Comparative Study of Ancient Gurukul and Modern Boarding School

Sandesh Vishwakarma[1], Ar.Swarna Junghare[2]
[1]Student, Amity School of Architecture and Planning, Amity University Chhattisgarh
[2]Assistant Professor, Amity School of Architecture and Planning, Amity University Chhattisgarh

Abstract—**This research paper presents a comparative study of ancient Indian Gurukul systems and modern boarding schools, focusing on architectural, environmental, cultural, and pedagogical dimensions. By studying spatial morphology, climatic responsiveness, materiality, circulation patterns, and learning philosophies, the research extracts lessons relevant for future educational campus design. Through literature review and four detailed case studies Nalanda Mahavihara, Takshashila, The Doon School, and Rishi Valley School the study identifies principles of decentralized planning, ecological symbiosis, material honesty, and experiential learning. The findings propose a hybrid educational model combining institutional efficiency with the environmental and humanistic grounding of the ancient Gurukul tradition.**

Index Terms—**Gurukul, Boarding School, Educational Architecture, Environmental Design, Pedagogy, Vernacular Planning, Learning Environments.**

I. INTRODUCTION

Education in India has undergone a profound evolution from the spiritually immersive and ecologically embedded Gurukul system to the modern boarding school model characterized by structure, infrastructure, and administrative rigor. While ancient Gurukuls integrated learning with nature, community, and self-discipline, modern institutions prioritize academic competition, leadership-building, and formal structure. Despite the temporal distance between these systems, both have shaped India's educational identity. This paper investigates these two paradigms by focusing on their architectural settings, environmental strategies, circulation logic, cultural symbolism, and pedagogical practices.

II. RATIONALE - LITERATURE-BASED STUDY

A literature-based research approach is essential for this study because ancient Gurukul systems and early educational institutions such as Nalanda and Takshashila no longer exist in fully functional physical form, making empirical or on-site analysis insufficient. Their architectural, environmental, and pedagogical characteristics are preserved primarily through archaeological reports, historical texts, and scholarly interpretations. Similarly, contemporary boarding schools represent diverse typologies across India, and a literature review offers the most comprehensive method to compare their theoretical foundations, design logics, and environmental strategies without limiting the study to a single site.

A literature-based methodology also allows the integration of multidisciplinary perspectives architecture, education, environmental design, vernacular studies, and cultural history ensuring a deeper and more holistic understanding of how learning environments evolve over time. By synthesizing established theories, documented case studies, and expert analyses, this approach provides a rigorous and credible foundation for deriving design principles applicable to future educational campuses. It ensures that the research remains analytical, historically grounded, and conceptually strong despite the absence of direct practical experimentation.

III. METHODOLOGY

The methodology for this research comprises:

1. A structured literature review of traditional and Modern educational typologies.
2. Comparative case study analysis of two ancient Gurukuls and two modern boarding schools.

3. Synthesis of architectural, environmental, and pedagogical insights to develop design principles.

IV. LITERATURE STUDY

Educational environments in India have evolved through diverse cultural, climatic, and pedagogical influences. The literature on ancient Gurukuls and modern boarding schools highlights several architectural and environmental themes that directly shape learning. The following sub-sections synthesise major findings from books, archaeological reports, vernacular architecture studies, and contemporary educational research.

4.1. Courtyard Planning in Educational Architecture

The courtyard is one of the most significant spatial typologies found across ancient Indian learning environments. (Iman Ibrahim, Nadia Al Badri, Emad Mushtaha, & Osama Omar, 2022) emphasises that courtyards function simultaneously as climatic moderators, social condensers, and pedagogical arenas. Archaeological analyses of Nalanda Mahavihara reveal that each vihara was organized around a central courtyard, enabling cross-ventilation, controlled daylight, and thermal comfort while creating a communal learning environment (Ar. Ruchika Srivastava & Dr. Mohit Kumar Agarwal, 2023)

(Pramar, 1989) asserts that the courtyard typology in Indian architecture establishes a balance between built and open space, encouraging interaction and reflection qualities essential to the Guru–Shishya tradition. In contrast, modern boarding schools use courtyards as formal lawns or assembly spaces, with reduced climatic or pedagogical integration. However, recent literature on school design (Dudek, 2000) suggests renewed interest in courtyard-based learning environments due to their flexibility, visibility, and environmental efficiency.

4.2 Structural Typologies: Clustered vs Institutional Models

Ancient Gurukuls primarily adopted cluster-based structural typologies, resulting in intimate and flexible learning environments. (Goutham, Bamboo U, 2022) notes that Gurukul structures typically bamboo, mud, wattle-and-daub, or timber were lightweight and organically distributed across natural terrain. Excavations at Takshashila reveal a network of dispersed hermitages rather than a centralized institutional block, demonstrating a fluid learning ecosystem shaped by nature (Marshall, 1951).

Conversely, modern boarding schools follow institutional structural systems, often influenced by British colonial planning. Broome's design for The Doon School reflects axial planning, symmetry, and functional zoning, resulting in strong institutional identity but limited spatial fluidity (Ritu Gupta & Saurabh Verma, 2020). (Foucault, 1977) argues that centralized and rigid institutional layouts privilege discipline, hierarchy, and surveillance over experiential forms of learning. In contrast, contemporary models such as Rishi Valley School attempt to blend traditional pedagogic values with modern requirements by organizing classrooms and residences into decentralized clusters that maintain structural stability while enabling openness, autonomy, and ecological engagement.

4.3 Materiality: Vernacular Wisdom vs Institutional Permanence

Material selection plays a significant role in shaping educational environments. (Oliver, 1997) describes vernacular materials mud, bamboo, thatch, lime plaster as inherently climate-responsive and sustainable. Ancient Gurukuls relied on these materials for insulation, comfort, and ecological harmony. Nalanda's use of fired bricks and lime mortar demonstrates early mastery in modular construction and thermal mass (Michell, 1995).

In contrast, modern boarding schools often prioritize institutional permanence through brick, concrete, steel, and manufactured roofing materials. (Hershberger, 1999) explains that such materials symbolize durability and authority but may reduce sensory richness and climatic adaptability. Rishi Valley School departs from conventional institutional architecture by integrating contemporary educational requirements with vernacular construction techniques such as stone masonry and compressed earth blocks thereby exemplifying an ecologically grounded spatial pedagogy that resonates with indigenous learning principles. (Aher, 2021)

4.4 Spatial Planning Logics

Spatial planning in Gurukuls was inherently decentralized and landscape-embedded. Historical

accounts describe movement within ancient Indian learning centres as an intentional experiential sequence, where learners transitioned through open-air classrooms, shaded courtyards, and landscaped pathways to reinforce ecological engagement (Aher, 2021). Nalanda's campus, recorded in Xuanzang's 7th-century travel writings and documented archaeologically by (Marshall, 1951), employed modular repetition across multiple monastic units to accommodate thousands of students while maintaining strong spatial continuity. In contrast, Takshashila's decentralized and non-hierarchical layout evident in Marshall's excavation reports enabled fluid mobility between its various specialized schools, fostering interdisciplinary learning. On the other hand, modern boarding schools utilize centralized, function-based zoning, where classrooms, dormitories, dining halls, and activity areas are distinctly separated (Dudek, 2000). Although efficient, this reduces the fluidity found in Gurukul models. Rishi Valley School is one of the few modern examples that restores spatial continuity by integrating cluster planning, pedestrian linkages, and contour-sensitive layouts.

4.5 Landscape Integration and Environmental Responsiveness

The literature strongly reflects the importance of landscape in shaping Indian educational traditions. Gurukuls traditionally used natural environments groves, water bodies, open grounds as direct extensions of the classroom. (Rachel Kaplan & Stephen Kaplan, 1989) agree that nature-enhanced environments support cognitive clarity, emotional stability, and creativity.

Environmental responsiveness in ancient campuses included passive cooling, shading trees, evaporative cooling via water systems, and orientation-sensitive layouts (Mitra, 1977). Modern boarding schools often treat landscape as a visual amenity. However, Rishi Valley's campus exemplifies ecological learning environments, where reforestation, water conservation, and biodiversity form active components of the curriculum (UNESCO, 2019).

4.6 Relationship Between Architecture and Pedagogy

The literature makes clear that architecture is not simply a container for education but a pedagogical tool itself. Ancient Gurukuls promoted experiential, dialogic, and community-based learning through open courtyards, semi-open verandahs, shared living spaces, and close teacher–student proximity (Ghosh, 2002). The spatial openness reinforced qualities such as humility, discipline, and introspection.

Modern schools emphasize structured timetables, institutional discipline, and academic rigor (Karnik, 1960). While effective for administration, these environments may not provide the sensory and emotional depth that Gurukul spaces offered. Schools such as Rishi Valley show that combining modern pedagogy with spatial openness, ecological awareness, and community living can recreate Gurukul-like learning within contemporary educational systems.

V. CASE STUDIES

This section examines four historically and culturally significant learning environments two ancient Gurukul systems and two modern boarding school models. Each case is analyzed through architectural, environmental, and pedagogical perspectives, supported by scholarly literature and archaeological evidence.

5.1 Nalanda Mahavihara, Bihar (Ancient Gurukul Model)

Nalanda Mahavihara (5th–12th century CE) is widely recognized as one of the earliest planned residential universities, representing the integration of architecture, pedagogy, and environmental responsiveness. Archaeological documentation by (Marshall, 1951) and later by (Michell, 1995) reveals that the campus followed a linear north–south axis composed of monasteries (viharas), shrines (chaityas), libraries, and landscaped corridors. Each vihara consisted of a quadrangular block enclosing a central courtyard, which acted as the primary climatic regulator, enabling cross-ventilation, stack cooling, and daylight penetration (Ar. Ruchika Srivastava & Dr. Mohit Kumar Agarwal, 2023).

The construction used thick burnt brick masonry bonded with lime mortar an early example of modular construction with substantial thermal mass (Mitra, 1977). The courtyard typology aligns with traditional Indian climatic design principles, as discussed by (Iman Ibrahim, Nadia Al Badri, Emad Mushtaha, & Osama Omar, 2022), where shaded perimeters and open central voids stabilize internal temperature. Nalanda's extensive water infrastructure tanks, wells,

terracotta drainage systems reflects sophisticated hydrological planning (Mitra, 1977).

Pedagogically, Nalanda reinforced the Guru–Shishya paradigm on a monastic scale. Students lived in small cells around the courtyard, creating proximity between learners and scholars (Ghosh, 2002). Spaces such as verandahs, temples, and open porches supported rituals, debates, and group learning. Nalanda demonstrates how built form, environmental intelligence, and spiritual learning merged into a holistic educational ecosystem.

5.2 Takshashila, Gandhara (Ancient Decentralized Gurukul Network)

Takshashila (Taxila), active between the 6th century BCE and 5th century CE, differed from Nalanda through its decentralized spatial organization. Archaeological excavations by (Marshall, 1951) show that the educational system comprised dispersed hermitages and teaching centers positioned along natural landscapes hillocks, riverbanks, and forests. These clusters formed an educational network rather than a single institutional complex (Hermann Kulke & Dietmar Rothermund, 2004).

Takshashila's architecture was lightweight and vernacular, consisting of mud-brick walls, bamboo frameworks, timber posts, and thatched roofs materials that offered thermal insulation and adaptability (Oliver, 1997). These structures created open and semi-open spaces suitable for outdoor teaching. (Aher, 2021) explains that indigenous learning spaces relied on informal, nature-integrated settings that encouraged experiential learning through observation, discussion, and environmental interaction.

Circulation patterns were organic and unprescribed, emerging naturally along contours, which encouraged interdisciplinary interaction across ashrams (Bongard-Levin, 1981). Environmental practices included rainwater catchment ponds and agroforestry, forming resilient resource systems (Dr. L. Elango & Dr. M. Sekar, 2015).

The decentralized architecture reflected a pedagogy driven by intellectual autonomy, holistic development, and close teacher–student relationships. Takshashila thus exemplifies a learning environment shaped primarily by ecological responsiveness and participatory knowledge systems.

5.3 The Doon School, Dehradun (Modern Institutional Boarding School)

Founded in 1935, The Doon School represents the modern, structured boarding school typology introduced during British India. Designed by architect R. L. Broome, the school incorporates colonial-era planning principles characterized by axial geometry, hierarchical zoning, and symmetrical massing (Ritu Gupta & Saurabh Verma, Residential Learning Models, 2020). The extensive use of red-brick masonry, high plinths, colonnaded verandahs, and pitched tile roofs reflects the British Public School architectural vocabulary (Karnik, 1960).

The campus follows a rigid functional zoning system that separates academic blocks, residential houses, dining facilities, and recreational grounds an organizational strategy consistent with (Foucault, 1977) analysis of how institutional spaces are designed to regulate movement, reinforce discipline, and enable subtle forms of surveillance. Although courtyards exist as formal quadrangles or landscaped lawns, they function mainly as circulation or representational spaces rather than as climatic or pedagogical devices, marking a clear departure from the integrated, experiential courtyards of traditional Gurukul environments. In terms of environmental design, the school uses passive features such as shaded walkways, wide verandahs, and tree-lined avenues to mitigate solar heat gain (Dudek, 2000). However, the campus's environmental integration remains limited to aesthetic landscape design. Pedagogically, the school emphasizes structured routines, academic excellence, and leadership formation, reflecting modern educational values. Teacher–student relationships are guided by institutional protocols rather than co-living systems, distinguishing this model from its ancient counterparts.

5.4 Rishi Valley School, Chittoor (Modern Gurukul-Inspired Ecological Model)

Rishi Valley School, founded by philosopher Jiddu Krishnamurti in 1926, represents a modern reinterpretation of the Gurukul ethos by integrating ecological planning with holistic education. The 350-acre campus demonstrates a deep relationship between built form and landscape, with its decentralized clusters following natural contours and emphasizing environmental stewardship (overview, n.d.).

Architecturally, Rishi Valley emphasizes vernacular and sustainable materials stone masonry, stabilized mud blocks, terracotta tiles, and timber aligning with (Oliver, 1997) principles of low-embodied-energy construction. Passive design strategies such as deep verandahs, ventilated sloping roofs, shaded courtyards, and earth berming create thermally comfortable environments with minimal reliance on mechanical systems, aligning with principles outlined by (Kumar, 2016).

The school has pioneered ecological restoration and watershed management in the region. Its reforestation programs, rainwater harvesting structures, soil conservation trenches, and biodiversity initiatives exemplify environmental stewardship (UNESCO, 2019). These systems are integrated into daily learning, supporting Krishnamurti's educational philosophy centered on awareness, perception, and community responsibility (Jayakar, 1986).

Pedagogically, the spatial layout cultivates autonomy, introspection, and informal learning, while the residential presence of teachers supports close mentorship relationships characteristic of the Guru–Shishya tradition (Aher, 2021). Rishi Valley thus serves as a contemporary model that successfully synthesizes ancient Indian educational values with modern sustainability practices.

VI. FINDINGS

6.1 Architectural Lessons

The analysis shows that ancient Gurukul environments relied on decentralized, courtyard-based spatial planning that supported social interaction, reflection, and communal living. Nalanda's modular vihara layout demonstrates how courtyards and repetitive clusters enhanced circulation and community dynamics (Michell, 1995) (Ar. Ruchika Srivastava & Dr. Mohit Kumar Agarwal, 2023). Takshashila's dispersed hermitages illustrate how organic, landscape-embedded planning encouraged interdisciplinary learning and autonomy (Marshall, 1951) (Aher, 2021).

In contrast, modern schools such as The Doon School follow centralized zoning and axial planning, rooted in British institutional design (Ritu Gupta & Saurabh Verma, Residential Learning Models, 2020). Rishi Valley, however, shows that decentralized clusters can still be effectively adapted in contemporary settings, offering a spatial model that enhances engagement and environmental awareness (Kumar, 2016).

6.2 Environmental Lessons

Ancient Gurukuls exhibit strong passive climatic strategies, including thick masonry, verandahs, orientation-based siting, and vegetative cooling (Mitra, 1977) (Oliver, 1997). Their material palettes mud, brick, bamboo, stone provided high insulation, low embodied energy, and climatic adaptability (Pramar, 1989).

Modern boarding schools tend to emphasize structural durability but often underutilize environmental responsiveness (Dudek, 2000). Rishi Valley demonstrates how combining vernacular materials with ecological restoration such as reforestation and watershed management creates a sustainable and resilient learning ecosystem (UNESCO, 2019)

6.3 Pedagogical Lessons

The Gurukul system embedded experiential learning, mentorship, and community living directly into its spatial design. Courtyards, open verandahs, outdoor classrooms, and shared living quarters naturally supported dialogue, introspection, and holistic development (Ghosh, 2002) (Aher, 2021).

Modern schooling emphasizes structured academics and formal hierarchy (Karnik, 1960), often reducing the emotional and environmental grounding present in ancient models. Rishi Valley bridges this divide by integrating ecological awareness, reflective learning, and teacher–student proximity within its spatial organization (Jayakar, 1986).

6.4. Synthesis for Future Educational Campuses

The findings support a hybrid design model that combines the ecological intelligence, spatial openness, and community-centered values of ancient Gurukuls with the infrastructural efficiency of modern institutions. Future educational campuses should prioritize:

- Decentralized cluster planning (Michell, 1995),
- Courtyard-oriented learning spaces (Iman Ibrahim, Nadia Al Badri, Emad Mushtaha, & Osama Omar, 2022),
- Vernacular and sustainable materials (Oliver, 1997),

- Strong landscape integration (Rachel Kaplan & Stephen Kaplan, 1989) and
- Pedagogical spaces supporting autonomy and interaction (Aher, 2021).

Such a model can produce learning environments that are climate-responsive, culturally rooted, and educationally holistic.

VII. CONCLUSION

This study shows that ancient Gurukuls and modern boarding schools embody fundamentally different yet complementary approaches to educational architecture. Gurukul examples such as Nalanda and Takshashila demonstrate how decentralized planning, courtyard-based layouts, vernacular materials, and landscape integration created environmentally responsive and community-driven learning environments. In contrast, modern schools like The Doon School emphasize structured zoning and institutional efficiency, while Rishi Valley illustrates how contemporary campuses can successfully reintegrate ecological sensitivity and holistic pedagogy.

Across the cases, key lessons emerge: passive climatic design, human-scaled clusters, nature-integrated spaces, and flexible learning environments significantly enhance educational experience. The findings suggest that future educational campuses in India should adopt a hybrid model that combines the sustainability and experiential richness of ancient Gurukul systems with the infrastructural clarity and organizational strengths of modern institutions. Such an approach offers a resilient and holistic framework for designing learning environments suited to contemporary needs.

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