

## Blocks: Great Learning Tools From Infancy Through the Primary Grades

**Diane Hobenshield Tepylo, Joan Moss, and Carol Stephenson**



**Preschool**

# A Developmental Look at a Rigorous Block Play Program

**S**INCE FRIEDRICH FROEBEL INTRODUCED blocks to kindergarten more than 150 years ago, researchers have attributed numerous developmental benefits to block play. Benefits for children include the development of motor skills, classification ability, imagination (Hirsch 1996), social skills, language, early reading ability (Hanline, Milton, & Phelps 2010), and later mathematics achievement (Petersen & Levine 2014). Research indicates that block play is also related to spatial reasoning (see Nath & Szücs 2014; Verdine et al., “Find the Missing Piece,” 2014). For children of preschool age, spatial reasoning involves the structuring of space: noticing and describing shape, location, orientation, movement, and spatial relations (NGA & CCSSO 2010; Ontario Ministry of Education 2010).

Despite all these benefits, in many early childhood classrooms, rather than forming a coherent program, block play is merely one of many options for choice time, with the blocks typically found in an out-of-the-way corner (Casey et al. 2008). As a result, many children rarely play with blocks or reap the multifaceted developmental outcomes associated with structured block play (2008). In the absence of a carefully considered block program, when children do use blocks in free play, boys and girls may play differently: boys tend to choose block play more often and build taller, more complex structures than the girls, who, when they choose to play with blocks, tend to build flat environments used for sociodramatic play (Kersh, Casey, & Young 2008). These distinctions result in very different opportunities to develop spatial reasoning skills.

Spatial reasoning is increasingly connected to achievement in geography and in science, technology, engineering, and mathematics—the economically valued STEM fields (see Newcombe & Frick 2010). Because of its role in learning, many early childhood educators worry about known discrepancies in spatial reasoning abilities—performance differences between boys and girls are found as early as 4½ years (Kersh, Casey, & Young 2008). Additionally, discrepancies in spatial performance between children from different socioeconomic backgrounds are found as early as 3 years (Verdine et al., “Deconstructing Building Blocks,” 2014). Fortunately, researchers find growing evidence that spatial reasoning can be improved (Uttal et al. 2013) and that guided block building is an effective strategy for developing spatial reasoning (Casey et al. 2008; Newcombe & Frick 2010).

Although there is a need for further research on the benefits of block play for spatial and STEM learning, evidence strongly suggests that block play is important in the early years in helping children understand many important concepts in geometry, number, and measurement. For example, in block play children often count, compare heights and volumes, and transform, compose, and decompose geometric shapes (Clements & Sarama 2009; Verdine et al., “Finding the Missing Piece,” 2014). Indeed, to support equitable learning for all children, NAEYC and the National Council for Teachers of Mathematics (NCTM), in their joint position statement on mathematics in early childhood (2010), recommend carefully planned and implemented block programs for all young children.

### A planned block play program

This article examines the prekindergarten classroom of Carol Stephenson (the third author), whose well-established block program meets many of the goals identified by NCTM and NAEYC (2010) and aligns with established learning trajectories for block building. In Carol’s full-day prekindergarten, every child regularly plays with blocks. While Carol intentionally plans (Epstein 2014) her block program to support children’s language, science, mathematics, and social development, we focus here on how the program helps children develop persistence, creativity, and spatial reasoning. By the final term, most of the children in Carol’s classroom play with blocks for up to

two hours, engrossed in their building and in their creation of structures that are often more complex than one might expect from reading the existing research.

## Block play is important in the early years in helping children understand many important concepts in geometry, number, and measurement.

We first consider Carol’s program through the important lenses of time, space, and building materials. We then provide snapshots of Carol’s program at two points in the school year: the first, at the beginning of the school year, describes how Carol builds engagement in and familiarity with block play for all children; the second, later in the school year, shows how Carol supports children in increasing the complexity of their block building.

### Key elements of the block play program

To describe Carol’s block program, we begin by discussing three important elements: the materials she chooses, the time she allots, and the use of space.

#### Materials

To encourage extended block play Carol chooses visually and tactilely interesting natural materials for the classroom, especially a wide variety of wooden blocks that fit easily in the children’s hands. She selects simple blocks—such as flat wooden slats and flat cylinders, and cubes, cylinders, prisms, and arches—believing that materials with less obvious purposes provide more possibilities for imaginative play. Each day, Carol sets out collections of blocks that address her instructional goals. To begin the sessions, she offers the children large bins of these simple blocks. As the building sessions continue, Carol encourages the children to incorporate a greater range of materials from the classroom shelves, such as ceramic and glass tiles, empty lipstick tubes, carpet tiles, small slices of branches, and a variety of small plastic shapes. By initially restricting choices, teachers can focus children’s attention on the blocks’ properties, letting them notice, for example, that two cubes make a rectangular prism, flat surfaces stack better than round or pointy shapes, and long pieces can bridge spaces between blocks.

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## Time

In addition to carefully selecting materials, Carol plans the daily schedule to include two play periods—morning project time and afternoon project time—during which blocks have a key role. In both project times, blocks are featured but are not the exclusive focus of the play period. During morning project time—generally 1½ to 2 hours—the children choose from an array of materials that may include LEGOs and small figurines, board games, structures such as a wooden farmhouse with animals, and a wide variety of wooden blocks. During afternoon project time, a greater focus is placed on sociodramatic play. Children are invited to play in dress-up areas and house centers. Carol provides large blocks to create environments and further dramatize the children's play. Small blocks are also available in the afternoon, for children to incorporate into dramatic play or simply gain further experiences in building.

## Carol's first goal is to encourage all the children's interest, engagement, and persistence in block play.

One morning per week, Carol dedicates morning project time to structures time, when all the children participate in rigorous and structured play with blocks. This focus on block play helps develop the children's persistence and engagement. For the 40 or 50 minutes of structures time, the children work exclusively with the building materials introduced by Carol. After this time, the children add small animals or people figures, which changes the narrative from structures to characters' actions. The addition of these small toys helps sustain less engaged builders, providing renewed inspiration to continue building. As the year continues, teacher prompts to sustain building become less and less necessary, and by the middle of the winter term many of the children are engrossed in building for the full project time.

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## Space

In addition to contemplating materials and the use of time, Carol carefully considers the use of space in the classroom. She sets up the room to leave a large, open, central area in the middle with most tables placed around the periphery. The large floor space is used for circle and story time gathering and also allows for major building projects, providing space for both height and sprawl. Carol places a variety of small blocks on tables. This arrangement lets the children build directly on the tables, providing a more constrained building area and an alternative to building on the floor.

## Creating an inclusive building program for all children

As mentioned earlier, not all children regularly choose to play with blocks (Kersh, Casey, & Young 2008). Children



who seldom opt for block play forgo valuable experiences that promote spatial understanding and other mathematics and engineering concepts. Knowing that many children resist playing with blocks, Carol's first goal is to encourage all the children's interest, engagement, and persistence in block play. Carol promotes interest in blocks in three important ways: during circle time discussion; in her interactions with individuals and groups of builders; and through the establishment of classroom norms.

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## Circle time discussions

Block building is often an important topic during circle time conversations, preceding structures time. Carol sometimes invites parents whose work involves building to visit the classroom and talk about their jobs. An architect might talk with the children about designing buildings, or a construction worker might focus on the physical act of building. Another way Carol engages the children in discussions about building is by making connections with the stories and books she is reading to them. For example, books such as *The Three Little Pigs* can inspire discussions about structurally sound building, and stories of kings and queens may inspire discussions about building castles, moats, and dun-

geons. In addition, Carol reads many children's novels aloud, chapter-by-chapter, including Roald Dahl's *Charlie and the Chocolate Factory*, which invariably leads to building block factories and complex candy-making machines.

### Teacher-child interactions

A second way Carol involves children in block building is by engaging in carefully considered interactions with them. She spends significant time circulating among the children, making encouraging suggestions about their creations and asking questions such as "What part of the city are you making here?," "Would you like to bring in something else?," "What would be interesting to add?," and "I notice that you built this up. I wonder what would happen if you . . ." And when it seems appropriate, Carol sits down and builds beside the children, modeling excitement and interest through her own playfulness. Initially, many children may consider their structures to be complete after only 10 minutes; but with Carol's carefully considered questions and prompts and her parallel building, the children are able to refocus and continue building for an extended time.

### Block play guidelines

Finally, Carol helps maintain engagement in block building by establishing classroom norms of ownership and respect. These norms, while jointly established with the children, always include three important features. First, the children learn that they must always leave another person's building standing. Second, while children are allowed to add to another child's structures, they may not dismantle what is already there. Finally, at the end of building time, it is the builders alone who may knock down their own creations. Carol contends that these few rules are important in contributing to the children's sense of personal ownership and accomplishment, and becoming the bedrock for children's engagement and persistence.

### Encouraging more sophisticated building

By the end of November, the majority of the children are building with considerable independence. Most children have progressed from solitary to collaborative building, having developed the necessary flexibility and negotiation skills to work in groups. Once the children can concentrate on block building for longer periods, Carol focuses more on increasing the complexity of the children's building.

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## Highlights of Four Block-Building Trajectories, Ages 4 to 8

<b>Patterning, Symmetry, and Intentionality</b> (Summarized from Johnson [1933] 1996)	<b>Symbolism and Spatial Relations</b> (Summarized from Reifel 1984)	<b>Architectural Features</b> (Summarized from Casey et al. 2008)	<b>Composition and Decomposition</b> (Summarized from Clements & Sarama 2009)
<p><b>Patterning and symmetry</b> Children build with balance, symmetry, and attention to decorative elements</p> <p><b>Early representational</b> Children decide what the building represents during or after building</p> <p><b>Late representational</b> Children decide their building plan in advance for dramatic play</p>	<p>Children begin to symbolically represent objects and spatial relationships</p> <p>Children begin to represent interior space and separate objects within a construction</p> <p>Children coordinate landmarks and buildings to create mini environments with a developing sense of scale</p>	<p>Children create interior space with blocks in a third dimension</p> <p>Children build one layer with (partial) enclosure and ceiling</p> <p>Children create 3-D enclosures with two or more layers, ceiling(s), and interior space</p>	<p><b>Shape composer</b> Children build with anticipation, using multiple 3-D shapes, including arches, corners, enclosures, and crosses (ages 4–5)</p> <p><b>Substitution composer and shape composite repeater</b> (ages 5–6) Children repeat simple structures as units, such as multiple arches with ramps or stairs</p> <p><b>Units of units</b> (Ages 6–8+) Children build complex structures (towers, buildings with multiple levels, and ceilings)</p>



From her many years of experience developing the block program, Carol has learned how children's block building develops and the different aspects and foci involved in building. Research on block play supports Carol's classroom-based knowledge about the different ways children work with blocks and the developmental pathways that emerge.

Researchers identify four key developmental progressions in block building: patterning, symmetry, and intentionality (Johnson [1933] 1996); symbolism and spatial relations (Reifel 1984); architectural features (Casey et al. 2008); and composition and decomposition (Clements & Sarama 2009). (See "Highlights of Four Block-Building Trajectories, Ages 4 to 8.") In both the block program's design and the highly focused intentional teaching she integrates with play-based learning, Carol pays attention to each of these four foci and the developmental pathways they suggest. Through careful observation, she notes the way children incorporate symmetry in the design and the structure of their buildings, and whether they build horizontally or vertically. She also notes their developing abilities to represent their chosen structures and buildings. In addition, Carol looks for complexity in children's building—do they include enclosed spaces and ceilings in their structures? And in terms of geometric composition and decomposition, she notes whether they begin by building simple units that increase in complexity. In response to these online and ongoing assessments, Carol selects materials and chooses prompts to help children develop the structural and representational aspects of their buildings.

For example, to promote architectural complexity in the children's buildings, Carol sets out unpainted blocks in a variety of shapes, including blocks that roll, have points, or look different from different perspectives. She prompts and questions the children, highlighting structural elements by saying, for instance, "The wide base allowed you to build so high" or "Sometimes people use a long block like this to create a bridge." When Carol is focusing on patterning and symmetry (aligned with the math unit), she sets out colorful materials that encourage patterning and incorporates com-

ments such as "I see that you used symmetry here—the two sides reflect each other" while she gestures mirroring with her hands. Finally, to focus children's attention on composition and decomposition, Carol may point out the layers in a building or ask which blocks the children think they need to complete an emerging work. She promotes representative thinking by asking the children what kind of structure they have built and what they want to build next.

### Evidence of rich spatial learning from the children's block play

The children's engagement, persistence, and creativity in building remarkable structures frequently surprise classroom visitors. Through the year, the children move from placing one block at a time using trial and error to choosing specific materials to meet their own building plans, envisioning alternate orientations of the blocks (mental rotation), and planning for the placement of units of blocks (composition and decomposition). By March, most children are creating complex symmetries and patterning in their building that are well above curriculum expectations (Ontario Ministry of Education 2010). They are building roofed structures with divided interior spaces, which Casey and





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colleagues (2008) found in only 2 or 3 percent of children of similar ages. Visitors observe most of the children building floor-covering structures that include paths, rooms, enclosures, towers, and hidden dungeons, all built to scale. Reifel (1984) found that only 10 percent of 7-year-olds were building at this late representational stage. With a rich building environment and careful consideration of time, space, and building materials, the majority of the children—both boys and girls—in a classroom can build at the top levels of research-based trajectories.

In addition, the children grow in their use of spatial language, which research suggests is strongly related to increases in spatial reasoning (Pruden, Levine, & Huttenlocher 2011; Verdine et al., “Finding the Missing Piece,” 2014). Indeed, Carol’s regular questioning and prompting about building and spatial features not only helps the children understand these concepts but also supports their overall development of spatial language. As the year progresses, the children in this classroom increasingly incorporate the spatial and mathematical language they have heard into their play.

**Jalad:** Look at how many levels there are!

**Camille:** I used lots of big blocks on the bottom for support.

**Roland:** Our tower is taller than my shoulder, my head, your shoulder, your head!

### Final thoughts

Research suggests that block play provides a wide variety of learning opportunities, including possibilities to help children develop the spatial reasoning skills important for later STEM learning (Kersh, Casey, & Young 2008). Growing evidence shows that well-planned, rigorous block play programs such as the one described here produce strong results for all children (Casey et al. 2008; Kersh, Casey & Young 2008; Verdine et al., “Finding the Missing Piece,” 2014). Additionally, teacher prompts and questions based on knowledge of block building trajectories can play an important role in scaffolding children’s building of more complex structures (Kersh, Casey, & Young 2008). Finally, time for all children to play with blocks is important: the more that children—both boys and girls—play with blocks, the more sophisticated they become as builders and the less pronounced gender-influenced differences in block building skills and spatial reasoning become (Kersh, Casey, & Young 2008). Given what we early childhood educators know about the deep learning block play offers, why wouldn’t we include it as part of every early childhood curriculum?

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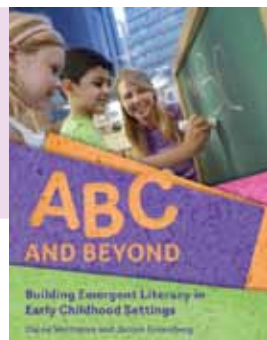
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