The Hotel-Room Problem: A Person × Visual-Environment Framework for Sustained Academic Attention

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Abstract

Academic attention is often studied as if visual environments affect learners uniformly. Yet students differ in attentional control, sensory responsiveness, motivation, and the environments they select or modify. This conceptual integrative review connects research on visual complexity and clutter with personality dynamics, cognitive control, and educational attention. It distinguishes image-computable cues, relational properties, and subjective appraisals; separates capture, mind-wandering, on-task behavior, effort, and learning; and proposes the Visual Environment-Attention Fit (VEAF) framework. VEAF defines fit as a criterion-specific response profile, not a preference score or fixed environmental type. Visual environments may affect academic work through three parallel paths: distractor costs, engagement regulation, and task support. Person attributes, task demands, momentary states, strategic modification, and exposure history condition those paths, while outcomes feed back into later selection and arrangement. Evidence justifies caution about salient task-irrelevant displays, especially for children, but direct person × visual-environment tests remain sparse and heterogeneous. Eight falsifiable propositions and a three-stage, six-module research program therefore target mechanisms, boundary conditions, adaptation, selection, and held-out prediction. VEAF rejects both universal minimalism and untested personalization: progress requires explaining which visual properties affect which learners, through what processes, for which outcomes, and under what conditions.

Keywords: academic attention, learning environments, person–environment interaction, personality dynamics, visual complexity

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Consider an adult learner who spends several nights each month in unfamiliar hotel rooms. The course material, laptop, and study intentions remain stable. The peripheral visual field does not. One room presents blank walls and a single desk lamp; another places a television, mirrors, patterned upholstery, artwork, luggage, and moving corridor light within view. The learner may respond by recreating a familiar arrangement (computer centered, light on the same side, materials in fixed positions) because a repeatable work zone seems to make concentration easier. This ordinary problem contains a difficult scientific question: To what extent does a surrounding visual environment alter sustained academic attention, and why might the answer differ across people and occasions?

The most common answer is a main-effect claim: clutter distracts, decoration captures attention, or simplicity promotes learning. That claim has intuitive force and some experimental support, particularly in research with children. Highly decorated classroom displays can attract overt gaze and coincide with lower immediate learning than sparse displays (Fisher et al., 2014; Hanley et al., 2017). Streamlined illustrations can improve beginning readers' attention and comprehension (Eng et al., 2020). Yet the evidence does not license a rule that fewer visible objects always produce better academic performance. Genuine-classroom observations suggest that both very low and very high display coverage may be associated with less on-task behavior than intermediate coverage (Godwin, Leroux, Scupelli, et al., 2022). In a sample of 36 children, lesson-related wall displays supported learning, whereas unrelated displays at the tested, relatively low density did not significantly differ from empty walls (Ríos-López et al., 2026).

Young-adult studies have also produced null effects of visually rich surroundings or workspace disorder (Manzi et al., 2019; Rodrigues & Pandeirada, 2020).

These contradictions are not noise around one universal environmental effect. They identify the theoretical problem. A visible object can be irrelevant but unobtrusive, salient but task relevant, visually dense but coherent, familiar but personally meaningful, or novel but quickly ignored. A person can be highly responsive to sensory stimulation yet capable of strong goal maintenance, or low in sensory responsiveness yet vulnerable to internally generated thought. An easy but monotonous task and a difficult task may create different opportunities for external capture, effort regulation, and mind-wandering. The same person may also modify a room, avoid an environment, or compensate with greater effort. The outcome labeled "attention" might be gaze away from a lesson, a thought probe, response-time variability, immediate comprehension, or delayed retention; these indicators are related but not interchangeable.

Personality science offers the conceptual tools needed to treat this heterogeneity as the object of explanation. Contemporary person–situation approaches understand behavior as a product of persons, situations, and their dynamic transactions, rather than as the additive result of isolated traits and environments (Mischel & Shoda, 1995; Rauthmann et al., 2015). Within-person distributions of states can be broad even when between-person differences are stable (Fleeson, 2001). Applied to academic attention, the relevant question is therefore not simply whether visually complex settings reduce an average student's score. It is whether environmental features alter momentary attentional states through identifiable processes; whether reliable person attributes change those processes; and whether people select, construe, and modify visual environments in ways that produce stable person-specific patterns.

This article develops that argument in three steps. First, it provides a construct architecture that separates environment cues, relational properties, subjective appraisals, person attributes, task conditions, processes, and outcomes. Second, it synthesizes what the evidence does and does not establish, preserving null results and developmental boundaries. Third, it introduces the Visual Environment-Attention Fit (VEAF) framework, eight falsifiable propositions, and a research program capable of distinguishing causal exposure from preference, self-selection, and measurement artifacts. The contribution is narrower than a general theory of learning-space design: it operationalizes person–situation principles for the surrounding physical or digitally rendered visual field during goal-directed academic work.

Scope and Approach to the Evidence

This is a conceptual integrative review, not a systematic review or meta-analysis. The literature was identified through purposive searches, backward and forward citation chaining from foundational classroom-display and attention studies, and cross-domain searches spanning visual clutter, classroom decoration, selective and sustained attention, working memory, mind-wandering, sensory responsiveness, ADHD-related distractibility, person–environment fit, and personality dynamics. Priority was given to peer-reviewed primary studies, meta-analyses, systematic reviews, and recent direct tests. This method cannot estimate the prevalence of effects or prove that an interaction is absent; references to sparse or mixed evidence describe the literature located for this review. No pooled effect is reported because age groups, manipulations, tasks, exposure periods, and outcomes differ substantially. A future systematic review should publish a reproducible search and screening protocol.

The review uses four evidence tiers. *Direct interaction evidence* tests whether a measured person attribute changes the effect of a manipulated or objectively measured visual environment on attention or learning. *Environmental main-effect evidence* tests visual features without a focal person moderator. *Person-level evidence* establishes individual differences in distractibility, sensory responsiveness, attention control, or environment selection without directly manipulating a study environment. *Adjacent mechanistic evidence* examines processes such as salient-distractor suppression, working-memory filtering, perceptual load, and mind-wandering in simplified tasks. These tiers are not treated as interchangeable. Adjacent mechanisms can make a proposition plausible, but they cannot establish that the same interaction occurs in a classroom, home, library, or hotel room.

The focal environment includes visible background and peripheral features present during academic work: displays, objects, color and contrast variation, spatial organization, movement or change, and task-relevant external aids. Primary instructional graphics are discussed only when they illuminate a comparable competition-for-attention mechanism. Auditory noise, temperature, lighting quality, furniture ergonomics, and architectural form are outside the framework unless they alter the visible field or are experimentally controlled. “Academic attention” refers to the goal-directed maintenance and allocation of attention during reading, studying, instruction, problem solving, or learning assessment. This scope excludes a claim that the same model automatically applies to creative ideation, leisure, clinical treatment, or all forms of office performance.

Construct Architecture

The Visual Environment Is a Profile, Not an Item Count

The terms visual load, visual complexity, clutter, decoration, and stimulation are often used as if they name one quantity. They do not. A room with ten aligned, muted, instructionally relevant objects may present less competition than a room with three high-contrast, personally significant, or moving objects. VEAF therefore distinguishes three analytical levels rather than treating the visual environment as an item count.

At the environmental-cue level, density and coverage describe the amount of material; feature complexity describes local variation in color, orientation, luminance, texture, and spatial frequency; feature-based salience describes image-computable distinctiveness; dynamicity describes actual or anticipated change; and spatial organization describes grouping, alignment, repetition, and location predictability. Feature congestion, edge density, entropy, saliency maps, change rate, and spatial regularity can index parts of this level (Rosenholtz et al., 2007). No single metric is visual load. Feature-based salience must also be separated from attentional priority, which depends on the observer, the task, learned history, and current goals.

At the relational level, task relevance, personal meaning, controllability, and exposure history describe relations between a field and a learner or goal; they cannot be recovered from the image alone. At the appraisal level, learners may experience the same field as ordered, threatening, beautiful, owned, or overwhelming. Objective cues are necessary because a field cannot be classified as distracting solely because a learner calls it distracting. Appraisals nevertheless may mediate or moderate effects after cues and relational properties are modeled (Rauthmann et al., 2015). Table 1 summarizes the resulting construct architecture and the inferences each level permits.

Table 1

Construct Architecture for Visual Environment–Attention Research

Construct	Definition	Candidate indicators	Inferential caution
Cue: Density and coverage	Amount of visible material within a bounded field.	Object count; occupied area; wall-display coverage.	Count does not identify salience, relevance, organization, or attentional priority.
Cue: Feature complexity	Local variation in color, orientation, luminance, texture, and spatial frequency.	Feature congestion; edge density; subband or color entropy.	Metrics operationalize different kinds of clutter and require perceptual validation.
Cue: Feature-based salience and dynamicity	Image-computable distinctiveness or change in the visual field.	Contrast; size; abrupt onset; motion; flicker; notification rate.	Feature salience is not the same as observer- and task-specific attentional priority.
Cue: Spatial organization	Grouping, alignment, repetition, and spatial predictability.	Regularity indices; grouping ratings; matched-density organization manipulation.	Perceived beauty or liking is not a substitute for organization.
Relation: Task relevance and personal meaning	How visible content relates to the current goal and to the learner.	Task-relevance coding; semantic similarity; personal-meaning ratings.	Instructional value, personal meaning, and feature salience must be separated.
Relation: Exposure history and controllability	Prior exposure, location stability, predictability, and the ability to alter the field.	Exposure count; change rate; stable locations; modification opportunities.	Late null effects do not prove habituation, and controllability is not an image property.
Person: Sensory responsiveness	Characteristic noticing of and reaction to stimulation, including overstimulation.	HSP-R dimensions; visual-specific sensory scales; daily overstimulation.	Self-report is not equivalent to a visual threshold, ADHD, autism, or neuroticism.
Person: Attention control and WMC	Ability to maintain goals, suppress interference, and recover after lapses.	Reliable latent battery; sustained-attention and working-memory indicators.	A single task or difference score is usually too narrow and unreliable.
Person: ADHD and distractibility	Dimensional inattention and separable tendencies toward external distraction or spontaneous thought.	ASRS; external-distraction scale; mind-wandering measures.	Diagnosis, symptom severity, external capture, and mind-wandering cannot be collapsed.
Person or state: Distal traits and momentary conditions	Attributes that shape appraisal, engagement, selection, or current regulation.	Self-control; openness; motivation; fatigue; stress; medication status.	Roles should be pathway-specific; an exploratory trait search is not a theory.

Construct	Definition	Candidate indicators	Inferential caution
Task: Demand and interest	Perceptual, control, and memory demands plus the task's motivational pull.	Orthogonal demand manipulations; validated interest manipulations; difficulty.	High focal perceptual demand is not equivalent to a visually rich room.
Process and outcome criteria	Distinct indicators of capture, goal maintenance, effort, performance, and learning.	Gaze; thought probes; RT variability; recovery; comprehension; delayed retention.	Fit must be defined for a prespecified criterion; gaze, comfort, and learning can diverge.

Note. HSP-R = Highly Sensitive Person Scale–Revised; WMC = working-memory capacity; ASRS = Adult ADHD Self-Report Scale; RT = response time.

Person Attributes Must Remain Distinct

Personality-relevant heterogeneity does not mean renaming every person variable as a personality trait. Four classes should be kept separate.

First, *characteristic attentional regulation* refers to relatively stable differences in maintaining goals, suppressing interference, and recovering after a lapse. Latent attention-control and working-memory-capacity measures are plausible indicators, but single task difference scores are often unreliable. Attention control is especially relevant to the conversion of initial capture into performance cost: a salient object can attract a brief glance without necessarily displacing the task goal.

Second, *responsiveness to sensory stimulation* concerns how readily people notice sensory detail or experience overstimulation. Sensory-processing sensitivity is a broad candidate construct, but it includes separable components and overlaps with emotional reactivity and neuroticism (Greven et al., 2019). Self-reported sensitivity should not be treated as equivalent to low-level visual thresholds, autism, ADHD, or weak cognitive control. Recent measurement work that separates overstimulation, sensitivity to details, and related dimensions offers a more defensible basis for visual-environment hypotheses than a global "highly sensitive person" label (Pluess et al., 2026).

Third, neurodevelopmental characteristics include dimensional ADHD symptoms and autism-related sensory differences. ADHD can involve spontaneous mind-wandering, external distraction, executive-control difficulty, or different sources of interference; diagnosis, symptom severity, and general distractibility are not synonyms (Osborne et al., 2023; Zhang et al., 2023). Hanley et al. (2017) found greater display-directed gaze among autistic pupils. Jones et al. (2026) found that classroom displays increased off-task behavior in both autistic and non-autistic groups, without a significant condition-by-group interaction. These findings do not establish one uniform sensory profile or an autism-specific visual-environment effect. Planned, dimensional, ethically interpreted tests are needed.

Fourth, *distal traits and momentary states* influence how environments are chosen, appraised, or managed. Conscientiousness and trait self-control may predict creating a distraction-reduced work zone more strongly than immunity to bottom-up capture. Openness may predict aesthetic complexity preferences without improving sustained attention. Fatigue, stress, task interest, motivation, and medication status can vary within a person and change vulnerability at a particular sitting. Conflating these states with stable person attributes produces misleading trait explanations for context-dependent failures.

Task Demands Change the Meaning of "Load"

The term load creates a recurrent conceptual error. Perceptual demand within a focal task is not the same as a visually rich surrounding room. In classic load theory, a task that occupies perceptual capacity may reduce processing of irrelevant distractors, whereas high working-memory or control demand can impair active prioritization (Lavie et al., 2004; Murphy et al., 2016). A recent multi-experiment failure to replicate the classic perceptual-load effect, together with null findings in a related working-memory-load paradigm, counsels against treating load theory as a settled account (Snowden & Gray, 2025; Yao et al., 2020).

VEAF therefore distinguishes perceptual demand, control demand, working-memory demand, and task interest. A monotonous task may permit both external capture and internal mind-wandering. A focal perceptual-demand manipulation may attenuate peripheral distractor processing, produce no change, or increase errors when target and distractor features overlap. Maintaining multiple rules may make a displaced goal harder to restore. Topic interest and motivation are associated with less mind-wandering during reading, independently of room design (Unsworth & McMillan, 2013). The same visual field can therefore interact with different task demands in different directions.

Attention, Distraction, and Learning Are Not Interchangeable

Sustained selective attention is the maintenance of goal-consistent processing over time while competing information is present. *Attentional capture* is an early orientation toward a stimulus; *attentional dwell* is the continuation of processing after capture; *external distraction* is task-unrelated processing attributed to the environment; and *mind-wandering* is task-unrelated thought whose immediate source may be internal. *On-task gaze* indicates where the eyes are directed, not what is being processed. *Response-time variability*, omissions, and commissions index aspects of behavioral stability but do not uniquely diagnose a mechanism. *Learning* depends on attention but also on prior knowledge, encoding strategy, task difficulty, and retrieval conditions.

This ontology matters empirically. Classroom observations show that off-task behavior is common and changes over lessons, but they cannot establish that a particular glance caused a missed concept (Godwin et al., 2016). Across 375 elementary pupils, on-task behavior predicted learning only weakly and inconsistently between classrooms (Godwin et al., 2021). Mind-wandering is generally associated with poorer performance (Randall et al., 2014) and lecture learning (Wammes et al., 2016), but direct evidence that room clutter causes mind-wandering is limited. A strong study must measure environmental capture, internal thought, sustained performance, and learning separately rather than treating any one as the definitive outcome.

What the Evidence Establishes and What It Does Not

Salient, Task-Irrelevant Displays Can Redirect Attention

The clearest evidence comes from child-focused experiments. Fisher et al. (2014) taught kindergarten-age children six science lessons in a heavily decorated or sparse laboratory classroom. Children spent more time off task in the decorated condition and learned less, although they learned in both environments. Hanley et al. (2017) found display-directed gaze in children with and without autism and greater such gaze among autistic pupils. Jones et al. (2026) later found more off-task behavior with classroom displays in both autistic and non-autistic groups, without a significant condition-by-group interaction. Other experiments found that visually rich surroundings impaired aspects of children's and adolescents' cognitive performance (Rodrigues & Pandeirada, 2018, 2019). Removing extraneous illustration detail also improved beginning readers' attention and comprehension (Eng et al., 2020), consistent with meta-analytic evidence for seductive-detail costs (Sundararajan & Adesope, 2020).

These findings establish that visible, task-irrelevant information *can* compete with a focal learning task. They do not establish that object count alone caused the effect, that all decoration is irrelevant, or that the effect generalizes unchanged to adults. Many manipulations alter density, color, semantic content, novelty, and organization simultaneously. The studies also tend to use brief lessons in controlled spaces, making long-term adaptation and environment selection difficult to assess.

Relevance and Organization Complicate a Sparse–Decorated Contrast

Ríos-López et al. (2026) compared empty walls with lesson-related and unrelated displays in a sample of 36 children. Lesson-related displays supported immediate and delayed learning. Unrelated displays at the tested, relatively low display density did not significantly differ from empty walls. Because density itself was not experimentally varied, the study identifies relevance and task support as important boundary conditions but does not estimate a density response function. Task-relevant external information can reduce search or memory demand, whereas weak, predictable, or distant unrelated material may impose no detectable cost.

Observational classroom evidence also resists a linear prescription. Godwin, Leroux, Scupelli, et al. (2022) examined 58 classrooms and found lower on-task behavior with greater visual noise and color variability, but display quantity showed a curvilinear relation: relatively sparse and highly covered classrooms were associated with lower attention than intermediate levels. Barrett et al. (2015) linked holistic classroom-design characteristics to year-long learning progress in a large multilevel dataset, but visual complexity was bundled with light, air quality, flexibility, ownership, color, and other features. That study broadens ecological scope but cannot show that changing wall density alone causes achievement gains.

Organization is a plausible independent property, yet direct evidence is thinner than the design literature often implies. A disordered field may increase local feature competition or slow search, while coherent enrichment may be visually dense but predictable. The relevant proposition is testable: at matched density, an organized field should produce less capture, overload, or performance cost than a disorganized field. If matched-density experiments find no difference, “coherent enrichment” should not be retained as a protective explanation.

Familiarity Does Not Guarantee Habituation

One response to decorated-classroom effects is that novelty, not complexity, explains distraction. The habituation account is plausible but incomplete. Across repeated exposure, attention to a stable stimulus can decline as locations and features become predictable. Yet two classroom studies found only limited support. In a controlled two-week study, children partially habituated to a decorated environment but remained more distracted than in a sparse baseline. In six genuine classrooms followed for 15 weeks, environment-directed distraction did not reliably decline (Godwin, Leroux, Seltman, et al., 2022).

Several explanations remain possible. The display field may contain many elements that compete and decay at different rates; lessons may repeatedly make different portions salient; stable background elements may be replaced or moved; and the task goal may not train suppression of a specific location. Habituation should therefore be modeled as an exposure-dependent process, not assumed as a reason short-term effects will disappear. Stable, predictable elements and changing or dynamic elements should be manipulated separately.

Developmental Generalization Is Unresolved

The evidence base is disproportionately developmental. This is theoretically meaningful: attentional control, classroom routines, prior knowledge, and strategy use change with age. It is also a constraint on generality. Rodrigues and Pandeirada (2020) found effects of high-load visual surroundings in older adults but not young adults. Manzi et al. (2019) found no reliable executive-function or creativity difference between orderly and messy workspaces in a young-adult sample. These nulls do not prove that adults are immune; they show that the child evidence cannot carry an adult claim by analogy.

Adult mobile learners may control their gaze, choose a seat, move objects, use a screen as a visual shield, or increase compensatory effort. Their academic tasks also differ from short child lessons. Conversely, fatigue, unfamiliarity, and unstable travel environments may produce vulnerabilities not captured in a one-session laboratory manipulation. Direct adult within-person research in realistic study spaces is therefore a central gap, not an optional extension.

Individual Differences Are Plausible but Direct Interactions Are Sparse

There are reliable between-person differences in self-reported distractibility and in attention-control ability, but their structure is still debated. Zhang et al. (2023) found correlated dimensions of external distraction, intrusive thought, and spontaneous mind-wandering, with evidence for a broader distractibility factor. Forster and Lavie (2016) reported a cross-context attention-distractibility trait, whereas Meier (2021) found that behavioral distractibility measures did not support a simple broad trait interpretation. A recent latent-variable synthesis supports attention control as a coherent individual-differences domain, while also underscoring measurement requirements that single tasks often fail to meet (Unsworth et al., 2024).

Working-memory capacity can buffer attention in some distracting contexts. Robison and Unsworth (2015) found context-specific relations among capacity, external distraction, and mind-wandering in silent and noisy study settings. Low-capacity learners have sometimes shown larger seductive-detail effects (Sanchez & Wiley, 2006), and an inability to suppress salient distractors predicts lower visual working-memory capacity (Gaspar et al., 2016). Yet moderation has not been uniform across tasks. The defensible conclusion is that latent attention control is a mechanistically proximal candidate moderator, not that any learner with a low score will benefit from a bare room.

Sensory-processing sensitivity offers a second candidate pathway. Reviews support meaningful individual differences in noticing and reacting to sensory environments, including overstimulation, but also document construct breadth, self-report dependence, and overlap with negative affect (Greven et al., 2019). In a one-week experience-sampling study, self-reported sensory-processing sensitivity was associated with daily overstimulation patterns that varied with stimulus pleasantness, fatigue, and mood (Weyn et al., 2026). The precise prediction is that visual responsiveness will moderate subjective overload and stress more strongly than objective accuracy. Whether it also changes sustained-attention cost remains an empirical question.

ADHD-related inattention warrants a secondary role. ADHD symptoms are associated with multiple distraction sources, but external distraction and spontaneous mind-wandering are separable, and classic perceptual-load effects are task dependent (Forster et al., 2014; Osborne et al., 2023). A visual-environment interaction should be tested incrementally after attention control and sensory responsiveness are modeled, not inferred from a diagnostic label.

Taken together, the literature supports environmental main effects under some conditions and reliable person-level variation in relevant processes. It does not yet establish a general visual-environment “type” for each learner. That evidentiary asymmetry is the starting point for VEAF.

Rival Explanations That the Framework Must Defeat

A useful framework should make it harder, not easier, to explain every result after it occurs. Five rival accounts can reproduce an apparent visual-environment effect without the proposed attentional process.

The first is *novelty or expectancy*. A dramatically decorated experimental room may attract attention because it is new, because participants infer the hypothesis, or because the sparse condition looks more conventionally “serious.” Repeated exposure, concealed hypotheses, realistic transitions, and manipulation checks for novelty and expected performance are required. If the effect disappears after novelty is equated, a stable-complexity explanation is not supported.

The second is *instructional substitution*. A task-relevant wall display can improve learning because it supplies information, not because its level of stimulation is optimal. Conversely, an unrelated display can impair learning by occluding a target or introducing semantic competition. Studies must therefore match informational availability or explicitly model it. A benefit from relevant decoration is evidence about external cognitive support, not automatically evidence for an engagement optimum.

The third is *global environmental quality*. Well-resourced rooms can differ simultaneously in light, thermal comfort, acoustics, furniture, maintenance, ownership, and visual design. Observational achievement differences may reflect any combination of those features, prior school resources, or student composition. Isolating the visual field experimentally and measuring correlated environmental features naturalistically are necessary before causal attribution.

The fourth is *selection and reverse causation*. Learners who regulate attention well may choose or construct certain environments. Teachers may add more reminders where students struggle, and adults may simplify a desk after poor performance. A photograph taken at one time point cannot determine whether the space produced the outcome or was produced by it. Randomization, temporal ordering, and within-person crossovers are needed.

The fifth is *measurement substitution*. Looking toward a display is not identical to losing the task goal, feeling overloaded, or failing to learn. A participant can glance at an object while continuing to process speech, or stare at a page while mind-wandering. Preference can increase persistence without improving accuracy, and compensatory effort can preserve performance while increasing fatigue. Multimethod measurement is therefore not decorative rigor; it determines which mechanism a result permits.

VEAF should be retained only if it makes predictions that these alternatives do not. Specifically, measured visual features should explain within-person changes after novelty and global quality are controlled; proximal person attributes should moderate the theoretically assigned pathways; and attention-process measures should precede and predict learning outcomes. Failure at any step narrows the model.

The Visual Environment-Attention Fit Framework

VEAF explains sustained academic attention as a dynamic relation among an environment profile, a task, a person, and an exposure history. Fit is not a trait, a preference rating, or an extra causal variable. It denotes the person- and task-specific response function linking a prespecified environment profile to a prespecified criterion, such as delayed retention, sustained performance, persistence, or effort cost. An outcome-specific fit signature is supported only when a person-specific model predicts held-out sessions better than a population-average model and the response pattern replicates. The same arrangement may fit retention but not comfort, persistence, or strain.

The distractor-cost path begins when a task-irrelevant feature acquires enough attentional priority to win selection. Orientation can be followed by dwell, goal displacement, overload, and reorientation cost. Repeated episodes can disrupt encoding even when a glance is brief;

perceptual distraction can intrude into visual-memory encoding (Dube & Golomb, 2021). Subjective overload and compensatory effort may add cost without reducing accuracy. Attention control should matter especially for suppression and recovery, whereas sensory overstimulation may predict affective cost even when performance remains stable.

The engagement-regulation path is a distinct, provisional hypothesis. Moderate, coherent, static, task-irrelevant enrichment may support interest, persistence, or goal cueing during validated low-interest tasks. The claim is not a general arousal law and is not supported merely because a relevant display supplies useful information. It should be rejected if enrichment does not improve engagement, flatten time-on-task decline, reduce mind-wandering, or sustain performance under the preregistered conditions.

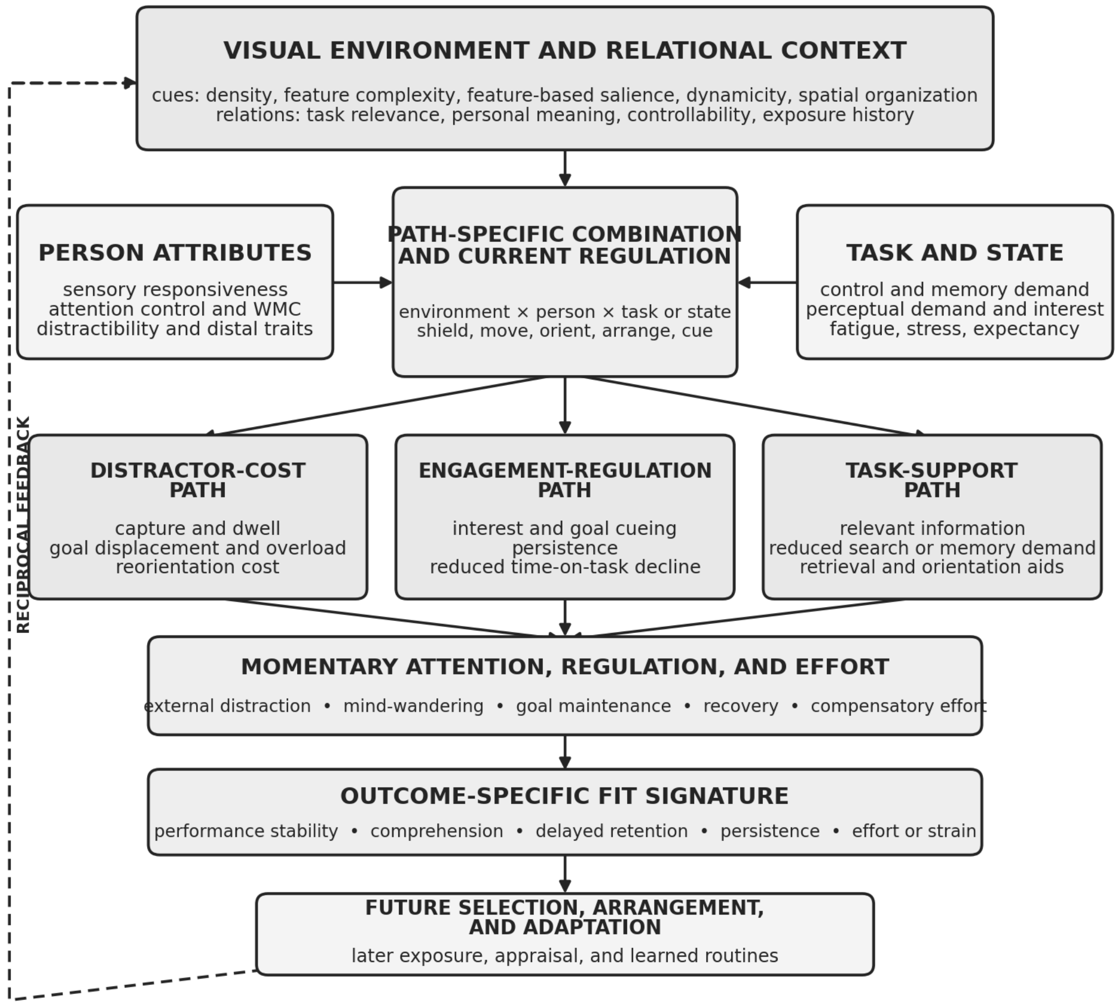
The task-support path covers benefits that arise because a visible aid supplies relevant information, reduces search or memory demand, or supports retrieval and orientation. It is analytically separate from engagement regulation. A display can support learning while also attracting gaze, and its net effect can differ across criteria. Separating these routes prevents a relevant-information benefit from being misread as evidence for an optimal level of stimulation.

Strategic regulation connects present exposure with later transactions. Learners can shield the periphery, move salient objects, center materials, choose a consistent orientation, or deliberately use an external display. A conscientious learner may repeatedly choose quieter-looking spaces; a struggling learner may add reminders after a difficult session. These actions create person-environment correlation, so cross-sectional simplicity-performance associations can reflect selection or reverse causation rather than exposure alone.

Figure 1 summarizes the model. Environment cues and relational context combine with person attributes, task demands, and momentary states in path-specific ways. Current strategic regulation can shield, move, orient, arrange, or cue, thereby changing exposure rather than susceptibility. The three routes influence momentary attention, regulation, and effort, which produce criterion-specific outcomes. Those outcomes then shape later appraisal, selection, arrangement, and adaptation. Exposure history is consequently part of the evolving relation, not a fixed property of a room.

Figure 1

The Visual Environment-Attention Fit Framework



Note. Solid arrows represent proposed process paths; the dashed arrow represents reciprocal feedback into later exposure. Person and task variables combine with environmental properties in path-specific ways. Current regulation modifies exposure, whereas selection and adaptation alter future exposure. Fit is criterion-specific and requires replicated improvement in held-out prediction; it is not inferred from preference alone. WMC = working-memory capacity.

What VEAF Adds to Personality Science

VEAF does not introduce person–situation interaction, reciprocal person-environment transactions, or distractor suppression as new principles. Its contribution is to operationalize them for visual learning environments by separating cue, relational, and appraisal levels; mapping sensory responsiveness and attention control to different paths; distinguishing distractor cost, engagement regulation, and task support; and separating current strategic regulation from future selection and adaptation.

Second, fit is represented as an outcome-specific response signature, not a preferred room category or decontextualized capacity. A person can show strong average control yet a steep response to dynamic peripheral stimuli, or high subjective overstimulation with little accuracy cost because compensatory effort is effective. The signature gains evidential status only through held-out prediction and replication.

Third, the framework separates susceptibility, current regulation, and later selection. Sensory responsiveness concerns the magnitude of initial experience; attention control concerns protection and recovery of the goal; current regulation changes exposure within an occasion; and distal traits can shape which environments are entered or maintained later. Repeated within-person manipulation can test whether a person attribute predicts a random slope while separating that slope from baseline performance (Fleeson, 2001; Mischel & Shoda, 1995).

Fourth, repeated success, failure, compensation, and arrangement can change future exposure and appraisal. A large higher-education study supports the relevance of personality–classroom fit to student outcomes but does not isolate visual-attention mechanisms (Pawlowska et al., 2014). The hotel-room learner who reconstructs a familiar focal zone may be building a portable regulatory scaffold rather than revealing a timeless environmental type. This links personality dynamics to environmental construction and makes adaptation an outcome to study (Kandler et al., 2024; van Vianen, 2018).

These claims also set limits. VEAF does not predict that every trait moderates every environmental feature, that idiosyncratic slopes must be stable, or that personalization will outperform a well-designed common environment. If reliable person-specific response curves do not emerge, a parsimonious population-level model should be preferred. Personality science gains credibility when heterogeneity is measured and tested, not presumed.

Eight Falsifiable Propositions

The propositions below are intentionally more specific than “person and environment interact.” Each states a predicted pattern, a rival explanation, and an outcome that would count against the claim. Table 2 grades the supporting evidence and identifies a decisive test.

Proposition 1: Relevance, Salience, and Dynamicity Will Outpredict Density

At equivalent item count or display coverage, task-irrelevant elements that are high in contrast, motion, abrupt change, personal meaning, or proximity to the focal task should produce greater capture and reorientation cost than low-salience elements. Task-relevant displays can have a neutral or beneficial net effect when their informational value exceeds their capture cost. This proposition would be weakened if density alone predicts attention and learning after relevance, salience, dynamicity, and proximity are controlled with reliable measures.

Proposition 2: Coherence Can Reduce Cost at Matched Density

At matched density and feature content, aligned, grouped, and predictable arrangements should create less subjective overload and external distraction than disorganized arrangements. The predicted benefit is not a license to label any aesthetically pleasing room “coherent.”

Organization must be manipulated or quantified independently of density. A null coherence effect across adequately powered replications would falsify its proposed protective role.

Proposition 3: Sensory Responsiveness and Attention Control Moderate Different Paths

Visual sensory responsiveness, especially overstimulation, should amplify effects of prespecified visual cues on independently measured overload, effort, and stress. Lower latent attention control should amplify the conversion of independently measured capture or goal displacement into response instability, comprehension error, and recovery latency. The key prediction is comparative: the sensory-response interaction should be larger for overload than for objective performance, whereas the attention-control interaction should be larger for recovery and performance than for overload. A same-source questionnaire pattern is insufficient. Failure of this multimethod double dissociation, under adequate precision, counts against the proposition.

Proposition 4: Task Demand and Interest Create Distinct Boundary Conditions

P4a predicts that higher control or working-memory demand increases the effect of salient distractors on recovery latency. P4b predicts that lower task interest increases both external distraction and internal mind-wandering. P4c treats attenuation under high focal perceptual demand as an explicit comparison with a precise null, not as an assumed effect. The proposition is weakened if preregistered demand and interest contrasts leave the environmental effect practically unchanged or if replicated directions fall outside the specified competing models.

Proposition 5: Moderate Coherent Enrichment Has a Conditional, Not Universal, Benefit

During validated low-interest tasks, moderate coherent, static, task-irrelevant, noninformational enrichment may produce greater engagement and a flatter time-on-task decline than low or high density. The pattern should be smaller or absent during high-interest tasks. Null, linear, and nonlinear functions must be preregistered, and preference is not an accuracy outcome. A precise null for engagement, or an engagement difference that does not reduce mind-wandering or sustain performance, rejects the proposed path.

Proposition 6: Familiarity Produces Selective and Incomplete Adaptation

Repeated exposure should reduce capture by stable, spatially predictable elements more than by changing, moving, or semantically renewed elements. Adaptation should be assessed as a time-varying slope, not inferred from a late null mean difference. The classroom evidence makes full habituation an especially demanding prediction. If stable and dynamic features decline at the same rate, or if distraction does not decline over repeated well-controlled exposures, familiarity should not be treated as a protective mechanism.

Proposition 7: Preference, Satisfaction, and Performance Will Diverge

Preference should predict choice, comfort, satisfaction, and persistence more strongly than held-out accuracy or retention. Person-specific process slopes for overload, capture, or recovery should predict attention and retention beyond preference. The test requires chosen, unchosen, assigned, and yoked conditions across sessions. High preference–performance concordance together with no incremental value from the process-based response model would count against the proposition.

Proposition 8: Selection and Modification Can Mimic Causal Environmental Effects

Prior-session difficulty should predict subsequent environment choice or modification, while randomized exposure should estimate the effect of the visual field on attention and learning. Cross-sectional room–performance associations should shrink or change after within-person exposure, prior performance, choice, and modification are modeled. A complementary experiment can test whether permission to recreate a stable near-field arrangement functions as a portable regulatory scaffold. Practical equivalence of lagged observational and randomized estimates within preregistered bounds would weaken the reciprocal claim.

Table 2

Falsifiable VEAF Propositions, Evidence Status, and Decisive Tests

Proposition	Evidence status	Rival or disconfirming pattern	Decisive test
P1. Relevance, salience, and dynamicity outpredict density.	Emerging/indirect: child display and relevance findings; adjacent capture evidence.	Density explains outcomes after the other properties are reliably controlled.	Orthogonal manipulation of density, relevance, contrast, motion, and proximity.
P2. Coherence reduces cost at matched density.	Emerging: observational visual-noise findings; limited matched-density tests.	Organized and disorganized fields produce equivalent capture, overload, and learning.	Matched-object, matched-feature experiment varying only spatial organization.
P3. Sensory responsiveness and attention control moderate different paths.	Generative/indirect: strong person-level evidence; sparse direct room interactions.	The constructs do not yield the predicted comparative double dissociation.	Latent person measures with independent overload, capture, recovery, and learning outcomes.
P4. Task demand and interest create distinct boundary conditions.	Emerging/mixed: load and mind-wandering findings; recent null replications.	Preregistered demand and interest contrasts do not alter the environmental effect.	Separate control, memory, focal perceptual-demand, and interest manipulations.
P5. Moderate coherent enrichment has a conditional engagement benefit.	Generative/mixed: observational nonlinearity and adult nulls; no direct path test.	No engagement benefit, or engagement changes without mind-wandering or performance change.	Compare null, linear, and nonlinear functions across validated low- and high-interest tasks.
P6. Familiarity produces selective and incomplete adaptation.	Emerging/mixed: partial controlled adaptation; persistent distraction in classrooms.	Stable and changing elements show equivalent trajectories, or neither changes.	Repeated exposure crossing location stability with feature change.
P7. Preference, satisfaction, and performance diverge.	Generative/indirect: fit and selection literatures; little visual-attention evidence.	Preference predicts held-out performance as well as the process-based response model.	Chosen, unchosen, assigned, and yoked conditions with held-out-session prediction.
P8. Selection and modification can mimic causal effects.	Generative/indirect: strong transactional rationale; limited visual estimates.	Lagged observational and randomized estimates are practically equivalent.	Longitudinal choice models plus randomized exposure and equivalence tests.

Note. Evidence status refers to directness for the stated proposition, not the overall quality of every adjacent literature. VEAF = Visual Environment-Attention Fit.

A Decisive Three-Stage, Six-Module Research Program

The next step is a three-stage program with six modules. Stage 1 separates stimulus mapping (1A) from person-construct validation (1B). Stage 2 contains modular causal tests of cues and organization (2A), task demand and interest (2B), and repeated exposure (2C), with Proposition 3 tested across modules. Stage 3 tests preference, selection, modification, and reciprocity in repeated natural study. Each proposition has a primary outcome and planned contrast; the program is proposed rather than reported, and no participant data were collected for this article. Table 3 maps the modules to their decision rules.

Stage 1: Construct and Stimulus Validation

Module 1A maps environmental cues, relational properties, and appraisals before testing interactions. A heterogeneous adult sample would rate balanced photorealistic or 360-degree rooms that vary orthogonally in density, feature complexity, feature-based salience, dynamicity, spatial organization, task relevance, personal meaning, exposure history, and controllability. Objective image measures, manipulation checks, and appraisals of order, overload, threat, beauty, ownership, and predicted focus would establish which intended dimensions are empirically separable.

Module 1B validates the person constructs needed for Propositions 3 and 7. Measures would prioritize overstimulation and visual-specific sensory responsiveness, a latent attention-control and working-memory battery, dimensional ADHD symptoms, external distractibility, spontaneous mind-wandering, preference, and choice. Multitrait-multimethod models should test whether sensory reactivity, attention control, and self-reported distractibility are distinct. Measurement invariance across age, gender, neurodivergence status, and cultural or regional groups is a gate for mean or interaction comparisons.

Stage 1 does not identify a causal best room. Its decisive products are a reproducible stimulus space, reliable person constructs, and prespecified manipulation checks. If density cannot be separated from organization, feature salience from attentional priority, or sensory responsiveness from negative affect, the corresponding interaction test should not proceed.

Stage 2: Modular Causal Tests

Module 2A uses counterbalanced within-person experiments that manipulate density, feature salience, dynamicity, relevance, and organization independently while holding illumination, geometry, sound, temperature, screen distance, and task content constant. Eye-tracked capture and dwell, overload, recovery latency, response stability, comprehension, and delayed retention provide the primary contrasts for Propositions 1 and 2 and the multimethod double dissociation for Proposition 3.

Module 2B crosses visual conditions with separate control-demand, working-memory-demand, focal perceptual-demand, and validated task-interest manipulations. External distraction, internal mind-wandering, engagement, recovery, time-on-task slope, and learning test P4a through P4c and the preregistered null, linear, and nonlinear functions in Proposition 5. Sleep, caffeine, time of day, corrected vision, medication status, and baseline interest should be planned occasion-level covariates.

Module 2C crosses stable locations with moving, changing, or semantically renewed elements across sessions to test Proposition 6. Capture and recovery trajectories, not a late mean alone, identify adaptation. Across Stage 2, sample size should be simulated for the smallest interaction of interest, with reliability, repeated observations, random slopes, and multiplicity included. Precise nulls narrow VEAF rather than constituting failed studies.

Stage 3: Ecological Reciprocity and Personalization

Stage 3 begins with repeated usual-environment baselines, then counterbalances assigned, chosen, unchosen, and yoked visual arrangements during real study sessions. Photographic audits and computational metrics verify exposure. Brief process probes and a standardized daily learning module measure external distraction, mind-wandering, overload, engagement, stress, persistence, immediate performance, and delayed retention alongside participants' own academic work.

Held-out sessions test whether preference predicts choice, satisfaction, and persistence more strongly than performance, and whether person-specific process slopes improve prediction beyond preference (Proposition 7). Lagged models test whether prior-session difficulty predicts subsequent choice or modification. Randomized exposure estimates the environment's effect on attention and learning, while equivalence bounds determine whether observational and causal estimates are practically distinguishable (Proposition 8).

A nested experiment can also permit reconstruction of a stable near-field arrangement to test the hotel-room idea as a portable regulatory scaffold. Randomized sequences and process measures distinguish reduced novelty, control of salient input, goal cueing, and the ritual of preparation. Table 3 presents the cumulative logic: failure at an earlier measurement gate constrains the later claim rather than being repaired by post hoc personalization.

Table 3

Proposed Cumulative Research Program

Module	Purpose and design	Core measures	Primary test or decision rule
1A. Stimulus mapping (P1–P2)	Orthogonally map cue, relational, and appraisal levels across photorealistic or 360° rooms.	Image metrics; relevance; meaning; controllability; order; overload; feature salience.	Retain only manipulations with discriminant validity and reproducible intended contrasts.
1B. Person-construct validation (P3, P7)	Validate sensory responsiveness, attention control/WMC, distractibility, and preference constructs.	Latent batteries; HSP-R; ASRS; external distraction; mind-wandering; choice and satisfaction.	Require reliability, factor separation, and measurement invariance before moderation tests.
2A. Cue and organization experiments (P1–P3)	Counterbalanced within-person manipulation of salience, relevance, dynamicity, density, and organization.	Capture/dwell; overload; recovery latency; RT variability; comprehension; delayed retention.	Test P1/P2 planned contrasts and P3's comparative double dissociation.
2B. Task-demand and interest experiments (P4–P5)	Cross visual conditions with control, memory, focal perceptual demand, and validated interest.	External distraction; mind-wandering; engagement; time-on-task slope; learning.	Compare P4a–P4c contrasts and preregistered null, linear, and nonlinear P5 functions.
2C. Repeated-exposure experiment (P6; P3 cross-cutting)	Cross stable locations with moving, changing, or semantically renewed elements across sessions.	Capture trajectory; recovery; expectancy; overload; performance; exposure history.	Estimate time-varying differences; do not infer adaptation from a late null mean.
3. Ecological transaction test (P7–P8)	Repeated baseline plus counterbalanced assigned, chosen, unchosen, and yoked arrangements.	Photographic audits; choice; satisfaction; persistence; process slopes; retention; prior difficulty.	Use held-out prediction, lagged choice models, randomized exposure, and equivalence bounds.

Note. Sample sizes should be set by simulation for the smallest interaction of interest, incorporating measurement reliability, repeated observations, random slopes, and multiplicity.

Analytic and Open-Science Safeguards

Several safeguards are essential because person × environment interactions are easy to overfit. Each proposition should have one primary criterion and planned contrast, with equivalence bounds where a precise null is theoretically decisive. Continuous person variables should not be dichotomized. Moderation requires a direct interaction test, not significance in one subgroup and nonsignificance in another. Primary moderators should be few, proximal, reliable, and selected before analysis; secondary tests require multiplicity control or shrinkage. Random slopes describe heterogeneity but do not identify the trait that explains it.

Randomization identifies the total effect of assigned exposure. Process evidence additionally requires that exposure changes the proposed mediator, that the mediator temporally precedes and predicts the outcome conditional on exposure and baseline, and that plausible alternatives are compared. Causal mediation requires explicit identification assumptions or an independent manipulation of the mediator. Objective cues, relational properties, appraisals, attention indicators, effort, and learning should be analyzed separately before composites are formed; self-report-behavior dissociations are substantive results.

A cumulative program should preregister hypotheses and functional forms, share standardized room stimuli and computational scoring code, report all exclusions and conditions, and replicate across laboratories and natural settings. Studies should report the precision of interaction estimates and the range of person and environment variables actually sampled. A registered-report format would be especially useful because the theory gains from informative null interactions and from rejecting a seductive personalization story when evidence does not support it.

Practical Implications Without Universal Prescriptions

Pending direct adult tests, a low-risk provisional heuristic is to control the most salient, dynamic, proximal, and task-irrelevant features before removing visual material indiscriminately. A learner who can alter a study area might create a stable focal zone, move motion and high-contrast objects outside the near periphery, close unused visual interfaces, and retain aids that serve the current task. These reversible actions target defensible mechanisms, but they are hypotheses to evaluate, not guaranteed interventions.

For classrooms and shared learning spaces, the framework favors modularity. Displays can be curated for relevance, organized into predictable regions, rotated deliberately rather than constantly, and paired with low-stimulation options. A wholly bare room can remove cues of identity, ownership, or learning content; a saturated room can create avoidable competition. Flexible visual shielding and choice may be particularly valuable for learners who experience overstimulation, but accommodations should not require a diagnostic label or imply that a learner is responsible for an unnecessarily demanding environment.

For mobile adult learners, a repeatable arrangement may function as both environmental control and a goal cue. Recreating the same near-field layout across hotel rooms, homes, or shared workspaces is a low-cost hypothesis worth testing. Its benefit should be evaluated against alternatives such as simple removal, mere familiarity, expectancy, and the ritual of preparation. The practical objective is not an aesthetically minimalist life. It is a visual field in which task-relevant information remains accessible and irrelevant competition is controllable.

Constraints on Generality, Equity, and Ethics

The framework is intended for goal-directed academic tasks in visually perceivable physical or digitally rendered environments. Its strongest direct evidence comes from classroom-display studies, many involving young children and brief tasks, while several mechanisms derive from adult laboratory and person-level research. Because this purposive integrative review did not use a systematic search or risk-of-bias protocol, it cannot estimate literature prevalence or treat unlocated interactions as proven absences. The direction and magnitude of effects should not be assumed to generalize across ages, cultures, disability or neurodivergence status, academic tasks, sensory modalities, or exposure durations. Static background displays likewise should not be generalized to instructional graphics or dynamic digital notifications without direct tests.

Cultural and material context matters. A decorated classroom may communicate belonging, local knowledge, achievement, or communal identity; a sparse space can reflect intentional calm or lack of resources. The same computational complexity score can therefore accompany different meanings. Research concentrated in Western laboratories or schools should not establish a universal visual norm. Multi-site work should include settings where educational displays, space ownership, lighting, household density, and shared study practices differ, and should test measurement invariance rather than merely adding country as a covariate.

Environmental control is unequally distributed. Advising a learner to “declutter” can become a disguised instruction to acquire private space, storage, a larger home, or authority over a shared classroom. Research should measure controllability and socioeconomic constraint, and applications should prioritize reversible, inexpensive changes. A person-centered model must not become a person-blaming model: structured heterogeneity can identify who is disproportionately affected while still locating responsibility in environments that can be made more accessible.

Eye tracking, passive sensing, room photography, and digital-behavior logs introduce privacy risks. Naturalistic studies should minimize capture of bystanders and private material, use local or on-device image processing when possible, and allow participants to review or delete images. Sensory and neurodevelopmental measures should be used to support accommodation and theory, not to rank learners’ suitability for particular spaces. The framework specifies hypotheses about boundaries; it does not establish a universally optimal environment or justify automated assignment of people to rooms.

Conclusion

The hotel-room problem appears simple because its visible ingredients are ordinary. Its science is not. A room is not a single level of stimulation, attention is not a single outcome, and a learner is not a passive recipient of environmental effects. The strongest evidence shows that salient, task-irrelevant visual information can capture attention and sometimes impair immediate learning, especially in children. Equally important evidence shows null adult effects, incomplete habituation, weak links between gaze and learning, benefits of task-relevant displays, and possible nonlinear relations in genuine classrooms.

VEAF converts those apparent inconsistencies into a testable person–situation account. Environment cues, relational properties, and appraisals feed three distinct routes: distractor cost, engagement regulation, and task support. Sensory responsiveness is expected to matter most for overload; attention control for protection and recovery; task interest and demand for opportunities for distraction; and distal traits for appraisal, current regulation, selection, and modification. Fit is an outcome-specific, held-out response signature, not a synonym for preference or an interaction presumed in advance.

The field should therefore stop searching for one visually optimal environment for an average learner. The more productive question is who is affected by which visual properties, through what processes, over what time scale, and with what freedom to change the space. Answering it requires precise constructs, within-person causal tests, naturalistic replication, and a willingness to retain null results. The practical promise is not universal minimalism. It is a more defensible science of environments that people can use, shape, and sustain.

Open Science Statement

This article presents a conceptual integrative review and reports no original participant data, participant materials, computational analyses, or statistical code. The review was not preregistered and was not designed as a systematic review or meta-analysis. Accordingly, there are no data, materials, or analysis scripts to deposit. The literature-identification and synthesis approach is described in the manuscript, and all works relied upon for substantive claims are identified in the reference list.

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