Intro lessons

Novice Lesson 1: Let's Build KIBO

Topics: Parts and Functions

Learning goals: students will learn what a robot is and that robots are designed by humans to solve problems. They will learn about the mechanical and robotic parts of the KIBO robot and understand that parts have functions.

Background: What IS a Robot?

Robots are **machines** and they are **not alive** (though some may move or even look like real people or animals).

Robots have **automated moving parts.** (This can be wheels, but could also simply be a fan that spins, a door that moves up or down, or an internal motor.)

Robots can be **programmed**, or given instructions, by humans (not just controlled by a joystick or a remote).

Robots usually have **input** (such as a sensor or a button that takes in information) and **output** (such as light, sound, or movement).

NOVICE

Inspire: What is a Robot?

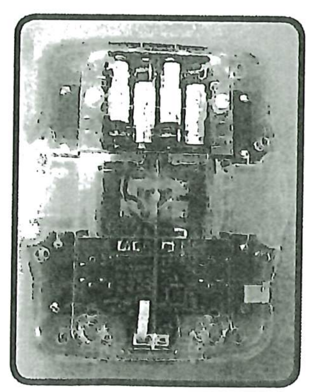
"Today we are all going to build special machines called robots. Have you ever heard of robots before? What do you think a robot is?" (Write children's ideas and questions on a large board for them to see).

Children may have heard of robots from popular songs or books, from TV shows or movies, or from family members who work with electronics. Their ideas may be very diverse. Try not to correct their ideas, but rather use them as a starting point to ask questions while using KIBO. Support children as they make discoveries and revisit their original ideas on their own. Feel free to ask prompting questions such as, "What are robots made of?" or "Do you think robots are alive?" or "How are robots different from animals and people?"

"We have a lot of ideas about robots, and a lot of questions also. Let's learn about the robot we will be building with today, and see if we can answer any of our questions."

Connect: Hello, KIBO!

Show the KIBO Robot, and begin a conversation saying, "This is KIBO, the robot we are going to build with. What do you see and notice about this robot?" Here are some options for presenting KIBO and its different parts.



- Present KIBO's body and parts on a tray and pass it around the circle; ask each child to add one part to KIBO.
- Ask children to each take different KIBO parts (e.g. a wheel, a motor). Go around the circle to each child so they can hold up and describe their part, like a show and tell circle.

List children's observations and questions prominently in the room. Encourage children to notice the body, the motors that connect to the top and sides, and the round wheels.

You can also flip KIBO over to look at its see-through bottom, and invite conversation about the parts inside KIBO as well. They may recognize parts like the batteries and the wires. You can compare KIBO's computer chip to a brain, and the wires inside to the veins and nerves in our human bodies that connect the brain to moving parts. KIBO's wheels help it move around, just like our legs help us move.

Finally, practice scanning a short program for the students. You can tell children that soon they will be sequencing their own instructions for KIBO, but for now they can watch how you scan a simple test program, such as BEGIN – SHAKE – BEEP – END. Show them how KIBO moves after you scan the program by pushing the flashing triangle button on the top of KIBO. That tells you that you connected all your robotic parts correctly!

Engage: Build and test KIBO

Allow groups to build their own KIBO robot using the bodies, 2 motors, and 2 wheels. Invite children to try to build a robot that looks like the one you demonstrated, with wheels and motors attached to sides and green dots facing down on all motors. Ask them to notice the shapes, colors, and materials. How many different ways can the parts fit together?

When children have built their KIBOs, invite them to come to a "testing station"where you can facilitate scanning the sample code from your demonstration. Allow them to test their programmed robot. Does it move the way your robotic demo did?

After scanning their program, allow children to re-attach KIBOs wheels and motors in new ways. Encourage children to press the triangle button on top of KIBO to run the demo program again after each new build. Does the way KIBO is built change how it moves? How many new ways can they build KIBO?

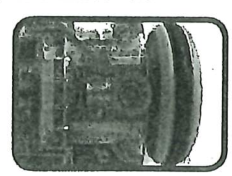
If children finish building quickly, allow them time to freely explore a small set of the programming blocks to create new programs. Limit these to the blue motion blocks plus BEGIN and END.

Reflect: Share Observations of KIBO

Ask children to bring their robots to the circle with them to show what they have learned. You can have children demonstrate and share one fact about their robot, run all robots at the same time for a fun "robot party," or do a combination of both. Return to the list of their ideas and questions, and see if they learned anything new that they did not know before. You can also ask children to share something that was hard for them while building or testing their robots, and see if others had the same problem. Sharing problems is an important part of the Engineering Design Process, which children will learn about later, and it helps children feel comfortable with the "hard fun" of working with robotics!

Tips for the Teacher:

Make sure the green dot is visible on the motors: KIBO's motors can be installed "right side up" or "upside down." When the motors are installed right side up, you'll be able to see a green dot on the motor through KIBO's clear bottom. If the motors are installed upside-down, KIBO will not move as expected.



Novice Lesson 2: What is a Program?

Topics: Sequencing, Symbols

Learning goals: students will learn that a program is a sequence of instructions. They will learn about the symbols that make up KIBO's programming language.

Background: What is a Program?

A **program** is a sequence of instructions that the robot acts out in order. Each instruction has a specific meaning, and the order of the instructions affects the robot's actions. Like a story, a program has a beginning and an ending, with a sequence of events in between.

Inspire: A Program is a Story

"Today we are going to be programmers and learn how to give KIBO instructions! A program is a list of instructions that a robot can understand. Just like people can understand languages like English, Spanish, and Chinese, KIBO has a language, too!"

"KIBO's language uses these wooden blocks with pictures on them. Each block is a different Instruction for KIBO. What do you think these blocks tell KIBO to do?" Show children a few different blocks (if you have a larger group, you can use the large KIBO Says cards, so that children can see clearly). "Each block has a symbol on it which tells KIBO to do one thing."

"We can guess what the instructions do because of the pictures and the words, but KIBO reads this black and white barcode down here." (Point to a barcode on a block). Children may recognize barcodes from the backs of library books, or foods at the grocery store. "KIBO can read the barcode with this red flashing light. This is KIBO's scanner." (Point to the flashing red light KIBO's front).

"A program is a like a story for KIBO to act out. Just like a story, a KIBO program needs a **beginning** and an **ending**." Show children the BEGIN and END blocks.

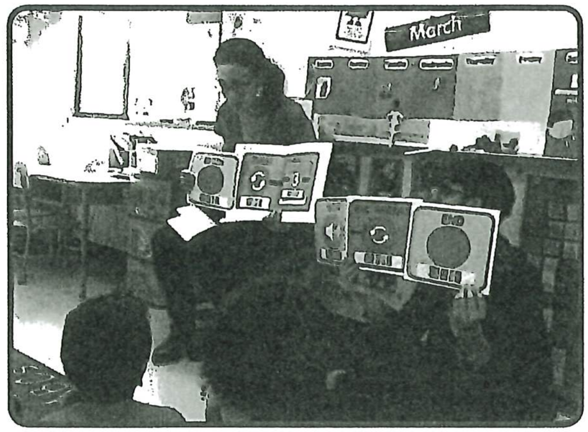
Other metaphors to explain programming include using a program to tell a story that KIBO acts out, or thinking of KIBO as a character in a play and the program as KIBO's lines.

Connect: Play KIBO Says

This activity teaches the KIBO programming language, symbols, and sequencing. You'll use the large KIBO Says cards which come with the KIBO curriculum package. For this first game, only use: BEGIN, END, BEEP, and all of the blue Movement commands.

The game is played like the traditional Simon Says game: Students repeat actions as instructed by the teacher. First, introduce each card and what it means. Have the class stand for the game. Hold up one card at a time and say "The programmer says to ________." Then give several instructions at a time for the students to act out in order. Finally, you can introduce complete KIBO programs with the BEGIN and END cards. The Programmer should also play around with order and sequence. For example, how does BEGIN, SHAKE, BEEP, END look different from BEGIN, BEEP, SHAKE, END?

Engage: Program KIBO



Demonstrate scanning a simple program for KIBO, to remind children of the work they did in the previous lesson.

Then give children plenty of time to work in small groups to build their own programs for KIBO. Children can use any of the movement blocks along with BEEP and SING to program their KIBOs. Remind them that every program must have a BEGIN and END block!

Invite children to create a dance with their programs! When their dance is complete, children can try to dance along with their robots, or to learn another group's KIBO dance. Remind children that they can plan their sequence by acting out a dance themselves, with their bodies. Then, they can remember their actions while they build a program for KIBO using blocks.

Reflect: Demonstrate Your KIBO Program

Invite children to sit in a circle and take turns sharing their programs, and then demonstrating their robot's movements. You can invite children to say out loud the programming instructions while KIBO is moving to check against the program they made. After every group gets a chance to share their finished KIBO, you can let children all start their KIBOs and follow along standing up at the same time for a fun dance party!

Tips for the Teacher:

Scanning tips. Here are some tips for scanning KIBO's blocks:

- Keep KIBO's flashing scanner light 3-4 inches from blocks, and tilted slightly.
- If children have trouble holding KIBO steady, encourage them to try resting KIBO flat on the ground and scanning the sides of the blocks.
- You can separate the blocks slightly to make it clearer for children which block is being scanned.
- Remember to aim KIBO's light at the barcode, not at the picture or word.
- When scanning, look for KIBO's green LED to flash and listen for a single beep. This lets you know KIBO understood the command.

She, He, or It? KIBO is not a girl or a boy, but students will often make assumptions about what pronoun to use with KIBO. Engaging this question with the students at circle time can help explore their ideas - and their implicit biases.

KIBO Pet Trick

The Sound Sensor and WAIT FOR CLAP Block

KIBO 15+

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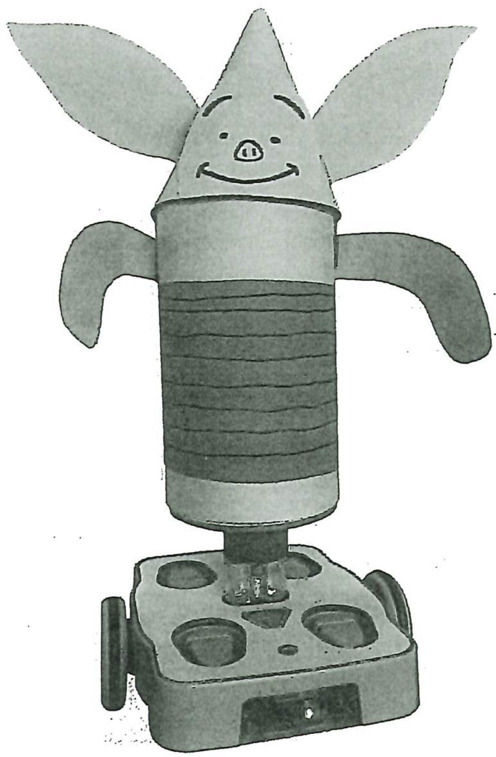
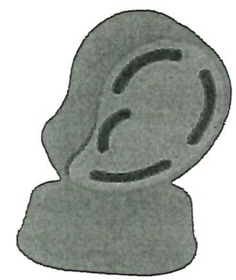
What's This?

Create a KIBO pet and teach it to do a trick when you clap!



Get Ready!

KIBO's sound sensor can hear sounds, just like your ear can.



The WAIT FOR CLAP block tells KIBO to wait until the sound sensor (ear) detects a loud clapping sound.

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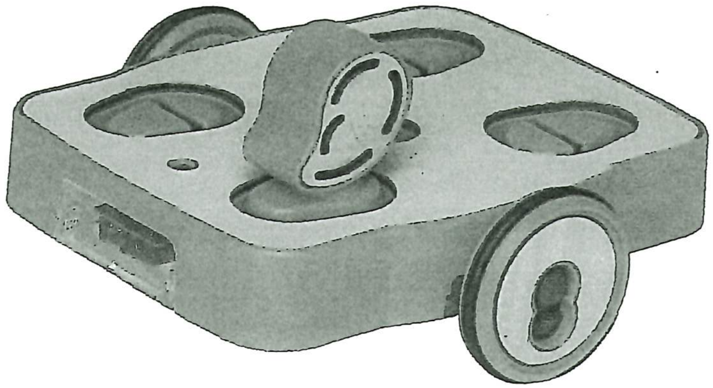
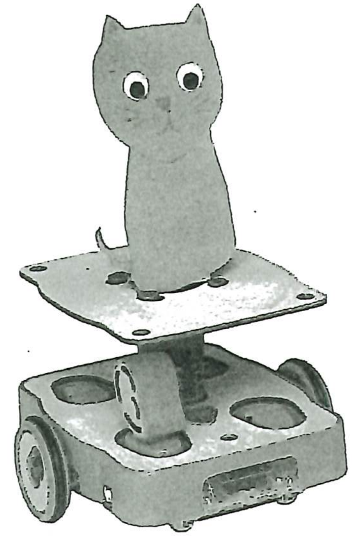
Build:



Attach KIBO's wheels and motors.

Attach KIBO's ear.

Make:



Decorate your KIBO pet!

1 2
3 4

Code:

What should KIBO do when you clap?

Play:

Did KIBO do your trick?

What else do you want KIBO to do when you clap?

Try these blocks:

Can two KIBO animals play together?

The Kibo Zoo

2nd

An Introduction to Creative Robotics & Programming in K-2

KinderLab robotics

Info, News, and Shop at: kinderlabrobotics.com

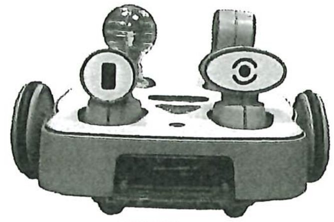


Table of Contents

Introduction to the Curriculum

The KIBO™ Zoo provides a ready-to-run series of lesson plans for 6–10 classroom hours, to help teachers implement KIBO™ coding and robotics in Kindergarten through 2nd–grade classrooms. Students will build and program their own KIBO animals, then share their work with their peers, caregivers, or community in their KIBO Zoo. The curriculum provides an engaging introduction to powerful ideas in a structured, developmentally appropriate way: the engineering design process, robotics, and sequencing.

The KIBO Zoo can also serve as a jumping-off point for students to explore KIBO robotics and programming more deeply. Our complete *Creating with KIBO* curriculum book expands on the activities presented here, introducing more advanced programming concepts such as control flow through parameters, branched statements, and sensors. *Creating with KIBO* also provides an open platform for the teacher to integrate curriculum areas and projects other than animals. More information about this complete curriculum can be found at our website, **www.kinderlabrobotics.com**.

We also encourage you to view the tutorials and classroom videos available at our KIBO Resources website: **resources.kinderlabrobotics.com**.

Pacing

The curriculum is designed to take roughly 8 hours of classroom time. The lessons are flexible and can accommodate a variety of formats: as a single intensive unit within one week; as one-to-two hour blocks weekly; or some other combination. If the curriculum is delivered over an extended period, we recommend building in some repetition and refresher activities.

Students are introduced to many new concepts though this curriculum. Additional free play and extra time to get to know the concepts being introduced is always suggested, based on the needs of individual students, teachers, and classes.

Lessons 1–3 provide structured activities for the children and teacher to follow to learn the basic concepts of KIBO robotics, programming and building. The activities in these lessons will also prepare students for their final project, where they will create KIBO animals for a classroom zoo final project. Each of these lessons take 1–2 hours.

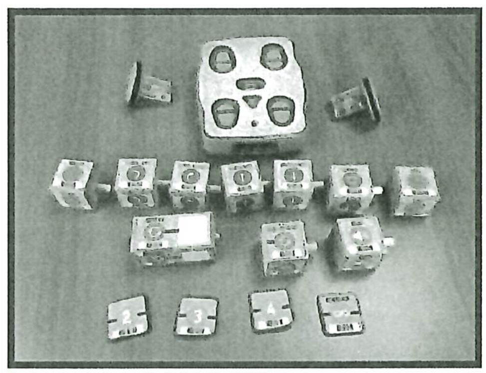
Lesson 4 allows plenty of time for students to work in a more open-ended fashion on their robotic animal final projects. The final project allows students to apply their new knowledge and skills. You may wish to allow more or less time for the final project depending on complexity. After the final projects are complete, you can invite peers, family, and the community to visit the KIBO Zoo to give students a chance to share their work in an open-house showcase.

Group Sizes

This curriculum includes some whole-class activities (such as warm-up games and circle times) and some individual/pair work (the lessons' main activities with KIBO). As a general recommendation, we suggest students work in groups of two per KIBO. However, some classrooms may benefit from other groupings, and each activity can be adapted to meet specific needs. Whether individual work is feasible depends on the availability of supplies. However, an effort should be made to allow students to work in smaller groups where possible. With larger groups (e.g. one KIBO per four students), each student in a group can have a special role. Children can rotate being builders, planners, scanners, programmers, etc. when working together on a KIBO creation.

During whole-class activities such as technology circle times, big classes may want to break up into smaller groups to allow more children the opportunity to speak and to maintain focus. The learning will be enriched by multiple voices, viewpoints, and experiences. It is important to find a structure and group size for each of the different activities (instruction, discussions, work on the challenges, and the final project) that meet the needs of the students and teachers in the class.

Materials Needed



You will need one KIBO kit per group. For *The KIBO Zoo* curriculum, any variety of KIBO kit will work, from the KIBO 10 to the KIBO 21; only the parts included in the KIBO 10 kit are required. (Please keep in mind, we will not use the REPEAT Blocks in this curriculum.)

You will also need a variety of arts and crafts materials for decorating, especially during the final project. We recommend scissors, masking tape, construction paper, tissue paper, pipe cleaners, straws, and a variety of recycled boxes. Follow your imagination!

The lessons in this guide suggest the following books as recommended reading:

From Head to Toe by Eric Carle (Lesson 1)
Move! by Robin Page (author) and Steve Jenkins (illustrator) (Lesson 2)
Rosie Revere, Engineer by Andrea Beaty (author) and David Roberts (illustrator) (Lesson 3)

Finally, we suggest a few optional items available at our web store, **shop.kinderlabrobotics.com**:

- "KIBO Says" game cards
- The Engineering Design Process and Meet KIBO posters
- Engineering Design Journals (one per student or group)
- KIBO fixed or rotating art stage platforms, to give students more building options. (These platforms come included in KIBO 14, 18, and 21 kits.)
- The Expression Module and/or the Sound Record/Playback Module (ideally one per group, to give additional options in the final project)

Assessments

Children will have fun while working with KIBO and will also learn about robots, programming and engineering. At the same time, evaluating the students' learning process and the outcomes is important. This can be done through documenting students' projects, evaluating the ways they talk about and share their projects, and analyzing their Engineering Design Journals. Evaluating individual children's learning, while they are working in groups, can be challenging. KinderLab Robotics' Assessment Workbooks can be useful for this task. These workbooks are available at our web store, **shop.kinderlabrobotics.com**.

Standards and Frameworks Addressed

See the tables below for examples of how the activities in this curriculum are aligned to the Common Core, ITEAA, and K–12 CS frameworks. For information about alignment with state standards, please visit **www.kinderlabrobotics.com/curriculum**.

Common Core Connections

In addition to teaching basic robotics and programming skills, the activities in this curriculum foster many of the foundational math, reading, and language skills that are commonly taught in early childhood classrooms.

Curricular Activity	Common Core Standards Addressed
"Technology Circle" and other group discussions	In technology circle time, children practice their speaking skills as they recount their experiences, share facts, and ask questions about one another's work. **CCSS.ELA–LITERACY.SL.K.1**: Participate in collaborative conversations **CCSS.ELA–LITERACY.SL.K.3**: Ask & answer questions to get information **CCSS.ELA–LITERACY.SL.K.6**: Speak audibly and express ideas clearly
Building with robotic and non-robotic materials	When building with robotic and non-robotic materials (arts and crafts and recyclables), children grapple with size and shape. **CCSS.MATH.CONTENT.K.G.B.4**: Analyze and compare shapes
Programming	When programming, children practice with sequence, order, counting, number sense, and estimation. **CCSS.MATH.CONTENT.K.CC.A.1**: Number names and count sequence **CCSS.MATH.CONTENT.K.CC.B.4**: Relationship between numbers and quantities **CCSS.MATH.CONTENT.K.OA.A.1**: Addition and subtraction

ITEEA Standards and K–12 Computer Science Framework Connections

This curriculum is also designed to align with standards from the International Technology and Engineering Educators Association (ITEEA) guidelines as well as the K–12 Computer Science Framework (K12 CS). Both of these frameworks highlight core competencies in areas of computer science and engineering education.

Curricular Activity	ITEEA Standard	K–12 CS Practices and Concepts
Engineering Design Process	• People plan to help get things done. (Std 2E; K–2); Everyone can design solutions to a problem. (Std 8A; K–2) • Design is a creative process (that leads to useful products and systems); (Std 8B; K–2/Std 8C) • The engineering design process includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others. (Std 9A; K–2) • Asking questions and making observations helps a person to figure out how things work. (Std 10A; K–2) • Troubleshooting is a way of finding out why something does not work so it can be fixed. (Std 10C; Gr 3–5)	Troubleshooting: Computing systems might not work as expected because of hardware or software problems. Clearly describing a problem is the first step toward finding a solution. (Grade 2: Computing Systems)
Robotics	• Build or construct an object using the design process. (Std 11B; K–2) • Discover how things work. (Std 12A; K–2)	A computing system is composed of hardware and software. Hardware consists of physical components, while software provides instructions for the system. These instructions are represented in a form that a computer can understand (Grade 2: Hardware and Software)
Programming	• Recognize and use everyday symbols (Std 12C; K–2) • People use symbols when they communicate by technology (Std 17C; K–2) • The study of technology uses many of the same ideas and skills as other subjects. (Std 3A; K–2)	Computing devices interpret and follow the instructions they are given literally (Grade 2: Devices) People follow and create processes as part of daily life. Many of these processes can be expressed as algorithms that computers can follow (Grade 2: Algorithms)

Curriculum at a Glance

Each of Lessons 1–3 represent an estimated 1–2 hours of classroom time. Lesson 4 can vary depending on the complexity of students' final projects, but can be assumed to require 2–3 hours.

Lesson	Main Activity and Objective
Lesson 1: Build onto a Bot	Students share and learn ideas about what robots are, and how they are different from animals. They are introduced to KIBO robotics concepts. Students will then think creatively in order to design, build, and test their own robotic animals. Students learn about: Robots and their parts.
Lesson 2: Dancing Animals	Students choose the appropriate instructions and learn the importance of sequence as they program their robots to dance the Hokey Pokey or other favorite classroom dances. Students learn about: Programming KIBO.
Lesson 3: What Animal will KIBO Be?	Students will learn about engineers and the Engineering Design Process. The students will choose animals to model for their final project. They will use the Engineering Design Process to guide their work. Students learn about: The Engineering Design Process.
Lesson 4: Refine Your Design	Students continue to work on their KIBO animals. They research their animals' appearance, sounds, and movements. Students build and program their KIBO robot to act as their animal, demonstrating their understanding and ideas related to robotics and programming. Students have ample time to share and revise their work.
Showcase: A Visit to the Zoo	A final showcase or demonstration inviting friends and family and school community members is strongly encouraged!

Lesson 1: Build onto a Bot

Estimated Time: 1–2 hours

Overview: Students share and learn ideas about what robots are, and how they are different from animals. They are introduced to KIBO robotics concepts. Students will then think creatively in order to design, build, and test their own robotic animals. Students learn about: Robots and their parts.

Prior Knowledge	Objectives	
	Students will understand that...	Students will be able to...
• Prior experience building with crafts or recycled materials is helpful. • No prior KIBO robotics knowledge needed	• **Robots** need moving parts, such as motors, to be able to perform behaviors specified by a **program**. • The robotic 'brain' has the programmed instructions that make the robot perform its behaviors.	• Describe the components of a KIBO robot. • Build onto a robot with craft materials.

Materials / Resources

- ❑ KIBO robot for each student or group, with motors and wheels
- ❑ A variety of craft and recycled materials for building and decorating
- ❑ Pictures of different robots and non-robots, including animals
- ❑ *From Head to Toe* by Eric Carle

- ❑ Demo scanning station with BEGIN, FORWARD, END programming blocks (teachers can review Lesson 2 to familiarize themselves with the blocks if needed)
- ❑ Optional: "Meet KIBO" poster

Lesson 1 Vocabulary

Automatic: by itself, without help from a person

Function: the reason a machine or robot was built

Motor: the part of a robot that makes it move

Program: a set of instructions for a robot

Robot: a machine that can be programmed to do different things

Wire: thread of metal that is covered with plastic and used to send or receive electricity

Main board: the computer "brain"

Background for the Teacher...

What is a Robot?

Key points about robots:

- Robots are machines.
- Robots are not alive. Contrast with animals, which are alive.
- People tell robots how to behave with a list of instructions called a **program.**
- Robot parts let robots do different things, like animal parts.
- Not all robots look alike.
- Some robots can tell what is going on around them through the use of sensors. (Examples: sensing light, temperature, sound, or a touch.)

When discussing robots with students, it may be helpful to share video clips of different types of robots in action such as home robots, space robots, factory robots, hospital robots, and child-made robots.

The Robot Parts Song *(sung to the tune of "Dem Bones")*

The wheels are connected to the motors,
The motors are connected to the body,
The engineers give it a program,
So move, robot, move!

Watch a Video: See the Robot Parts Song in action! Visit the videos section of www.kinderlabrobotics.com/curriculum for a video of the Robot Parts Song.

Need Help with Scanning?

Tutorial videos demonstrating scanning technique are available at our Resources website: http://resources.kinderlabrobotics.com/tutorials.

Activity Description

Warm up: Jump for the robots! Show a variety of different pictures of robots and non-robots such as computers, cars, animals, foods, and famous robots such as Wall-E and R2D2. Include pictures of toy robots (e.g., plush toys). To play this game, children jump up and down if they think the picture shown is of a robot. They stay standing still if it is not a robot. Later, make an "Is it a Robot?" chart putting these images in one of three categories: Robots, Maybe Robots, and Not Robots.

Introduce the concepts: What is a robot and what is an animal? As a class, children discuss what they think a robot is and examples of robots they know of. Talk about your "Is it a Robot?" chart as a class, and define the characteristics of robots. Recalling the toy robots, discuss how something can look like a robot or machine on the outside but not have any actual mechanical parts. Next, introduce the question of how robots differ from animals. Robots and animals both have parts, and both can move; but robots are not alive, and they act based on programs that people give them. Finally, show a KIBO robot and introduce the robot's key parts and their functions (with the help of the poster, if available). Teach the **Robot Parts Song** (see previous page) and ask all students to stand up and sing it while dancing.

Suggested reading: *From Head to Toe* by Eric Carle introduces animal parts and movements in a fun, involving way. Encourage students to mimic the animals' movements as you read. Discuss with students how the animals' parts are related to their movements.

Individual/pair work: Taking inspiration from the animals and movements in *From Head to Toe*, students create a moving animal by building onto KIBO! Offer a range of craft materials and allow the students to design creatively and build how they see fit. Encourage them to attach the materials sturdily. When they would like to see their animal move, they can bring it to a testing station to scan the program BEGIN, FORWARD, END with the help of a teacher and run it. This test is to ensure that their robot follows the instruction properly and that it is sturdy. Invite them to play with the different ways of attaching the wheels to the motor hubs and see the difference in KIBO's motion.

> **Classroom Tip:** Is a student's KIBO turning or going backward when it should be moving forward? Make sure the green dot on each motor can be seen through the clear KIBO body.

Extra challenge: Once students have created their first KIBO animal and brought it to life with the demo program, have students experiment with the different "wobbly" movement created when they attach the KIBO motors to the wheels off-center. They can also experiment with building different animals.

Technology circle: After finishing their animals, students share their creations. Encourage them to explain the features of their animal and what materials they used to construct it. Ask students to compare their creations to actual animals. Which features are similar and which are different?

Free play: Provide opportunities for children to build freely with KIBO parts and other building materials. Encourage students to experiment with materials they did not use in their robot animals. Depending on the group, you may also want to allow students to experiment with scanning the demo program on their own.

Lesson 2: Dancing Animals

Estimated Time: 1–2 hours

Overview: Students choose the appropriate instructions and learn the importance of sequence as they program their robots to dance the Hokey Pokey or other favorite classroom dances. Students learn about: Programming KIBO.

Prior Knowledge	Objectives	
	Students will understand that...	Students will be able to...
• Symbols (pictures, icons, words, etc.) can represent ideas or things. • Some ability to recognize letters or to read is helpful, but not required. • A robot is a machine that can act on its own once it receives proper instructions. • KIBO robots have special parts (e.g., motors, wheels, and a "brain").	• Each icon or "block" corresponds to a specific **instruction**. • A **program** is a list of instructions that is followed by a robot. • The **order** or **sequence** of the instructions dictates the order in which the robot executes the instructions.	• Point out or select the appropriate block corresponding to a planned robot action • Connect a series of wooden KIBO blocks to make a program • Scan a program onto the robot • Fix the sequence as they see it doesn't work (debugging)

Materials / Resources

- ❑ KIBO robot for each student or group, with motors and wheels
- ❑ BEGIN and END blocks
- ❑ All blue motion blocks
- ❑ *Move!* by Robin Page, author, and Steve Jenkins, illustrator

- ❑ Optional: BEEP and SING blocks
- ❑ Optional: "KIBO Says" game
- ❑ Optional: Engineering Design Journals

Lesson 2 Vocabulary

Instruction: a direction that a robot will listen to; also called a **command**

Scanner: electronic device for reading printed barcodes

Barcode: a pattern of lines that are readable by machines, like the KIBO robot

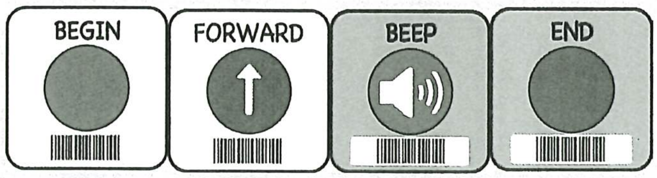
Order: parts of a group arranged to make sense

Sequence: the order of instructions that a robot will follow exactly

Background for the Teacher...

What is a Program?

- A **program** is a sequence of instructions that the robot acts out in order. Each instruction has a specific meaning, and the order of the instructions affects the robot's actions. **A KIBO program always starts with BEGIN and ends with END.**

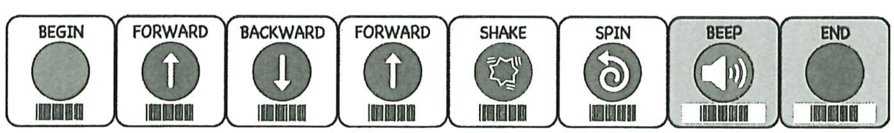


The Hokey Pokey KIBO Verse

In this lesson, the children will program the robot to dance the Hokey Pokey. With your guidance, they will translate the movements of the Hokey Pokey song into KIBO commands. When you introduce the song, you can lead the children through a few of the familiar verses, then add a KIBO verse:

You put your KIBO in, you put your KIBO out,
You put your KIBO in, and you shake it all about.
You do the Hokey Pokey, and you turn yourself around.
That's what it's all about. (Clap!)

Here is one possible Hokey Pokey program for you to keep in mind. Of course, this is just one possibility; the students will come up with their own creative ways to turn the Hokey Pokey into KIBO movements.



Watch a Video: See the Hokey Pokey robot verse in action! Visit the videos section of **www.kinderlabrobotics.com/curriculum** for a Hokey Pokey classroom video.

Activity Description

Warm up: Play "KIBO Says" to learn each of the KIBO programming icons and what each icon represents. If you have the large "KIBO Says" game cards, use those; otherwise you can use actual KIBO blocks or make your own large cards.

> **KIBO Says:** This activity is played like the traditional "Simon Says" game in which students repeat an action if Simon says to do something. After briefly introducing each programming instruction and what it means, have the class stand up for this game. Hold up one KIBO command at a time and say "The **Programmer** says to _________". Go through each individual instruction a few times until the class seems to get it. Once the class is familiar with each instruction, the Programmer can start giving the class full programs to run through. Just like in the real Simon Says, the Programmer can try to be tricky! For example, if the Programmer forgets to give a BEGIN or END instruction, should the class still move?

Introduce the concepts: "Today we will give instructions, or programs, to our robots so they will do the Hokey Pokey." As a class, sing and dance the Hokey Pokey to make sure everyone remembers it. Conclude with a "**KIBO verse**" (see the box on the previous page). Discuss the concept of a program with the students, as a set of instructions that an engineer gives a robot or computer to tell it what to do. Relate the concept back to the warm-up game.

The introductory circle meeting is also an opportunity to demonstrate scanning blocks with KIBO. You may find it helpful to have the students practice the technique in a circle setting.

> **Classroom Tip:** Tutorial videos demonstrating scanning technique are available at our KIBO Resources website: **resources.kinderlabrobotics.com/tutorials**

Suggested reading: *Move!* by Robin Page (author) and Steve Jenkins (illustrator) explores the many different ways animals move. Flying, climbing, swimming, and running animals will get students thinking about how their robots might move as well.

Individual/pair work: Individually or in groups, students program their KIBOs to do the Hokey Pokey dance, or another favorite classroom dance. How would one of the animals from *Move!* dance? Students should work in groups to translate the movements of the dance into KIBO commands for their robots. Programming the entire Hokey Pokey (or any dance) can be a daunting task. Try breaking down the Hokey Pokey dance one step at a time to figure out which KIBO programming block corresponds to each dance step. For example, the FORWARD block may correspond to "Put your robot in."

> **Classroom Tip:** For this activity, you may want to have students or groups work together and pool their blocks between KIBO kits, so students have more blocks.

Technology circle: Students share their creations. They may do one or more of the following: explain the blocks they used for the Hokey Pokey program, talk about what they found easy and difficult, and talk about how an animal might dance. If you want, video-record the class dancing the Hokey Pokey with their robots to make a "music video" to send home!

Free play: Provide opportunities for children to play with scanning different blocks and seeing what happens.

Lesson 3: What Animal Will KIBO Be?

Estimated Time: 1–2 hours

Overview: Students will learn about engineers and the Engineering Design Process. The students will choose animals to model for their final project. They will use the Engineering Design Process to guide their work. Students learn about: The Engineering Design Process.

Prior Knowledge	Objectives	
	Students will understand that...	Students will be able to...
• Prior experience building with crafts or recycled materials is helpful. • A robot is a machine that can act on its own once it receives proper instructions. • KIBO robots scan blocks to learn a program.	• Craft and recycled materials can fit together to form **sturdy structures**. • The **engineering design process** is useful for planning and guiding the creation of **structures**. • There are many different kinds of **engineers**.	• Build **sturdy structures.** • Use the **engineering design process** to facilitate the creation of their **structure.**

Materials / Resources

- ❑ KIBO robot for each student or group, with all previously used blocks and parts
- ❑ A variety of crafts and recycled materials for building and decorating
- ❑ *Rosie Revere, Engineer* by Andrea Beaty

- ❑ Pictures of naturally occurring and human-made objects, such as trees, clouds, animals, buildings, roads, and tools
- ❑ Engineering Design Journals (available from KinderLab, or use your own notebooks)
- ❑ Optional: Sound Record/Playback Modules, Expression Modules, and art stage platforms, for additional options
- ❑ Optional: Engineering Design Process poster showing the six steps

Lesson 3 Vocabulary

Cycle: something that moves in a circle (i.e. the seasons, the Engineering Design Process)

Design: a plan for a building or invention

Engineer: someone who invents or improves things

Material: something used to build or construct

Structure: a building or object made with different parts

Background for the Teacher...

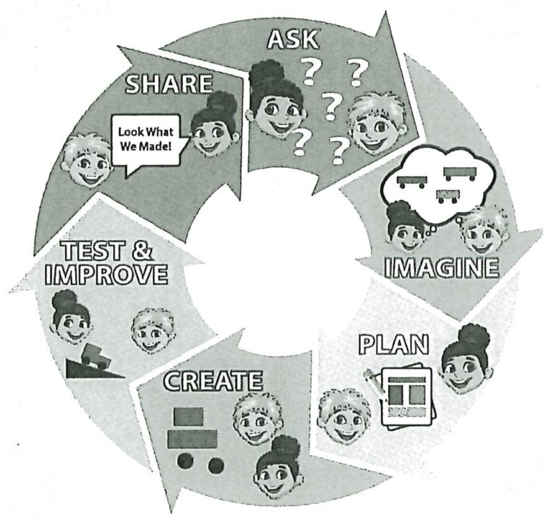
What is an Engineer?

An **engineer** is anyone who invents or improves things (for instance, just about any object you see around you) or processes (such as methods) to solve problems or meet needs. Any human-made object you encounter in your daily life was influenced by engineers.

Different kinds of engineers: There are many kinds of engineers, including biomedical engineers, aerospace engineers, computer engineers, and industrial engineers. For descriptions and further activity ideas related to engineering, we recommend the **Engineering is Elementary** curriculum from the Boston Museum of Science.

Think Like an Engineer!

When making projects, engineers follow a series of steps called the "Engineering Design Process." It has 6 steps: **ASK, IMAGINE, PLAN, CREATE, TEST & IMPROVE**, and **SHARE**. The Engineering Design Process is a cycle — there's no official starting or ending point. You can begin at any step, move back and forth between steps, or repeat the cycle over and over!



The Engineering Process Song

(sung to the tune of "Twinkle, Twinkle Little Star")

Ask and imagine, plan and create.
Test and improve and share what we make. (repeat)

Activity Description

Warm up: Engineered or not? Show a variety of different pictures of naturally occurring and human-made objects, such as trees, clouds, animals, buildings, roads, and tools. Ask students to stand if they think the object is human-made and to sit down if they think it is natural. Explain to students that any human-made object is influenced in some way by engineering.

Introduce the concepts: "Today we are going to explore the Engineering Design Process, a process that engineers use when building, programming, and designing new things. We have all been engineers while we have been building and programming with KIBO over the past few sessions." Discuss what an engineer is and introduce the steps of the engineering design process using the poster (if you have it) or the image in this booklet. Teach the **Engineering Process Song**. Relate the work the students have done in the previous lessons to the steps of the process: for example, students **imagined** how KIBO might dance to the Hokey Pokey, and they **shared** at technology circle. Close with an overview of the work today: students will choose what animal they would like to create for the KIBO Zoo. They will engage mostly in **asking**, **imagining**, and **planning** today. You may also find it helpful to include some KIBO scanning practice during circle time.

Suggested reading: *Rosie Revere, Engineer,* by Andrea Beaty, shows the importance of both imagination and persistence in an engineer's work. Rosie engages in the Engineering Design Process as she tests and improves her creation.

Individual/pair work: For this meeting, students will work in groups to plan their robot animals for the classroom final project, the KIBO Zoo. They will decorate a robot animal and give the robot a program that represents the animal's movements. They will begin this work today and will continue the work in the next meeting.

Today's meeting will be more open-ended than previous lessons, giving students time to think and talk about their animals, plan their constructions, and experiment with KIBO programming. Students use their Engineering Design Journals to document their work towards their final project. Documenting and planning might include sketches of their animal and plans for their KIBO program.

> **Classroom Tip:** If possible, provide a selection of books about animals (from the school library or classroom book corner) and encourage students to look for inspiration there.

The Engineering Design Process is flexible. Some children like to plan, while others work best through hands-on experimentation and building, and may prefer to jump right into crafting and programming. This is an opportunity to suggest students take on roles within their groups; one student can sketch while another experiments with KIBO programming, for example.

If your classroom has access to Expression Modules or Sound Record/Playback Modules, introducing them now will give students more options for their final projects.

Technology circle: Students should share the work they have done toward their final projects. They might choose to: share their sketches and plans; demonstrate a program they've created; or show any craft building they've done. Encourage other students to ask questions and share their reactions, to give the presenters ideas for revision.

Free play: Provide opportunities for children to build freely with other building materials. This can be a continuation of their animal work or an opportunity to experiment freely.

Lesson 4: Refine Your Design

Estimated Time: 2–3 hours

Students continue work on their KIBO animals. They research their animals' appearance, sounds, and movements. Students build and program their KIBO robot to act as their animal, demonstrating their understanding and ideas related to robotics and programming. Students have ample time to share and revise their work.

Provide all of the same materials and resources that you provided in Lesson 3.

> **Classroom Tip:** You can use the last page of this booklet to help plan for, and document, the final project open house / exhibition. This sheet prompts you to think about theme feasibility, materials needed, and logistics.

Introduce the concepts: In this lesson, students will continue working on their animals until the KIBO Zoo is complete. Depending on how often and how long you meet with students for KIBO work, this lesson may extend across multiple meetings. Each day, you should start with a circle to remind the students of their work so far and their goals. Review the steps of the Engineering Design Process and remind them that not all plans work the first time; revision and testing are important parts of the process too!

Individual/pair work: Students continue their work on their KIBO Zoo animals, with the goal of completing their portions of the Zoo. The ongoing work might include the following:

§ Students use their Engineering Design Journals to plan and document all steps of their work towards their final project.

§ Students decorate their KIBOs with craft and recycled materials to represent their chosen animal.

§ Students program their KIBOs to exhibit a behavior representing their animal.

§ Students build an environment or habitat for their KIBO animal with craft materials.

§ Students prepare their Engineering Design Journals for sharing during the final exhibition.

§ Students might choose to prepare a poster describing their animal or its habitat for sharing during the final exhibition.

§ Students practice how they will present their creations at the final exhibition. For example, they should practice running their program and debug any problems they encounter.

§ Teachers document each project to create a video or slide show to share the learning process with parents.

Technology circle: The ongoing work the groups are doing during this lesson may proceed at different rates and require different facilitation by you. Groups can support each other informally; suggest the rule of "ask three before you ask me" to encourage peer support. Call whole-class Technology Circles whenever you feel they would be helpful. Sharing work and seeking feedback is not only an important part of the engineering design process; it is also helpful for keeping students on track. Students should be encouraged to share a problem they are currently experiencing or which they have recently solved.

A Visit to the Zoo! (Project Showcase)

Estimated Time: 1 hour

A final showcase or demonstration inviting friends and family and school community members is strongly encouraged. Documentation of both learning process and final projects is very important.

The KIBO Zoo Project Showcase

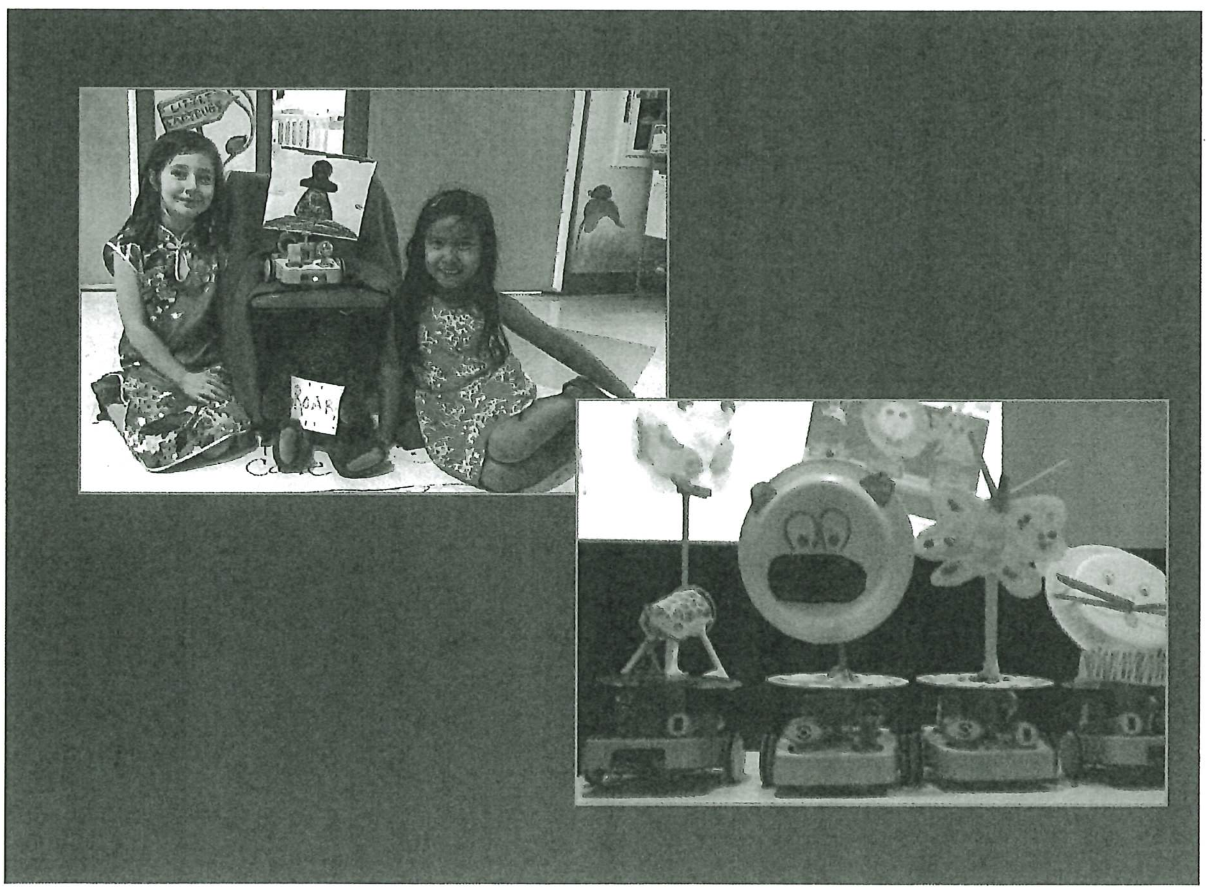
Now that students have completed their KIBO Zoo, it's time for them to share their work!

Organize an open house and invite families, other classes, or members of the community to attend. If you are working with more than one class, this is a great opportunity to celebrate the shared work of the school.

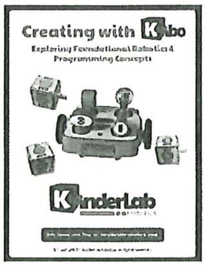
At the open house, students share their KIBO animals, their Engineering Design Journals, and any posters they've created describing their animals or habitats. A "gallery walk" format where students' robots are set up at stations is a great fit for the KIBO Zoo theme.

Create printouts with starter questions for visitors to begin asking questions to the students, such as: How did you program your robot? How did you make it? What was hard? What would you do differently? How can you improve your project? What was your favorite part?

If you have recorded any videos or photographs of the children's work along the way, you can have a slideshow or movie playing in the background during the showcase as well.



Next Steps with KIBO



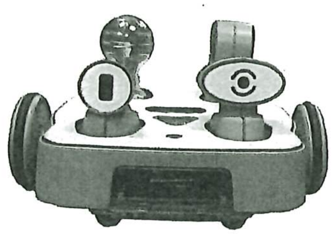
Our *Creating with KIBO* curriculum guide expands on the activities presented in *The KIBO Zoo*, providing 20–40 hours of classroom lessons and introducing more advanced programming concepts such as control flow through parameters, branched statements, and sensors. *Creating with KIBO* also provides an open platform for integration, for teachers interested in linking KIBO to other curriculum areas.

Purchase *Creating with KIBO* and all of the other teaching materials we offer at:

shop.kinderlabrobotics.com

Our **KIBO Resources** website has tutorials, activities, and classroom stories, contributed by teachers who use KIBO:

resources.kinderlabrobotics.com



Acknowledgements

This curriculum was developed by integrating ideas from researchers at the DevTech Research Group at Tufts University, Mollie Elkin and Amanda Sullivan, under the direction of Dr. Marina Umaschi Bers.

More information about Dr. Bers research and theories, including the Positive Technological Development (PTD) framework, can be found in her books:

- Bers, M. (2008). *Blocks to Robots: Learning with Technology in the Early Childhood Classroom.* NY, NY: Teachers College Press

- Bers, M. U. (2012). *Designing digital experiences for positive youth development: From playpen to playground.* Cary, NC: Oxford.

- Bers, M. U. (2017). *Coding as a Playground: Programming and Computational Thinking in the Early Childhood Classroom.* London, England: Routledge.

Final Project Planning Sheet

FINAL PROJECT THEME What is the theme of your culminating project?	**FINAL PROJECT SHOWCASE** How will you showcase the final projects? Will you invite family or other classes?
SUBJECTS/DISCIPLINES INTEGRATED Will this project integrate math, history, science, literacy, or other disciplines?	**LEARNING GOALS** What specific learning goals/objectives do you have for this project?
FINAL PROJECT TIME FRAME How many hours will this take to complete? How will these hours be distributed?	**FINAL PROJECT PREP** What kinds of prep, research, building/programming, and displays will the kids make leading up to the showcase?
GROUPING THE KIDS How will the kids be broken into partners or groups?	**SPECIAL ARRANGEMENTS** Do any kids need special arrangements to complete the project?
MATERIALS What materials will your class need?	**ASSESSMENTS** What assessments will you be using and how do they relate to your learning goals?
LOGISTICS Any other logistics that need to be planned for?	

KinderLab robotics

3rd

KIBO "Dream Car" – 1 hour

Imaginative Building (Engineering connection)

Overview: Students will become engineers, learning the steps of the Engineering Design Process. Inspired by the book *If I Built a Car* by Chris Van Dusen, students will follow the engineering design process to create their own "dream cars" out of craft and recycled materials. They will scan a short programming sequence to get their cars moving!

Learning Goals: Students will:

- Define an **engineer** as someone who invents and improves things.
- Understand the steps of the **engineering design process.**
- **Build a sturdy construction** of a car with craft supplies, LEGO® bricks, or other familiar building materials.
- **Program** a robot to move.

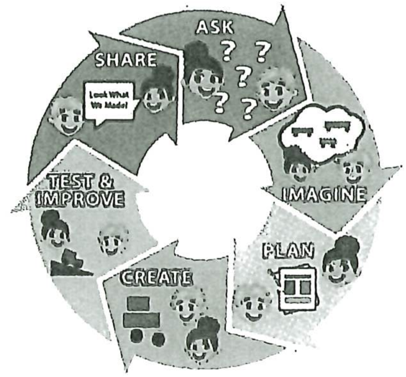
Materials/Resources:

- One KIBO 10 kit or higher per group of 2-4 students
- A variety of craft and recycled materials for building and decorating.
- Engineering Design Process poster (included as page 3 here).

New to KIBO? Watch the Videos!
If this is your first time using KIBO, we encourage you to check out our short tutorial videos at **kinderlabrobotics.com/getting-started**.

Lesson Plan

Inspire: "Today we will all become **engineers**. We will build and improve our own creations. An engineer is anyone who invents or improves things."



Introduce the engineering design process using the poster image on page 3. "In their projects, engineers follow a series of steps called the "**Engineering Design Process.**" It has just 6 steps: ASK, IMAGINE, PLAN, CREATE, TEST & IMPROVE, and SHARE. The Engineering Design Process is a cycle – there's no official starting or ending point. We can keep going around and around as we imagine and invent our creations."

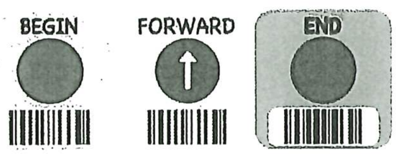
Ask children to share their ideas about what each of the steps mean. Record their ideas on the board. Ask the students to share examples of times they've imagined something new and then created it.

Connect: Read *If I Built a Car*. Read *If I Built a Car* by Chris Van Dusen. This book will get kids thinking creatively about how they might design their own dream car. You can connect the book to the Imagine phase of the Engineering Design Process.

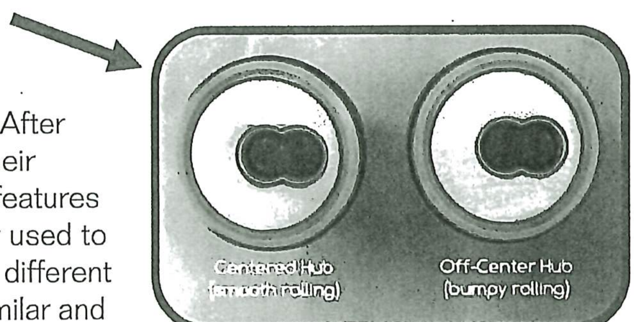
Small-Group Work: Build your dream car. Student groups will design and build their own "dream cars" with KIBO. Students will use a variety of arts and crafts materials to build directly onto KIBO. They can attach art materials to KIBO with masking tape, pipe cleaners, string, and other fasteners. Remind students to attach their materials in a sturdy way!

Allow the students to design creatively and build how they see fit to create a dream car like Jack's from *If I Built a Car*. (Some students may not connect with the notion of building a car. Allow these students to define their own creative goal for this lesson.)

When ready, student groups can bring their cars to a testing station to scan the program "BEGIN, FORWARD, END" with the help of a teacher, then run the program. This test is to ensure that their robot follows the instruction properly and that it is sturdy. Students can continue trying different programs when this is mastered.



Invite students to play with the different ways of attaching the wheels to the motor hubs and see the difference in KIBO's motion.

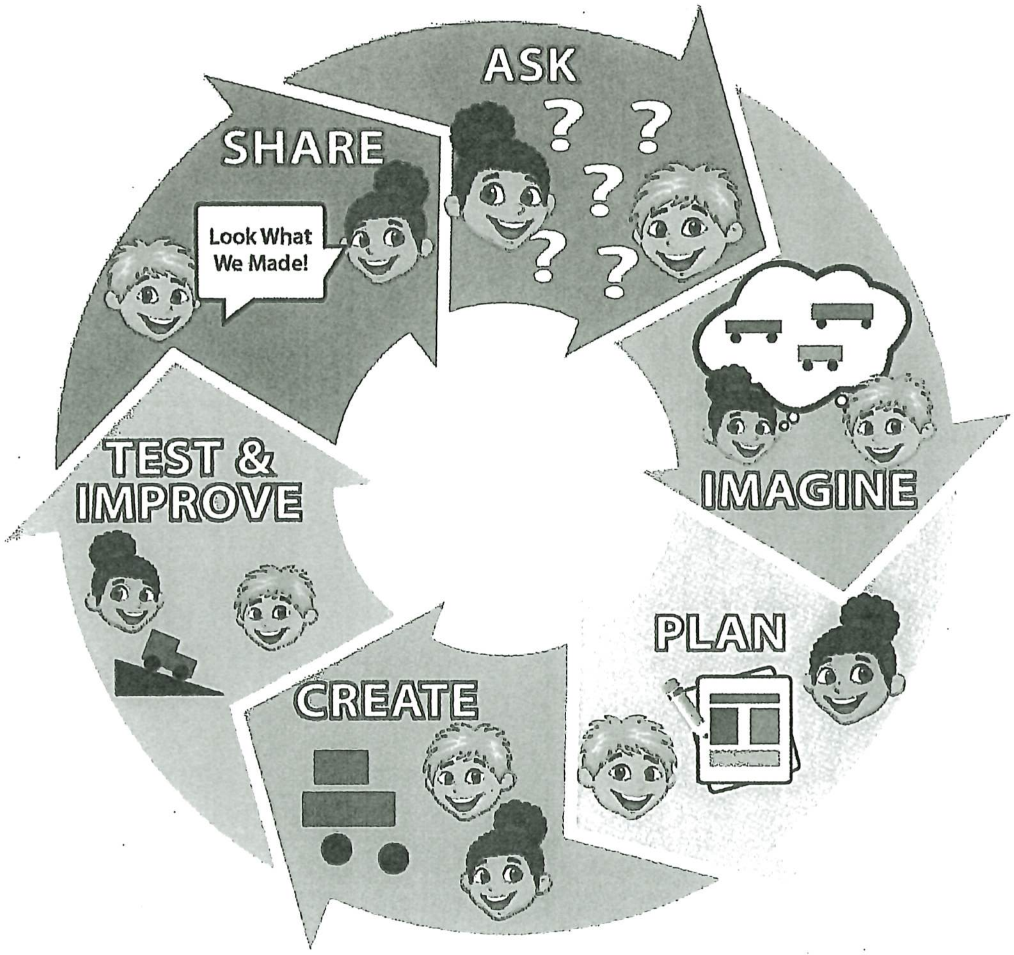


Reflect: What Does Your Car Do? After finishing their cars, groups share their creations. Encourage them to explain the features of their dream car and what materials they used to construct it. Ask students to compare the different dream cars and see which features are similar and different. Do they think their cars could be built?

Standards Addressed

CSTA K-12 Computer Science Standards: 1A-AP-10, 1A-AP-11, 1A-AP-15
NGSS Science Standards: K-2-ETS1-1, K-2-ETS1-2, K-2-ETS1-3

The Engineering Design Process



When making projects, engineers follow a series of steps called the Engineering Design Process. It has just 6 steps: ASK, IMAGINE, PLAN, CREATE, TEST & IMPROVE, and SHARE. The Engineering Design Process is a cycle – there's no official starting or ending point. You can begin at any step, move back and forth between steps, or repeat the cycle over and over!

2nd lesson #2

Novice Lesson 9: Hokey Pokey

Topics: Sequencing, Decomposition, Patterns

Learning goals: students decompose and sequence a dance as individual commands as they program their robots to dance the Hokey Pokey.

Inspire: What is a Program, Revisited

"Today we will give instructions, or programs, to our robots so they will dance the Hokey Pokey." Discuss the concept of a program with the students, as a set of instructions that an engineer gives a robot or computer to tell it what to do. Relate the concept to the KIBO Says games played earlier and the experience in the earlier lesson when children first programmed their robots to move.

Remind students of the lyrics of the Hokey Pokey song and dance, and relate these to the idea of a program as well. "The instructions in the Hokey Pokey — put your right foot in, put your right foot out — are like a program for the dancer. When everyone follows the instructions at the same time, our whole group can dance together. We'll teach our KIBOs to dance along. But first we will need to break down (or **decompose**) the steps of the Hokey Pokey into instructions for KIBO."

Note: If the Hokey Pokey is not a familiar song and dance for your student population, you can substitute a familiar song instead. Ideally, choose a song that involves specific movement instructions.

Connect: Hokey Pokey Dance

As a class, sing and dance the Hokey Pokey! Dance to the normal verses about moving the human body. Then conclude with a "robot verse":

You put your KIBO in, you put your KIBO out,

You put your KIBO in, and you shake it all about.

You do the Hokey Pokey, and you turn yourself around.

That's what it's all about!

Watch a video: See the Hokey Pokey in action! Visit the videos section of **www.kinderlabrobotics.com/curriculum** for a video of the Hokey Pokey.

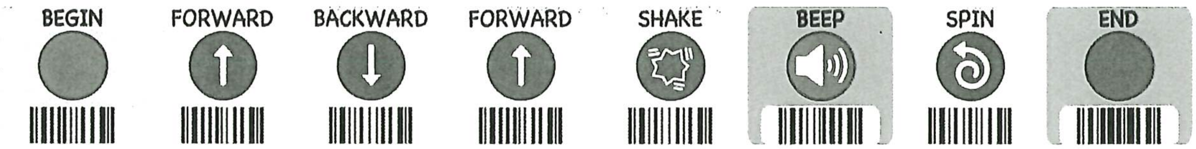
Repeat the process until you feel that the class is familiar with the song and the sequence of movements that make up the dance.

Engage: Program KIBO to Dance

Students work in small groups to program their KIBOs to do the Hokey Pokey dance.

Programming the entire Hokey Pokey can be a daunting task. Try breaking down the Hokey Pokey dance one step at a time. In programming terms, this is called **decomposition**. Then figure out which KIBO programming block could represent each dance step. For example, the FORWARD block may correspond to "Put your robot in."

Here is one possible Hokey Pokey program for you to keep in mind:



Of course, this is just one possibility and there is no "right" KIBO Hokey Pokey program; the students will come up with their own creative ways to turn the Hokey Pokey into KIBO commands.

Reflect: Hokey Pokey Dance Party

When all groups are done, it's dance party time! Gather all the groups together to dance the Hokey Pokey verse one more time with their KIBOs. If you want, video-record the class dancing the Hokey Pokey with their robots to make a "music video" to send home to parents!

Students can then share about their creations. They may do one or more of the following: explain the blocks they used for the Hokey Pokey program, talk about what they found easy and difficult, and share anything they changed from their original plan.

Tips for the Teacher:

FORWARD blocks. The sample Hokey Pokey program shown here includes two FORWARD blocks, while only one such block is included in each KIBO kit. For this activity, you may want to have students or groups work together and pool their blocks between KIBO kits.

See the Hokey Pokey in action! Visit the videos section of www.kinderlabrobotics.com/curriculum for a video of students dancing the Hokey Pokey with their KIBOs.

Novice Lesson 10, 11: KIBO Dance Party

Topics: Integration (Social Studies)

Let's have a KIBO dance party! Students will decorate their KIBO as a dancer to represent a chosen culture or community; then they will create a program to teach their KIBO to dance to the music of that community. Students build on the decomposition and sequencing work they did in the Hokey Pokey lesson. They'll use those new skills to explore and express what they learn about dancers from their own or other cultures. Allow two meetings for this integration project.

This is a multi-lesson integration project. This project is estimated to require two meetings. However, you can organize the individual meetings in whatever way makes sense for you and your class. A typical integration project might flow like this, spread out over multiple meetings:

- Circle time, readings, games and movement activities to inspire and connect
- Small group time to imagine and plan
- Circle discussion to share plans
- Small group hands-on time to create
- Circle discussion to share challenges and successes
- Small group time to test and improve the creation
- *Alternate circle meetings and small group work as needed*
- Final showcase to reflect on the process and share the projects

Inspire: Dances and Dancers from Many Cultures

In this project, students will build on their experience with the Hokey Pokey in the prior lesson. They'll decorate KIBO as a dancer and create a program to let KIBO dance to the music.

This integration project can connect to an exploration of the dances, music, and costumes of a particular culture. Are there cultures, countries, or festivals that might be of particular interest to your students based on their backgrounds, their families, or just their curiosity? Even if you don't want to make a cultural studies connection, you can give the students the goal of making outlandish costumes for their own "KIBO Festival," playing any song of your choice.

Connect: Let's Dance Together

Use Connect times to explore videos, books, and music about the culture you've chosen. Include the music you'd like to use in the dance project. This project can be a wonderful opportunity to collaborate with a music teacher!

Engage students in choosing the song(s) to which the KIBOs will dance. Give students the chance to dance to these songs themselves, to give them ideas about how their KIBOs might move. You may want to include the Hokey Pokey dance, to build upon the work students did in the previous lesson.

Engage: Building and Testing the Dancing Robots

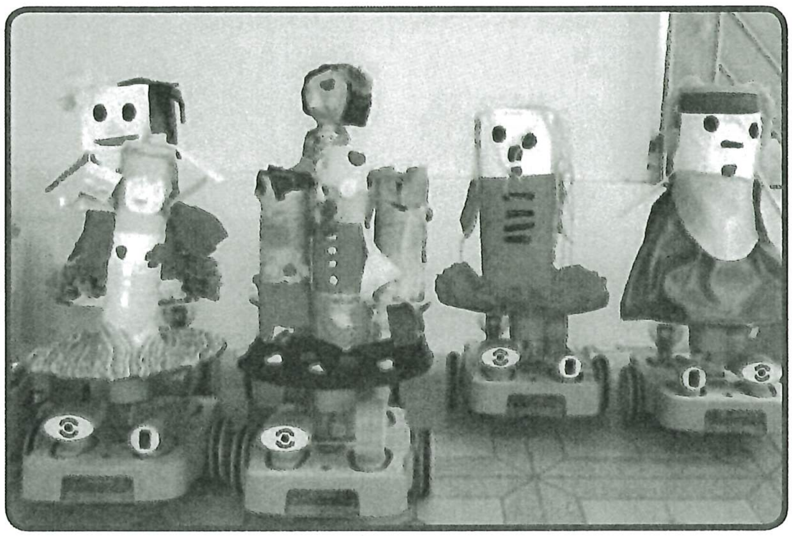
During the work periods for this project (as with all longer-term, integrated projects in the curriculum), students will alternate as needed between programming, building, decorating, and testing their robots.

During the work periods for this project, provide lots of "loose parts" for building onto KIBO. Ensure that the students have some structural materials to provide sturdy bodies for the dancers, such as paper towel tubes, boxes, cardboard pieces, or the like; along with options for connecting these to the KIBO motorized platforms.

Some children like to plan, while others work best through hands-on experimentation and building, and may prefer to jump right into crafting and programming. This is an opportunity to suggest students take on roles within their groups; one student can sketch while another experiments with KIBO programming, for example.

KIBO **Engineering Design Journals**, available from **shop.kinderlabrobotics.com**, are a useful resource to allow student groups to record their ideas, plans, and designs when working on longer-term integrated projects.

Check in with students frequently on an individual/group basis, and with whole-class Technology Circle meetings.



Reflect: Final Project Showcase

Once the dancing robots are completed, it is time to share! A group dance party is a great way to bring all of the students' work together.

Children can choose to share about one or more of the following if they would like: how they built or decorated their robot, how they programmed their robots, what inspired them, what was difficult, etc. They should also be encouraged to thank any friends from the class who helped them when they encountered challenges. Remember, teamwork is an important part of engineering. Ask questions that allow children to reflect on their process and not just their final products. For example, "How did you decide to make the robot Beep twice?" or "Why did you decide to have your robot go forward and then turn?"

This showcase can easily be extended into an Open House that you invite parents, siblings, and more to attend. Additionally, the dance theme is a wonderful way to get a music teacher involved a presentation that unites classes throughout your school.

Tips for the Teacher:

See KIBO Dancers in action! Visit the videos section of **www.kinderlabrobotics.com/curriculum** for videos of dance integration projects. One class in Boston programmed their robots to dance to Hava Nagila; while Kindergartens in Singapore used KIBO to explore the different traditional cultures and music of their country.

The Engineering Design process. Integrated activities highlight the importance of the engineering design process for children. Using the Engineering Design Journals (or notebooks of your own devising) makes the process concrete for students. If you like, you can also create stations or badges for each section of the design process. For example, you can have children tally how many times they tested their robot at the testing station.

Mid-point technology circle ground rules. At mid-point technology circles, invite children to share their in-progress work, and let them know that this is a time for questions and feedback. You may want to model for children what helpful feedback is, and lay some ground rules to avoid hurt feelings. Sample rules might include:

- If you say something you don't like about someone's project, also say something you do like.
- If someone is dealing with a problem that you also had, share how you solved it, or let them know you also have the problem and you can work together to solve it.
- Remember how you would feel if someone told you they don't like your creation that you worked hard on. Try to use words that wouldn't hurt a friend's feelings when you give your feedback.
- Use sentences that start with "I" (example: "I like...", "I notice...", etc.).