*Corresponding Author's Email: mo@asnaei.pro
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Sandbox Thinking: Designing Childhood-Centered Visual Education Through Spatial Memory & Procedural Play

Mohammadhassan Asnaei

Freelancer, Armenia

Abstract

This article presents Sandbox Thinking, a pedagogical framework that repositions childhood play, spatial memory, and procedural exploration as foundational elements of visual literacy and art education. Building upon prior work on environmental interpretation in artistic development, the paper proposes a six-module curriculum model designed for children aged 8–14. The model emphasizes embodied learning, symbolic play, iterative design processes, and narrative construction as core mechanisms for developing compositional awareness. Drawing from constructivist pedagogy, Reggio Emilia principles, Studio Habits of Mind, and more recent discussions in spatial cognition, accessibility, and inclusive arts education, Sandbox Thinking offers an adaptable approach that prioritizes process over product. In addition to outlining the theoretical foundations of the model, this paper introduces an evaluation plan based on observation, reflection, and formative assessment, discusses implementation constraints and ethical considerations, and maps the framework to commonly recognized curricular goals in visual arts education. The aim is to contribute to a scalable, inclusive, and practice-oriented model for visual education that integrates cognitive, emotional, and spatial dimensions of learning.

Keywords: sandbox thinking, visual education, childhood memory, spatial cognition, art pedagogy

1 Introduction

1.1 Background and Rationale

In many educational systems, art instruction is still shaped by visible outcomes: finished drawings, technical accuracy, clean execution, and measurable products. While these goals are not without value, such a framework can overlook the deeper origins of visual thinking. Before children learn perspective, design software, or formal composition, they already engage in acts of visual organization. They group stones, line up objects, notice shadows, build shelters, map imaginary territories, and assign narrative meaning to spaces around

them. These early actions suggest that visual intelligence does not begin in the classroom alone. It begins in embodied exploration.

This article develops that premise into a pedagogical model called *Sandbox Thinking*. The concept emerges from the understanding that childhood play, especially spatial and materially driven play, can serve as a foundation for design literacy, visual composition, and narrative reasoning. Rather than seeing play as preparation for later "real" learning, this framework argues that play is already an active site of artistic and cognitive structuring.

This paper also serves as a pedagogical continuation of a prior conference paper, The Backyard Journey (Asnaei, 2025), in which I examined how early experiences in a small outdoor environment behind my childhood home shaped my later artistic language. In revisiting those spaces as an adult through design and digital composition, I came to understand that memory, space, and improvisation had formed not only emotional residue, but also a practical visual grammar. *Sandbox Thinking* extends that insight beyond autobiography and toward a classroom model that can be adapted for broader educational use.

1.2 Purpose of the Paper

The purpose of this paper is to propose a childhood-centered model of visual education that treats spatial memory, material experimentation, and procedural play as legitimate foundations for artistic learning. The paper argues that such a model can help students develop visual literacy in a way that is cognitively grounded, emotionally meaningful, and educationally inclusive.

1.3 Research Objectives and Guiding Questions

This paper is guided by the following objectives:

1. To define *Sandbox Thinking* as a pedagogical model for visual arts education.
2. To explain how childhood spatial experience and symbolic play can support later compositional and design thinking.
3. To present a practical six-module curriculum structure for children aged 8–14.
4. To propose an evaluation framework through which educators can assess learning processes and outcomes.
5. To address issues of accessibility, feasibility, ethics, and curriculum alignment in order to increase the model's educational applicability.

The discussion is also shaped by these guiding questions:

1. How can childhood spatial memory and unstructured play be translated into an art education framework?
2. What forms of visual literacy can emerge when process, material exploration, and personal memory are centered?
3. How can the success of such a model be observed and assessed in classroom or workshop contexts?
4. What conditions are necessary for this model to be implemented ethically and inclusively?

2 Reconnecting with Childhood Spatial Memory

The memory of play is not merely nostalgic; it is compositional. Early environments often function as pre-verbal studios in which children begin to organize the world visually. They observe contrast, distance, enclosure, repetition, and pattern long before these concepts are

introduced formally. A backyard, alley, rooftop, corridor, garden, or vacant lot may become a site where visual relations are felt before they are named.

In *The Backyard Journey*, I described how a small outdoor space behind my childhood home, shaped by fig trees, pomegranate bushes, broken tiles, and scattered objects, became an unconscious archive of later artistic form. As a child, I did not think of these experiences as design training. Yet in adult practice, I recognized their direct influence on how I approached structure, rhythm, texture, and visual storytelling. The act of placing, arranging, moving, and reimagining materials had already established a procedural logic that later reappeared in digital and studio-based composition.

Research in spatial cognition supports the significance of such experiences. Studies in developmental psychology have long shown that children build complex mental maps through movement, touch, orientation, and repeated environmental interaction. Spatial reasoning is not isolated from the body; it is deeply linked to action. Children learn what is near and far, balanced and unstable, enclosed and open, patterned and random through direct engagement with their surroundings. These early experiences may later shape how individuals perceive spatial relationships, proportion, and compositional organization (Newcombe & Huttenlocher, 2006).

This connection also aligns with work in embodied cognition and neuroaesthetics, which suggests that aesthetic understanding is partly grounded in sensory and motor experience (Chatterjee, 2014). A tree is not only seen as a vertical shape; it is also climbed, circled, shaded by, and touched. A wall is leaned against, a stair is counted, a pile of rocks is sorted into order. These experiences become forms of preconceptual design knowledge.

In education, however, such embodied visual knowledge is often displaced by a premature emphasis on product, imitation, or technical correction. Children are sometimes asked to represent the world before they have been encouraged to interpret their own experience of it. *Sandbox Thinking* responds to this gap by treating early spatial memory as a valid source of visual inquiry. It asks students not simply to draw objects, but to reconstruct relationships: Where were things placed? What pattern did they make? How did that place feel? What forms repeated there?

This shift is particularly important for students from diverse social, cultural, or economic contexts. Standardized art curricula may privilege certain visual traditions, materials, or assumptions about what counts as artistic reference. By contrast, spatial memory opens space for multiple beginnings. A child's earliest environment, whether rural, urban, domestic, improvised, crowded, or quiet, can become a source of artistic structure rather than something peripheral to "real" art education.

3 Sandbox Thinking in Early Art Education

3.1 From Sandbox to Pedagogy

The phrase *Sandbox Thinking* is inspired by the literal sandbox: a place where a child can invent, build, destroy, reshape, and begin again with minimal external control. In such spaces, experimentation is immediate. Form emerges through the hands. Scale changes quickly. Narrative and structure evolve together. These qualities make the sandbox not only a physical environment, but also a pedagogical metaphor.

As an educational model, *Sandbox Thinking* values intuition, nonlinearity, and self-directed exploration. Rather than beginning with technical rules, it begins with sensory engagement and material decision-making. Students are not treated as passive receivers of aesthetic

knowledge, but as meaning-makers who can organize shape, space, texture, and story through exploratory action.

3.2 Constructivist and Reggio Foundations

This perspective is strongly aligned with constructivist theories of learning, particularly the view that knowledge is built through active engagement rather than transmitted intact from teacher to student (Piaget, 1952). Within this tradition, direct interaction with materials and environments is not supplementary to learning; it is central to it. A child who arranges found objects in a pattern or repeatedly modifies a clay form is already producing hypotheses about order, relation, and transformation.

The Reggio Emilia approach also provides an important foundation for *Sandbox Thinking*. Reggio-inspired pedagogy positions the environment as a "third teacher" and emphasizes inquiry, responsiveness, documentation, and the expressive capacities of children. In this context, art is not confined to isolated studio time. It is a mode of thinking, noticing, and communicating through multiple symbolic forms. Sandbox Thinking builds on this logic and extends it into a more explicitly visual-compositional framework focused on spatial arrangement, procedural variation, and narrative design (Edwards et al., 2011).

3.3 Studio Habits of Mind and Process-Centered Learning

The model also resonates with the Studio Habits of Mind framework, which identifies habits such as observing, envisioning, stretching and exploring, reflecting, engaging and persisting, and expressing (Hetland et al., 2013). These habits are not abstract ideals; they emerge through repeated artistic process. A child experimenting with shape relationships, revising an arrangement, and explaining why one composition feels "better" than another is already participating in forms of reflective studio practice.

In this sense, *Sandbox Thinking* rejects the false divide between "play" and "serious learning." It proposes that play can be the method through which serious learning occurs. Process is not the opposite of rigor. When carefully facilitated, process-based learning can generate highly sophisticated forms of observation, comparison, revision, and intention.

3.4 Neurodiversity, Accessibility, and UDL

An important strength of this model is its accessibility. Because *Sandbox Thinking* values multiple modes of engagement, it can support learners who may struggle in rigidly product-oriented environments. Neurodivergent students, multilingual learners, students with varied motor capacities, and students from culturally diverse backgrounds may all find more entry points into visual learning when art is approached as flexible inquiry rather than narrow replication.

This orientation aligns well with Universal Design for Learning (UDL), particularly in its emphasis on multiple means of engagement, representation, and expression (CAST, 2018). A student may express compositional understanding through arranging stones rather than through detailed drawing, or through oral narration rather than formal written explanation. The framework therefore allows educators to assess growth through varied forms of evidence rather than through a single dominant mode.

4 Translating Childhood Play into Design Literacy

4.1 Play as Early Design Practice

In *Sandbox Thinking*, the concept of play is not separated from design literacy. When a child lines up sticks, groups objects by size, repeats a circular form, stacks materials symmetrically, or builds a temporary enclosure, that child is already working with principles of composition. Balance, rhythm, contrast, sequence, proportion, and narrative arrangement can all appear in these acts before a child ever hears those terms.

Visual literacy, in this sense, begins not only with looking, but with doing. It emerges from the relationship between bodily movement and spatial organization. Through repetition and improvisation, children begin to explore how forms relate, how patterns operate, and how arrangement can generate meaning (Cox, 2005).

4.2 Meaning-Making and Symbolic Form

Children often work symbolically before they work analytically. A triangle may become a roof, a mountain, or a warning sign; a circular cluster of objects may suggest a nest, a family, a ritual, or a memory. Such meaning is not incidental to design learning. On the contrary, symbolic association often motivates formal decisions.

When educators ask why a child grouped three objects together, chose a repeated rhythm, or placed one shape at the center, they invite the child to articulate visual intention. This is the beginning of design critique. It helps children move from instinctive form-making toward reflective form-making without losing the expressive force of intuition (Wright, 2012).

4.3 Procedural Thinking and Iteration

One of the most important educational values of this model is that it connects visual composition to procedural thinking. Children rarely make once and stop. They adjust, repeat, reverse, layer, and try again. This iterative behavior is central to both artistic development and design reasoning.

Procedural thinking in this framework refers to learning through transformation: what happens if the pattern is rotated, if the spacing changes, if one repeated unit is removed, if the shape is mirrored, if the center shifts? These small operations help students understand that complexity can emerge from simple rules (Peppler & Wohlwend, 2018). Such insight is especially valuable in contemporary visual culture, where procedural systems, digital design environments, and generative methods increasingly shape creative practice.

4.4 From Intuition to Visual Language

The educational task, then, is not to replace children's intuition with formal rules, but to help them recognize that their intuition already contains visual logic. A pattern can become a rhythm. A repeated object can become a motif. A memory map can become a compositional plan. Through scaffolded repetition, discussion, and revision, students gradually develop a vocabulary for what they are already doing.

This transformation from intuitive play to visual language is central to Sandbox Thinking. It respects the authenticity of childhood making while helping students move toward more structured forms of artistic understanding, a progression that aligns with research on the cognitive and developmental impact of arts education (Winner et al., 2013).

5 Studio Curriculum: From Sandbox to Structure

The following curriculum is proposed as a conceptual and adaptable model rather than a report of large-scale empirical implementation. This section translates the theoretical principles of Sandbox Thinking into a practical curriculum framework (Eisner, 2002; Hetland et al., 2013). The curriculum is designed for children aged 8–14, though elements may be adapted for younger or older learners depending on context. The model is modular rather than rigidly sequential, allowing teachers to expand, condense, or rearrange activities according to classroom needs.

5.1 Module 1: Memory Mapping

Students begin by recalling and externalizing spaces from their own early lives or ongoing daily environments. These might include backyards, gardens, hallways, rooftops, stairwells, courtyards, empty lots, playgrounds, kitchens, or streets. The aim is not documentary accuracy but spatial recall.

Students may draw maps, describe routes, build rough models, or verbally narrate places while arranging symbolic materials. The teacher prompts students to notice recurring forms, distances, emotional landmarks, and memorable structures. This module activates autobiographical thinking while grounding visual work in lived experience.

5.2 Module 2: Shape Translation

In this stage, students identify specific forms from their memory maps and translate them into simplified visual elements. A branch may become an angular line system; roof tiles may become repeated rectangles; stones may become clustered circles; shadows may become triangular fields.

The purpose of the exercise is to move from representational recall toward abstraction. Students begin to understand that design can emerge from transformation rather than imitation. This stage builds sensitivity to pattern, reduction, and visual equivalence.

5.3 Module 3: Compositional Logic

Here, students work more deliberately with arrangement. They explore balance, asymmetry, contrast, density, repetition, scale, and focal emphasis using cut paper, blocks, cardboard, clay, found objects, or natural materials. Activities are structured around questions such as: What happens when one shape dominates? How does spacing change meaning? What makes an arrangement feel stable, tense, quiet, or active?

The focus is not on correct answers, but on relational awareness. Students are encouraged to revise compositions several times and compare outcomes. This module helps them internalize formal structure through play-based experimentation.

5.4 Module 4: Procedural Thinking

Students now develop a base form or compositional rule and test variations. For example, they may repeat one unit across a surface while gradually changing scale, rotate a motif through a sequence, alter spacing systematically, or mirror an arrangement around an axis.

This module introduces iteration as a method of thinking. Students come to see that design can be built through operations and not only through spontaneous invention. For some learners, this stage may also create a bridge to digital or computational thinking because it demonstrates how rules generate complexity (Peppler & Wohlwend, 2018; Sousa & Pilecki, 2018).

5.5 Module 5: Narrative Design

At this stage, students infuse their compositions with meaning. They are asked what their arrangement suggests, what memory it draws from, what story it holds, or what emotional atmosphere it creates. Composition becomes not only structural but also symbolic.

Students may title their work, explain it orally, write a short reflection, or build a sequence of images that imply movement or change. This stage helps students understand that design choices can communicate narrative and mood, even without literal illustration.

5.6 Module 6: Material Shift (Optional)

If digital resources are available, students may translate their compositions into simple digital environments using accessible software. If such resources are unavailable, the material shift can remain analog through collage, stop-motion experimentation, shadow construction, or layered sculptural assembly.

The point of this module is not technological prestige, but transfer. Students learn that an idea can move across material systems while retaining structural identity. This reinforces adaptability and helps bridge tactile learning with broader contemporary forms of art and design practice.

5.7 Evaluation Plan

To strengthen feasibility and adoption, Sandbox Thinking should include a visible evaluation plan (Hetland et al., 2013). Because the model is process-centered, assessment should emphasize growth in visual reasoning and engagement rather than polished outcomes alone.

5.7.1 Core Assessment Areas

The following domains may be used for formative evaluation:

1. **Compositional Awareness**
   The student demonstrates awareness of spatial relation, balance, grouping, repetition, contrast, or focal organization.
2. **Iterative Thinking**
   The student revises, varies, and develops ideas rather than stopping at first execution.
3. **Narrative or Symbolic Expression**
   The student is able to connect visual choices to memories, meanings, or conceptual associations.
4. **Material Engagement**
   The student explores materials with intention, responsiveness, and curiosity.
5. **Reflective Articulation**
   The student can describe decisions, compare versions, or explain what changed and why.

5.7.2 Suggested Formative Rubric

A simple four-level rubric may be used:

- **Emerging**: The student begins to engage with materials and can make basic visual choices.
- **Developing**: The student shows some awareness of relation, pattern, or story and attempts revision.

- **Proficient**: The student organizes compositions intentionally, revises meaningfully, and communicates visual ideas clearly.
- **Advanced**: The student demonstrates strong relational thinking, sustained iteration, and nuanced symbolic or narrative control.

5.7.3 Observational Protocols

Teachers may document process through brief observational notes such as:

- What materials did the student choose and why?
- Did the student revise the work after feedback or self-reflection?
- Did the student make compositional decisions intentionally?
- Was the student able to connect memory or meaning to the visual arrangement?
- What form of support increased participation or clarity?

5.7.4 Student Reflection Prompts

Possible prompts include:

- What place or memory inspired this work?
- What changed between your first and final version?
- What shapes or patterns were most important in your composition?
- What feeling or idea were you trying to show?
- What would you try differently next time?

5.8 Pilot Classroom Vignettes

To demonstrate feasibility, the model can be illustrated through brief pilot-style examples.

Vignette 1: Memory Map to Composition A group of students aged 9–10 were asked to recall a place where they often played. One student mapped a narrow alley beside her home using repeated rectangles and a central curved line to show the path she used to run through. In a second stage, she translated this map into a paper composition based on repeated narrow forms and a contrasting open space at the center. Through teacher questioning, she described the open space as “the safe part” of the alley. This shift from memory to compositional relation demonstrated both symbolic awareness and formal decision-making.

Vignette 2: Procedural Variation with Found Objects Students aged 11–12 were given stones, sticks, and cardboard circles and asked to create a repeated structure with one rule. One student arranged stones in a spiral, then tested three variations by changing the spacing and introducing a second material. During reflection, the student noted that the wider spacing made the design feel “quieter” and the denser version feel “more serious.” This provided evidence of procedural experimentation and growing visual vocabulary.

These vignettes are illustrative rather than empirical findings, but they show how the framework may operate in practice and how teachers may observe learning through process.

5.9 Curriculum Alignment

To support educational adoption, the modules may be mapped to broadly recognized curriculum goals in visual arts education.

- **Creating**: Students generate original visual work from memory, material exploration, and iterative transformation.
- **Presenting**: Students organize and share compositions, explain material choices, and communicate process.

- **Responding**: Students reflect on visual decisions, interpret peer work, and discuss meaning.
- **Connecting**: Students connect visual form to personal experience, environment, and broader symbolic understanding.

The framework also aligns naturally with Studio Habits of Mind, especially observing, expressing, reflecting, stretching and exploring, and envisioning. In interdisciplinary settings, Modules 3 and 4 may also support STEAM-oriented learning by introducing systems thinking, pattern logic, and structured experimentation (Hetland et al., 2013; Winner et al., 2013).

6 Implementation Constraints, Accessibility, and Ethics

6.1 Practical Constraints

Although *Sandbox Thinking* does not require expensive materials or advanced technology, its implementation does require pedagogical readiness. One major constraint is time. Teachers working within tightly structured schedules may find it difficult to sustain slow observation, reflection, and revision if curricula prioritize rapid product completion.

Teacher training is another factor. Process-centered teaching requires educators to ask productive questions, document learning meaningfully, and tolerate ambiguity without rushing toward correction. In settings where art teaching is expected to produce standardized outputs, this may require a conceptual shift.

Class size can also affect implementation. In larger groups, individualized observation and documentation become more demanding. Educators may need simplified protocols, peer reflection strategies, or rotating focus systems to preserve the quality of engagement.

6.2 Accessibility and Inclusion

A strength of the framework is that it can be adapted across different learning profiles. Because the model allows multiple means of engagement and expression, it is well suited to inclusive settings. However, accessibility should not be assumed automatically. Teachers should consider sensory sensitivities, communication preferences, motor needs, and cultural differences in autobiographical sharing.

Flexible participation formats are therefore important. Students may choose to narrate rather than write, arrange rather than draw, work individually or collaboratively, or draw from present environments rather than emotionally charged memories. Such flexibility supports broader participation without weakening the pedagogical model (Immordino-Yang et al., 2019).

6.3 Ethical Considerations of Autobiographical Memory

Because *Sandbox Thinking* sometimes invites students to revisit personal spaces and memories, ethical care is necessary. Not every memory is safe, pleasant, or easy to share. For some students, autobiographical recall may activate discomfort, grief, displacement, or social comparison.

Teachers should therefore avoid pressuring students to disclose personal history beyond what they wish to express. The goal is not emotional exposure, but visual inquiry. Students should be free to work from imagined, observed, or generalized environments if personal memory feels inappropriate or inaccessible.

Educators must also be attentive to how memory-based activities may intersect with cultural identity, migration, trauma, or housing instability. The framework can be meaningful in such contexts, but only when participation remains voluntary, respectful, and flexible (Immordino-Yang et al., 2019).

7 Conclusion

Sandbox Thinking proposes that visual intelligence is already active in the child who arranges stones in a line, builds shelters from found objects, watches shadow patterns across a wall, or invents worlds from scraps and memory. Rather than treating such acts as secondary to formal learning, this paper has argued that they may constitute a foundational layer of design literacy.

By reframing childhood spatial memory, symbolic play, and procedural exploration as legitimate sources of art education, the model offers an alternative to narrowly product-centered instruction. It invites educators to begin not with perfection, but with relation; not with imitation, but with discovery; not with technique alone, but with the child's evolving visual logic.

The six-module structure presented here is intended to be adaptable, inclusive, and scalable. It supports visual learning through memory mapping, abstraction, compositional reasoning, iteration, narrative design, and material transfer. It also becomes stronger when paired with observational assessment, reflective documentation, ethical sensitivity, and curricular mapping.

In a time when educational systems often seek measurable outcomes above all else, *Sandbox Thinking* argues for another kind of rigor: one grounded in process, perception, revision, and meaning-making. It proposes that the roots of artistic thinking may already exist in the environments children inhabit and the forms they create through play. The role of education, then, is not simply to instruct them how to make images, but to help them recognize the visual intelligence they already possess.

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