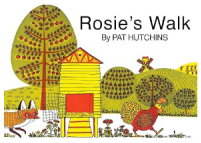
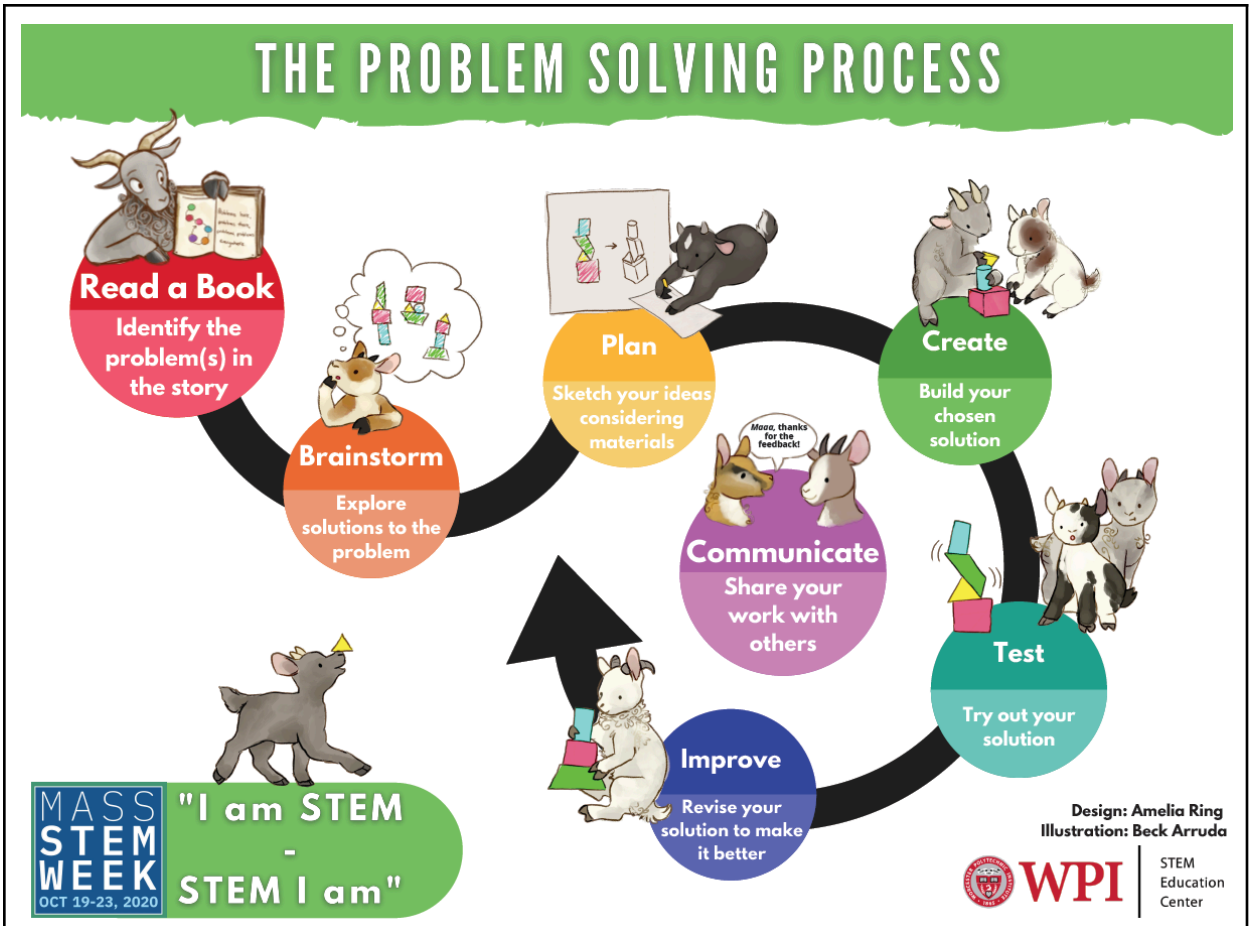
I am STEM: STEM Week Lesson

Written by: Tiffany Davis

Selected Book	**Title: Rosie's Walk** **Written by: Pat Hutchins** **Illustrated by: Pat Hutchins** 		
Grade	PK/K	Read-Aloud Link	*https://safeshare.tv/vjs-embed/rmbAmGcThWY*
Challenge Overview	Rosie the hen walks around the farmyard, avoiding obstacles that include a rake, pond and beehive. But Rosie is not alone on her journey—careful readers will see Fox lurking in the background. Can you help Rosie make it safely home to the henhouse, no matter where Fox hides?		
Note	This lesson addresses standards from the 2016 Massachusetts Digital Literacy and Computer Science (DLCS) Curriculum Framework, which includes four domains: computing and society, digital tools and collaboration, computing systems, and computational thinking. For more information about the standards, visit the DLCS website created by the MA Department of Elementary and Secondary Education. *Rosie's Walk* focuses on standards from the **computational thinking domain**, and challenges students to create an algorithm for Rosie's original walk (the walk Rosie takes in the story), and then different algorithms as Fox moves around. You can take a "plugged" or "unplugged" approach to the lesson (with or without devices like computers, tablets and robots).		



	Monday	Tuesday	Wednesday	Thursday	Friday
STEM/ Problem Solving	Read the book. **Identify the problem(s)** in the story. Define criteria and constraints. **Brainstorm** possible solutions.	**Plan** your solution: Sketch your ideas. Gather and explore materials. **Share** your work.	**Create** your chosen solution. **Share** your work.	**Test** your solution. **Share** and obtain feedback. **Improve** your solution.	**Communicate** your revised solution to an audience.

STE, Math, DLCS, and ELA Practices

STE	Math
✓ Asking questions and defining problems ✓ Developing and using models ✓ Planning and carrying out investigations ✓ Analyzing and interpreting data ✓ **Using mathematics and computational thinking** ✓ Constructing explanations and designing solutions ✓ Engaging in argument from evidence ✓ Obtaining, evaluating, and communicating information	✓ Make sense of problems and persevere in solving them ✓ Reason abstractly and quantitatively ✓ Construct viable arguments and critique the reasoning of others ✓ Model with mathematics ✓ Use appropriate tools strategically ✓ Attend to precision ✓ Look for and make use of structure ✓ Look for and express regularity in repeated reasoning
ELA	**Computer Science (DLCS)**
✓ Demonstrate independence ✓ Build strong content knowledge ✓ Respond to the varying demands of the audience, task, purpose and discipline ✓ **Comprehend as well as critique** ✓ Value evidence ✓ Use technology and digital media strategically and capably ✓ Come to understanding other perspective and cultures	✓ **Creating computational artifacts** ✓ Connecting computing concepts ✓ Abstracting to develop models and manage information ✓ **Analyzing computational artifacts created by themselves and others** ✓ **Communicating clearly, accurately, and responsibly** ✓ **Collaborating with others** ✓ Researching

Culturally & Linguistically Sustaining Practices (CLSP)

- ❏ Connect the content of the book to your students' cultural and linguistic backgrounds.
- ❏ Ask relevant and inclusive questions that connect to all students from various backgrounds (i.e. Asking what kind of instruments and music they like or hear in their homes, rather than what instruments they play).
- ❏ Ask students to make connections to the problems in the stories by relating them to their home and community experiences.
- ❏ Encourage students to express and communicate their knowledge and ideas using multiple modes and modalities (i.e. writing, drawing, speaking, etc…), including students' home language.
- ❏ Select materials and tools that are developmentally appropriate, culturally accepted and easily available for all students.
- ❏ Give students plenty of opportunities to discuss and share various stages and possibilities of the design.
- ❏ When possible, assist students in group work by providing them clear and fluid roles.
- ❏ Scaffold students' learning using their family and home funds of knowledge (i.e. connect the students' family/community expertise to inform the problem solving process).

MA STE, Math or DLCS Standards

K-2 Digital Literacy & Computer Science

Algorithms [K-2.CT.b]

1. Define an algorithm as a sequence of defined steps.
2. Create a simple algorithm, individually and collaboratively, without using computers to complete a task (e.g., making a sandwich, getting ready for school, checking a book out of the library).
3. Enact an algorithm using tangible materials (e.g., manipulatives, your body) or present the algorithm in a visual medium (e.g., storyboard).

Programming and Development [K-2.CT.d]

1. Define a computer program as a set of commands created by people to do something.
2. Explain that computers only follow the program's instructions.
3. Individually or collaboratively, create a simple program using visual instructions or tools that do not require a textual programming language (e.g., "unplugged" programming activities, a block-based programming language).

Learning Targets:	Students will be able to: ● Explain what an algorithm is. ● Work with a partner to design an algorithm that re-creates Rosie's walk around the farmyard by putting images from the book in order. ● Work with a partner to design an algorithm that helps Rosie escape Fox, using a grid decorated with locations/items from the farmyard, and cards with directional arrows. If you follow the "plugged" version of the lesson (with a device and robot): ● Use a block-based language or buttons with directional arrows to program a robot to re-create Rosie's travels using a mat decorated with locations/items from the farmyard.

MA ELA Standards

Grade PK, English Language Arts

Reading Literature, Key Ideas & Details

2. With prompting and support, retell a sequence of events from a story read aloud

Social and Emotional Development and Approaches to Play and Learning

8. the child will engage socially and build relationships with other children and with adults
9. the child will demonstrate the ability to manage conflict.

Grade K, English Language Arts

Reading Literature, Key Ideas & Details

2. With prompting and support, retell familiar stories, including key details

ELA Learning Targets:	Students will be able to … ● Listen to the story. ● Use picture cards to sequence the events/locations in the story. Language objectives: ● Repeat prepositional phrases from the story and act out the place and movement words. ○ across the yard ○ around the pond ○ over the haystack ○ past the mill ○ through the fence ○ under the beehives ● Use sequence picture cards and place and movement words (across, around, over, past, through, under) to orally retell the events in the story. ● Use prepositional phrases to narrate Rosie's travels through the "farmyard" to a peer.

Key Vocabulary Words

Tier 1	Tier 2	Tier 3
- Robot	- Across, - Around - Over - Past - Through - Under	- Algorithm - Debug - Program

CLSP Strategies	● Connect the content of the book to your students' cultural and linguistic backgrounds. ● Encourage students to express and communicate their knowledge and ideas using multiple modes and modalities (i.e. writing, drawing, speaking, etc…), including students' home language.

Materials

GPK/K Rosie's Walk caregiver letter (SLIDES)
GPK/K Rosie's Walk rubric

Lesson Handouts
GPK/K Rosie's New Walk student handout

GPK/K Rosie's Walk algorithm cards
GPK/K Rosie's Walk farmyard chase materials-board game
GPK/K Rosie's Walk farmyard chase materials-human robots
GPK/K Rosie's Walk sequencing cards
GPK/K Rosie's Walk Word Wall: comp thinking cards
GPK/K Rosie's Walk Word Wall: preposition cards
GPK/K WPI EDP 1

Online Resources
https://safeshare.tv/vjs-embed/rmbAmGcThWY
Algorithm AI (song with lyrics)

Hands-on Materials
N/A

CLSP Strategies	Select materials and tools developmentally and culturally appropriate/available for all students.

Monday	
Teacher Preparation:	• Copy and distribute Caregiver Letter GPK/K Rosie's Walk caregiver letter (SLIDES) • Lesson Rubric GPK/K Rosie's Walk rubric • Read the book. • Post the Engineering Design/Problem Solving Process visual. • Print and laminate one set of the algorithm cards. • Print the preposition cards (for the word wall). • Create one set of materials for testing algorithms/acting out the farmyard "chase." For today, you will need **just one** farmyard board game set for teacher demonstration purposes. See the materials section for more details.
Student Preparation:	N/A
Problem Solving:	• Read the book. • **Identify the problem(s)** in the story. • Define criteria and constraints. • **Brainstorm** possible solutions
Practice(s) of the Day	ELA: Comprehend as well as critique
CLSP Strategies	• Connect the content of the book to your students' cultural and linguistic backgrounds. • Ask relevant and inclusive questions that connect to all students from various backgrounds (e.g. Asking what kind of instruments and music they like or hear in their homes, rather than what instruments they play). • Connect the problems in the stories to all students' home and community experiences. • Scaffold students' learning using their family and home funds of knowledge (e.g. connect the problem to the students' family/community expertise).

Activity (Duration)	Instructions	Product
I Notice / I Wonder (5 minutes)	Show students the cover of the book, and have them turn and talk: • What do you notice? • What do you wonder? • Ask students to share their notices / wonders with the class and scribe students' answers.	List of notices / wonders scribed by the teacher

	Be sure to discuss: ● Where do you think the story takes place? ● Have you ever been to a farm? ● What might you see on a farm?	
Read the Book (10 minutes)	Read the story to students. Then use the sequencing cards to retell the story with the whole class. Repeat the prepositional phrase on each card and ask students to repeat the whole phrase back to you and act out the movement. As students act out each word, add the preposition to your word wall.	Students' demonstrations and verbalizations Word wall with preposition cards added
Identify the Problem (5 minutes)	Present the Engineering Design / Problem Solving Process visual and review the steps. Discuss: ● What is an engineer? ● Where are we in the process? Mark with an arrow. Have students turn and talk: what is the main problem in the story? Ask students to share, while the teacher scribes. Then discuss the main problem in the story as a whole class.	EDP poster with arrow List of problems scribed by the teacher
Design Challenge (5 minutes)	Create a written challenge statement, using as many of the students' own words as possible. Example: in the story, Rosie is being chased around the farmyard by Fox. Can we create a plan that will keep Rosie safe on her daily walk, no matter where Fox is hiding?	Challenge statement written on flipchart and posted in the room
(5 minutes)	Show students the farmyard board game mat and spinner or card deck (to determine where Fox will hide), and ask for volunteers to: ● Place Rosie in the hen house. ● Use the spinner or location cards to determine where to put Fox. ● Trace a path Rosie can follow around the farmyard to avoid Fox and return safely home. Repeat as time allows.	Students' demonstrations and verbalizations

Tuesday	
Teacher Preparation:	• Preview the Algorithm AI song and connect a computer to a projection device so that you can share the song with students. • Post the challenge statement and Engineering Design/Problem Solving Process visual. • Print and laminate one set of algorithm cards for each pair of students. • Print the computational thinking cards for the word wall. • Create one set of materials for testing algorithms/acting out the farmyard "chase." You will need one farmyard board game set **for each pair of students**. See the materials section for more details.
Student Preparation:	N/A
Problem Solving:	**Plan** your solution: • Sketch your ideas • Gather and explore materials. • Share your work
Practice(s) of the Day	STE: Using mathematics and computational thinking DLCS: Creating computational artifacts DLCS: Collaborating with others
CLSP Strategies	• Encourage students to express and communicate their knowledge and ideas using multiple modes and modalities, including students' home language. • Give students plenty of opportunities to discuss and share various stages and possibilities of the design. • Assist students in group work by providing them clear and fluid roles, whenever possible.

Activity (Duration)	Instructions	Product
Engineering Design / Problem Solving Process (5 minutes)	Present the Engineering Design / Problem Solving Process visual and review the steps. Discuss: ● Where are we in the process? ● What is the problem we are trying to solve? Discuss: we are creating a special kind of plan for Rosie, called an "**algorithm**". Explain that an algorithm is a list of steps that you do in order. Play the Algorithm AI song, and invite students to sing along. Add the word "algorithm" to your word wall. Explain that students will practice creating an algorithm by creating an algorithm for the walk Rosie takes in the book.	EDP poster with arrow Challenge statement written on flipchart and posted in the room Word wall with algorithm card added
Plan: Practice Creating an Algorithm (15 minutes)	Partner students and give each pair their own copy of the sequencing cards. Students should work with their partners to put the sequence cards in order and then take turns orally retelling/reading the story. Walk around and use the preposition cards to encourage students to use the appropriate preposition when retelling the story. As each pair finishes, hand them a farmyard mat and a set of algorithm cards. Direct students to recreate Rosie's walk by placing the arrows on top of the mat, in order, starting and ending at the hen house.	Ordered sequence cards Ordered algorithm arrow cards
Share (15 minutes)	Partner groups and direct students to share their algorithms and check each other's work. Do the two algorithms match? Ask a few groups to share their algorithms with the whole class, using a farmyard board game mat displayed at the front of the room to review the correct sequence of Rosie's walk. Tape the algorithm cards to the mat and save for tomorrow's lesson.	Farmyard mat with algorithm cards taped down to show the correct sequence of Rosie's walk

Wednesday	
Teacher Preparation:	• Connect a computer to a projection device so that you can share the Algorithm AI song with students. • Post the challenge statement and Engineering Design/Problem Solving Process visual. • Locate a set of sequencing cards (one copy for teacher demonstration purposes). • Post the farmyard mat with algorithm cards attached (created at the end of yesterday's lesson), and **swap two of the arrows so that the order is no longer correct**. • Gather and organize materials for testing algorithms/acting out the farmyard "chase" from yesterday. You will need one farmyard board game set **for each pair of students**. See the materials section for more details. • Tape (to attach arrow cards to mat) OR copies of Rosie's New Walk (student handout) (one per pair of students) for recording final algorithms.
Student Preparation:	N/A
Problem Solving:	• **Create** your chosen solution. • Share your work.
Practice(s) of the Day	STE: Using mathematics and computational thinking DLCS: Creating computational artifacts DLCS: Collaborating with others
CLSP Strategies	• Encourage students to express and communicate their knowledge and ideas using multiple modes and modalities, including students' home language. • Give students plenty of opportunities to discuss and share various stages and possibilities of the design. • Assist students in group work by providing them clear and fluid roles, whenever possible.

Activity (Duration)	Instructions	Product
Engineering Design / Problem Solving Process (5 minutes)	Present the Engineering Design / Problem Solving Process visual and review the steps. Discuss / review: ● Where are we in the process? ● What is the problem we are trying to solve?	EDP poster with arrow Challenge statement
Review (10 minutes)	Use the Algorithm AI song to review the definition of an "algorithm." Tell students that the algorithm arrow cards from yesterday got mixed up, and you need their help "debugging" or fixing the order of the steps. Add the word "debug" to your word wall. ● Have students retell the story and act out the prepositions as you place the sequence cards in order. ● Have students use the posted sequence cards to find and fix the mistake in the algorithm.	Students' demonstrations and verbalizations Ordered sequence cards Word wall with "debug" card added Re-ordered algorithm arrow cards
Create (15 minutes)	Explain that today, students will create brand new algorithms that will help Rosie walk around safely no matter where Fox is hiding. Demonstrate the process: 1. Place Rosie in the hen house. 2. Use the spinner or location cards to determine where to put Fox. 3. Place the arrow cards on top of the mat to give Rosie step-by-step directions, in order, on how to walk around the farmyard and avoid Fox. Partner students and send them off to work. Each pair will need a farmyard mat, a spinner or location card deck, and a set of algorithm arrow cards. As groups finish, tape their arrow cards to the mat and set aside for tomorrow's lesson, or give each group a Rosie's New Walk (student handout) for recording their final algorithms.	Mats with ordered algorithm arrow cards OR student handouts with written algorithm Student discussions (teacher circulates and listens in)

Thursday	
Teacher Preparation:	• Connect a computer to a projection device so that you can share the Algorithm AI song with students. • Post the challenge statement and Engineering Design/Problem Solving Process visual. • Gather and organize materials from yesterday: farmyard mat (with algorithm cards taped down OR completed Rosie's New Walk student handouts) and other game materials for each pair of students. • Extra copies of Rosie's New Walk (student handout) for students who need to revise their algorithms.
Student Preparation:	N/A
Problem Solving:	• **Test** your solution. • Share and obtain feedback. • **Improve** your solution.
Practice(s) of the Day	STE: Using mathematics and computational thinking DLCS: Analyzing computational artifacts created by themselves and others DLCS: Collaborating with others
CLSP Strategies	• Encourage students to express and communicate their knowledge and ideas using multiple modes and modalities, including students' home language. • Give students plenty of opportunities to discuss and share various stages and possibilities of the design. • Assist students in group work by providing them clear and fluid roles, whenever possible.

Activity (Duration)	Instructions	Product
Engineering Design / Problem Solving Process (2 minutes)	Present the Engineering Design / Problem Solving Process visual and review the steps. ● Where are we in the process? ● What is the design challenge?	EDP poster with arrow Challenge statement
Review (3 minutes)	Use the Algorithm AI song and word wall to review the definition of "debug." Explain that today, students will help each other "debug" or improve their algorithms for Rosie's new walk around the farmyard.	N/A
Share (10 minutes)	Hand out materials from yesterday and give students a few minutes to set up. Students will need either: ● farmyard mat with arrow cards taped down; OR ● blank farmyard mat and completed Rosie's New Walk student handout plus a set of algorithm arrow cards. Partner groups and direct students to share their algorithms and check each other's work.	Mats with ordered algorithm arrow cards OR student handouts with written algorithm Student discussions (teacher circulates and listens in)
Improve (10 minutes)	Students should "debug" (find and fix any mistakes) their algorithms, and then practice using words from the word wall to explain their algorithms. Note: be sure to save students' completed algorithms for sharing with tomorrow's special guest—set aside or photograph mats with taped down arrow cads, or save revised Rosie's New Walk handouts.	Same as above
Share (5 minutes)	Let students know that tomorrow a special guest will join the class to see their algorithms. Ask for volunteers to share their algorithms with the class, and prompt volunteers to use words from the word wall (prepositions and computational thinking words) as they share.	N/A

Friday	
Teacher Preparation:	• Lesson Rubric - GPK/K Rosie's Walk rubric • Locate a robot to use as your “special guest.” Any child-friendly robot, such as a BeeBot, BlueBot, Code&Go Mouse, Ozobot, Root, etc. would work. The first three robots don’t require a programming device—simply push directional arrows on top of the robot to program it. Be sure to resize the grid on your mat according to the default distance traveled by the robot. Also decorate the robot to look like a chicken. • Post the challenge statement and Engineering Design / Problem Solving Process visual. • Gather and organize materials for student presentations: farmyard mats (with algorithm cards taped down) OR completed Rosie’s New Walk student handouts OR slide deck with photographs of students’ completed mats. • Gather coloring/writing materials for students to use for the reflection activity.
Student Preparation:	N/A
Problem Solving:	• **Communicate** your revised solution to an audience.
Practice(s) of the Day	DLCS: Communicating clearly, accurately, and responsibly
CLSP Strategies	• Ask relevant and inclusive questions that connect to all students from various backgrounds. • Encourage students to express and communicate their knowledge and ideas using multiple modes and modalities, including students’ home language. • Give students plenty of opportunities to discuss and share various stages and possibilities of the design.

Activity (Duration)	Instructions	Product
Share (30 minutes)	Introduce the special guest (robot) to the class. Discuss: robot's don't have brains; they need step-by-step directions from a human to know what to do. You will use the algorithms created by students to tell Rosie the Robot how to escape Fox. Have students share their algorithms with the class, using words from the word wall (prepositions and computational thinking words) as they share. After each group presents, program the robot with the algorithm designed by that group. Does Rosie make it back to the hen house safely? If not, have the class work together to debug the program.	Students revised algorithms (actual mat with arrow cards taped down, OR handout, OR photographs of mats)
Reflect (10 minutes)	Have students draw or write about themselves in STEM, using the prompt "I do STEM when …".	Students' "I do STEM when …" reflections
Family connection	*Optional:* Put together a digital class book or slideshow and share it with all students and families after the lesson	Optional: Book or Slideshow

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Optional Extension Activities

For a kinesthetic option, have students take on the role of Rosie and Fox, and act out the "chase" on a large floor grid.

- Use painter's tape to make a 4X4 grid with squares @ 32 cm. or 12 in. in size on the floor. See example on p. 1 of the human robot slide deck.
- Tape down images of locations from the book on (pages 2-9 of the human robot slide deck) in the appropriate locations on the grid.
- Print one fox and one Rosie the chicken and attach to a headband so students can tell who is Rosie and who is the fox (page 10 of the human robot slide deck).
- Print one location spinner image (page 11 of the human robot slide deck) and follow the directions in the notes field to build a spinner **OR** print the location images (pages 12-13 of the human robot slide deck) to create a card deck. This is how students will determine the location of the fox.

For a "plugged in" version of this lesson have students program a robot to recreate Rosie's walk and then create Rosie's "new walk". Any child-friendly robot, such as a BeeBot, BlueBot, Code&Go Mouse, Ozobot, Root, etc. would work. The first three robots don't require a programming device—students simply push directional arrows on top of the robot to program it. Be sure to resize the grid on your mat according to the default distance traveled by the robot.

Have students write and illustrate a book about "Rosie the Robot's Walk" that uses place and movement prepositions. With an app like Seesaw, Book Creator, or Wixie students can take advantage of multimedia tools that allow for multiple modes of expression: writing, drawing, recording audio and/or recording video. Students can choose to have Rosie the Robot travel around the farmyard or choose a completely different location, real or imaginary.

This design challenge could be adapted for first-grade students—Rosie's Walk aligns well with these first-grade ELA standards:

- Reading Literature, Key Ideas & Details 2. Retell stories, including key details, and demonstrate understanding of their central message or lesson.
- Speaking & Listening, Presentation of Knowledge and Ideas 4. Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly and using appropriate vocabulary.
- Language, Conventions of Standard English 1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking ….
- Word Usage g. Use frequently occurring prepositions, adjectives, adverbs, conjunctions, and articles.