

Learning & Teaching

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AUTHOR NAMES:

Wager, Anita A.; Caldwell, Brittany; and Vescio, Jamie

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Mission Statement

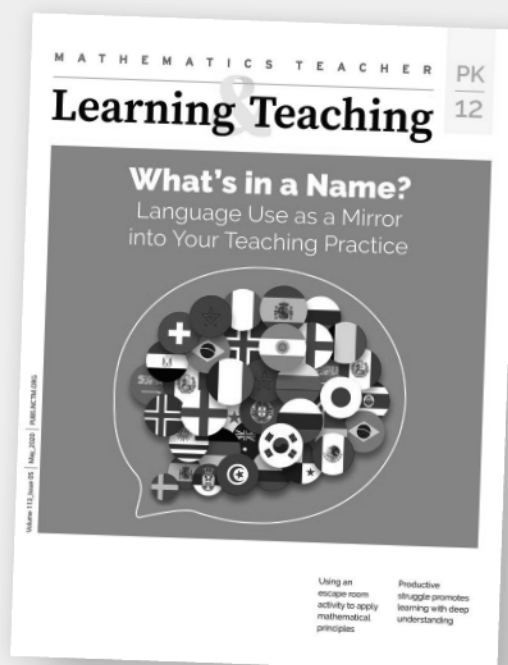
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CONTACT: mtlt@nctm.org



NATIONAL COUNCIL OF
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Imagine It!

Choose Your Own Pattern Block Adventure

When given the opportunity to play with mathematical materials and ideas, children demonstrate their mathematical understanding in innovative ways.

Anita A. Wager, Brittany Caldwell, and Jamie Vescio

This *Build It!* task is derived from our observations of how young children engaged with pattern blocks when provided with agency to choose how and what they wanted to build. Almost ubiquitous in elementary classrooms, pattern blocks are used for a variety of mathematical tasks. Provided the opportunity for open-ended play, we observed the ways children go beyond the mathematical content goals of the original lesson and demonstrate several Standards for Mathematical Practice (SMP; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). When the children used pattern blocks to “*imagine it*,” they thought outside the box and stretched the boundaries of the activity.

This child-inspired *Imagine It!* task reflects the ways children demonstrate their mathematical understanding in innovative ways when provided with an unstructured playful mathematics activity and time for free play with building materials. We know that children need opportunities to engage in authentic, playful mathematics activities so that they see their interactions as mathematical (Clements & Sarama, 2017; Wager & Parks, 2014). The playful task we describe provides examples of how children show more of the mathematics they know when we open up activities so children have agency to choose how to engage. From our observations of how children engaged with pattern blocks, we designed this *Imagine It!* task that offers four ways to engage with pattern blocks.

CHOOSING THEIR OWN PATTERN BLOCK JOURNEY

During explore time in Ms. Rosinsky's kindergarten class, children chose one of four centers for guided play. Each center task and the materials were introduced over a series of weeks, and the teacher modeled for children what to do at the centers. The pattern block center included a large box of pattern blocks and pattern-block puzzles (printed pattern block shapes arranged to make a picture; several free puzzles are available [[link online](#)]). At first, the four children at this center worked on the puzzles by placing the pattern block on the page with the puzzle pattern. Although this was the intended activity, children knew they had the freedom to engage with the materials in other ways, as long as they were doing math. After a minute, a student named Wesley said, “Remember guys, the teacher said we are making shapes out of other shapes. We’re creating!” This comment prompted a shift in how the children approached the task and an example of how the task made space for imaginative thinking.

The teacher's prompt “make shapes out of other shapes” offered an invitation for children to use their imaginations to build with the pattern blocks. Their imaginative responses included: tessellating, duplicating, replicating, and covering. We describe what we observed children doing for each, the mathematics

standards they demonstrated, and how we framed it for our *Imagine It!* task.

Tessellating

Wesley built an intricate pattern with the blocks, where he carefully filled all the spaces to create a symmetrical, flower-like, two-dimensional structure (see Figure 1). As he designed the patterns, he attended to precision (SMP 6) and made sense of structure (SMP 7) as he intentionally filled all the space between shapes. In one instance, he replaced one diamond with three thinner diamonds to fill the spaces between the shapes. Throughout this episode, Wesley extended the goal of the activity using the materials to explore patterning,

symmetry, and creating a tessellation. Wesley was analyzing, comparing, and creating shapes (K.G.4). The tessellating path encourages students to explore how shapes fit together, the creation of mental images, and thinking outside the box.

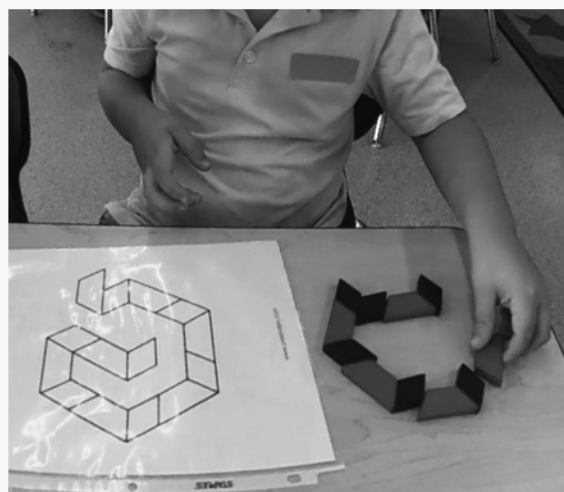
Duplicating

Max chose to duplicate the snake pattern from the pattern-block puzzle to a separate space on the table. He collected all the shapes represented in the puzzle and flipped, turned, and combined them to duplicate the design. He continually looked back and forth between his pattern and the puzzle until he successfully completed the design on the table next to the

Figure 1 Wesley Tessellates to Create a Flower



Figure 2 Max Duplicates the Snake Pattern



Anita A. Wager, she/her, anita.wager@vanderbilt.edu, is a professor at Vanderbilt University, where she teaches math methods courses to prospective elementary teachers. She is interested in the power of play in math teaching and learning.

Brittany Caldwell, she/her, brittany.caldwell@vanderbilt.edu is a post-doctoral fellow in the department of Teaching and Learning at Vanderbilt University. She is passionate about early childhood education and her research focuses on play-based, equitable math teaching in early elementary.

Jamie Vescio, she/her, jamie.vescio@vanderbilt.edu is a doctoral student at Vanderbilt University in the department of Teaching and Learning. She specializes in learning and design and currently researches play integration in elementary mathematics classrooms.

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puzzle (see Figure 2). During Max's build, he participated in rotating shapes, adjusted shapes in relation to other ones, and attended to the placement of the pattern blocks in relation to the picture. Max attended to orientation (K.G.2), compared shapes of different sizes and orientations (K.G.1), as well as attending to precision (SMP 6) and making sense of structure (SMP7). The duplicating path encourages students to explore how shapes fit together and to employ computational thinking in the form of pattern recognition.

Replicating

Abraham took on a challenging task of creating his own puzzle by building a replica of the hourglass timer that was on the screen in the classroom (see Figure 3). During this construction, Abraham attended to the symmetry of the shape and used his choice of shapes to create something new. Abraham compared shapes (K.G.4) by replicating something in the world using the tools strategically (SMP 5). The replicating path encourages students to create innovative designs using mathematical thinking.

Covering

James completed the activity as originally conceived (and commonly used in early childhood classrooms). He had a choice of pattern puzzles and selected the

dog, then carefully placed the pattern blocks on the puzzle to cover exactly the shapes on the puzzle (see Figure 4). James approached this task by placing all the rhombi, then hexagons, and then triangles on the dog puzzle. Although this was the task suggested by the available materials, James still had the choice to complete the puzzle in the order he wanted. This task supported James in analyzing and comparing shapes (K.G.4) and composing simple shapes to form larger shapes (K.G.6). The covering path makes space for students to engage in pattern recognition.

A NEW VERSION OF THE PATTERN BLOCK TASK

In this activity, the children interpreted the teacher's prompt, "make shapes out of other shapes," in ways that sparked their imagination and challenged them mathematically. As they carefully flipped, turned, exchanged, and aligned the blocks to engage in tessellating, duplicating, replicating, and covering, the children engaged in imaginative thinking, employed computational thinking, created innovative designs, and thought outside the box. Inspired by the imaginative ways that children chose to build, we developed a new task for building with pattern blocks that allows children to choose their own journey and decide how and what they want to build. Figure 5 offers prompts teachers could use to describe the four options.

Figure 3 Abraham Uses Blocks to Replicate an Hourglass Timer



Figure 4 James Uses Shapes to Cover the Dog Puzzle

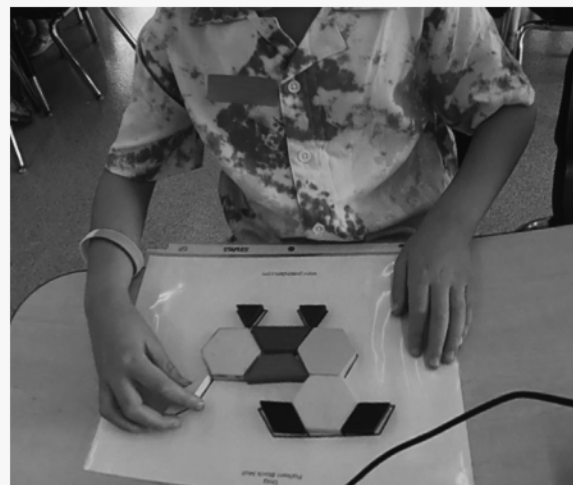


Figure 5 Teacher Prompts for Choose Your Own Pattern Block Adventure

Choose your own pattern block adventure!

In combination with the placemat invite students to choose what pattern block adventure they would like to take. You can use these prompts to explain the options.

Cover it!
(K.G.4, K.G.6)

- select a pattern block puzzle
- use the pattern blocks to cover each part

Tessellate it!
(K.G.4)

- start with a pattern block in the center
- build out from the center in a repeating pattern

Duplicate it!
(K.G.1, K.G.2)

- select a puzzle pattern
- duplicate on the table

Replicate it!
(K.G.4)

- find an object in the room (or a picture from a book)
- recreate the object using the pattern blocks

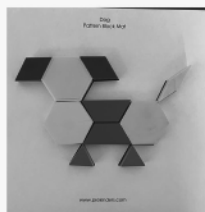
Figure 6 could be used as a placemat to model the four paths that students could take as they build with pattern blocks; this might be used in conjunction with the Task Sheets.

CONCLUSION

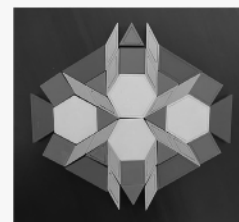
The open-ended nature of the activity provides agency for children to decide how to approach the tasks, ways to differentiate beyond more common pattern-block puzzle choices, and opportunities to demonstrate a variety of content and practice standards. To modify the task for other grades, you might increase the complexity of the puzzles by removing the lines from inside the puzzles (i.e., covering and duplicating), offer more challenging pictures or objects to replicate, and set specific rules for tessellating (e.g., how many of each shape must be used). Although these examples were from a kindergarten classroom, we believe that similar opportunities at any grade level may provide a chance for young mathematicians to employ their imaginations and thereby demonstrate what they know. —

Figure 6 Choose Your Own Adventure Placemats

Cover it!



Replicate it!



Duplicate it!



Tessellate it!

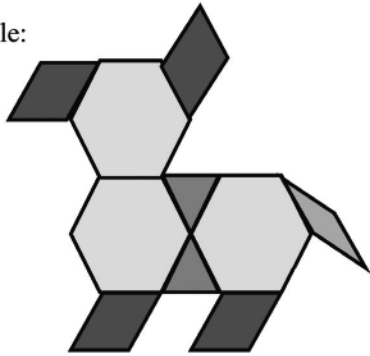


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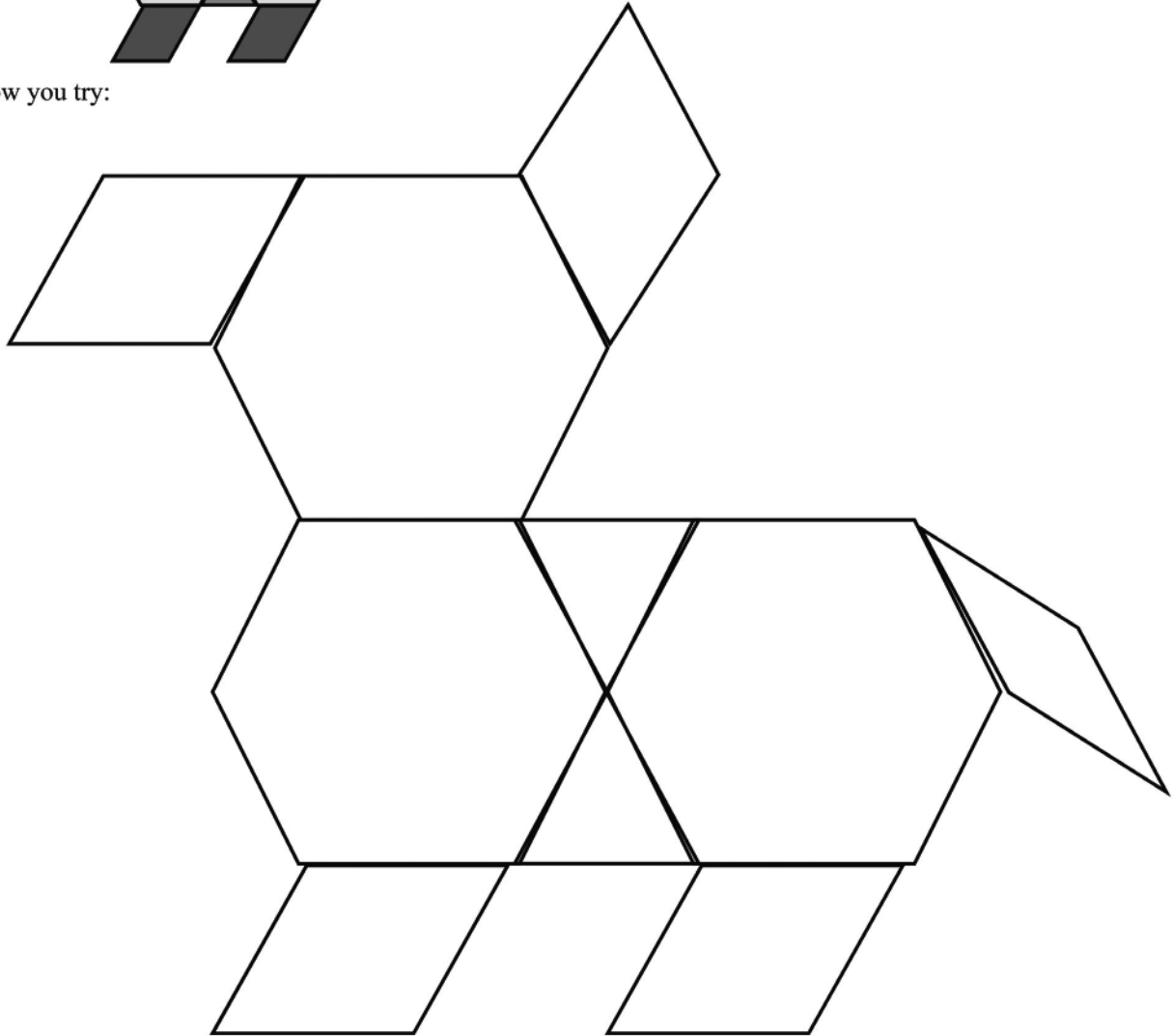
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Cover it!

Example:

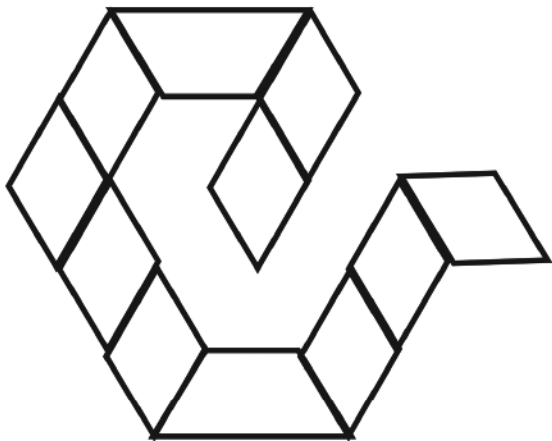


Now you try:



Duplicate it!

Example:



Now you try:

Replicate it!

Example:

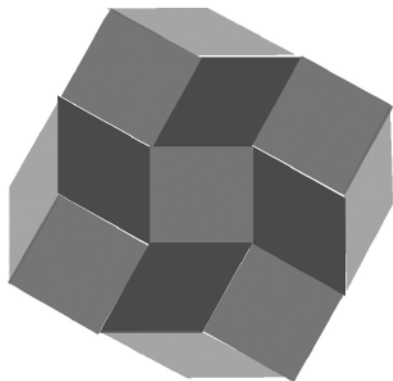


Now you select one and try (or find something in your classroom):



Tessellate it!

Example:



Now you try with your own pattern: