Lea Ann Christenson and Jenny James

Photos courtesy of the authors

Preschool

Building Bridges to Understanding in a Preschool Classroom: A Morning in the Block Center

Emma, 4 years old, carefully steps around the other block structures to inspect the hospital she helped build. She is problem solving. What will the community need next? Dylan and Rohit, frequent players in the block center, are deep in conversation. How should the river flow through the community? Nearby, Aditya, who recently began to play in the block center, chimes in, saying, "I think you need a bridge over the river. The ambulance has to get to the hospital." Further down the river Ms. Lisa kneels down to examine Emma's work. Emma discusses with her the merits of building the doctor's bed next to the hospital.

Weeks earlier scenes in the block center looked much different. Children wandered in and out of the area, playing without a clear purpose and rarely for any sustained period of time. When Ms. Lisa introduced the design process used by engineers—a methodical, creative, and recursive approach for problem solving—the block center was transformed into a child-centered hub of collaborative play.

STEM in the block center

With an increasing emphasis on science, technology, engineering, and math (STEM) at the pre-K to 12 levels, as manifested by the creation

and adoption of STEM standards by many states, early childhood teachers and administrators may wonder how these STEM standards fit with developmentally appropriate practice and the needs of young learners (Moomaw 2012; Lindeman, Jabot, & Berkley 2013). An intentionally crafted and stocked preschool classroom block center can support planned intentional learning experiences, specifically in the area of engineering (Wynn & Harris 2013). Teachers can maintain all the hallmarks of child-directed play in the block center while incorporating STEM—in the form of the engineering design process—in developmentally appropriate ways.

Children as engineers

Engineers are problem solvers. To encourage children to think like engineers, the lead teacher, Ms. Lisa, introduces the engineering design process. The process provides a framework for children's block center activities: children learn how to define problems, research solutions, build and test prototypes, and share the results with friends and family. Research shows that when teachers facilitate the engineering design process, the amount of time children engage in an activity increases, as does the number of engineering behaviors they exhibit and the likelihood that they will finish the activity (Wang et al. 2013). Ms. Lisa decides to test the effectiveness of using the engineering design process during a curriculum unit on community.

Step 1. Asking questions and defining problems

To begin exploring the topic of community, Ms. Lisa plans a class field trip to the local shopping center. The children tour the grocery store, post office, tae kwon do dojang, and optometrist's office. She discusses the jobs community helpers do and other buildings where they work. On their return to the classroom, the children record their observations by writing or drawing pictures about their experiences in their journals—they are recording the data. Now it is time for the first step in the engineering design process—asking questions. Ms. Lisa models this by asking the class questions such as "What does a community need?" and, more specifically, "What buildings does a community need?" She then encourages the children to come up with questions of their own.

In the block center, Ms. Lisa asks, "Do you think we could build a community with blocks?" The children respond by building a hospital, firehouse, and post office. Ms. Lisa extends the play by questioning how the people in the community will get to the buildings. The children review and reflect on the data they recorded in their journals. Ms. Lisa asks, "How did we get to the shopping center?" When the children respond "by bus," Nadia adds that building roads is a good solution. Ms. Lisa asks the children to consider what material they could use to build roads in the block community and why they would choose that material. The children collectively decide that using felt pieces will be the best way to make roads. In response to Ms. Lisa's question "How will we know what the buildings are?," the children plan to label their buildings using signs they make in the writing center.

Building with blocks helps the children define the roles of people in their community.

At the next meeting time, Ms. Lisa uses community helper dolls to start a new conversation—this one about people who do service jobs such as driving buses and providing health care. She asks the children what each community helper does, where he works, where he sleeps, and where he plays. Without further prompting from Ms. Lisa, the children connect the meeting time dialogue to their play in the block center by building beds outside each workplace. Emma, whose father is a police officer, builds a jail and includes the police officer's bed outside the jail. Rohit, whose father is an information technology specialist, constructs a building in which people fix computers and also makes a bed outside the workplace. Building with blocks helps the children define the roles of people in their community. They begin to make the connection that community helpers are people with the same needs as people in their own families—they need places to work, sleep, eat, and play.

Toward the end of center time, Dylan decides the dark blue felt represents a river. This creates a problem in the community because people now need a bridge to get to the hospital.

Step 2: Using background research to plan and create

To build on the children's idea of bridges in their community, the next day at meeting time Ms. Lisa reads two books about bridges. The first book, an expository text about

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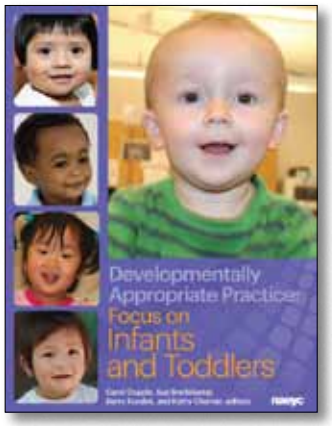

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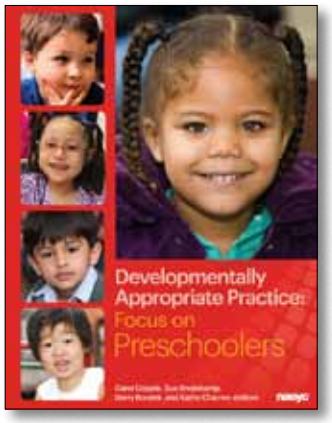

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the Golden Gate Bridge, prompts interest in the different types of bridges. Ms. Lisa and the children discuss bridges they have seen or crossed. The second book, a storybook, is about animals waiting to cross a drawbridge. Ms. Lisa supplements the reading material by playing videos of real bridges being built for the children who want to view them during center time. She places the books about bridges in the block center so children can revisit them.

Step 3: Building, testing, and redesigning

With a river running through their community, the children decide that boats and bridges can help people get to the buildings. When Tomas starts building a bridge in the water, Ms. Lisa says, "That bridge needs to be above the water. How can we fix that?" Akish uses different shapes of blocks for his structure and exclaims, "Hey look! That's balancing!," as he creates a bridge over the water. To challenge the children, Ms. Lisa asks, "How can you build bridges that boats can fit under and cars can go over?"

Emma covers a hollow block with felt to make a bridge. She attempts to build on top of the felt, but the soft felt offers no support. Emma solves the problem by placing a block over the hole in the supporting block so that the felt piece is supported. This shows engineering skills at work; Emma came up with a solution to a problem by testing and redesigning her bridge.

Step 4: Communicating results

After they finish building the community, Ms. Lisa videotapes the children talking about their constructions. She shows the families the videos when they pick up their children. The next day the families tell Ms. Lisa that their children recounted what they had built in the block center, in many cases using more detail than they had shared about any other school activity. Two families reported that their children talked at length about what they would build next and replicated their buildings at home. The impressed families also relayed that their children used the engineering vocabulary they learned. These extremely engaged children are eager to share their classroom activities and accomplishments with their families.

Understanding the importance of play

The engineering design process proves to be a meaningful way to deconstruct play for families and teachers, administrators, and policy makers. Their children's experiences help families understand that this type of block play is instrumental in promoting learning in a content-rich, developmentally appropriate preschool (Neuman 2014). Ms. Lisa links these connections by integrating the block center with STEM using the engineering design process. By viewing videos of their children learning in authentic ways, families understand the connection between play and discovery, and can more easily see what their children have learned in school and at home.

Gross motor and fine motor skills development

Children develop gross motor and fine motor skills (Ferrara et al. 2011) in the block center. The engineering design process enhances these opportunities by increasing motivation. Children create structures that fit in their community. They practice gross and fine motor skills by carrying large, heavy blocks and balancing smaller blocks on top of each other, and they explore different shapes and sizes of blocks and other materials. The enthusiastic children choose to spend more and more time in the block center (Cohen & Uhry 2011).

Collaboration and cooperation

By enhancing block play through the engineering design process, teachers encourage children to use the block center in more engaging ways and for longer periods of time (Tunks 2009; Stoll et al. 2012). After the initial teaching sessions, Ms. Lisa encourages the children to play on their own. The engineering design process nurtures group work, so children develop important social skills and higher levels of critical thinking. The entire group works together toward a unified goal (Wang et al. 2013). Real-world examples make scientific conceptual knowledge easier to grasp via the hands-on activity of block play. Roughly a third of Ms. Lisa's class are English language learners, and the hands-on nature of the engineering design process lets them be more fully engaged in learning language for more abstract concepts. With the addition of the community helper dolls in the block center, the children discover through play that building a community means building for people with a variety of needs. Thus one type of building does not meet the needs of all people. The actual building process (balancing blocks to build a bridge) offers reliable and authentic cause-and-effect experiences and provides information about whether a prototype will work. Interestingly, whereas previously the block center was mostly the domain of a few boys, now more girls choose to play there as a direct result of learning the engineering design process (Tokarz 2008; Robelen 2012).

Literacy acquisition

Block play, when enhanced by the engineering design process, yields an environment conducive to fostering literacy (Wellhousen & Giles 2005). Oral language, the foundation of reading and writing, is cultivated by conversations guided by the teacher and then continued by the children during play in the block center (Patè 2009). Ms. Lisa asks questions that encourage critical thinking. A great deal of debate occurs between the children about whether to build an arch bridge or a drawbridge. The children learn vocabulary, particularly the disciplinary vocabulary of engineering, as they ponder solutions to authentic situations. Children's crossover to the writing center to make signage for their constructions promotes the development of writing skills. Children not usually interested in the writing center are now motivated to make signs for their buildings. Throughout this unit Ms. Lisa exposes the young learners to a wide variety of informational and literary print and video sources; including fiction and nonfiction stories and exposition, as well as maps, charts, graphs, and primary source documents such as photographs. Children connect what they learn from these resources to their play. For example, Jamar revisits a story previously read to the class, saying, "These cars are in line waiting for the drawbridge to open." Julia creates a suspension bridge based on a video she watched.

Conclusion

The engineering design process turned the block center into a hub of activity. When children were introduced to the process they became more inventive and excited about their work. Through the developmentally appropriate environment of the block center, children built and tested solutions to real-world problems, demonstrating engineering skills. Ultimately, the block center proved to be a place where children can apply critical thinking—a desired outcome of STEM and English language arts standards. Using simple classroom blocks, props such as dolls and felt, and the engineering design process as a guide, teachers can confidently provide authentic and developmentally appropriate educational experiences.

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