

Aligning pedagogical scenarios and interior design through a functional design code for learning environments

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Abstract

Educational interiors often provide mobile furniture and open layouts without specifying how learners can move between individual work, collaborative discussion, presentation, and short breaks. This narrative analytical review develops a functional design code that connects pedagogical scenarios with observable spatial requirements. A purposive set of 21 sources covering design theory, educational environments, studio pedagogy, classroom environmental quality, flexible learning spaces, and attention restoration informs a comparative synthesis and conceptual model. The framework distinguishes a baseline of environmental suitability and regulatory compliance from three functional domains: concentration, social interaction, and provision for attention recovery. Transition buffers connect these domains through spatial boundaries, storage, circulation, and understandable cues for use. The proposed criterion of switchability describes the ease of moving between activity modes; candidate indicators include transition duration, reconfiguration actions, and interference with adjacent activities. Editable matrices translate the framework into design requirements, observable checks, and common failure patterns. A proposed assessment procedure specifies how these indicators could be recorded without combining them into an unvalidated score. The contribution is a coherent language for design briefing and subsequent evaluation, rather than evidence of improved learning outcomes. The model has not been tested in occupied buildings, and the three domains are a design classification rather than an exhaustive taxonomy of learning. Empirical studies are needed to assess reliability, age-specific applicability, accessibility, and relationships between transition conditions and educational practice.

Keywords: learning environments, interior design, pedagogical scenarios, flexible learning spaces, attention restoration, switchability, functional zoning

1 Introduction

Educational interiors must support sequences of activities rather than a single arrangement of desks. A lesson may move from explanation to individual work, peer discussion, presentation, and revision. In art, design, and architecture education, these sequences also involve models, tools, unfinished objects, and shared displays. The practical question for a designer is how an interior can support these changes while allowing work already in progress to continue. A room can offer several furniture arrangements yet require substantial effort every time its occupants use a different one.

Research on flexible learning spaces describes potential benefits associated with learner choice, movement,

engagement, and collaboration, but also shows that interior design and environmental performance must be considered together [1,2]. The presence of movable furniture does not establish that an educational activity can begin readily or proceed without disturbance. Nor does an open plan demonstrate that users can find a suitable place for sustained individual work. Design decisions therefore need to be connected to the demands of particular learning activities and to the conditions under which those activities coexist.

This article uses pedagogical scenario to mean a planned sequence of learning actions, participants, materials, and transitions. A scenario specifies what learners and educators need to do, rather than merely naming a teaching method. For example, project critique requires a visible object, opportunities to speak and listen, and a subsequent return to individual revision. Describing these actions reveals requirements that a label such as flexible classroom may conceal. It also makes the relationship between pedagogy and space available for discussion by designers and educators.

The term design code is used here in a functional sense. It denotes a design specification connecting an activity, its spatial requirements, possible design interventions, and observable checks. It is not restricted to colors, finishes, graphic identity, or a prescribed visual language. Visual coherence remains relevant, but the code addresses what an interior enables its users to do. Similarly, a productive learning environment is defined narrowly as one that avoids unnecessary spatial obstacles to educational activity; the term does not imply a demonstrated increase in attainment.

The proposed framework applies to educational interiors in schools, colleges, and universities, with particular attention to studio teaching. These settings are not treated as equivalent populations. They provide contexts in which a common design language may be useful, while the eventual criteria must be adapted to learners' ages, activities, and support needs. The immediate purpose is to formulate a conceptual specification for design briefing and evaluation, rather than to validate a universal classroom layout.

The research question is how the relationship between pedagogical scenarios and interior decisions can be expressed so that transitions receive explicit attention alongside environmental comfort. The review develops three functional domains and a set of transition buffers, then proposes switchability as a criterion for evaluating changes between activity modes. The contribution lies in connecting established concerns within one inspectable framework. No claim is made that the component design measures are individually new, that three domains exhaust educational activity, or that the framework's effectiveness has already been measured.

2 Methods

2.1 Review design and scope

The study is a narrative analytical review with conceptual modeling. It uses a purposive set of 21 references published between 1975 and 2024: 12 journal articles, one conference contribution, seven books, and one sanitary regulation. The selection connects Russian design and educational-environment traditions with international work on studios, flexible learning spaces, environmental conditions, participation, and restoration. It includes empirical studies, systematic reviews undertaken by other researchers, theoretical works, and professional design guidance. Their different evidential functions are retained rather than treated as interchangeable support.

Sources were selected for their relevance to at least one relationship between educational activity and material or spatial conditions. The review considers requirements for individual concentration, shared work, temporary reduction of stimulation, and movement between these modes. It does not attempt an exhaustive search of all learning-space research. There was no registered protocol, comprehensive database search, independent duplicate screening, formal risk-of-bias appraisal, or meta-analysis. Consequently, the selection cannot

establish the prevalence of a finding across the literature or estimate an intervention's effect size.

2.2 Analytical procedure

The unit of analysis is the relationship between an activity mode and an interior characteristic that can be specified or modified. The analysis follows four steps. First, the literature is examined for descriptions of educational action and relevant spatial conditions. Second, requirements are grouped thematically around concentration, interaction, sensory load, materials, and transitions. Third, mandatory environmental conditions are distinguished from scenario-dependent design choices. Fourth, the resulting relationships are translated into working definitions and a matrix of requirements, observable checks, and typical design failures.

A design intervention, termed a design operator in the framework, is a controllable element such as an acoustic boundary, shared surface, local light, storage location, or movable component. The analytical link is expressed as activity, spatial requirement, operator, and proposed check. For instance, peer critique requires shared visibility; a display location is an operator; whether every participant can view the object without obstructing circulation is a proposed check. Such links are design inferences from the synthesis, not observations collected in a new field study.

The grouping into three domains is based on differing immediate demands for sustained individual work, reciprocal interaction, and temporary reduction of stimulation. Presentation is included within social interaction because it requires a shared field of attention and communication. Material making may involve concentration or collaboration, depending on the task, and therefore cuts across the domains. Transitions are analyzed separately because their requirements concern the change between modes. This arrangement favors a compact design specification; alternative classifications remain possible.

2.3 Limits of the method

The synthesis does not generate a new participant dataset or assess a completed building. It cannot determine which configuration improves attainment, establish numerical thresholds, or validate an attention-recovery intervention. The proposed checks are intended to make later assessment feasible. Statements about published research are distinguished from the author's design proposals, and the future assessment procedure is described prospectively. The value of the method is conceptual traceability between activities and design decisions; its limitation is the absence of empirical testing and comprehensive evidence appraisal.

3 Synthesis of the literature

3.1 Space as a condition of activity

Design theory provides a basis for examining environments through use and the organization of human action [3,4]. Educational-environment approaches extend this perspective to learner agency, developmental opportunities, and relationships between people and their surroundings [5,6]. Activity theory and research on joint action draw attention to objects, tools, and the coordination of participants [7,8]. Together, these traditions support asking how a spatial arrangement participates in educational activity. They do not, however, yield a complete specification of furniture, boundaries, circulation, or storage for every teaching scenario.

Vasilyeva's model of an interactive university educational environment situates space among the conditions for participants' interaction and different forms of work [9]. Human-centered school design addresses the relationship between furniture, users, and educational processes [10]. Russian contributions also discuss transforming school environments, assessing spatial provision, and interpreting the visual image of a school

[11,12,13]. These perspectives inform the functional code by identifying relationships that need translation into inspectable design decisions. Their theoretical and professional recommendations are not treated as independent demonstrations of causal learning gains.

3.2 Environmental quality and scenario suitability

Barrett and colleagues examine classroom design through a holistic, multilevel analysis rather than an isolated furniture feature [14]. Reviews of classroom acoustics and environmental conditions likewise connect learning-related processes with several aspects of the indoor environment [15,16]. These studies support treating light, air, temperature, and sound as interacting conditions. They do not justify attributing an educational outcome to the functional code proposed here. The design inference is that a scenario-based framework should begin with environmental suitability and assess how later interventions affect it.

Regulatory compliance provides a necessary baseline. The Russian sanitary regulation included in the source set illustrates how environmental requirements are formalized in a particular jurisdiction [17]. The framework does not transfer that regulation to other countries or reproduce its numerical limits. Applicable standards and amendments must be identified for each project. Beyond this baseline, requirements depend on activity: audibility and shared visibility matter during discussion, while protection from irrelevant conversation may matter during individual revision. A compliant interior therefore still needs an explicit account of the scenarios it is intended to support.

3.3 Flexible spaces and studio practice

Kariippanon and colleagues report promising findings for adolescent movement behavior and educational outcomes in their mixed-methods systematic review, which included a small set of quantitative and qualitative studies [1]. Vijapur and colleagues connect flexible primary-school interiors with indoor environmental quality and identify the need for stronger empirical evidence to inform design [2]. Read together, these reviews support flexibility as a context-sensitive relationship between pedagogy and physical provision. They offer no basis for assuming that every open or mobile arrangement works equally well for every learner or task.

Corazzo's review of the material studio extends the analysis to art, design, and architecture education [18]. Studio space participates in making, displaying work, learning together, and disciplinary practice. A design code for these settings must therefore consider where unfinished work remains while learners discuss it and how they return to production. Connor's qualitative study also shows a gap between the intended meaning of flexible space and its enactment by teachers and students [19]. This finding makes rules of use and users' understanding of spatial cues relevant to design, alongside physical configuration.

3.4 Recovery and user participation

Attention-restoration theory provides a conceptual account of recovery from directed-attention fatigue, particularly in relation to experiences of nature [20]. It does not demonstrate that any quiet alcove restores students' attention. The recovery domain proposed here is therefore a provision for a brief reduction in acoustic and visual demands, with possible restorative effects left for testing. Plants, natural materials, or a designated break area cannot establish that function by appearance alone. The relation between reduced stimulation, the user's experience, and readiness to resume a task needs separate investigation.

Woolner and colleagues examine how participatory change in learning environments can challenge assumptions and alter practice [21]. The implication for the present framework is procedural: educators and learners should help define scenarios and assess whether design intentions are realized. Participation can reveal obstacles that

are difficult to infer from a floor plan, including informal territory, unclear permission to use an area, or the displacement of materials. The review thus supports combining environmental provision with activity-based interpretation, while the particular three-domain organization remains the author's conceptual proposal.

4 Results of the conceptual synthesis

4.1 The functional design code

The resulting design code has four components: a baseline of environmental suitability and compliance, three functional domains, transition buffers, and observable checks. Table 1 defines the principal terms. A domain is a set of spatial conditions for an activity mode, not necessarily a separate room. Several domains may occupy one interior at different times, or exist simultaneously in differentiated areas. Figure 1 presents their conceptual relationships. It is a functional diagram rather than a floor plan, and its arrows indicate possible transitions rather than measured causal effects.

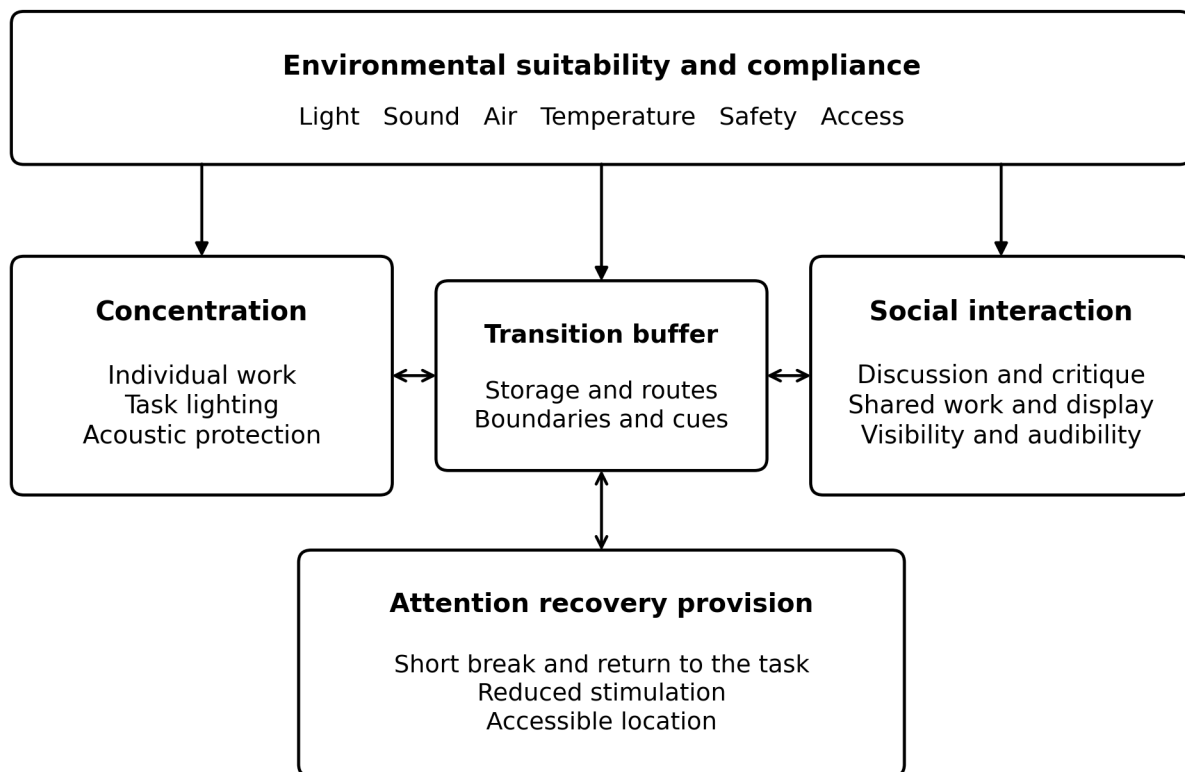


Figure 1. Conceptual relationships within the functional design code

The baseline applies throughout. The transition buffer connects the three activity domains. Arrows indicate possible transitions; the diagram represents functions rather than a floor plan or measured effects.

The concentration domain supports individual activity requiring sustained engagement with a task. Its requirements include a usable work surface, suitable task lighting, materials within reach, and protection from irrelevant noise or distracting movement. These requirements do not mandate complete enclosure. A niche, furniture arrangement, screen, or separate room may meet them, depending on the task and surrounding activities. The proposed check is whether individual work can start and continue without reorganizing the whole room or being repeatedly displaced by adjacent uses.

The social-interaction domain supports discussion, critique, collaborative production, and presentation. Its central requirements are reciprocal visibility, intelligible speech, a shared object or working surface, and accessible materials. Bringing desks together is insufficient if participants cannot see the work or if its placement blocks a route. The domain may use a table, display wall, presentation area, or combination of these elements. Its definition concerns participation in a shared activity, so the arrangement should also account for people who cannot readily move or reposition themselves.

The attention-recovery domain offers a short opportunity to reduce stimulation and subsequently return to work. A location outside the main transit stream, some acoustic protection, and limited competing visual demands are candidate requirements. Partial enclosure must be considered alongside supervision, accessibility, and local safety obligations. A socially isolating or difficult-to-reach space would conflict with the intended function. The proposed check concerns availability and use of the provision; a claim of restored attention would require additional outcome measures. The domain is therefore a design hypothesis, not a validated therapeutic or educational intervention.

Table 1. Working definitions and objects of assessment

Term	Working definition	Object of assessment
Baseline suitability	Environmental conditions and regulatory compliance required throughout the interior.	Light, sound, air, temperature, safety, and access.
Functional domain	Spatial conditions supporting a particular activity mode.	Provision for concentration, interaction, or a short recovery break.
Switchability	Ease of changing activity mode under stated conditions.	Transition duration, actions, and interference.
Design operator	An interior element or intervention that can be specified and assessed.	Boundary, surface, storage, local light, or movable element.
Transition buffer	A spatial, organizational, or perceptual provision reducing conflict during a change of mode.	Routes, material continuity, boundaries, and cues for use.

Author-developed definitions. The terms specify design functions, not validated scales.

4.2 Transition buffers and material continuity

A transition buffer reduces conflict when users change modes. It can be spatial, organizational, or perceptual. A partition may limit sound transfer; nearby storage may preserve unfinished work; a clear route may allow a group to gather without disturbing others. Lighting or visual cues can communicate a change of use, but their meaning must be understandable to occupants. A buffer is consequently not an additional room that every project must provide. It is a relationship between adjacent or successive activities that is addressed through identifiable design decisions.

In studio teaching, continuity of materials is particularly important. The location of models, drawings, tools, and partially completed objects affects whether critique can begin and whether individual production can resume afterward. A display surface should not depend on clearing the only available workbench. Storage should accommodate ongoing projects as well as finished materials. The functional code therefore treats access to materials as part of each scenario and its transitions, rather than a residual furnishing decision made after the main layout is complete.

Table 2 expresses the code as requirements, observable checks, and common failure patterns. These entries

do not prescribe one plan or one product. An acoustic boundary may combine distance, enclosure, geometry, and absorbing surfaces; storage may be fixed or mobile. The designer retains choices about form while making the intended function explicit. The same operator may support several domains, and interventions must be assessed together. For example, a screen that reduces distraction may also affect shared visibility or circulation.

Table 2. Activity modes and proposed design checks

Mode	Spatial requirements	Observable check	Common failure
Concentration	Task surface and lighting; protection from irrelevant noise and movement.	Individual work can begin without reorganizing the entire room.	Mobile furniture with no usable quiet provision.
Social interaction	Shared visibility and audibility; surface or display; nearby materials.	Participants see the work and gather without obstructing routes.	Grouped desks without a shared surface or display.
Attention recovery	Reduced stimulation; accessible location outside main circulation.	A short break is available without leaving the learning area.	Decorative greenery in a noisy transit area.
Transition	Material storage, clear routes, manageable reconfiguration, understandable cues.	The next activity starts with limited interference to adjacent work.	Rearrangement displaces materials or interrupts neighboring activities.

Author-developed specification. Checks concern provision and use; they do not demonstrate learning gains or attention restoration.

4.3 Switchability as a proposed criterion

Switchability is the capacity of an interior to support changes between activity modes with manageable time, actions, and interference. It differs from counting possible furniture layouts. A room may have many theoretical configurations but require users to move materials repeatedly, search for storage, and stop neighboring work before they can use them. Conversely, a relatively stable layout may support several scenarios through readily available surfaces and clear boundaries. The criterion directs attention to an actual transition under stated conditions, rather than to furniture mobility as an isolated attribute.

Three primary indicators are proposed: transition duration, the number of reconfiguration actions, and interference with adjacent activities. Table 3 specifies candidate recording rules. Duration describes elapsed time until the intended activity can begin, while actions describe the work needed to achieve that state. Interference records the consequences for others, including interruptions and obstructed routes. These indicators should initially be reported separately. The review provides neither validated weights nor an empirical reason to combine them into an overall score or impose a universal threshold.

The original concept also concerns attention costs, but attention cannot be inferred directly from duration or furniture movements. Observers may record pauses, searching, repeated instructions, or requests for assistance as contextual events. User reports may help interpret these events. Neither approach by itself measures cognitive load. A subsequent study wishing to make claims about attentional effort would need an appropriate measurement instrument and a design that distinguishes spatial demands from task difficulty, familiarity, and other influences.

Table 3. Candidate indicators for future transition assessment

Indicator	Proposed recording rule	Interpretive limit
Duration	Seconds from the agreed start cue until the target activity is ready to begin.	Record the scenario, occupancy, and start and end conditions.
Actions	Count separately furniture moves, material transfers, and searching events using predefined categories.	Distinguish who acts and whether the action is necessary.
Interference	Record interruptions to neighboring activities and route obstructions during the transition.	Report event type and duration; do not infer cognitive effects.
Reported effort	Obtain brief user accounts after the transition, with an age-appropriate procedure.	A contextual supplement, not an objective attention measure.

Prospective indicators only. No observations were collected, and no combined score or numerical cutoffs are proposed.

4.4 A proposed assessment procedure

Assessment would begin by agreeing on representative scenarios with educators and learners. For each scenario, the evaluator would record the intended activity, number of participants, relevant materials, starting configuration, and target configuration. A transition would then be observed from the agreed start cue to the point when the next activity is ready to begin. Furniture moves, material transfers, searching events, and interference would be documented with their locations. This procedure is proposed for future application; no transition timings or action counts were collected for this article.

Action counting would require a predefined unit. One furniture move could be recorded as relocating one item to its target position, while a material transfer could describe carrying one agreed set of task materials between locations. A searching event would begin when a participant looks for an item needed for the next activity and end when it is found or the search is abandoned. These candidate definitions should be piloted rather than assumed to be reliable. Concurrent actions by several participants should be distinguished from elapsed duration, and a higher count should not automatically be interpreted as waste.

Repeated observations should distinguish an unfamiliar arrangement from routine use and document occupancy, task demands, and adjacent activity. Before-and-after comparisons would also need to account for changes in teaching practice and participants' experience of the space. The design code can help identify what to observe, but it does not establish that a shorter transition is inherently better. A deliberate pause, safe handling of equipment, or time for discussion may be educationally appropriate. The assessment should examine avoidable spatial effort within the scenario's purpose.

The start and end of a transition should be specified for each scenario before comparing configurations. For a critique-to-revision transition, readiness could mean that work is returned to usable positions, tools are accessible, and the group can resume the intended task. For an individual-to-discussion transition, readiness could mean that participants and shared materials are in place and speech can be heard. An agreed readiness definition prevents an apparently faster arrangement from being favored simply because its observation ends earlier. The procedure should also record unsuccessful transitions, substitutions for the planned activity, and learners who cannot access the target configuration.

5 Discussion

5.1 Contribution and relationship to existing work

The framework connects issues that are usually addressed at different levels: educational aims, environmental conditions, furniture and materials, and transitions in use. Its contribution is the inspectable link between an action and an interior decision. It does not replace activity theory, environmental-quality research, or participatory design. Instead, it provides an intermediate vocabulary through which their implications can be discussed in a design brief. The code's value would be demonstrated if it helped users identify and resolve scenario-related obstacles consistently, a proposition that remains open to evaluation.

The distinction between baseline suitability and scenario organization is central. Environmental-quality studies inform the former, while studio and flexible-space research helps interpret the latter [1,2,14,15,16,18]. Neither level substitutes for the other. Adequate physical conditions can coexist with inconvenient storage or unsuitable display locations; a persuasive scenario layout can also coexist with poor acoustics. The framework keeps these concerns visible together. This interpretation avoids treating a visual sign of innovation as proof that an interior supports educational practice.

The three domains are practical groupings of spatial demands. They should not be interpreted as a complete theory of learning or as three distinct psychological states. An individual learner may communicate during concentrated work, and a collaborative task may require moments of withdrawal. The classification remains useful only if such overlaps can be described without forcing every activity into a rigid category. Where specialized activities introduce different requirements, the design brief should extend the code rather than conceal those requirements within a generic flexible-space label.

5.2 Implications for design briefing and use

At the pre-design stage, the code can structure an account of activities, materials, and routes in an existing interior. During briefing, it translates broad requests into functions that designers and educators can examine together. A request for flexibility becomes a question about which transitions are needed, who performs them, and which ongoing activities must continue. During evaluation after occupation, the same account provides a basis for checking whether the intended functions are available. These are proposed applications, with effectiveness still to be established.

For retrofit projects, this approach may help formulate targeted changes when full reconstruction is impractical. Moving storage closer to a work area, providing a display surface, or changing the relation between discussion and quiet work could address a documented obstacle. Such measures should be considered in relation to the baseline and the complete scenario. The code does not establish that inexpensive interventions are always sufficient or that costly spatial changes are unnecessary. Its purpose is to make the reason for an intervention explicit and assessable.

Implementation also depends on shared understanding. Users need to know when an area is available, how materials should remain between activities, and who restores the configuration. A physically suitable place may remain unused if its status is unclear. The participatory perspective discussed by Woolner and colleagues and the practice-related tensions examined by Connor support examining these arrangements with occupants [19,21]. For this reason, operational rules are part of transition buffering, while the adequacy of those rules must be assessed in actual use.

Availability over time matters as much as the presence of an element on a plan. A quiet place may become a temporary store, a display wall may be permanently occupied, and a movable component may lack a usable parking position. The brief should therefore identify the intended duration of each use and the arrangements for

restoring availability. Later evaluation can compare these intentions with everyday occupancy. This extends the code from a description of the completed interior to its operation, without assuming that maintenance routines or users' willingness to reconfigure the space are automatically secured by design.

5.3 Accessibility and competing requirements

A transition that is easy for one user may be difficult for another. Reliance on lifting furniture, carrying large objects, rapid movement, or visual cues alone may make the same configuration unequally usable. Accessibility therefore needs to be considered in the scenario definition and in each proposed check. Evaluators should record who performs reconfiguration and who needs assistance. An interior cannot be judged readily switchable solely because an able-bodied designer can demonstrate a quick rearrangement in an otherwise empty room.

Spatial requirements may also conflict. Greater visibility can support discussion while increasing distraction; enclosure can protect concentration while reducing oversight. Shared surfaces can facilitate critique yet become congested during making. These tensions require decisions about simultaneous use, occupancy, and priorities. The code supports recording the intended compromise and its consequences. It should not be used to claim that one material, one partition type, or an open-versus-closed choice resolves all competing requirements.

5.4 Limitations and empirical validation

The principal limitation is that the framework has not been tested in occupied educational buildings. The purposive review may omit important counterevidence, and it does not formally appraise the quality of each empirical study. Findings from primary schools, adolescents, universities, and studios cannot be transferred without considering their contexts. The proposed recovery provision is especially uncertain: reducing stimulation does not by itself establish restoration. No validated threshold exists here for acceptable transition time, action counts, acoustic interference, or spatial openness.

Validation should first examine whether different observers can apply the definitions and recording rules consistently. Pilot observations could test the clarity of transition boundaries, action categories, and interference events, followed by revisions to the instrument. Field studies could then compare repeated scenarios under documented configurations, combining environmental measurements with observations and user accounts. Claims about educational outcomes would require a separate design capable of addressing pedagogy, prior attainment, group composition, and other confounders. A successful usability assessment would not by itself establish a causal learning benefit.

Outcome selection would also need to match the claim being tested. A reduction in searching events would support a claim about material access; fewer neighboring interruptions would support a claim about coexistence of activities. Neither finding would establish that attention has been restored or learning has improved. These latter claims would require suitable assessments and follow-up beyond the transition itself. Reporting unsuccessful or unchanged configurations would be necessary to determine where the code is useful and where its categories fail to describe the practical problem.

Three propositions follow from the model and can guide such testing. For comparable scenarios, the location of materials may relate to the time and actions required for transition. The arrangement of boundaries and routes may relate to interference with neighboring work. Clear, accessible cues and agreed rules may relate to the predictability of use. These are testable expectations rather than reported findings. Evidence that contradicts them should prompt revision of the operators, indicators, or domain structure instead of being treated as incorrect use of the framework.

6 Conclusions

This narrative analytical review presents a functional design code connecting pedagogical scenarios with interior requirements and observable checks. The code combines a baseline of environmental suitability and compliance with domains for concentration, social interaction, and provision for attention recovery. Transition buffers address the continuity of activities through boundaries, circulation, storage, and understandable rules of use. The model supports describing what a learning interior is intended to enable while retaining freedom in its physical form.

Switchability focuses assessment on changes between activity modes. Transition duration, reconfiguration actions, and interference are proposed as separate indicators, without an unvalidated composite score or universal thresholds. The framework can inform design briefing and future evaluation, but its usability, reliability, and educational implications require field research. The immediate result is a coherent and inspectable design language; improved learning outcomes remain a question for empirical investigation.

Declarations

Author contributions. Nataliya Bikiniaeva: Conceptualization, Methodology, Formal analysis, Writing – original draft.

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Data availability. No original participant or building-performance dataset was generated or analyzed. The sources informing the narrative synthesis are listed in the References, and the complete conceptual specification and proposed indicators are presented in Figure 1 and Tables 1–3.

Ethics approval and consent. This article is a literature-based conceptual study and did not involve human participants, personal data collection, or animal research. Ethics approval and informed consent were not applicable.

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