

Colour Psychology in Learning Spaces: Insights from Indian Heritage & Vāstu Texts and Contemporary Colour theories

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Abstract

This paper explores the role of colour psychology in designing learning environments through the lens of Indian heritage knowledge systems. Drawing on architectural treatises such as the *Samarāṅgaṇa Sūtradhāra* and the *Māyāmātam*, along with *Vāstu Śāstra* principles and Vedic symbolism, it highlights how traditional frameworks provide a nuanced understanding of colour, light and direction. These insights can guide the design of contemporary educational interiors.

By integrating textual interpretation, comparative literature review and environmental psychology, the study relates traditional ideas about hue, tone, and spatial orientation to modern research on attention, mood and cognitive function. Examples include using cool, pale shades in the northeast to encourage concentration, warm tones in the east for alertness and graduated colour transitions to indicate activity changes—all rooted in scriptural guidance.

The paper examines where classical prescriptions align with or diverge from empirical findings, considering India's climatic diversity and the symbolic complexity of the *sattva-rajas-tamas* colour typology. It proposes a design framework that merges traditional colour wisdom with psychological metrics to promote wellbeing, inclusivity, and learning efficiency. A mixed-methods research agenda—combining archival study, experimental classrooms and participatory design—is recommended to validate culturally grounded chromatic strategies for modern educational spaces.

Keywords: *Colour psychology, Vāstu Śāstra, Samarāṅgaṇa Sūtradhāra, Māyāmātam, Indian heritage, learning environments, educational interiors, environmental psychology, cognitive wellbeing.*

1. Introduction

Colour, light and spatial orientation are subtle yet powerful elements in shaping our psychological and cognitive experiences. In educational environments, these elements can influence attention, mood, memory, and general learner wellbeing. While much of contemporary design for classrooms draws on Western theories of colour psychology and environmental psychology, India's rich tradition of architectural and aesthetic theory—including *Vāstu Śāstra*, *Samarāṅgaṇa Sūtradhāra* and related treatises—contains

prescriptive and symbolic frameworks for colour, direction, and spatial harmony. This paper seeks to (a) *revisit such traditional Indian systems in relation to modern empirical findings* and (b) *propose a hybrid framework for using colour in learning spaces in India that is culturally sensitive, contextually adaptive and psychologically sound*.

The motivation is twofold. First, much of design practice in India either neglects or superficially references *Vāstu* without integrating its deeper perceptual and symbolic implications. Second, purely Western-derived guidelines can overlook climate, light conditions, material realities, and cultural semantics that matter greatly in Indian settings. By bridging textual-historical insight and empirical scholarship, we aim to uncover chromatic strategies that are both meaningful (in the local symbolic frame) and effective (in terms of learner outcomes).

This introduction first reviews the theoretical relevance of colour in learning spaces. It then articulates the research gap—namely, the underutilization of Indian heritage systems in evidence-based design—and states the aims of the study. The remainder of the paper will

- i. review existing literature in colour psychology and *Vāstu* tradition,
- ii. analyse directional and chromatic prescriptions from heritage texts,
- iii. compare these with modern empirical findings,
- iv. propose a design framework and
- v. outline an agenda for validation via experiment and participatory design.

2. Literature Review

Below we divide the review into two thematic streams, which will later be brought into dialogue: (1) *Colour and learning / environmental psychology* (2) *Indian heritage architectural theory and Vāstu texts relating to colour, light and direction*

2.1 Colour, Cognition and Learning Environments

Colour and Memory / Attention

Empirical studies have long examined how colour affects cognitive performance. For example, Spence, Wong, Rusan and Rastegar (cited in reviews) found that participants better recognized coloured images than grayscale images ($\approx 5\%$ higher recognition) under certain conditions. Similarly, Colour has been shown to influence memory performance by increasing arousal and attentional engagement. A broader review of colour and psychological functioning notes that the literature is still nascent and heterogeneous but

acknowledges that hue, lightness, and chroma can all play roles in emotional and attentional effects.

Colour in Learning / Educational Settings

In educational contexts, colour is often proposed as a low-cost but high-impact design lever. According to PPG Paints, well-chosen colours can enhance or impair learning, morale and behaviors; colour affects attention span and even the perception of time. Feature-walls or accent walls painted in deeper or brighter shades are recommended to draw visual focus while allowing rest on adjacent neutral walls.

A quantitative study of learners' perceptions in university settings (UHD, Sulaimani) found that "cool" colours such as white, green and blue were preferred in educational spaces and linked to feelings of hope, curiosity and satisfaction; conversely, darker or neutral tones (black, grey) were more often associated with negative emotions. Another recent empirical work in China investigated how warm vs. cool colour tones in classrooms affected elementary school students' emotional states (using the PANAS-C instrument). They report that while overall positive affect predominated in both colour settings, cool tones had a stronger effect in evoking calmness, and warm tones had a modest tendency to generate irritation in some students.

Furthermore, a study titled *"Cold and warm coloured classrooms. Effects on students' attention ..."* found that cooler hue colours (i.e. those biased toward blue/green) can increase arousal and improve performance in attention and memory tasks, suggesting that cold hues may facilitate cognitive engagement.

These findings suggest that in classroom settings, base or background hues that are cooler or more neutral may help sustain focus, while warmer or accent hues can be used judiciously to energize particular zones.

Limitations, Gaps and Contextual Variation

Despite promising findings, research in colour psychology is marked by several caveats. The complexity of human emotional response to colour means that context, saturation, brightness and scale matter deeply (not just hue). Effects often interact with individual differences (personality, cultural associations), lighting conditions and expectations. There is also a tendency for descriptive (rather than prescriptive) studies. Many design recommendations (e.g. "blue improves focus") are repeated in practitioner articles and blogs, but empirical backing is uneven.

Moreover, cross-cultural variation is large. A hue that conveys calm in one cultural or climatic context may carry different connotations elsewhere. In sum, the empirical literature supports the idea that colour can influence attention, mood, and memory, but the precise effects depend on multiple interacting factors. For educational design in India, these findings offer useful guideposts, but they must be adapted considering climate, lighting, culture and symbolic associations.

2.2 Indian Heritage, Vāstu Theory and Colour in Spatial Design

Indian architectural thought has long recognised that colour, light and direction influence both the physiological and psychological states of occupants. The *Vāstu Śāstra* tradition – the “science of dwellings” – links spatial orientation with elemental balance (*pañca mahābhūta*: earth, water, fire, air and ether) and with corresponding hues that evoke specific emotional and behavioural responses. Although these correspondences were expressed symbolically rather than experimentally, they reveal an early understanding of what modern science calls colour psychology.

2.2.1. Colour, Direction and Human Disposition

In *Vāstu Śāstra*, each cardinal direction is ruled by a *dikpāla* (directional deity) whose energy determines the emotional tone of that space.

- **East (Indra)**, associated with sunrise and vitality, invites brightness, gold and soft yellow – tones that stimulate alertness and optimism, akin to findings that warm hues enhance arousal and attentiveness.
- **North (Kubera) and Northeast (Īśāna)** correspond to water and air, favouring pale blues, greens, or whites that induce calm and mental clarity – paralleling modern results linking cool hues with tranquillity and focus.
- **South (Yama) and Southeast (Agni)**, aligned with the fire element, encourage energising yet controlled reds or terracottas – tones empirically shown to heighten stimulation and motivation but requiring moderation in learning settings.
- **West (Varuṇa)**, linked to introspection and closure, traditionally uses muted ochres or earthy browns that ground emotion and reduce overstimulation.
- **South-West (Nairṛta)** – Symbolising stability, security and grounding, this zone benefits from earthy browns, muted reds, or ochres. These hues create a sense of

rootedness and comfort, akin to modern design advice that natural tones enhance psychological safety and belonging.

- **North-West (Vāyu)** – Under the air deity Vāyu, this quarter represents movement and communication. Balanced neutral or light grey-blue palettes maintain freshness and mental agility—consistent with empirical findings that cooler neutrals support verbal interaction and group work without fatigue.

Such prescriptions appear in commentaries on *Mayāmātam*, *Mānasāra* and *Samarāṅgaṇa Sūtradhāra* (Bhoja, 11th century CE). Though these texts seldom quantify colour effects, their repeated concern with *chāyā* (light and shadow) and surface treatment indicates sensitivity to brightness, contrast and reflection—the same parameters that modern environmental psychology identifies as shaping cognitive comfort.

2.2.2. Symbolic Colour Typologies

Indian aesthetics also classifies colours through the **tri-guṇa system**—*sattva* (balance, lightness, clarity), *rajas* (activity, stimulation) and *tamas* (inertia, heaviness). Light, cool hues express *sattva* and are considered beneficial for concentration and wellbeing; intense reds and oranges express *rajas* and are suited to active zones; dark, heavy tones convey *tamas* and are limited to restful or grounding areas. This typology anticipates the modern differentiation between calming versus arousing colours in behavioural design research.

2.2.3. Perceptual Ecology and Environmental Fit

Texts like the *Samarāṅgaṇa Sūtradhāra*'s "*Chāyā Vidhi*" chapter detail how sunlight orientation should guide the play of colour and shadow—essentially a proto-study of light-colour interaction. Surfaces exposed to strong eastern or southern light are advised lighter coatings to diffuse glare, whereas shaded northern walls may bear deeper tones to maintain visual equilibrium. These guidelines align with current recommendations in biophilic and evidence-based design that seek balanced luminance and reduced visual fatigue.

2.2.4. Synthesis

Taken together, the *Vāstu* corpus embeds a holistic chromatic psychology: colour operates not in isolation but through direction, light, elemental resonance, and moral temperament. Its emphasis on harmony, moderation and contextual appropriateness

mirrors contemporary insights that emotional and cognitive responses to colour depend on hue, brightness, saturation and environmental fit. By interpreting these textual frameworks through the lens of modern colour psychology, we can recover culturally grounded principles for designing emotionally supportive learning environments in the Indian context.

2.3 Toward Integration: Threads of Dialogue

From the two streams above, a few points of convergence and tension emerge:

Convergence on light and moderation. Both modern research and *Vāstu* texts emphasize the importance of balance — neither overly saturated, nor starkly neutral environments, but a moderated interplay of base + accent.

(1) **Direction, scale and surface matter.** Modern work on colour often treats hue in isolation; traditional systems embed colour within orientation, surface, scale and light path. (2) **Symbolic semantics vs. physiological semantics.** The traditional system gives colours ritual and symbolic weight (e.g. directional auspiciousness). Modern work anchors colour to cognitive/emotional outcomes. The challenge is to map symbolic meaning onto measurable outcomes. (3) **Context specificity.** Because climate, daylight, materials, and visual culture differ across geographies, a direct transposition of either Western or *Vāstu* rules will be insufficient. (4) **Gap in empirical validation.** There is a notable lack of experimental studies that test *Vāstu*-derived chromatic prescriptions in actual learning spaces, especially in Indian climates.

Given these observations, the next section will examine particular chromatic-directional prescriptions from *Vāstu* texts (especially *Samarāṅgaṇa Sūtradhāra*) and trace their possible psychological correspondences. We will then propose a framework that bridges traditional insight and empirical design strategies for contemporary learning spaces.

3. Mapping Colour, Direction and Spatial Emotion

Colour Gradation, Surface Hierarchies and Activity Zoning

Traditional design often implies a **gradation of chromatic intensity** according to proximity to activity zones or thresholds. For instance:

(a) Areas of **contemplation or spiritual focus** (e.g. the northeast, *īśāna* corner) would adopt pale, “sattvic” tones – whites, very light creams, or soft pastels. (b) **Active zones** (e.g. south, southeast, activity rooms) may receive more saturated or warm hues – deep reds, oranges, terracottas – tempered by surrounding lighter fields. (c) **Transitional zones** (corridors, vestibules) might use intermediate or neutral tones to mediate between intense and quiet zones.

Though explicit chromatic charts are rare in surviving *Vāstu* texts, these gradation logics are implied by how classic treatises handle spacing, sequencing of built forms, thresholds and light exposure.

4. Modern Correlations and Comparative Analysis

Recent empirical research supports many traditional prescriptions about colour and its effect on mood, attention, memory, and behaviour, while also revealing nuances. A Sri Lankan study over two years with Grade-2 students exposed to monochromatic classrooms (coloured entirely in one hue) found that blue and orange classrooms produced more favourable outcomes in learning behaviour and performance. Blue tended to enhance artistic creativity, while orange and yellow supported logical thinking such as in mathematics; green and purple classrooms showed balanced improvements in both creative and logical domains.

Similarly, a study on colour temperature in classroom lighting found that ~4000 K was optimal: at this temperature, participants reported higher visual comfort and they performed better in cognitive tasks relative to lower or higher colour temperatures. Also, neural-measures (e.g. EEG) showed more favourable activation in occipital and parietal regions under those “middle” light conditions.

5. Climatic & Cultural Considerations

Climate – temperature, sunlight angle, humidity – plays a major role in how colour is perceived, how interior surfaces heat up, and what material finishes are comfortable. Delhi, for instance, suffers from very high heat indices during the pre-monsoon and monsoon months ($\approx 46\text{--}50^\circ\text{C}$), with nights staying warm due to the urban heat island effect and humidity adding to perceptual discomfort.

High temperatures and bright sunlight affect material behaviour: lighter, reflective colours reduce heat absorption and glare; darker or saturated colours can exacerbate thermal load inside rooms. For example, cool roof coatings are being introduced in Delhi to reflect solar radiation.

In sum, design guidelines should be climate-responsive (light, heat, humidity), use colour & material adaptively (reflective surfaces, shade) and account for local cultural aesthetics and meanings – rather than assuming universal preferences.

6. Proposed Framework for Colour in Learning Environments

Drawing on the alignment between ancient Vāstu/heritage prescriptions and contemporary empirical findings, the proposed framework comprises four interlinked dimensions:

1. **Directional-Chromatic Zoning:** Assign base wall hues and accent tones based on cardinal / intercardinal orientation. For example, lighter, cool-coloured hues in the north and northeast (to support calm, intellectual activity), warmer and more saturated tones in east and southeast zones (for alertness and energy) and muted or grounding tones in west/southwest to moderate glare and heat.
2. **Light, Material & Finish Calibration:** Taking into account natural light path (morning / afternoon sun), material reflectance and surface finish. Light colours and reflective finishes in high-sun areas; matte, deeper tones in lesser light zones to avoid glare or visual fatigue.
3. **Activity-Based Colour Layering:** Distinguishing spaces according to the kind of learning activity (lectures, group work, quiet reading, etc.). Use strong warm accents for interactive zones; cool, soothing backgrounds for concentration; neutral transitional tones in corridors or vestibules.
4. **Cultural and Symbolic Resonance:** Incorporate colour meaning local to the learners (cultural associations of specific colours, religious or symbolic significance) to maintain acceptance and psychological comfort. Ensure the colour scheme works with climatic demands (heat, sun exposure) and with regional heritage sensibilities.

Together, these dimensions form a framework that is context-sensitive (both climate and culture), orientation aware, empirically informed and capable of enhancing learning mood, attention and wellbeing.

7. Future Research Agenda

To validate, refine and operationalize the proposed framework, future research should include:

- ✓ **Experimental classroom studies:** Controlled comparison between learning spaces designed per the framework vs. standard classrooms, measuring cognitive metrics (attention, memory), emotional/mood scales and physiological indicators (e.g. skin conductance, heart rate variability).
- ✓ **Longitudinal interventions in real schools:** Over the course of an academic year, observe effects of painted rooms or re-colouring on academic outcomes and student wellbeing, accounting for seasonality (monsoon, summer) and changes in daylight.
- ✓ **Participatory design and user feedback:** Involve students, teachers, local communities in co-designing colour schemes to ensure cultural fit, symbolic acceptability and subjective comfort. Gather feedback on preferences, perceptions and comfort.
- ✓ **Climatic/Material studies:** Quantify effects of material, finish, and reflectance in various directions under local climatic conditions (for Delhi/North India or other zone) to guide colour choices that minimize glare, heat load and energy usage.
- ✓ **Cross-cultural comparative work:** Compare colour preferences and psychological responses in different regions of India and between India and other countries to understand universals vs. culture-specific responses.

8. Conclusion

Colour in educational spaces is not merely aesthetic; it is deeply intertwined with attention, mood, learning performance and wellbeing. This paper has shown that Indian heritage texts, especially Vāstu and works like *Samarāṅgaṇa Sūtradhāra*, include rich, orientation-based ideas about colour, light, and spatial order that anticipate many findings of modern environmental psychology. Empirical studies corroborate many of these: cool hues tend to calm; warm accents can energize; dark neutrals may evoke negative emotions under certain settings.

The proposed framework builds a bridge between tradition and science, allowing for design that is orientation-aligned, climate-sensitive, activity-aware and culturally resonant. While limitations exist—especially in terms of empirical validation, climatic discomfort and interpretive variation across texts—the framework offers a structured way forward. Ultimately, the goal is to design learning spaces that are not only functional and energy-efficient but also psychologically nourishing, culturally meaningful and adaptive to local contexts.

By doing so, educators, architects and designers can draw on India's rich architectural heritage while responding to modern evidence of what supports learning and wellbeing.

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