

Introduction to Looping

A LEGO® Education Unit for

LEGO® Education Coding Express

Unit Introduction

This unit allows students to develop their computational thinking skills and build foundational computer science knowledge. Students will investigate algorithmic thinking concepts by creating looped tracks that contain repeating patterns.

Students are encouraged to ask questions and test their answers as they build skills and knowledge in the following areas:

- Exploring algorithmic concepts through physical coding
- Understanding the concepts of sequences and looping
- Exploring how to break problems down into smaller chunks
- Using hardware to explore the science idea of how pushes and pulls affect movement
- Building communication, problem-solving, collaboration, and creativity skills
- Working together to solve a simple problem according to a need

Unit Learning Promise

In this unit, students will explore the computer science concept of looping through creating and exploring circular train track configurations. They will begin to understand how loops can create a repeating pattern. Students will also learn how to program their train to support storytelling, using action bricks that allow for physical coding and controlling the train's action as it moves in a loop.

Investigation Questions:

What is a loop? Why would I use a loop in a program? How can the shape of a track help me repeat steps to complete a task?

Unit Lessons

Lesson 1	Lesson 2	Lesson 3	Lesson 4
<u>Up, Down, Around Again</u>	<u>O-Shaped Track</u>	<u>Animal Concert</u>	<u>The Never-Ending Story</u>
Time: 30 min.	Time: 30–45 min.	Time: 30–45 min.	Time: 30–45 min.

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Assessment

We recommend assessing students on various skills throughout the unit.

- Use the progression of lessons as an opportunity to provide on-going feedback to prepare students for success for the open-ended project at the end of the unit.
- Each lesson includes a recommendation for teacher observations, student self- assessment, evaluation of success.

Unit Standards

CSTA

- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- 1A-AP-14 Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops.

Integrated Standards

ISTE

- ISTE 1.5.c With guidance from an educator, students break a problem into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving (computational thinking)

CSTA

- 1A-CS-01 Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use.
- 1A-AP-08 Model daily processes by creating and following algorithms (step by step instructions) to complete tasks.
- 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1A-AP-14 Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops.

CCSS ELA

- SL.K.2 Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
- SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- SL.K.4 Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.
- SL.K.6 Speak audibly and express thoughts, feelings, and ideas clearly.

CCSS Math

- MP1 Make sense of problems and persevere in solving them
- K.G.A.2 Correctly name shapes regardless of their orientations or overall size.
- K.G.B.5 Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.

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Up, Down, Around Again!

Move based on the order of the brick color, and then loop it!

STEM, Creative Exploration, and Computer Science

K

30 min.

Beginner



Prepare

- Prior to starting the lesson, make sure the LEGO® Education Coding Express sets are ready to use.
- This lesson is designed to be used with the LEGO® Education Coding Express App. Download it at <https://education.lego.com/en-us/downloads/early-learning/software> and pair it with trains in the sets.
- Select four different colored bricks for four actions. Select a different colored brick as a symbol for repeat or loop.
- Provide two sets of the selected five bricks to each student or group.
- **Vocabulary:** sequence, loop, repeat

Engage

- Ask students to play a few rounds of head, shoulders, knees, and toes with you.
- Say: When we play this game, we often go in the same order. Do you remember the order based on the song?
- We are going to have some fun by assigning some of the movements from the song to a brick.

Explore

- Lead students through the following steps to assign a movement to each of the four different colored bricks.
 - Display a brick and say:
Whenever I show you this brick, touch your head.
 - Say: Let's practice!
 - Lead practice by showing the first of the colored bricks and asking students to touch their heads.
 - Display a different colored brick and say:
Whenever I show you this brick, touch your shoulders.

KEY OBJECTIVES

Students will

- Understand that loop means to complete the steps again in the same order.
- Perform an assigned movement based on the color of a brick.

STANDARDS

- CSTA 1A.AP.10 Develop programs with sequences and simple loops, to express ideas or address a problem.

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- Say: Let's practice!
- Lead practice by showing the second of the colored bricks and asking students to touch their shoulders.
- Repeat until you have assigned a movement (touch head, shoulders, knees, and toes) to each of the four different colored bricks.
- Confirm whether students can recall the movements for each.
- Place the bricks in a random order. Using the song, ask students to tell you how to put the bricks in order by assigning one brick for each movement.
- **Optional:** Organize partners to assign movements to a set of their own four bricks. Have groups share with each other.

Explain

- Display the brick assigned as a symbol of looping (See Prepare.)
- Introduce looping by saying:
Sometimes, when we sing songs or make up funny dance moves, we want to do them again. Loop is another word for repeating a series of steps. In coding, I can use this block to tell the program to loop, or repeat, a series of steps.
- Sometimes you want to repeat the steps once and sometimes you want to repeat them many times.
- Lead practice by saying: I have one loop block, so let's repeat all four moves one time.
- Show the loop brick. Then add duplicate bricks to repeat all four movements in order (head, shoulders, knees, and toes; head, shoulders, knees, and toes).
- Point to the bricks and lead students in repeating the four assigned movements.

Elaborate

- Continue practicing looping with students.
- Organize the series of bricks to repeat each move twice (head, head; shoulders, shoulders; knees, knees; toes, toes).
- Place the loop brick before each repeat to show the action, moving the loop brick as you lead students in performing the assigned movements in the series.
- Have pairs create their own head, shoulders, knees, toes move sequences with a loop brick and their sets of colored bricks.
- Ask:
 - How did you know when to repeat a move?
 - What are some other ways we loop the moves more than one time using our bricks?

Evaluate

Evaluate the student's skills development by observing if they can:

- Understand a loop means to repeat a series of steps.
- Perform the correct movements associated with the brick colors.

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O-Shaped Track

Explore and understand use of the O-shaped track for repeating sequences.

STEM, Creative Exploration, Social Emotional Development, Early Math and Science

K

30–45 min.

Intermed.



Prepare

- Prior to starting the lesson, make sure the LEGO® Education Coding Express sets are ready to use.
- This lesson is designed to be used with the LEGO® Education Coding Express App. Download it at <https://education.lego.com/en-us/downloads/early-learning/software> and pair it with trains in the sets.
- If desired, download a [printable model card](#) for Explore.
- Consider the abilities and backgrounds of all your students and decide when and how to introduce and differentiate lesson content, activities, or concepts.
- If necessary, pre-teach these related **vocabulary words**: during, daily, weekly, often, usually.
- **Coding Concept:** Looping – repeating a portion of code a set number of times until a process is complete

Engage

- Ask students if there's anything they do many times a day or week (e.g., brushing their teeth, showering, cleaning their room).
- Tell students that they will play a game!
- Model a sequence of hopping, jumping, running, walking backward, dancing, spinning, or other actions in a circle.
- Ask students to copy what you've just done and to repeat (i.e., loop) the sequence at least twice.

Tip: For younger students and beginners, limit your loop to one or two actions.

KEY OBJECTIVES

Students will

- Understand use of the O-shaped track for repeating sequences
- Be able to compare different train track shapes and their uses

STANDARDS

- CSTA 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.

Extension

- CCSS.ELA-LITERACY.SL.K.4 Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.

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Explore

- Ask students to combine curved and straight track pieces to make an O-shaped train track (six curved and four straight pieces is recommended).
- Have students build two or three places they'd like to visit on the train. For inspiration, share the [printable model card](#) (below). Alternatively, students may use the Building Cards from the LEGO® Education Coding Express set for ideas or build any three places they wish.
- Say: Let's go on a day trip!
- Have students use some LEGO® DUPLO® figures as passengers.
- Tell students that the passengers would like to have a picnic in the forest and then visit the beautiful castle.
- Ask: Can you help the passengers take the train to the forest and then to the castle?

Tip: Remind students to use action bricks to make sure that the train will be able to stop at each location. Encourage them to use the blue action bricks for any stops with drinks, water, or gas.



Explain

- Tell students that the passengers enjoyed their trip so much that they'd like to do it again! Talk with students about how they could help make this happen.
- Ask questions like:
 - Will you be able to help the passengers take the same trip again? How? (The O-shaped track creates loops.)
 - Which action bricks will you use and why?

Elaborate

- Encourage students to build a double-ended track next to the O-shaped track.
- Talk about the difference between the two types of tracks.
- Ask questions like:

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- What's the difference between these two types of tracks?
- Will you be able to repeat the same journey on the double-ended track? Why or why not?

Evaluate

- Ask guiding questions to elicit students' thinking and their decisions while ideating, building, and programming.

Observation Checklist

- Review the learning objectives and educational standards addressed in this lesson (blue sidebar box).
- Share specific student responses and behaviors at different levels of mastery.
- Use the following checklist to observe students' progress:
 - Students can create an o-shaped track and can describe this as a loop.
 - Students can describe, with prompting, the repeating sequence of events on the trip.
 - Students can discuss the difference between a journey on the O-shaped track and one on the double-ended track.

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Animal Concert

Recognize different animal sounds and be able to compose a simple melody using digital tools.

STEM, Creative Exploration, Social Emotional Development, Early Math and Science

K 30–45 min. Intermed.



Prepare

- Prior to starting the lesson, make sure the LEGO® Education Coding Express sets are ready to use.
- This lesson is designed to be used with the LEGO® Education Coding Express App. Download it at <https://education.lego.com/en-us/downloads/early-learning/software> and pair it with trains in the sets.
- Consider the abilities and backgrounds of all your students and decide when and how to introduce and differentiate lesson content, activities, or concepts.
- If necessary, pre-teach these related **vocabulary words**: animal sounds, compose, concert, melody, safari.
- If desired, gather stuffed animals or other animal toys to use as props in Elaborate.

Engage

- Ask the students if they know what sounds different animals make.
- Have them try to imitate some of these sounds.
- Pick a song about animals that is well-known to your class and sing and/or dance to it.
- Tell students that today the safari bus is full of kindergartners. They're going to a concert performed by forest animals!
- Would you like to join them and meet the animal singers?

KEY OBJECTIVES

Students will:

- Understand that the action bricks' behavior can be changed using the app
- Be able to recognize different animal sounds
- Be able to compose a simple melody using digital tools

STANDARDS

- CSTA 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.

Extension:

- CCSS.ELA-LITERACY.SL.K.6 Speak audibly and express thoughts, feelings, and ideas clearly.

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Explore

- Ask students to build the safari bus and a train track (an O-shaped track is recommended).
- Now experiment with the app. Put the safari bus on the track and invite students to explore the different functions of each button.
- Place one action brick of each color on the track.
- Have students take turns using the app to "drive" the bus.
- Ask: What happens after the bus passes each action brick?

Explain

- Talk to students about the sounds they've just heard.
- Ask questions like:
 - What did you hear when the bus went over the action bricks?
 - Did you know those animal sounds?
 - What animals did you hear? (Ask the students to build the animals they've named.)
- Ask the students to place each animal next to its action brick.
- Use the app to see if the sound matches the animals that students built.

Elaborate

- Now you're going to make your own animal concert!
- Have students place action bricks on the track in any order to compose their own music!
- Talk to students about their composition.
- Ask what they want their music to express (e.g., happiness, excitement, nice weather).
- Encourage students to sing and dance to their music.
- Stuffed animals or similar toys can be used as props for their performance.

Evaluate

- Ask guiding questions to elicit students' thinking and their decisions while ideating, building, and programming.

Observation Checklist

- Review the learning objectives and educational standards addressed in this lesson (blue sidebar box).
- Share specific student responses and behaviors at different levels of mastery.
- Use the following checklist to observe students' progress:
 - Students can describe the repeating pattern of the sounds on the track as a loop.
 - Students can design simple sequences to compose a simple melody.
 - Students can express their thoughts, feelings, and ideas clearly.

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More Ideas

- Use this lesson's format to create lessons for the **Music Band** in the app. Involve different instruments in the Engage phase discussion and explore more interesting sounds with your kindergartners.
- For a more challenging music lesson, try the activity **Are You sleeping Brother John?**
 1. Investigate the melody of each action brick.
 2. Sequence the action bricks to match the song.
 3. Compose a new song by remixing the action bricks.



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The Never-Ending Story

Create a story with a loop.

STEM, Creative Exploration, Social Emotional Development, Early Math and Science

K

30–45 min.

Advanced



Prepare

- Prior to starting the lesson, make sure the LEGO® Education Coding Express sets are ready to use.
- This lesson is designed to be used with the LEGO® Education Coding Express App. Download it at <https://education.lego.com/en-us/downloads/early-learning/software> and pair it with trains in the sets.
- Locate an age-appropriate story that repeats. (e.g., "If You Give a Mouse a Cookie" by Laura Numeroff where the ending allows the story to repeat itself.)
- **Vocabulary:** debug, loop

Engage

- Read a story that repeats. (See Prepare for an option.)
- Ask students to think about how the author wrote the story so it could be told over and over again.

Explore

- Have students work together to create a loop track.
- They can use the train, action bricks, LEGO® DUPLO® bricks, and craft materials to retell the story you read.

Explain

- Explain how we use something called a loop in a program, when we want something to repeat over and over again.
- Ask students how the loop of the track helps to repeat the story.

KEY OBJECTIVES

Students will:

- Create and program a story that repeats
- Debug errors in their program as needed

STANDARDS

- CSTA K-2 1A.AP.10 Develop programs with sequences of commands and simple loops, to express ideas or address a problem.
- CSTA 1A.AP.14 Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops.
- ISTE 1.5.c With guidance from an educator, students break a problem into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving (computational thinking)

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- Ask questions like:
 - How did you decide where to place the action bricks to tell the story?
 - Where does the story begin to repeat? Show me in your build.

Elaborate

- Challenge students to create their own repeating stories in small groups.
- Students can create scenery to accompany the story around the track using LEGO® DUPLO® bricks or craft material.

Evaluate

Evaluate the students' skills development by observing if they can:

- Use the loop to repeat a story.
- Try different strategies to debug the problem.
- Observe and describe objects and events.
- Ask questions about concepts related to science and technology.

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