The Kibo Zoo

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

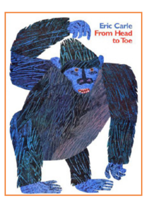
Estimated Time: 1–2 hours

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

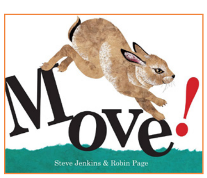
Estimated Time: 1–2 hours

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

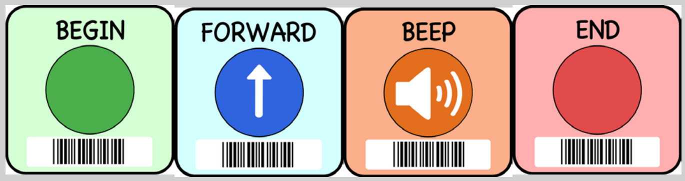
Order: parts of a group arranged to make sense

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.**

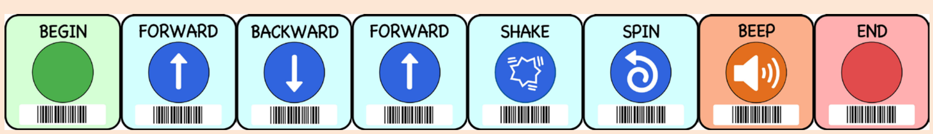


The Hokey Pokey KIBO Verse

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?

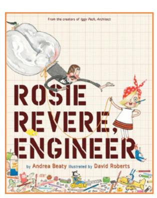
Estimated Time: 1–2 hours

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

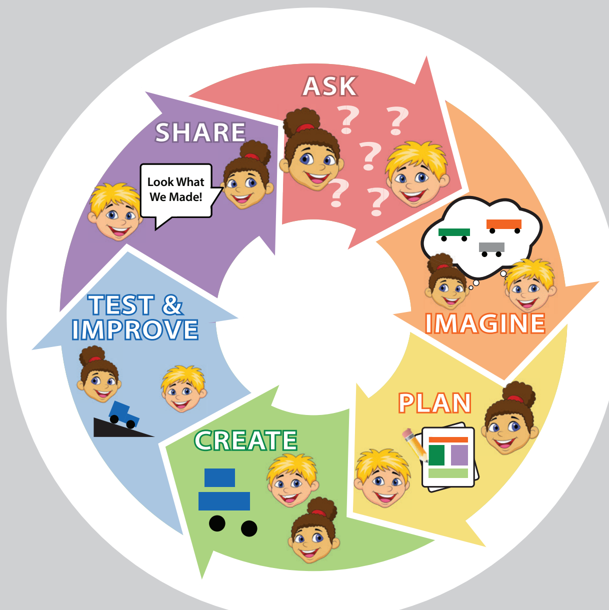
What is an Engineer?

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?	