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Working Hypotheses
(Insights from Visual Notes – Fall 1999-Spring 2002)

Category: Visual Images

- Children who are predominantly visual-spatial learners may be over-stimulated by the volume of visual images they encounter in today's society. Giving children ways to make sense of visual images, and categorizing them so they can see patterns will reduce the amount of over-stimulation.
- Children who are predominantly visual-spatial learners may be more adversely affected emotionally by violent images than children who are not visual-spatial learners. It is critical that our research help parents be aware of the potential impact of the images that their children are exposed to and that we provide children with rich visual images from architecture, nature, etc.
- Providing children with intentionally chosen rich visual images improves the quality of work they do with blocks and 3-D objects.
- Providing 3-D images that children can physically handle (e.g., replica buildings) provides more powerful/compelling learning for children than only working in 2-D.
- Providing children with rich visual images extends their thinking beyond their own personal experience. It provides them with knowledge about something they may not have necessarily experienced personally – and in a way that we could never do verbally.
- Rich visual images expose children to layers of knowledge including aesthetics, features/characteristics, historical perspectives, etc. It is important for teachers to think intentionally about the ways children are interacting with the visual images teachers are providing, to help children gain the most knowledge from the image(s) as possible. It is important for parents to think carefully about the kinds of toys they choose for their children, and for teachers to think carefully about the kinds of materials they provide for children to interact with. Supplying children with intentionally selected, rich, visual images is a vehicle for incredible knowledge acquisition.
- Children communicate knowledge through their visual-spatial work with blocks and 3-D objects. By creating or re-creating the visual images they hold in their minds they can show us what they know, which in some cases they may not be able to communicate verbally. Teachers and parents can learn a great deal about what children know by studying the visual images they create.
- Children store knowledge in visual images – and seeing a particular visual image can trigger that knowledge stored in their memory. Visual images help children make associations and aids memory.
- A great deal of information is stored in children's brains by visual images. Giving children stories with the images helps them hold visual images in their mind/memory (we believe the reverse is true also – seeing a visual image can help children remember a story). Visual image + story aids memory. We believe visual image + movement also aids memory.

Category: Visual Notes

- Visual notes help teachers…
  - learn more about children's visual-spatial thinking
  - strengthen their own visual-spatial thinking
  - practice visual discrimination
  - notice and document the sequence and process of building
  - focus on capturing the most relevant information (i.e., meaningful incidents)
  - recognize children's visual-spatial ability and skill development/level (i.e., recognize strong VS thinkers and also see deficiencies)
  - see better…i.e., be better observers (notice things they may have taken for granted)
- The knowledge gained from visual notes can help teachers scaffold children's learning, by helping teachers identify where in the zone of proximal development children are so they can support their learning accordingly.
- When children observe teachers taking visual notes, they may be encouraged to draw their own work. The value of children taking visual notes includes:
  - helping them make the transition from 3-D to 2-D
  - training them to become better observers
  - aiding their visual memory by not only building but drawing
  - making a link between large motor skills (building) to fine motor skills (drawing)…for children who do not have strong fine motor skills this can give them the opportunity to practice.
  - providing a link between their work, their drawing, and literacy activities
  - practicing the skill of one-to-one correspondence
  - helping them see and physically experience whole-to-part relationships – they see the whole and also have to draw the parts
- Once children have had the physical experience of building an object, they seem to be able to draw what they have constructed – probably more easily than drawing something from their mind without the physical experience.
- The use of visual notes is not an art technique – we can learn just as much from a simple, crude drawing that conveys a great deal of information than we can from a beautiful drawing. It is key to help teachers understand this!
- The assessment of visual-spatial thinking must come through a visual-spatial technique. Teachers are familiar with anecdotal note taking – taking visual notes is the analog to that in the visual-spatial domain.
- The use of visual notes may entice children into the block area (we have seen this occur with little girls who wanted to have their structures recorded) and may entice children to build. It is critical to remind teachers how important it is for children to see teachers sketching children's work (especially at the beginning of the year).

Category: Gender

- Typically preschool girls spend less time working in the block area than boys. Boys seem to naturally gravitate to the block area whereas girls often need to be enticed or invited in. (Note: from looking at early infant toddler data, it seems there is a change for girls around age 3…girls in the infant toddler area don't seem hesitant or intimidated to be in the block area – in fact, they can hold their own with little boys. When they move to the preschool side, they seem to be concerned about having too many boys in the area, and become more hesitant to work in the block area – this is something to continue to explore).
- Teacher presence/encouragement is often key to enticing little girls into the block area. (One way teachers have done this is to provide girls with the opportunity to do something they are familiar/comfortable with in the block area).
- Girls seem to be less assertive than boys when they are in the block area. They may be more likely to withdraw or defer to boys. They may be more likely to be discouraged by "failure" or critique/criticism from other children.
- Girls tend to play with smaller blocks, add decorative features to their structures, and tend to build more stereotypical structures that are accompanied by role play and story.
- Boys often engage in block work that provides them with the opportunity to gain physical mastery over their fears (i.e., this becomes a way of working out their emotions). If girls spend less time doing block work, they will miss this opportunity to physically confront their fears and build their self-confidence. Girls who have little experience building will miss out on key visual-spatial skill development.

Category: Failure/Critique (related To Gender)

- Working with blocks provides immediate feedback and a venue for experiencing public failure. Little girls who are sensitive to this may be more reluctant to engage in block work, especially with large blocks, and/or may become frustrated and quit/leave the area.
- When little girls' ideas are challenged (e.g., boys suggest girls should do something differently) they are more likely to defer to boys or leave the area than continue working. Helping little girls become more comfortable experimenting, less concerned with perfectionism, and more persistent when they have difficulty working with materials can help them develop the ability to both critique their own work, and accept critique from others. The learning that comes from persistence in experimenting will aid their skill development.
- Children who have the opportunity to receive feedback on their work and critique their own work are developing self-confidence that will enable them to be more assertive in the future and aid them later in life in professions where critique is a critical component (such as architecture, engineering, law).

Category: Emotions

- When children use blocks to act out fearful situations it helps them feel a sense of mastery over their fears. If children are physically controlling what they perceive to be dangerous scenarios through their block work, their sense of empowerment will increase. Since we see boys doing this more than girls, we believe girls are missing an important opportunity to experience this type of empowerment.
- Children can act out their feelings with blocks before they can verbalize them. Working with blocks gives children the feeling of physically controlling a situation.

Category: Visual-Spatial As A Language

- Children's physical work with blocks and related materials enables children to demonstrate knowledge before they can verbalize it (especially young children, language delayed and ELL children). In fact, the dominant form of communication for some children is through their visual-spatial work. If we do not recognize that children are communicating knowledge through their work, we have lost a vital link to their communication. For some children, their work in the block area may actually help them begin to communicate about it verbally. The block area may be the best place to make the link between visual-spatial and verbal literacy as children are engaged in work that is meaningful and they want to talk about it.
- Block work provides children who do not have many verbal skills with the opportunity to interact socially with other children. Communication/interaction can take place in the process of negotiating block work without verbal language.

Category: Special Needs Children

- As we have observed children for the past seven years it has become apparent that children who have special needs often have strong visual-spatial skills (e.g., children with ADD, verbal language delays, autism).
- Children with verbal language delay(s) seem to be driven to build – perhaps to use their visual-spatial work as a means of communication.
- It is critical to recognize that children communicate through their visual-spatial work; this is especially critical for language-delayed children. If we do not recognize this, we may significantly diminish what we believe they know/are capable of/can do…and will not be in a position to scaffold their learning.
- In the block area, special needs children can interact with other children without using verbal language. It is a place where they can have their knowledge/work affirmed…and may even become "masters" who mentor other children.

Category: Materials

- Children's use of non-standard blocks and materials promotes problem solving, divergent thinking, and a wide range of skill development.
- Blocks support children's abstract thinking abilities in a way that pre-formed toys (e.g., Fisher Price Garage, telephone,

trucks) do not. Children think more abstractly when they select blocks/materials to construct a garage, or choose a block that may resemble the shape of a telephone, or use blocks to represent trucks – this gives children the opportunity to engage in representational thinking. With pre-formed toys this representational thinking is not necessary.

- Replica buildings are an excellent tool for providing rich 3-D visual images, to help children understand the concept of scale, provide a link to history and culture, and to expose children to great aesthetics and architecture.
- Use of larger materials in the classroom promotes the use of larger muscles and kinesthetic movement.
- Use of non-standard materials such as frame-and-cover can teach problem solving skills and promote mathematical skill development such as estimation, covering area, and volume.
- Using multiple materials to represent the same image aids in visual images, making visual analogies, and divergent thinking.
- Adding many kinds of materials to the block area changes children's experience there in positive ways – different kinds of materials provide different kinds of skill development, the need for divergent thinking, and making visual analogies (e.g., straws and connectors, PVC pipe, fabric and clips).
- Key – Teachers need to explore the properties of materials/the kinds of skills that can be developed using those materials before they introduce those materials to children! (e.g., the workshop on straws and connectors!). Teachers need to have the opportunity to explore and understand the properties of various materials and the skill development that specific materials can support in order for them to scaffold children's learning effectively.
- Some materials may be better than others to challenge advanced builders (e.g., straws and connectors, fabric and clips)…they provide more opportunity for divergent thinking and problem solving.
- Teachers need to think much more carefully/intentionally about the selection of materials and how specific materials support children's skill development. Materials need to be linked to specific skills we want to help children develop or specific problems we need to solve.
- Materials do not need to be expensive or commercially made (e.g., blue Styrofoam pieces helped us think outside the box). They may be homemade and may be made of recyclables.

Category: Teacher Support (for children's visual-spatial learning)

Teacher presence in the block area is critical. Teachers need to be in the block area long enough to carefully observe children so they can: 1) notice and note the sophistication of children's work, 2) key into children who are communicating primarily through their visual-spatial work (and the knowledge they are communicating); 3) most effectively scaffold children's learning by being there and recognizing the teachable moment, 4) entice little girls and reluctant builders into the block area and encourage them to stay longer, and 5) help beginning block builders so they do not become so frustrated.

- Teacher support includes:
  intentionally providing the best materials for skill development
  knowing the best time to introduce materials
  knowing when to intervene when children are problem-solving
  understanding where children are developmentally and recognizing ways they can scaffold learning/when children are ready to progress.
- Teachers can use the construction typology as a tool…. to help them identify the specific skills children are trying to work on (though one challenge of this is that the typology is non-linear…skills are not necessarily staged…but some skills are more simple and some more complex).

Category: Kinesthetic Skill Development

- Children who tend to be more kinesthetic seem to more often build structures that are larger scale that they can physically use (this may provide a self-constructed outlet for these children to move).
- When teachers use kinesthetic movement in their teaching, children tend to remember the concept more because their bodies are moving (i.e., kinesthetic movement cements concepts in children's memory). The more experience children have with movement, the more they will be able to remember those movements and think abstractly about them.

- As children work with three-dimensional materials over and over, they not only develop visual memory, they also develop muscle memory.
- Teachers need to think intentionally about the kinds of materials that are oriented toward physical movement (e.g. larger blocks, fabric, materials that move such as trucks). The kinds of materials children use influences the way their bodies move while they work (e.g., different movements when carrying heavy vs. light, when working with large vs. small or thick vs. thin materials, and the amount of movement inherent in the materials used).
- Kinesthetically children experience volumetric thinking by building structures large enough to get inside….they can explore inside and outside and this also gives them a scale relationship with themselves. This experience with volume should help later with 2-D/3-D math problems.

Category: Skill Development

Note: This is not an all-inclusive list!!!!!! The skills listed below were evident in our analysis of one group of specific insights only. Also see the Construction and Aesthetic typologies for specific skills, and see other data sets)

- Social interaction skills including:
  - communicating concepts
  - negotiating
  - collaborating
  - taking initiative
  - helping/mentoring
- Learning time concepts (e.g. past-dinosaur age; future-space travel)
- Kinesthetic skills including:
  - maneuvering materials
  - fluidity (motor skills)
  - working in 100% scale (building structure for physical use)
  - negotiating body space
  - experiencing area, volume (awareness-inside/outside)
  - abstract thought about movement
  - physically rotating objects in space
  - using a tool to extend body reach
- Making visual analogies/using blocks to represent objects
- Classification skills including categorizing shapes/materials and pattern-making
- Fluidity/flexibility of thinking (morphing objects)
- Divergent thinking (new ways to use/position materials, using materials in non-standard ways)
- Problem solving (taking initiative to solve a problem, perseverance to keep trying)
- Analytical thinking and use of logic
- Making associations/associating visual objects with their functions
- Sequential thinking
- Observing environment/taking in visual information
- Noticing detail in visual images
- Identifying relevant parts/salient features of a visual object
- Mentally deconstructing visual images into parts that can be represented by blocks
- Reductive thinking – how to convey the essence of an object (e.g. what makes a mailbox a mailbox)
- Determining the proximity of parts to each other
- Assembling parts (from a mental image) into a whole that is consistent with the mental image
- Remembering long chains of connected visual images (e.g. route to the airport/layout of a city)

- Using visual memory including storing images in one's mind (filing/sorting), retrieving the images, and re-creating the images
- Replication of a structure from visual memory (can be from a mental or physical image)
- Creating a new visual image (create in mind, or combine visual images into a new image)
- Changing a visual image
- Adding decorative/aesthetic features to structures (creativity)
- Math skills including:
  - recognizing and creating geometric shapes
  - whole-to-part and part-to-whole relationships
  - scale relationships
  - estimating distance
  - estimating size
  - knowledge/experience of area/position/volume
  - rotating objects in space
  - estimating trajectory of an object
  - thinking about dimensionality/how to show it (2-D/3-D)
  - making angles
  - making dimensional decisions – vertical/horizontal
- Verbal language skills including:
  - describing images/objects (may be visual image(s) in one's mind or a physical object)
  - negotiating with other builders verbally
  - naming parts or structures
  - inventing names/words
- Link to written language skills (e.g., writing name, identifying object in writing on a sketch)
- Link from concrete object to abstract thinking
- Going from 3-D (build it) to 2-D (draw it) and vice versa
- Construction/Engineering skills including:
  - sizing
  - strong base
  - loading
  - stacking
  - aligning
  - squaring
  - cornering
  - ramping
  - bridging
  - selecting appropriate materials for concept
  - knowledge of stability and weight
  - trial-and-error problem solving
  - using fasteners
  - covering area

SYNTHESIS NOTE: As a product of our analysis, we have decided to focus on three key things children are conveying through their visual-spatial work:

- construction/engineering skills
- specific content knowledge, and
- emotions.

We have seen these conveyed over and over in the data. Specifically the construction typology speaks to #1.