

Basic Coding Concepts in LEGO® Education SPIKE™ Essential Lessons

Sequences, Loops, and Events

Coding is a way of expressing ourselves with technology, similar to how we organize ideas and communicate with words when writing. Both coding and writing help us think systematically, solve problems, and use tools to design and express our ideas.

Using basic coding concepts such as sequences, loops, and events will help your students understand cause and effect relationships, in school and beyond.





- **Sequence:** A set of steps carried out in a particular order. Think about the steps involved in making a sandwich. You complete the steps in a particular order to create your sandwich – find the bread, add mayo, slice a tomato, etc. If not, you might end up having the tomato on the counter instead of the bread! Coding is also like that. The LEGO® Education SPIKE™ Hub will do exactly what you tell it to, in the order you specify.
- **Loop:** Loops repeat a piece of code a specified number of times or forever. Think about how a traffic light works. It cycles through the three colors to organize traffic and prevent accidents. In coding, loops save time and minimize errors. They enable us to repeat sections of code to shorten the written program and make it more manageable.
- **Event:** occurrences that determine when a set of coding blocks runs. This can be when a button is clicked, when the built-in Gyro Sensor detects a tilt, when the Color Sensor detects the specified color, or immediately when the program is started. Think about when you enter a grocery store. A motion sensor detects movement when a person walks in front of it, which opens the automatic doors. In coding, Event Blocks allow us to trigger different actions (e.g., start the motor when the Color Sensor detects a green LEGO® brick).


The tables on the following pages show how your students will practice and develop their understanding of these basic coding concepts throughout the SPIKE Essential lessons. Use this guidance to help you prepare to teach these lessons with a focus on driving and scaffolding your students' coding skills. As you prepare to teach each lesson, you can:


- Use the information in the '*FIRST, student will...*' and in the '*THEN, student will...*' column to identify places in the lesson where your students will practice and learn the coding concepts.
- Use the information in the '*First, student will...*' and in the '*Then, student will...*' column to assess your students' progress. Give formative feedback about their progress with creating sequences and using loops and events. Ask questions like these: *How does your program sequence work? Why did you use those programming blocks? What do they do for your program? What can you do to improve the program?*
- Expand your coding knowledge and start talking with your students and colleagues about coding concepts in an everyday language. What are they, what do they look like, and how do we use them to organize ideas, think systematically, problem-solve, and express ourselves with technology?




		Coding Concepts	
		FIRST, students will...	THEN, students will...
 Unit: Great Adventures	Lesson	Create a sequence by placing the programming blocks in the right order. This will...	Change and expand the sequence by applying more programming blocks that will...
	1: Boat Trip	Push the boat into the water.	Add sounds, displays, and more Motor Blocks to improve the program.
	2: Arctic Ride	Make Leo's snowmobile go.	Create a round-trip journey for Leo's next trip.
	3: Cave Car	Turn on the cave car's light.	Add displays, loops , and different lights to improve the cave car.
	4: Animal Alarm	Make the alarm turn on in the event that a blue creature walks by.	Add a new event to make the alarm react when a red creature walks by.
	5: Underwater Quest	Make the submarine move by using a loop to control repeated motion.	Change the program based on modifications to the model.
	6: Treehouse Camp	Open the treehouse roof so Sofie can see the moon.	Fix the program so it can also close the roof again and change the program based on modifications to the model.
	7: Great Desert Adventure	Students will build their own models to solve the team's challenge of getting to the pyramids. They'll create, test, and modify a program sequence; and independently apply what they've learned in previous lessons to solve the team's challenge.	

		Coding Concepts	
		FIRST, students will...	THEN, students will...
 Unit: Amazing Amusement Park	Lesson	Create a sequence by placing the programming blocks in the right order. This will...	Change and expand the sequence by applying more programming blocks that will...
	1: The Fast Lane	Make the Fast Lane's light turn on in the event that a yellow ticket is shown to the Color Sensor.	Add sounds and bar graphs, and use loops to automate the Fast Lane.
	2: Classic Carousel	Make the carousel spin.	Add more Motor Blocks to control the speed and direction of the carousel, and add Sound and Display Blocks.
	3: The Perfect Swing	Make the swing move.	Add more Motor Blocks to control the speed of the swing, add sounds, and use loops to automate the swing.
	4: Snack Stand	Serve a snack in the event that a blue snack ticket is shown to the Color Sensor.	Add more Motor Blocks, sounds, and displays to improve the snack stand.
	5: Twirling Teacups	Start the teacup ride and play a sound in the event that a blue message is sent to start the Sound Block.	Add more Motor Blocks and use loops to automate the ride.
	6: The Spinning Ferris Wheel	Make the Ferris Wheel move by using a loop to repeat the movement.	Add more Motor Blocks to improve control of the Ferris Wheel's spins, and add light.
	7: The Most Amazing Amusement Park	Students will build their own models to solve the team's challenge of creating a new ride for the amusement park. They'll create, test, and modify a program sequence; and independently apply what they've learned in previous lessons to solve the team's challenge.	

		Coding Concepts	
		FIRST, students will...	THEN, students will...
 Unit: Happy Traveler	Lesson	Create a sequence by placing the programming blocks in the right order. This will...	Change and expand the sequence by applying more programming blocks that will...
	1: River Ferry	Make the river ferry go to Spike Tower.	Add more Motor Blocks to send the ferry back again, and add sounds and displays.
	2: Taxi! Taxi!	Make the taxi drive forward and turn.	Create a round-trip journey to the Spike Art Museum.
	3: Hovering Helicopter	Turn on the helicopter's rotor blades.	Trigger sounds, displays, and more Motor Blocks in the event that the built-in Gyro Sensor is tilted.
	4: Swamp Boat	Make the swamp boat's light turn on in the event that a crocodile is near the boat.	Add sounds and more lights, and use bar graphs to count the crocodiles.
	5: Cable Car	Make the cable car move across the lake by using a Loop Block.	Add sounds and insert time delays to improve the cable car's performance.
	6: Big Bus	Make the bus stop for Daniel in the event that it's at the green bus stop.	Add sounds, displays, and more Motor Blocks to improve the program for the bus.
	7: Get Around Town	Students will build their own models to solve the team's challenge of creating a way to get to Spike Castle. They'll create, test, and modify a program sequence; and independently apply what they've learned in previous lessons to solve the team's challenge.	

		Coding Concepts	
		FIRST, students will...	THEN, students will...
 Unit: Crazy Carnival Games	Lesson	Create a sequence by placing the programming blocks in the right order. This will...	Change and expand the sequence by applying more programming blocks that will...
	1: Mini Mini-Golf	Hit a hole-in-one.	Add sounds, light, and more Motor Blocks to improve the program.
	2: Bowling Fun	Bowl a strike.	Add a display, sounds, or use their own ideas to improve the bowling game.
	3: High Stick Hockey	Score as many goals as possible.	Add sound and random blocks to improve the program, and use a loop to automate the game.
	4: A-Maze-Ing	Complete the maze in the event of four tilts of the built-in Gyro Sensor.	Add light and a Sound Block to improve the game.
	5: Avoid the Edge	Play a sound in the event that the ball stops at the target.	Add Display or Sound Blocks or use their own ideas to improve the program.
	6: Junior Pinball	Start the pinball game.	Add a Random Block to set the motor speed and use a loop to automate the program.
	7: Creative Carnival Games	Students will build their own models to solve the team's challenge of creating a new carnival game. They'll create, test, and modify a program sequence; and independently apply what they've learned in previous lessons to solve the team's challenge.	

		Coding Concepts	
		FIRST, students will...	THEN, students will...
 Lesson		Create a sequence by placing the programming blocks in the right order. This will...	Change and expand the sequence by applying more programming blocks that will...
	1: Good Morning Machine	Make the waving machine wave.	Add Sound Blocks to improve the program and use a loop to automate the waving machine.
	2: Big Little Helper	Make the robot helper move forward and turn.	Create a journey to enable the robot helper to follow Daniel home.
	3: High-Tech Playground	Make the seesaw rock to the left and right in the event that the built-in Gyro Sensor is tilted left or right.	Add sounds, light, and their own ideas to improve the program for the seesaw.
	4: Trash Monster Machine	Make the trash monster react in the event that blue trash is shown to the color sensor.	Add more events to the program to make the trash monster react to different-colored trash.
	5: Winning Goal	Make the goal move, so it's difficult for Sofie to score a goal.	Add Display Blocks, use a Random Block to improve the program, and use loops to automate the goal's movement.
	6: Literary Randomizer	Help Daniel pick a book genre by creating a program that uses a loop .	Add Sound Blocks and Display Blocks or use their own ideas to improve the program.
	7: Your School Creation	Students will build their own models to solve the team's challenge of designing a new creation for their classroom. They'll create, test, and modify a program sequence; and independently apply what they've learned in previous lessons to solve the team's challenge.	

