

# Introduction to Sequencing

## 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 explore algorithmic thinking concepts through physical coding and challenges that allow them to investigate how to create sequences.

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 concept of sequencing
- 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 begin to understand that sequences are the order of steps in a program. They will explore how to program their train using action bricks and create a track to run a sequence of steps. They will begin to understand how to debug a program and how to break down big tasks into smaller steps.

#### Investigation Questions:

What is a sequence? How do sequences help me create a program? How do I know the sequence of steps I need for a program?

### Unit Lessons

| Lesson 1                           | Lesson 2                          | Lesson 3                           | Lesson 4                                 | Lesson 5                                   |
|------------------------------------|-----------------------------------|------------------------------------|--|--|
| <a href="#"><u>Memory Game</u></a> | <a href="#"><u>First Trip</u></a> | <a href="#"><u>Train Sound</u></a> | <a href="#"><u>Are You Sleeping?</u></a> | <a href="#"><u>Trip to See Animals</u></a> |
| Time: 30 min.                      | Time: 30–45 min.                  | Time: 30–45 min.                   | Time: 30–45 min.                         | Time: 45–60 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, and evaluation of success.

## Unit Standards

### CSTA

- 1A-AP-08 Model daily processes by creating and following algorithms (set of step-by-step instructions) to complete a task.
- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- 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.

### 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-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.

#### CCSS ELA

- SL.K.1 Participate in collaborative conversations with diverse partners about Kindergarten topics and texts with peers and adults in small and larger groups.
- 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.
- L.K.5.A Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent.

#### CCSS Math

- K.CC.B.4 Understand the relationship between numbers and quantities; connect counting to cardinality.

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# Memory Game

Can you remember the color of the LEGO® bricks in order?

STEM, Creative Exploration, and Computer Science

K 30 min. Beginner



## Prepare

- Prior to starting the lesson, make sure all students have the same set of three to four LEGO® DUPLO® bricks.
- **Vocabulary:** sequence, order

## Engage

- Ask students to count from one to five with you.
- Explain:
  - When we count from one to five, we say the numbers in order. Sometimes we use numbers to count objects. Other times we use numbers to know the steps in a set of directions. Then the order is very important.
  - Where have you seen numbered steps in directions? Where might I find these? (worksheets, school activities, recipes, putting together a toy)
  - Today, we'll play a game where we try to remember bricks in order from one to three. We'll start off easy and then I will challenge you!

## Explore

- Select two bricks and model using them to count.
- Show the first brick to students. Say: This is brick one.
- Connect the second brick above the first brick to make a stack. Point to the second brick and say: This is brick two.
- Repeat that the bottom brick is "brick one" and the top brick is "brick two."
- Display the stacked bricks for students to see.
- Ask students to mirror your actions and create the brick sequence with their bricks.

## KEY OBJECTIVES

Students will

- Understand that a sequence has an order (1,2,3).
- Recall or recreate a simple sequence of bricks shown from memory.

## STANDARDS

- CSTA 1A.AP.10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- CSTA 1A.AP.11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.

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- Lead them in comparing their stacks with your example. Say:
  - Do your bricks look like my bricks? Let's count and see.
  - (Point the bottom brick) One and (point to the top brick) two.
  - What color is the first brick?
  - What color is the second brick?
  - If your bricks do not look like my bricks, what can you change so that they are the same?
- Repeat the process with two bricks, and then extend to three bricks.
- If you wish, partner students for the second practice.
  - One partner builds a stack and the other builds the exact stack next.
  - Each partner should practice speaking and listening skills as they mirror the modeled counting to say: "This is brick one, this is brick two, etc."

## Explain

- Ask: When you build your stack of LEGO® bricks to look like mine or your partner's, how does knowing the order of bricks help you?
- Explain that a sequence, or order, helps when we create instructions to make something. It tells the person using those instructions exactly what to do in what order to make the exact same thing.
- Prompt students: Now, let's see if you can build a stack that looks just like mine from memory.

## Elaborate

- Repeat the modeling from Explore: Connect two bricks together in a stack. Say: The bottom brick is "brick one" and top brick is "brick two."
- After 10–15 seconds, hide the bricks.
- Ask students to copy the brick sequence from memory. Say: Make your stack just like mine.
- After students build, ask questions like:
  - How did you remember the sequence of colors? (Say the colors over and over; use the brick numbers)
  - What helps you remember the best? (This will vary by student.)
  - What are some other ways we could remember the sequence of bricks? (Write numbers on them.)

## Evaluate

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

- Understand a sequence is an order.
- Recreate a stack of bricks in the correct sequence.

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# First Trip

This getting started activity will allow students to explore the action bricks and different bricks in the set.

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



K

30-45 min.

Beginner

## Prepare

- Before 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 the app at <https://education.lego.com/en-us/downloads/early-learning/software> and pair it with trains in the sets.
- If desired, download printable model [Card 1](#) for Explore, [Card 2](#) for Explain, and [Card 3](#) for use in Elaborate.
- 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**: action brick, stop (as a noun), destination, most, train station, journey.

## Engage

- Ask students if they've ridden a train, subway, or tram. Where did they go?
- Tell them they're going to play the choo choo train game!
- Have students line up and put their hands on the shoulders of the person in front of them.
- Explain that when you say, "go" they'll move around the classroom like a choo choo train, and when you say, "red light" they'll slow the train down and stop.
- Play a few rounds of the choo choo train game.

## KEY OBJECTIVES

Students will

- Understand the function of action bricks
- Understand how to use the different types of bricks
- Use action bricks to complete tasks

## STANDARDS

- CSTA 1A-AP-08 Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks.

## Extension

- CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.

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## Explore

- Share printable model [Card 1](#) and have students build a model from it. Alternatively, they may use the Building Cards from the LEGO® Education Coding Express set as inspiration or build any destination they like.
- When the students have finished building, ask them to work together to build a double-ended track.
- Make sure the track is long enough to fit the train station and the destination (using eight track pieces is recommended).
- Start at the train station and use a LEGO® DUPLO® figure as a passenger.
- Tell students that the passenger would like to go fishing at the harbor.
- Ask: Can you help them get to the harbor?



- The students are likely to stop the train one of three ways:
  - By hand, which they've learned in the getting started activities
  - Using the red action brick
  - Using the red stop brick

## Explain

- Show the three different ways of stopping the train. Talk to students about the red action bricks.
- Ask questions like:
  - How many red action bricks did you use?
  - Where did you place the red action brick(s). Why?
  - Where did the train stop?



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## Elaborate

- Encourage the students to build a longer track and to create more stops. Pique their interest in using the green action bricks on the track.
- Ask questions like:
  - What did you see when the train went over green bricks?
  - How can we help the train get back to the station?



## 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 work in collaborative groups to build a model and the double-ended track and then take turns using their model as the destination.
  - Students create and follow an algorithm (step-by-step actions) for the train to move from the train station to one or more destinations along the track.
  - Students use the action bricks (or appropriate elements) to program the train to start at the train station and stop at the destination.

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# Train Sound

In this lesson students will understand the function of each action brick and how to use them to solve problems.

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

K 30–45 min. Beginner



## Prepare

- Before 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 the app for student devices at <https://education.lego.com/en-us/downloads/early-learning/software> and pair it with trains in the sets.
- If desired, download printable model cards for use in Engage: [Card 1](#); and Elaborate: [Card 2](#), [Card 3](#).
- 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**: approach, refill, gas station, react, describe.
- **Coding Concept**: Sequencing – the order in which commands are executed by a computer

## Engage

- Ask students if they've ever been to a train station.
- Talk about what they might've seen.
- Ask questions like:
  - How did you know when a train was approaching? (Trains make a steam whistle sound to warn people that they're approaching.)
  - What made the trains move? (Trains use different sources of energy to move, such as wood, electricity, gas, etc.)

## KEY OBJECTIVES

Students will

- Understand the function of action bricks
- Use action bricks to complete tasks
- Define the train's journey (sequencing)

## STANDARDS

- CSTA 1A-AP-11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.

Extension

- CCSS.ELA-LITERACY.L.K.5.A Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent.

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- Tell students that they're going to play another choo choo train game!
- Have the students line up and put their hands on the shoulders of the person in front of them, just like they did in the First Trip lesson.
- Explain that when you say, "yellow light" they'll make a "choo choo" sound and walk around the classroom.
- When you say, "blue light" it means the train needs gas; they should stop and make a "bloop bloop" sound to refill train with gas.

**Tip:** If students are ready for a challenge, make the game more difficult by adding the red and green actions from the choo choo train game you played in the First Trip lesson.

## Explore

- Share [printable model Card 1](#) and have students build a model from it (e.g., picnic area, gas station, train). Alternatively, they may use the Building Cards from the LEGO® Education Coding Express set as inspiration or build any destination they like.
- When the students have finished building, ask them to work together to build a double-ended track (using eight track pieces is recommended).
- Have students use some LEGO® DUPLO® figures as passengers.
- Say: Let's start the train!
- Tell students that the passengers would like to go from the picnic area to the gas station.
- Ask: Can you help them get to the gas station?

## Explain

- Talk to the students about the action bricks.
- Ask questions like:
  - Where did you place the blue action brick(s) and why?
  - Where did you place the yellow action brick(s) and why? (Try to tie this back to Engage discussion; a steam whistle sound is a warning.)
  - Can you describe the train's journey? (i.e., the train started from.... and passed... and stopped at...)

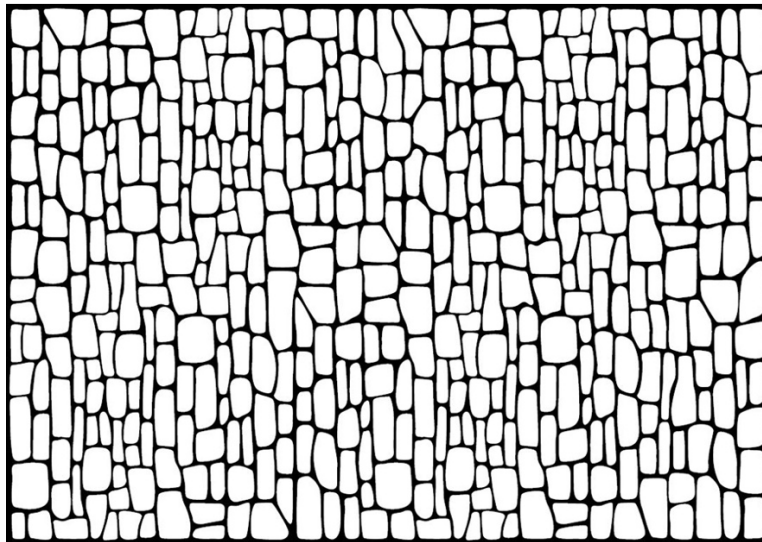
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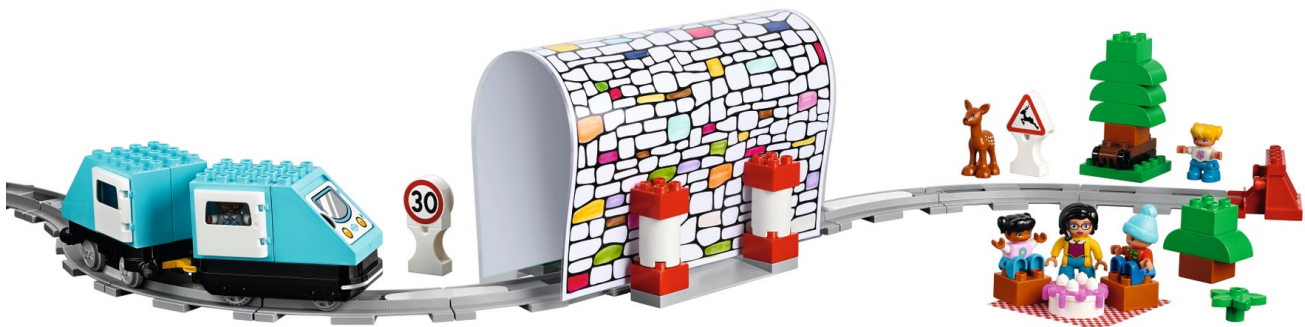


## Elaborate

- Encourage the students to build a longer track and to create more stops. Pique their interest in using all the action bricks in appropriate places.
- Ask questions like:
  - What happened when the train went over the white brick?
  - Think about how you placed the action bricks and models along the track. Can you describe the train's journey?
- The white action brick turns the train's light on and off. Use [printable Card 3](#) to print out the tunnel image and position it over the track as shown below and on [printable Card 2](#).
- Place the white action bricks on both sides of the tunnel and ask the students to observe what happens when the train goes through the tunnel.



Card 3



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## 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 use the building cards to sort the elements from the LEGO® Education Coding Express kit into categories that represent the destinations.
  - Students can express why they believe those objects belong in that destination.
  - Students can decompose, or break down into steps, the journey a train makes that includes multiple stops and multiple action bricks.

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# Are You Sleeping, Brother John?

In this lesson, students will debug errors in a program that includes a sequence.

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

K 30–45 min. Advanced



## Prepare

- Before 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.
- Gather craft materials for students to use in Elaborate.
- Locate a recording of "Are You Sleeping Brother John?" by using the song title as a search term.
- **Vocabulary:** debug, sequence, melody

## Engage

- Listen to or chorally sing the song, "Are You Sleeping Brother John?"
- Ask students to hum the melody of the song aloud.
- Explain that we can program the App to play this song by placing the action bricks in the correct order.

## Explore

- Have pairs or groups create a sequence track together.
- Place the action bricks on the track in the wrong order, so the song melody will play out of order.
- Click on the music note to launch the music activities in the App, then select the sleeping child to launch the "Are You Sleeping Brother John?" activity.
- Have students test the sequence of the action bricks. (The song melody will play in an incorrect sequence.)

## KEY OBJECTIVES

Students will

- Fix problems in a sequence of steps
- Break a problem into small tasks

## 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.11 Decompose (breakdown) the steps needed to solve a problem into a precise sequence of instructions.
- 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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## Explain

- Explain that the song doesn't play correctly because there's a problem in our program.
- When programs don't work the way that we want them to, we can try different ways to fix the problems. We call that process debugging.
- Challenge students to debug the song by changing the sequence of steps in the program.
- Encourage them to brainstorm different ways to find the correct sequence of action bricks.
- Ask questions like:
  - How did you decide which brick needs to be first in the sequence?
  - When the melody did not sound correct, what are some ways you tried to correct it?

## Elaborate

- Invite students to create scenery that matches the song as it plays along the track. Scenery can be made from LEGO® DUPLO® bricks or other craft material.
- Then encourage students to compose a new song by remixing the action bricks. Have them create song lyrics to match the new song.
- Ask questions like:
  - How did you make a new song?
  - Did you have any problems with the program? How did you solve them?

## Evaluate

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

- Correctly sequence action bricks.
- Use 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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# Trip to See Animals

Can you decompose the steps needed to solve a problem into a sequence of instructions?

STEM, Creative Exploration, and Computer Science

K 45-60 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.
- If desired, download a printable model card for use in Explore: [Card 1](#).
- **Vocabulary:** animals, program, sequence, decompose

## Engage

- Read a book about different animals we might see in different places. Ask students if they have ever ridden a train or a bus in places where animals live. What might you see? (Animals eating, running, hopping, etc.)
- You can walk around a place to see all the animals that live there. But taking a train is another way to see different animals in different places.
- Introduce the problem through this story:  
The passengers on the train would like to visit different places. They would like to always start at the same place. Then they want to ride the train and stop to see bears, giraffes, elephants, and penguins, in that specific order. Help the passengers stop at each of these places on their ride.



## KEY OBJECTIVES

Students will:

- Break down a problem into small tasks.
- Describe the train's journey through a place with animals.
- Explain that the train is only following the directions given.

## STANDARDS

- CSTA 1A.AP.10 Develop programs with sequences and simple loops, to express ideas or address a problem.
- CSTA 1A.AP.11 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.

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## Explore

- Have pairs or groups work together to create the different animals and areas named in the problem.
- Students can use LEGO® DUPLO® blocks and craft materials to create the animals and areas.
- **Note:** For animal build inspiration, share [printable model card 1](#) (see image below).



- Once the areas are created, have students create a sequence track to travel to each area. Use the LEGO® DUPLO® figures as passengers.

## Explain

- With students, talk about taking this big problem and breaking it into smaller pieces.
- Say: When we break a problem into smaller pieces, we call it decomposing.
- Listen as I retell the problem from our story. What are the steps needed to solve it?  
The passengers on the train would like to visit different places. They want to always start at the same place. Then they want to ride the train and stop to see bears, giraffes, elephants, and penguins, in that specific order. Help the passengers stop at each of these places on their ride.

(Answers:

1. The passengers need to start at the same place each time.
2. The passengers need to be on the train.
3. The train needs to stop next to the bears.
4. The train needs to stop beside the giraffes.
5. The train needs to stop in front of the elephants.

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6. The train needs to stop beside the penguins.)
- Have students arrange the areas where the train must go and then use the track and action bricks to solve the problem.
  - Guide students with questions and prompts like:
    - What action brick(s) did you use and why?
    - Why did you place the stops where you did? How did that help solve the problem?
    - Describe the train's journey for me. (i.e., the train started from.... and passed... and stopped at...)

## Elaborate

- Create a new problem for students by rearranging the order of the desired stops OR challenge students to create a new track that will make all the stops necessary and then return to the starting place.
- Use questions and prompts like:
  - How did you solve the new problem?
  - Think about how you placed the action bricks and models along the track. Describe the train's journey for me.

## Evaluate

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

- Correctly sequence events.
- Observe and describe objects and events.
- Ask questions about concepts related to science and technology.

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