Thita pak</i>	Dance element
52	<i>Cereki pak</i>	Dance element
53	<i>Shari pak</i>	Dance element
54	<i>Geri pak</i>	Dance element
55	<i>Thengmela tukura pak</i>	Dance element
56	<i>Udha cereki pak</i>	Dance element
57	<i>Teltupi</i>	Conditioning exercise
58	<i>Zor kamitona</i>	Conditioning exercise
59	<i>Kamitora</i>	Conditioning exercise
60	<i>Tukura pak</i>	Dance element
61	<i>Kati pak</i>	Dance element
62	<i>Uddha cereki pak</i>	Dance element
63	<i>Theng mela tukura pak</i>	Dance element
64	<i>Uor pak – tukura pak (combined sequence)</i>	Dance element