

# **KIBO Curriculum for 2nd Grade (CAL-KIBO-2)**



**Using the Coding as Another Language (CAL) approach developed  
by**

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## **2nd Grade Curriculum**

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[Appendix A: KIBO Word Bank](#)

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The *Coding As Another Language (CAL) for KIBO (CAL-KIBO)* curriculum introduces powerful ideas from computer science, in conversation with literacy, to children in Pre-Kindergarten through 2nd grade in a playful, structured, and developmentally appropriate way. The Coding as Another Language (CAL) approach, developed by Prof. Marina Umaschi Bers and members of her DevTech Research Group at Tufts University, understands the learning of computer science as a new literacy for the 21st century that supports young learners in developing new ways of thinking about themselves and the world.

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## The Pedagogy

The CAL curriculum is implemented following the pedagogical approach developed by Prof. Marina Bers that can be found in her books *Coding as a Playground* and *Beyond Coding: Teaching Human Values to Children*. This pedagogy has four main frameworks:

**Coding as a Playground:** When engaging children in a computer science learning experience, we welcome play. Through play we can impact all areas of human development: cognitive, social-emotional, language, moral, physical and even spiritual. The coding playground, in contrast with the coding playpen, promotes opportunities for open-ended exploration, creation of personally meaningful projects, imagination, problem solving, conflict resolution and collaboration. The coding playground engages children in six behaviors that we can also find in the regular playground: content creation, creativity, choices of conduct, communication, collaboration, and community building. These 6C's are further explained in the PTD theoretical framework in Marina Bers' book, and are highlighted in the activities throughout the curriculum with their respective icons:



**CONTENT CREATION** by designing a KIBO program and programming its behaviors. The engineering design process of building and the computational thinking involved in programming foster competence in computer literacy and technological fluency.



**CREATIVITY** by making and programming personally meaningful projects, problem solving in creative playful ways and integrating different media such as recyclable materials, arts and crafts, and a tangible programming language. Final KIBO projects that represent a theme found in the overall early childhood curriculum are a wonderful way to engage children in the creative process of learning.



**COLLABORATION** by engaging children in a learning environment that promotes working in teams, sharing resources and caring about each other while working with their KIBO programs. Collaboration is defined here as getting or giving help with a project, programming together, lending or borrowing materials, or working together on a common task. While working on their final projects, children create a collaboration web: a tool used to foster collaboration and support. Children can write or draw "thank you cards" to the other children with whom they have collaborated the most.



**COMMUNICATION** through mechanisms that promote a sense of connection between peers or with adults. For example, technology circles, when children stop their work, share their KIBO creation, and explain their learning process. Technology circles present a good opportunity for problem solving as a community. Some teachers invite all the children to sit together in the rug area for this. Each classroom will have its own routines and expectations around group discussions and circle times, so teachers are encouraged to adapt what already works in their class for the technology circles in this curriculum.



**COMMUNITY BUILDING** through scaffolded opportunities to form a learning community that promotes contribution of ideas. Final projects done by children are shared with the community via an open house, demo day, or exhibition. These open houses provide authentic opportunities for children to share and celebrate the process and tangible products of their learning with family and friends. Each child is given the opportunity not only to run their

program, but to play the role of teacher as they explain to their family how they built, programmed, and worked through problems.



**CHOICES OF CONDUCT** which provide children with the opportunity to experiment with “what if” questions and potential consequences, and to provoke examination of values and exploration of character traits while working with KIBO. As a program developed following the PTD approach, the focus on learning about coding is as important as helping children develop an inner compass to guide their actions in a just and responsible way.

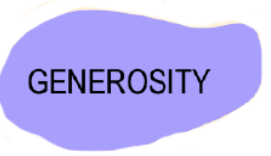
**Coding as Another Language:** Characterizing coding as a STEM activity is limiting. Instead, if we position the teaching and learning of programming as a new way of thinking and expressing ourselves, we are in the domain of language. Mastering a symbolic system of representation with communicative and expressive functions, opens up many opportunities. Learning to code becomes a creative, expressive activity, to produce something meaningful and shareable, and not only a problem-solving skill set. The CAL pedagogy promotes the exploration of the similarities and differences between natural and artificial languages for the creation process, their syntax and grammar, and their potential to empower individuals. When coding is taught as a language, and not only as STEM, the human dimension comes into play.

**Coding as a Bridge:** Programming is a semiotic act, a meaning making activity that uses and combines symbols to represent abstract ideas. When we learn to code, we learn a new language. Languages can create or destroy, and can serve to build bridges or walls. In the coding playground, the intention is to build bridges. CAL proposes that by learning the artificial language of machines, we can also learn the human language that serves us to interact with others, to connect in deep ways, and to create meaningful relationships. The metaphor of coding as a bridge promotes dialogue and meaningful encounters with others and situates coding as socio emotional learning, and not only a cognitive activity.

**Coding as a Palette of Virtues:** Any human activity involves human values. Making choices to engage in some behaviors and not others. Understanding and taking on responsibilities and consequences. The coding playground, through the CAL pedagogy, provides an intentional opportunity to teach and learn values. The metaphor of a palette of virtues recalls the painter’s palette. Like the artist who makes her palette with new colors and mixes and matches them, the coder also has a dynamic virtues palette that she puts to use. In the coding playground, ten of these values are explicitly explored: Curiosity, Perseverance, Open-mindedness, Optimism, Honesty, Patience, Generosity, Gratitude, Forgiveness, and Fairness. However, new ones can be added. Creative programming can be a pathway for character development and for exploring the socio emotional dimension and ethical dimension of learning. Ultimately, to understand that our actions, like the actions of anyone who creates, have consequences.



| Value                                                                                            | Definition                                                                                                                                                     | Activities                                                           |
|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
|  CURIOSITY     | A strong desire to know or learn something; novelty seeking.                                                                                                   | <a href="#">Star and a Wish</a>                                      |
|  PERSEVERANCE | Persistence in a course of action in spite of difficulty or adversity; determination in pursuing goals; firmness of purpose; grit; belief that we can improve. | <a href="#">Debugging Board</a><br><a href="#">I am a CODER</a>      |
|  PATIENCE     | The capacity to accept or tolerate delay, trouble, or suffering without getting angry or upset                                                                 | <a href="#">Debugging Board</a><br><a href="#">I am a CODER</a>      |
|  OPTIMISM     | Hopefulness and confidence about the future or a successful outcome; expecting the best.                                                                       | <a href="#">Star and a Wish</a><br><a href="#">Crossing the Room</a> |

|                                                                                                            |                                                                                                                                                                     |                                                                                                                      |
|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
|  <p>HONESTY</p>           | <p>The quality of being honorable; rectitude; uprightness; integrity</p>                                                                                            | <p><a href="#">Debugging Board</a><br/><a href="#">Relaying the Rules</a></p>                                        |
|  <p>FAIRNESS</p>          | <p>Impartial and just treatment without favoritism or discrimination; justice</p>                                                                                   | <p><a href="#">Relaying the Rules</a><br/><a href="#">Trading</a></p>                                                |
|  <p>GENEROSITY</p>        | <p>The quality of being kind; giving and receiving, helping self and others</p>                                                                                     | <p><a href="#">Making a Web (In-Person)</a><br/><a href="#">Trading</a></p>                                          |
|  <p>GRATITUDE</p>         | <p>The quality of being thankful; readiness to show appreciation; being aware of good things</p>                                                                    | <p><a href="#">Star and a Wish</a><br/><a href="#">Making a Web (In-Person)</a><br/><br/><a href="#">Trading</a></p> |
|  <p>FORGIVENESS</p>     | <p>The action of pardoning and accepting, giving a second chance to self and others</p>                                                                             | <p><a href="#">I am a CODER</a></p>                                                                                  |
|  <p>OPEN-MINDEDNESS</p> | <p>the quality of being willing to consider ideas, opinions and feelings that are new or different from your own; flexibility in taking different perspectives.</p> | <p><a href="#">Debugging Board</a><br/><a href="#">Crossing the Room</a></p>                                         |

## Curriculum Organization: Powerful Ideas

The curriculum is organized around powerful ideas from both computer science and literacy. The term **powerful idea** refers to a central concept or skills within a discipline that is simultaneously personally useful, inherently interconnected with other disciplines, and has roots in intuitive knowledge that a child has internalized over a long period of time.

The **powerful ideas from computer science** addressed in this curriculum include: algorithms, design process, representation, debugging, control structures, modularity, and hardware/software. The **powerful ideas from literacy** that will be placed in conversation with these powerful ideas from computer science are: sequencing, the writing process, alphabet and letter-sound correspondence, editing and audience awareness, literary devices, phonological awareness, and tools of communication and language.

Table 1: Powerful Ideas

| Powerful Ideas from Computer Science                                                                                                                                                                                                                                                                                                              | Powerful Ideas from Literacy                                                                                                                                                                                                                                                        | Connecting the Powerful Ideas                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Algorithms</b><br><i>Relevant Lessons:</i> <a href="#">3</a> , <a href="#">4</a> , <a href="#">5</a> , <a href="#">7</a> , <a href="#">8</a> , <a href="#">13</a> , <a href="#">14</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">17</a> , <a href="#">18</a> , <a href="#">19</a> , <a href="#">20</a> , <a href="#">22</a>      | <b>Sequencing</b><br><i>Relevant Lessons:</i> <a href="#">3</a> , <a href="#">4</a> , <a href="#">5</a> , <a href="#">6</a> , <a href="#">7</a> , <a href="#">13</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">19</a> , <a href="#">20</a> , <a href="#">22</a>       | Emphasis on “order matters,” and that complex tasks can be broken down into step-by-step instructions in a logical way.                                                                                                            |
| <b>Design Process</b><br><i>Relevant Lessons:</i> <a href="#">5</a> , <a href="#">6</a> , <a href="#">7</a> , <a href="#">9</a> , <a href="#">10</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">18</a> , <a href="#">19</a> , <a href="#">20</a> , <a href="#">21</a> , <a href="#">22</a> , <a href="#">23</a> , <a href="#">24</a> | <b>Writing Process</b><br><i>Relevant Lessons:</i> <a href="#">5</a> , <a href="#">6</a> , <a href="#">7</a> , <a href="#">9</a> , <a href="#">10</a> , <a href="#">15</a> , <a href="#">20</a> , <a href="#">21</a> , <a href="#">22</a> , <a href="#">23</a> , <a href="#">24</a> | Creative, iterative, cyclic processes that involve imagining, planning, making, revising, and sharing, with different starting points.                                                                                             |
| <b>Representation</b><br><i>Relevant Lessons:</i> <a href="#">1</a> , <a href="#">3</a> , <a href="#">4</a> , <a href="#">7</a> , <a href="#">8</a> , <a href="#">9</a> , <a href="#">11</a> , <a href="#">12</a> , <a href="#">14</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">18</a> , <a href="#">20</a> , <a href="#">21</a>   | <b>Alphabet and Letter-Sound Correspondence</b><br><i>Relevant Lessons:</i> <a href="#">3</a> , <a href="#">6</a>                                                                                                                                                                   | Symbols have different attributes (color, shape, sound, etc.) in order to represent something else.                                                                                                                                |
| <b>Debugging</b><br><i>Relevant Lessons:</i> <a href="#">3</a> , <a href="#">4</a> , <a href="#">10</a> , <a href="#">12</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">18</a>                                                                                                                                                       | <b>Editing and Audience Awareness</b><br><i>Relevant Lessons:</i> <a href="#">3</a> , <a href="#">10</a> , <a href="#">16</a>                                                                                                                                                       | Systematic analysis, testing, and evaluation to improve communication to the intended audience (computer or person). Whenever miscommunication occurs, the programmer or writer uses a variety of strategies to solve the problem. |
| <b>Control Structures</b><br><i>Relevant Lessons:</i> <a href="#">12</a> , <a href="#">13</a> , <a href="#">14</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">17</a> , <a href="#">18</a>                                                                                                                                            | <b>Literary Devices</b><br><i>Relevant Lessons:</i> <a href="#">12</a> , <a href="#">13</a> , <a href="#">14</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">17</a> , <a href="#">18</a>                                                                                | Advanced strategies to communicate a set of ideas using repetition, patterns, conditionals and events.                                                                                                                             |



|                                                                                                                                                                                                                                                      |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Modularity</b><br/> <i>Relevant Lessons: <a href="#">13</a>, <a href="#">17</a></i></p>                                                                                                                                                        | <p><b>Phonological Awareness</b><br/> <i>Relevant Lessons: <a href="#">1</a>, <a href="#">6</a></i></p>                                                                                            | <p>Decomposition, or breaking down a complex task into smaller tasks and re-using those new modules.</p>                                                                                                                                         |
| <p><b>Hardware / Software</b><br/> <i>Relevant Lessons: 1, 2, <a href="#">3</a>, <a href="#">4</a>, <a href="#">8</a>, <a href="#">9</a>, <a href="#">11</a>, <a href="#">12</a>, <a href="#">14</a>, <a href="#">15</a>, <a href="#">16</a></i></p> | <p><b>Tools of Communication and Language</b><br/> <i>Relevant Lessons: <a href="#">1</a>, <a href="#">2</a>, <a href="#">4</a>, <a href="#">8</a>, <a href="#">11</a>, <a href="#">14</a></i></p> | <p>Communicating abstract ideas through tangible means. Just like hardware and software work together, the expression of thoughts through language requires a medium for communicating to the outside world, such as spoken or written word.</p> |

## KIBO Skills

The most important skills from KIBO used in each lesson are as listed below (see Table 2). Note that this is not a complete list because each activity is meant to be creative and typically open-ended. This table is meant to indicate which skills it would be difficult to complete a lesson without. Children are always encouraged to use any blocks or skills they learn in class or on their own on any project.

Table 2: KIBO Skills

| <b>KIBO Skills</b>                        | <b>Relevant Lessons</b>             |
|-------------------------------------------|-------------------------------------|
| Parts of the KIBO Robot                   | Lesson 2                            |
| Begin/End blocks                          | Lessons 4*, 7                       |
| Motion blocks                             | Lessons 4*, 7                       |
| Light blocks                              | Lesson 11                           |
| Beep/Sing blocks                          | Lesson 8                            |
| Wait for Clap block                       | Lessons 12*, 15,                    |
| Play Triangle/Square/Circle blocks        | Lesson 12                           |
| Repeat blocks with Number Parameters      | Lessons 13*, 14, 15, 16, 17, 18, 20 |
| Repeat blocks with Sensor Parameters      | Lessons 14*, 15, 16, 17, 18, 20     |
| Conditional blocks with Sensor Parameters | Lessons 16*, 17, 18, 20             |
| Decorating KIBO                           | Lessons 9, 18, 21                   |

\* This lesson contains the introduction or tutorial for the associated KIBO concept.

## Integrated Curriculum Design

The CAL approach allows children to make connections between coding and literacy, as well as between coding and math. This curriculum encourages children to express their thoughts, ideas, and learning through KIBO activities. The curriculum is designed for a total of 18 hours, but can be adapted to particular learning settings. Each lesson contains a variety of activities, including:

- Warm-up activities to playfully introduce or reinforce concepts
- Opening/Closing Technology Circles to discuss, share, and reflect on activities and concepts
- Structured Challenges with KIBO to introduce the powerful ideas from computer science
- Expressive Explorations with KIBO to practice the skill in a creative, open-ended way
- Unplugged Time Games/activities to promote social interactions and movement
- Word Time to introduce the powerful ideas from literacy

The culmination of the unit is an open-ended project to share with family and friends. Just as young children can read age-appropriate books, computer programming can be made accessible by providing young children with appropriate tools such as KIBO. This curriculum provides integration between computer science and programming in the context of literacy. Children will explore two books, [\*Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer\*](#) by Traci Sorell (ISBN-13: 978-1-541-57914-9) and [\*My Granny Went to Market\*](#) by Stella Blackstone (ISBN-13: 978-1905236626) to write creative programs on KIBO.

## Pacing

This is an 18-hour curriculum unit divided into 24 lessons of approximately 45 minutes per lesson. Some children may benefit from further division of the activities into smaller steps or from more time to explore each new concept before moving onto the next, either in the context of free-exploration or with teacher-designed challenges. Each of the powerful ideas from computer science in this curriculum can easily be expanded into a unit of study which will extend the curriculum and allow children to explore a range of different activities.

| Lesson                        | Objectives                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. What Languages Do We Know? | Children will be able to... <ul style="list-style-type: none"> <li>• Define language as a structured method of communication</li> <li>• Identify programming languages as languages used to communicate with computers</li> <li>• Compare human languages and programming languages</li> <li>• Recognize the KIBO programming language as consisting of bar codes</li> </ul> |

|                               |                                                                                                                                                                                                                                                                                         |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2. Meet KIBO                  | Children will be able to... <ul style="list-style-type: none"> <li>• Define a robot</li> <li>• Categorize items as “robots” or “not robots”</li> </ul>                                                                                                                                  |
| 3. Order is Key               | Children will be able to... <ul style="list-style-type: none"> <li>• Identify the importance of precision and order in step-by-step instructions</li> </ul>                                                                                                                             |
| 4. We Are All Programmers!    | Children will be able to... <ul style="list-style-type: none"> <li>• Scan KIBO blocks</li> <li>• Identify and use the KIBO Begin and End Blocks</li> <li>• Identify and use KIBO Motion Blocks</li> <li>• Identify the role of the programmer in programming a robot</li> </ul>         |
| 5. Let’s Design!              | Children will be able to... <ul style="list-style-type: none"> <li>• Identify the steps of the design process</li> <li>• Recognize the design process as a cycle without a set beginning or end</li> <li>• Apply the steps of the Design Process to an engineering challenge</li> </ul> |
| 6. Exploring Space            | Children will be able to... <ul style="list-style-type: none"> <li>• Compare and contrast the writing and design processes</li> <li>• Discuss the characters and story of a book</li> <li>• Plan a goal-directed KIBO project</li> </ul>                                                |
| 7. Collaboration Time         | Children will be able to... <ul style="list-style-type: none"> <li>• Write a goal-directed KIBO program.</li> <li>• Write a KIBO program consisting of the Begin block, the End block, and motion blocks.</li> </ul>                                                                    |
| 8. Making Noise               | Children will be able to... <ul style="list-style-type: none"> <li>• Recognize and use the KIBO Beep Block and Sing Block</li> <li>• Write a 5-6 block program including the Beep Block and/or Sing Block</li> </ul>                                                                    |
| 9. Decorating Our Spacecrafts | Children will be able to... <ul style="list-style-type: none"> <li>• Decorate their robotic creations using arts and crafts materials</li> </ul>                                                                                                                                        |
| 10. Find That Bug             | Children will be able to... <ul style="list-style-type: none"> <li>• Define and celebrate the process of debugging</li> <li>• Identify strategies for debugging and editing</li> <li>• Locate errors or “bugs” in KIBO programs</li> </ul>                                              |
| 11. Lights On!                | Children will be able to... <ul style="list-style-type: none"> <li>• Use the Lightbulb and Light Block with KIBO</li> </ul>                                                                                                                                                             |
| 12. What’s That Sound?        | Children will be able to... <ul style="list-style-type: none"> <li>• Distinguish between human senses and robot sensors</li> </ul>                                                                                                                                                      |

|                              |                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <ul style="list-style-type: none"> <li>• Use the KIBO Sound Sensor with its appropriate Wait for Clap block</li> </ul>                                                                                                                                                                                                                                                                        |
| 13. Repeat After Me          | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Identify an AAAA pattern in a KIBO program</li> <li>• Identify an ABAB pattern in a KIBO program</li> <li>• Use the Repeat and End Repeat Blocks in KIBO to create a program with an ABAB repeating pattern.</li> <li>• Recognize that one program output can be represented using multiple approaches</li> </ul> |
| 14. Shine a Light            | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Compare and contrast human senses and robot sensors</li> <li>• Successfully test a KIBO program using the Light sensor</li> </ul>                                                                                                                                                                                 |
| 15. Silly Challenge!         | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Successfully test a KIBO program using the Distance sensor</li> <li>• Program KIBO to be part of a “silly challenge.”</li> </ul>                                                                                                                                                                                  |
| 16. What If?                 | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Identify conditional situations in everyday life</li> <li>• Identify situations that would require an If statement or a Repeat loop</li> <li>• Successfully test a conditional KIBO program using the Distance and Light sensors</li> </ul>                                                                       |
| 17. Over and Over            | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Identify complex repeating patterns</li> <li>• Create nested loops and statements using the KIBO programming blocks</li> </ul>                                                                                                                                                                                    |
| 18. Ready, Set, Go!          | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Revise and finish a “silly challenge” program</li> <li>• Decorate their robotic creations using arts and crafts materials</li> </ul>                                                                                                                                                                              |
| 19. My Granny Went to Market | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Order the events of a story in a logical sequence.</li> <li>• Plan a project using a graphic organizer</li> </ul>                                                                                                                                                                                                 |
| 20. Your Final Project I     | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Begin programming their final projects</li> </ul>                                                                                                                                                                                                                                                                 |
| 21. Your Final Project II    | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Decorate their robotic creations using arts and crafts materials</li> </ul>                                                                                                                                                                                                                                       |
| 22. Your Final Project III   | <p>Children will be able to...</p> <ul style="list-style-type: none"> <li>• Recall KIBO skills learned throughout the curriculum</li> <li>• Test both hardware and software elements of final projects</li> <li>• Give and receive constructive peer feedback using the “2 Stars and a</li> </ul>                                                                                             |

|                          | Wish” prompt                                                                                                                                                                                                           |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23. Project Showcase     | Children will be able to... <ul style="list-style-type: none"> <li>• Speak and express themselves in front of the class through guided questions from a teacher</li> <li>• Share their final KIBO creations</li> </ul> |
| 24. Our Coding Community | Children will be able to... <ul style="list-style-type: none"> <li>• Recognize help they received and gave to others</li> <li>• Express gratitude through a thank-you card</li> </ul>                                  |

## Materials

The robotics kit referred to in this curriculum is the [KIBO 21 robotics kit](#), developed by the DevTech Research Group at Tufts University and made commercially available through [KinderLab Robotics, Inc.](#) This curriculum also uses the book [Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer](#) by Traci Sorell (ISBN-13: 978-1-541-57914-9) and [My Granny Went to Market](#) by Stella Blackstone (ISBN-13: 978-1905236626). Additionally, the curriculum uses a series of Design Journals (for Lessons [1](#), [3](#), [6](#), [13](#), [15](#), [19](#), [23](#), [24](#); see the full set of Design Journals [here](#)), and KIBO [Job Cards](#).

Other materials used in the curriculum are inexpensive crafts and recycled materials. The use of crafts and recycled materials, a practice already common in other domains of early childhood education, provides opportunities for children to use materials they are already comfortable with.

## Classroom Management

During the CAL curriculum, children will be singing, moving, talking to each other, showing each other work, and asking questions. The CAL pedagogy offers guidance for developing positive classroom behaviors through these and other coding and technology-related activities. The [Positive Technological Development framework](#) includes Choices of Conduct, which encourages children to make positive choices for themselves and their community members. Additionally through teaching [Coding as a Palette of Virtues](#), teachers are encouraged to embed the language of the virtues and foster discussion regarding virtues within classroom activities. We suggest using this language when guiding children to make positive choices during coding activities. More information on Positive Technological Development and Coding as a Palette of Virtues, including activities to promote these, are included in the description of our Pedagogy above.

**Managing Materials:** Classroom-scale robotics projects require a lot of parts and materials, and the question of how to manage them brings up several key issues that can support or hinder the success of the unit.

The first issue is accessibility of materials. Some teachers may choose to give a complete kit of materials to each child, pair, or table of several children. Children may label the kit with their name(s) and use the same kit for the duration of the curriculum. Other teachers may choose to take apart the kits and have

materials sorted by type, and place all the materials in a central location. A word of caution, however: If materials are set up centrally, they must be readily visible and accessible, so children don't forget what is available to them or find it too much of a hassle to get what they need. It is also important to find a clearly visible place to set up materials for demonstrations, posters or visual aids to display for reference, and for robotics and programming materials for each lesson. To facilitate teamwork and equal participation, teachers can distribute "Scanner, Assistant, and Organizer" Job Cards to children to help assign specific roles when working with KIBO.

The second issue is usability. In some cases, children's desks or tables do not provide enough space to build a robot and program it. Care must be taken to ensure that children have enough space to use the materials available to them. If this is not the case, they may tend towards choosing materials that fit the space but not their robotics or programming goal. You should carefully consider how to address these issues surrounding materials in a way that makes sense for your class's space, routines, and culture. Then, it is crucial to set expectations for how to use and treat materials. These issues are important not only in making the curriculum logistically easier to implement, but also because, as described in the Reggio Emilia tradition, the environment can act as the "third teacher."

**Group Sizes:** The curriculum refers to Whole Class, KIBO Groups, and Individual Work. During KIBO Group activities, we recommend groups as small as three students per KIBO kit, but no larger than five children. At the same time, the curriculum includes numerous opportunities to promote conversations which are 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, free play, projects) that meet the needs of the teacher and students in the class.

## Alignment Of Academic Frameworks

The CAL KIBO curriculum fosters young children's general technical skills, computational thinking, and engineering abilities. It also supports foundational math, reading, and language arts skills that are commonly taught in early childhood classrooms. The curriculum is specifically aligned with the [K-12 Computer Science Frameworks](#), [ISTE Standards for Students](#), as well as [Common Core Math & English Language Arts \(ELA\) Frameworks](#). The table below provides examples of how lessons in the Kindergarten CAL KIBO curriculum are aligned with particular K standards and frameworks.

Table 3: Academic Framework

| ISTE Student Standards                                                                                                                                                                                                                                                                                 | K-12 Computer Science Frameworks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Common Core 2nd Grade ELA Standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Common Core 2nd Grade Math Standards                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ISTE Student Standards #1</b><br><b>Empowered Learner- 1a, 1c</b><br>Relevant Lessons: <a href="#">6</a> , <a href="#">7</a> , <a href="#">9</a> , <a href="#">11</a> , <a href="#">12</a> , <a href="#">18</a> , <a href="#">19</a> , <a href="#">20</a> , <a href="#">21</a> , <a href="#">22</a> | <b>K-2.Computing Systems.Devices</b><br>Relevant Lessons: <a href="#">1</a> , <a href="#">2</a> , <a href="#">3</a> , <a href="#">4</a><br><br><b>K-2.Computing Systems.Hardware and Software</b><br>Relevant Lessons: <a href="#">1</a> , <a href="#">2</a> , <a href="#">3</a> , <a href="#">4</a> , <a href="#">8</a> , <a href="#">9</a> , <a href="#">11</a> , <a href="#">12</a> , <a href="#">14</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">18</a><br><br><b>K-2.Computing Systems. Troubleshooting</b><br>Relevant Lessons: <a href="#">3</a> , <a href="#">4</a> , <a href="#">10</a> , <a href="#">12</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">18</a><br><br><b>K-2.Algorithms and Programming.Control</b><br>Relevant Lessons: <a href="#">3</a> , <a href="#">4</a> , <a href="#">11</a> , <a href="#">12</a> , <a href="#">13</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">17</a><br><br><b>K-2.Algorithms and Programming. Algorithm</b><br>Relevant Lessons: <a href="#">3</a> , <a href="#">4</a> , <a href="#">7</a> , <a href="#">11</a> , <a href="#">13</a> , <a href="#">15</a> , <a href="#">16</a> , <a href="#">17</a> , <a href="#">20</a> | <b>CCSS.ELA-LITERACY.R L.2.1</b><br>Relevant Lessons: <a href="#">5</a> , <a href="#">19</a><br><br><b>CCSS.ELA-LITERACY.R L.2.3</b><br>Relevant Lessons: <a href="#">8</a> , <a href="#">12</a> , <a href="#">19</a><br><br><b>CCSS.ELA-LITERACY.R L.2.5</b><br>Relevant Lessons: <a href="#">19</a><br><br><b>CCSS.ELA-LITERACY.SL.2.1</b><br>Relevant Lessons: <a href="#">8</a> , <a href="#">10</a> , <a href="#">12</a> , <a href="#">13</a> , <a href="#">20</a> , <a href="#">21</a> , <a href="#">24</a><br><br><b>CCSS.ELA-LITERACY.SL.2.4</b><br>Relevant Lessons: <a href="#">23</a><br><br><b>CCSS.ELA-LITERACY.SL.2.6</b><br>Relevant Lessons: <a href="#">3</a> , <a href="#">11</a> , <a href="#">23</a> | <b>CCSS.MATH.CONTENT.2.NBT.A.3</b><br>Relevant Lessons: <a href="#">4</a> , <a href="#">10</a> , <a href="#">13</a> , <a href="#">17</a> |



|  |                                                                                                                                        |  |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------|--|--|
|  | <p><b>K–2.Algorithms and Programming.</b></p> <p><b>Modularity</b></p> <p>Relevant Lessons: <a href="#">13</a>, <a href="#">17</a></p> |  |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------|--|--|

## Assessments

The CAL curriculum understands assessment as a critical component of the teaching and learning process. It is a chance to stop the work and evaluate how things are going. Assessment provides opportunities for revisiting ideas, content and skills, to adjust and modify instructional practices, and to gather the needed information to communicate with parents. It can serve to eliminate achievement gaps and to modify pedagogical strategies. CAL assessments are rooted in the observation of children’s behaviors, the listening of children’s stories and reasoning, and the analysis of the work they produce. CAL includes both formative assessments that are integrated throughout the lessons (these are called Check for Understanding and can be found in lessons 6, 13, 16, and 18) and summative assessments (called [Show What You Know](#)) that are conducted at the end of the curriculum. In addition, children’s projects are evaluated following the [KIBO Project Rubric](#) to identify coding skills as well as the expressiveness and purposefulness of the created projects.

When CAL is used in the context of research projects there are three other forms of assessments commonly used.

First, the Coding Stages Assessment (CSA) which happens before starting the curriculum, and after its completion. The CSA assesses progress in learning the KIBO programming languages. This assessment is conducted one-on-one by asking the child interactive and open-ended programming questions. The assessment probes the five Coding Stages (Emergent, Coding and Decoding, Fluency, New Knowledge, and Purposefulness) that children go through when engaging in the CAL curriculum. CSA is administered as a game before and after the CAL curriculum and takes under 45 minutes to complete.

Second, [TechCheck \(Relkin, de Ruiter, Bers, 2020\)](#) is an “unplugged” assessment of Computational Thinking (CT) that presents children with challenges analogous to those that arise in the course of computer programming but does not require coding experience to complete. The assessment probes six domains of CT described by [Bers \(2018\)](#) as developmentally appropriate for young children (Algorithms, Modularity, Hardware/Software, Debugging, Representation, and Control Structures). The format is multiple choice and the assessment can be administered individually or to groups in 20 minutes or less. *TechCheck* is administered before and after the CAL curriculum.

Third, the [PTD checklist](#) evaluates six positive behaviors (“six C’s”) supported by programs such as CAL that implement educational technologies. These are communication, collaboration, community building, content creation, creativity, and choice of conduct ([Bers, 2012](#); [Bers, 2020](#)). The PTD checklist is divided

into six sections, each one representing a behavior described in the PTD framework. It is scored on a 5-point Likert scale based on approximately 20-30 minutes of observation. The PTD checklist is used at various points throughout the CAL curriculum to rate the extent to which learning environments/facilitators and child behaviors are contributing to positive technological development.

## Lessons

### Lesson 1: What Languages Do We Know?

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Hardware/Software, Representation                                                                                                                                                                                                                                                                                                                                                                  |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Tools of Communication and Language, Phonological Awareness                                                                                                                                                                                                                                                                                                                                        |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Communication, Community Building                                                                                                                                                                                                                                                                                                                                                                  |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Open-Mindedness, Curiosity                                                                                                                                                                                                                                                                                                                                                                         |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Define language as a structured method of communication.</li> <li>• Identify programming languages as languages used to communicate with computers.</li> <li>• Compare human languages and programming languages.</li> <li>• Recognize the KIBO programming language as consisting of bar codes</li> </ul>                                                |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Barcode: a pattern of lines that are readable by machines (like the KIBO robot)</li> <li>• Instruction: a direction that a robot will understand</li> <li>• Languages: rule-based methods for sharing information and ideas</li> <li>• Program: a set of instructions for a robot</li> <li>• Programming languages: language used by computers</li> </ul> |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <input type="checkbox"/> Read lesson plan.<br><input type="checkbox"/> Print <a href="#">Lesson 1 Design Journal</a> or have children's <a href="#">Full Design Journals</a> on hand.                                                                                                                                                                                                              |
| <b>Warm Up</b> <ul style="list-style-type: none"> <li>• <b>Listing Our Languages</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Ask children what languages they know.                 <ul style="list-style-type: none"> <li>■ Does anybody speak another language at home? Does anybody have a family member who knows another language?</li> </ul> </li> <li>○ As a class, brainstorm as many languages as possible.</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                    |

- Include both languages people in the room know and also languages people have only heard of.

### Opening Tech Circle

- **Programming Languages** (*Suggested Time: 15 minutes*)
  - Ask children what all of those languages have in common? What makes a **language**? Some examples include:
    - Languages are ways to say things to each other.
      - Note: If children say, “languages are all spoken out loud,” prompt children to consider American Sign Language.
    - Languages have rules, and different languages have different rules.
      - Some languages (like Spanish, Hebrew) have gender rules for words.
      - Some languages use adjective-noun order (“blue house”) and some use noun-adjective order (“house blue”).
  - Explain that we use language to do different things:
    - To talk about things (e.g., “The cat is on the mat,” “The weather is nice”).
    - Tell someone/something what to do (e.g., “Please give me your pencil”).
    - Ask questions (e.g., “How old are you?” “What’s your favorite animal?”).
  - Ask children, *What happens when people don’t speak the same language?*
    - This leads to misunderstandings and confusion.
  - Explain that computers also use languages.
    - Computers use languages called **programming languages**, and not all computers use the same programming language.
      - For example, iPhones and Android phones use different languages.
    - Have children heard of or know the names of any programming languages (C, JAVA, Scratch, etc.)?
  - Discuss differences and similarities between human languages and programming languages.
    - Human languages can talk about things, ask questions, and tell what to do, but programming languages can only tell what to do.
    - Human languages can still be understood by others even with typos or mispronounced words. That is not the same for programming languages.
    - Human and programming languages are both ways of communicating. Both types of languages have a set of rules.

*NOTE: If children ask about smart speakers etc.: Explain that with Siri, Alexa, Google etc. the computers don’t actually speak English, but someone translated English into the computer’s language.*

### KIBO Time

- **KIBO's Language** (*Suggested Time: 10 minutes*)
  - Show children various KIBO programming blocks. Have children point out what they see on each block (the text, the icon, colors, the barcode, etc.) Ask children: *What part of the block is KIBO's language? Is it the words, or the pictures, or something else?*
  - Once children identify the barcode as the answer, discuss other objects or places where they have encountered **barcodes** (e.g., grocery store, mall, etc.). Then ask children: *Do you think KIBO can think on its own? How can we give KIBO instructions to make it do something?* Lead a child-centered discussion on how robots are programmed by humans and cannot think for themselves. Everything that KIBO says and does is determined by how the programmer chooses the program, or set of instructions, for KIBO.
  - Tell children that KIBO reads the barcode on each programming block. Each block is an instruction that tells KIBO what to do, like spin, or go left or forward.
  - Every time we program KIBO to do something, we have it tell KIBO when to start and stop. For example, if we want KIBO to move forward, KIBO needs the barcode instructions for Begin, Forward, and End. Note how these **instructions** are read from left to right, just like the English language! Point out the similarities and differences between KIBO's language and our language(s). For example: *KIBO needs a "begin" and "end" block, just as a sentence in English starts with a capital letter and ends with punctuation. You can also think of Begin and End blocks as similar to the front and back covers of a book, and tell a story through the rest of the program (the blocks in between Begin and End).*

### Word Time

- **Expressing Thoughts and Ideas** (*Suggested Time: 10 minutes*)
  - Tell children that now that we've learned a little bit about KIBO's language, they should think back to the other languages they know and use that they talked about at the start of the lesson.
  - Ask children to think of a language they speak at home. Have them consider what one of their favorite words in that language is, and why. What does it express?
    - We can express different thoughts and ideas through our language. We can also program KIBO to represent different ideas through its actions, which we program.
    - Children will start [Lesson 1 Design Journal](#), and write down answers to the following two prompts: **What is one of your favorite words in a language you speak?** and **What is one question you have about programming languages you want to learn more about?**

### Closing Tech Circle

- **Design Journal Share** (*Suggested Time: 5 minutes*)
  - Have each child share what they wrote in their Design Journal.

## Lesson 2: Meet KIBO

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Hardware/Software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Powerful Ideas of Literacy         | Tools of Communication and Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| PTD                                | Communication, Choices of Conduct                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Palette of Virtues                 | Curiosity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Children will be able to...        | <ul style="list-style-type: none"> <li>● Define a robot</li> <li>● Identify characteristics of a robot</li> <li>● Categorize items as “robots” or “not robots”</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Vocabulary                         | <ul style="list-style-type: none"> <li>● Robot: a machine that can be programmed to do different things</li> <li>● KIBO: a screen-free robot for children</li> <li>● Program: a set of instructions for a robot</li> <li>● Hardware: the physical parts of a computer or robot (e.g., KIBO body)</li> <li>● Languages: rule-based methods for sharing information and ideas</li> <li>● Motor: the part of a robot that makes it move</li> <li>● Scanner: electronic device for reading printed barcodes</li> <li>● Program: a complete set of instructions for a robot</li> <li>● Wheels: the round parts of a vehicle that turn in circles and allow it to move</li> <li>● Main board: the robot’s “brain” that has the programmed instructions that tell the robot to perform its behaviors</li> </ul> |
| Teacher Preparation                | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Gather pictures of robots and non-robots (e.g., food, plants, cars).</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about the parts of KIBO.</li> <li><input type="checkbox"/> Memorize the lyrics of the <a href="#">Robot Parts Song</a>. Open the link and be ready to play it at the end of class.</li> </ul>                                                                                                                                                                                                                                                                                                                      |

## Warm Up

- **Robot Corners** (*Suggested Time: 10 minutes*)
  - Tell children that over the next couple of weeks, they will be learning about robots and robotics.
    - Tell children that we are going to warm up with a game to see what they already know and think about robots.
  - Designate three corners of the classroom: one corner for “Robots,” one corner for “Maybe Robots,” and one corner for “Not Robots.”
    - One at a time, show a variety of different pictures of robots and non-robots (e.g., computers, plants, cars, animals, food, famous robots such as Wall-E and R2D2) (see example pictures in Appendix B, [here](#)).
    - Ask children to move to the corner that they think represents the picture.
    - After children pick a corner, ask children why they picked that corner.  
*What features make it or don't make it a robot? Is this something that was made by a human or by nature?*
  - Tell children that now that they have learned a bit more about robots, they will have an opportunity to play with one particular fun **robot** called **KIBO**! They will learn how to make the robot do different things by **programming** the robot.

## Opening Tech Circle

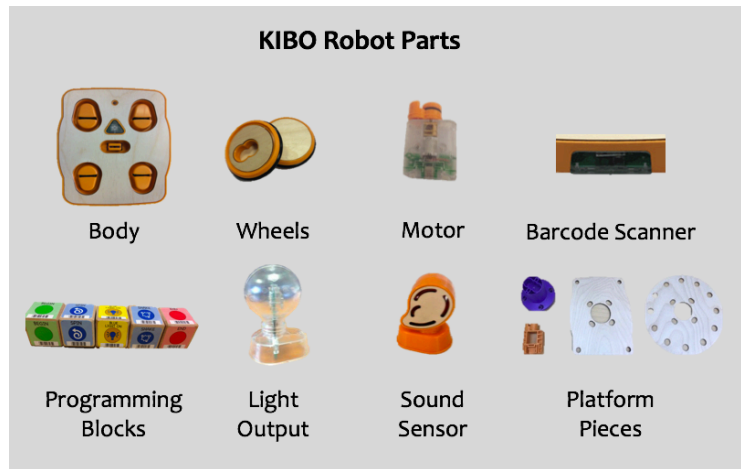
- **Our Bodies and KIBO's Body** (*Suggested Time: 5 minutes*)
  - Explain to children that today they will be learning how to put together the different parts of the KIBO robot.
  - Show children a KIBO robot **body**.
    - Ask children what they think will be similar about their bodies and KIBO's body.
      - E.g. both can move and do things, wheels are similar to legs, both can see and hear
    - Ask children what will be different about their body and KIBO's body.
  - E.g. KIBO has many pieces, KIBO has wires and batteries, KIBO has wheels instead of legs, KIBO has to be turned on, KIBO can have a lightbulb

## KIBO Time

### Structure Challenge

- **Hello, KIBO!** (*Suggested Time: 10 minutes*)
  - Show children a KIBO robot **body**.
  - Ask children: *What parts do you see through the clear backside of KIBO? What are the main board and wires inside of KIBO for? What do the batteries do?*
  - *What are some human body parts that are similar to KIBOs? For instance, what part of our body tells the rest of it what to do?*
    - Our brain
  - *And what part of KIBO tells the rest of it what to do?*
    - The **main board**

- *What parts of our body move to make us go forward and what part of KIBO moves to make it go forward?*
  - Our legs make us go forward, and the motor and wheels help KIBO go forward
- Using the KIBO parts guide below, introduce the KIBO robot's key parts and their functions.



- Tell children that KIBO is a robot that was created by engineers. A **robot** is a machine that is given instructions by humans to do different physical tasks (e.g., move around, throw a ball, etc.).
- Demonstrate how to attach the **wheels**, **motors**, and **art platforms**. Point out that when attaching the motors to the KIBO body, both “green dots” are visible from the outside. Otherwise, the robot will wobble!
- When introducing the motor, tell children that they should not spin the motors with their fingers because that can break the motors. Just like we do not push our friends to make them walk, we should not spin KIBO's motors. KIBO will spin its motors on its own.
- These physical parts of KIBO are part of KIBO's **hardware** (the physical parts of a robot, like the KIBO body).
- Lead a child-centered discussion on how robots are programmed by humans and cannot think for themselves. Everything that KIBO says and does is determined by how the programmer chooses the **program**, or set of instructions, for KIBO.
- These instructions are KIBO's **language**, which is very different from the language(s) that people use to communicate.



## What is a Program?

A **program** is a sequence of instructions that the robot acts in order. Each instruction has a specific meaning, and the order of the instructions affects the robot's overall actions. This is an example of a KIBO program.



### Expressive Explorations

- **Exploring KIBO** (*Suggested Time: 10 minutes*)
  - Pass out KIBO bodies, wheels, and motors (or have children take them out of their kits).
  - Have children practice assembling and disassembling the KIBO wheels and motors (the motors should show a green dot when they are attached to the KIBO bodies). If children are working in groups, each group member should take a turn.
  - Take this time to introduce classroom procedures related to KIBO usage. Use a classroom organizational system that works best for you and your classroom. Your system should cover procedures such as:
    - Taking KIBO kits out from storage/central area
    - Putting KIBO parts and blocks back into each bin
    - Checking for any missing parts
    - Calling for children's attention during a KIBO activity
    - Listening to others during whole class discussions and technology circles
    - Putting KIBOs back into storage/central area

### Closing Tech Circle

- **Robot Parts Song** (*Suggested Time: 5 minutes*)
  - Introduce the [\*Robot Parts Song\*](#) (sung to the tune of "Dry Bones") and have the class sing along. Explain to children that this song will help them remember the parts of KIBO!

[\*The wheels are connected to the motors,\*](#)  
[\*The motors are connected to the body,\*](#)  
[\*The engineers give it a program,\*](#)  
[\*So move, robot, move!\*](#)



### Lesson 3: Order Is Key

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Algorithms, Hardware/Software, Representation, Debugging                                                                                                                                                                                                                                                                                                                                                              |
| Powerful Ideas of Literacy         | Sequencing, Alphabet and Letter-Sound Correspondence, Editing and Audience Awareness                                                                                                                                                                                                                                                                                                                                  |
| PTD                                | Communication                                                                                                                                                                                                                                                                                                                                                                                                         |
| Palette of Virtues                 | Curiosity, Patience                                                                                                                                                                                                                                                                                                                                                                                                   |
| Children will be able to...        | <ul style="list-style-type: none"> <li>Identify the importance of precision and order in step-by-step instructions</li> </ul>                                                                                                                                                                                                                                                                                         |
| Vocabulary                         | <ul style="list-style-type: none"> <li>Algorithm: instructions for a computer to solve a problem in a particular order</li> <li>Program: to give a computer a set of instructions</li> <li>Programmer: A person who writes instructions for computers to tell them what to do</li> <li>Programming languages: language used by computers</li> </ul>                                                                   |
| Teacher Preparation                | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Print one copy per child of the <a href="#">Cut Out Words</a> file and cut each word. Make sure to shuffle the sets but not mix them.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 3 Design Journal</a> or have children's <a href="#">Full Design Journals</a> on hand.</li> </ul> |

#### Warm Up

- **Did that Sentence Make Sense?** (*Suggested Time: 5 minutes*)
  - This activity is designed to demonstrate the need for order in languages.
    - Use [cut out words](#) of the sentence (“She sat the robot on the mat.”), scramble them, and read out/have someone read the scrambled sentence (e.g., “The mat robot she sat on the.”).
    - Ask children if this makes sense. Why or why not?
    - Ask children to put the words into the correct order. This means that each word should be after the one that should be before it.
    - Discuss that language needs to be in the right order to be understood.

### Opening Tech Circle

- **What is an Algorithm?** (*Suggested Time: 5 minutes*)
  - Explain that with computers, language is used to tell it what to do.
    - Remind children about your discussion of human and robot languages in an earlier lesson.
    - Ask children to give an example of a question, a sentence, and an instruction in a language of their choosing.
    - When we give a list of instructions to a computer, we call this **programming**. This is why computer languages are known as **programming languages**.
    - We call the people who write these instructions **programmers**.
    - The list of steps that the computer follows is called an **algorithm**.
  - Collect examples of activities that need to be done in a certain order.
    - E.g., brushing your teeth, putting on socks and shoes.

### Unplugged Time

- **Program the Teacher** (*Suggested Time: 10 minutes*)
  - Tell children that the teacher will now be the computer and they will get to program them! Remind them that they need to say all the steps in the right order!
  - Children will be responsible for verbally directing their teacher to special locations in the classroom (e.g., to a bookcase or a closet) or doing a task (e.g., making a sandwich).
  - The instructions the children give to the teacher must be specific. For example, children should not simply say, “Move forward.” They should instead say, “Move forward \_\_\_\_ steps.” Or “Put the peanut butter on the bread” should be “Open the peanut butter jar and use your knife to scoop the peanut butter onto the bread.”
  - When sequences of instructions do not work (perhaps because the number of steps taken were incorrect), children should alter their instructions.
  - Discuss how important it is to be specific and how important order is in programming.

### KIBO Time

- **Order Matters** (*Suggested Time: 10 minutes*)
  - Show children the Begin, Forward, and End Blocks, and ask what they notice about the shapes of the blocks.
    - Talk about how the Begin and End Blocks can only be at the beginning and end of a program because they have either only a peg or hole.
    - Explain that if we give KIBO a program with these blocks in the wrong order, KIBO will be confused and not read the program.
  - Show children the following two programs: “Begin, Forward, Shake, End” and “Begin, Shake, Forward, End.” Ask what they think the two programs will do differently.
    - Remind children of the importance of order within the steps of the

program to explain to KIBO what to do.

### Word Time

- **How-To-Book Design Journal** (*Suggested Time: 10 minutes*)
  - In the [Lesson 3 Design Journal](#), children will write instructions for a younger sibling or friend who needs help getting ready to go to bed at night. Remind them they need to be specific and put all the steps in the right order, just like when they were programming the teacher!

### Closing Tech Circle

- **Different How-Tos!** (*Suggested Time: 5 minutes*)
  - Ask for a few volunteers to share what they wrote in their Design Journal.
  - Discuss the differences between how-to-books as everyone gets ready to go to bed in different ways.

## Lesson 4: We Are All Programmers!

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Algorithms, Hardware/Software, Representation, Debugging                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Tools of Communication and Language, Sequencing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Communication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Optimism, Curiosity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• Scan KIBO blocks</li> <li>• Identify and use the KIBO Begin and End Blocks</li> <li>• Identify and use KIBO Motion Blocks</li> <li>• Identify the role of the programmer in programming a robot</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                 |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• Program: a set of instructions for a robot</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about how to scan KIBO's programming blocks.</li> <li><input type="checkbox"/> Read about the people featured on the <a href="#">Pictures of Programmers</a> slideshow. Have it open before class starts.</li> <li><input type="checkbox"/> Memorize the lyrics of the <a href="#">Clean-Up Song</a>. Open the link and be ready to play it at the end of class.</li> <li><input type="checkbox"/> Print out <a href="#">KIBO Blocks</a>.</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b><a href="#">Who Are These People?</a></b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Illustrate that programmers can be of all different backgrounds (gender, race, ethnicity, age) with pictures!                 <ul style="list-style-type: none"> <li>■ Ask children: <i>What do you think these people have in common?</i> <ul style="list-style-type: none"> <li>• Answer: They're all programmers!</li> </ul> </li> <li>■ Tell children that, like the people in the pictures, they are also programmers (optional: end the slideshow with a class picture)!</li> </ul> </li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

- **Programmer Says** (*Suggested Time: 10 minutes*)
  - In order to program the KIBO robot, children first need to learn KIBO's language: the programming blocks! This activity is played like the traditional "Simon Says" game, in which children repeat an action if Simon says to do something. Before playing the game, hold up each large [KIBO Block](#) and have children guess what the block does (use only the Begin, End, and blue Motion Blocks for now).
  - Have the class stand up. Hold up one big KIBO icon at a time and say, "Programmer says to \_\_\_\_\_". Go through each individual instruction a few times until the class seems to get it. Once children are familiar with each instruction, ask for volunteers to be the Programmer who gives the class full programs to run through (e.g., Begin, Forward, Spin, End).
  - Just like in the real "Simon Says" game, 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? Just like Simon Says, if the Programmer forgets to say, "Programmer says to \_\_\_\_\_", then children should not perform the action!

### **KIBO Time**

#### **Structure Challenge**

- **Scanning How-to** (*Suggested Time: 5 minutes*)
  - Explain to children that scanning is how KIBO reads and understands language.
  - Demonstrate scanning the barcodes on the blocks using the KIBO body's embedded barcode scanner. Ask the children: *What do you see during scanning? What do you hear during scanning?*

#### **Expressive Explorations**

- **Free Play** (*Suggested Time: 10 minutes*)
  - Take out KIBOs and blocks and have children engage in free play creating and scanning three-block programs (Begin, Motion, End).
  - Encourage children to use different strategies to scan.
    - Strategies can include disconnecting and separating the blocks to ensure each block is individually scanned, lifting KIBO between scanning each block, or working collaboratively with a partner (one person holds the robot to scan, and the other person checks to make sure each block is scanned properly).
  - Encourage children to use different strategies to scan. Use your chime or call to action every few minutes to signal the switching of [Job Cards](#), so that every child has the opportunity to be the "Scanner." By the end of this activity, children should feel comfortable assembling and scanning programs with KIBO.

**[Lesson 4 Check for Understanding:](#)** Check your children's understanding of the new concepts they've just learned. Read each question to the children. Have children hold up 1, 2, or 3 fingers (corresponding to the first, second, or third choice). Stop and re-explain concepts as needed.

### **Closing Tech Circle**

- **Cleaning Up KIBO** (*Suggested Time: 5 minutes*)
  - Clean up KIBO parts.
    - To make cleaning up more fun, here's a [\*KIBO Clean-Up Song\*](#) you can introduce to children!

***KIBO Clean-Up Song***

*(To the tune of "Itsy Bitsy Spider")*

*We're turning off our KIBOs and putting them away*

*We had so much fun but we're finished for the day*

*We're using both our hands and we walk instead of run*

*We put away our KIBOs and now the song is done!*



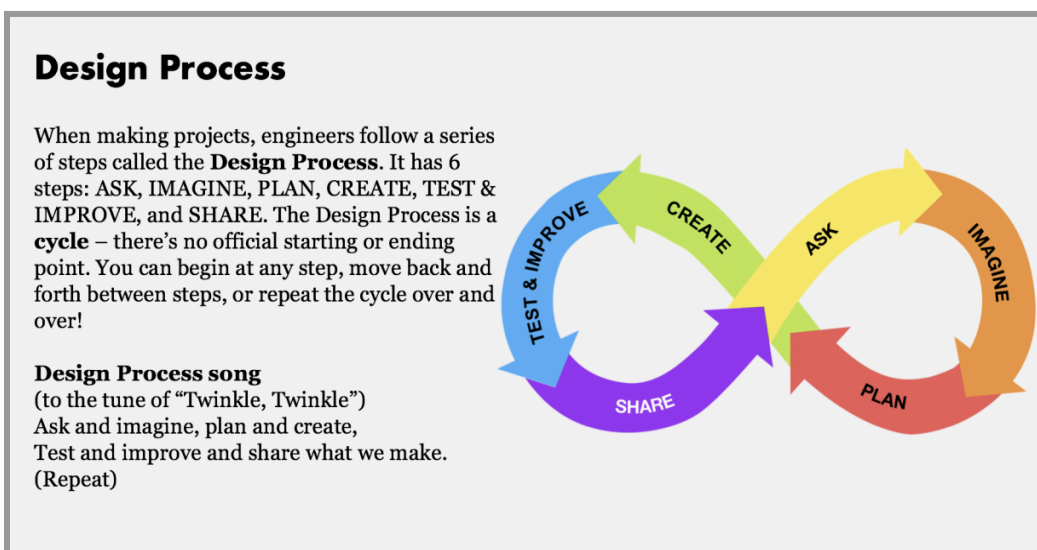
## Lesson 5: Let's Design!

|                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                  | Algorithms, Design Process                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Powerful Ideas of Literacy                                                                                                          | Writing Process, Sequencing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| PTD                                                                                                                                 | Creativity, Content Creation, Collaboration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Palette of Virtues                                                                                                                  | Curiosity, Perseverance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Children will be able to...                                                                                                         | <ul style="list-style-type: none"> <li>● Identify the steps of the design process</li> <li>● Recognize the design process as a cycle without a set beginning or end.</li> <li>● Apply the steps of the Design Process to an engineering challenge.</li> </ul>                                                                                                                                                                                                                                                                                    |
| Vocabulary                                                                                                                          | <ul style="list-style-type: none"> <li>● Engineer: someone who invents or improves things</li> <li>● Cycle: something that repeats</li> <li>● Design Process: <ul style="list-style-type: none"> <li>○ Ask: to use a question</li> <li>○ Imagine: to make an idea in your mind</li> <li>○ Plan: to decide what to do and how to do it</li> <li>○ Create: to make something</li> <li>○ Test: to see if and how your idea works</li> <li>○ Improve: to make something better</li> <li>○ Share: to show others what you made</li> </ul> </li> </ul> |
| Teacher Preparation                                                                                                                 | <ul style="list-style-type: none"> <li>● Read lesson plan.</li> <li>● Prepare to display the <a href="#">Design Process Anchor Chart</a>.</li> <li>● Memorize the lyrics of the <a href="#">Design Process Song</a>. Open the link and be ready to play it at the end of class.</li> <li>● Gather materials for the Unplugged Time design challenge. Materials can include recycled materials, craft supplies, building blocks, or other materials of your choosing.</li> </ul>                                                                  |
| <b>Warm Up</b> <ul style="list-style-type: none"> <li>● <b>What Do Engineers Do?</b> (<i>Suggested Time: 10 minutes</i>)</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

- Ask children: *What do you think an engineer is? Do you know anyone who is an engineer? What types of things do they do?*
- **Engineers** solve problems. They use science and math to understand how to create new things or improve something.
- Lots of things are made by engineers, like the chairs and tables in the room and slides and swings in the playground. And some engineers design computers and robots, like KIBO.
- Ask children: *When engineers start to create or improve things—like changing a slide so people will slide down faster, or making a swing go even higher—what do you think they need to do first?*
- Explain to children that first, engineers need to create a plan.
- Today, you're going to be engineers and plan and design your own creations!

### Opening Tech Circle

- **The Design Process** (Suggested Time: 10 minutes)



- Explain the Design Process using the [Design Process Anchor Chart](#).
- Walk through the Design Process to make KIBO celebrate.
  - **Ask:** How can we program a celebration?
  - **Imagine:** Brainstorm movements.
  - **Plan:** Decide on the blocks we want to use.
  - **Create:** Make the program.
  - **Test and Improve:** Were the movements right? Did we like the timing?
  - **Share:** We will share with the class!

### Unplugged Time

- **Your Own Design Process** (Suggested Time: 20 minutes)

- Explain that the Design Process isn't just for KIBO, it's for making anything! Today they are going to get to choose what they design using the Design Process!
- **Ask:** Ask the children a question to serve as a prompt for their creation. For example, how strong can we make a tower out of building blocks, or what kind of butterfly house would be good for our playground? These creations can be done with recycled materials, craft supplies, building blocks, or other materials of your choosing, so select a prompt that aligns with the building materials you choose.
- **Imagine:** Break into small groups to brainstorm ideas for their projects.
- **Plan:** Ask the children to decide what they want to do for their projects and how they will do it.
- **Create:** Give children time to use craft supplies, recycled materials, or building blocks to make their creation!
- **Test and Improve:** Pause and ask children if their creations are following their plan? Are there any changes they want to make now that they've started actually making their project?
- **Share:** Go around and share creations as a class.

### Closing Tech Circle

- **Cycles of Creation** (*Suggested Time: 5 minutes*)
  - Ask the children if seeing everyone's projects, and working on their own projects, gave them any ideas of new things they want to make!
  - Refer back to the anchor chart, and remind children that the Design Process is a loop—it doesn't have a start or end. Sharing just leads to more asking and more creating and then more sharing!
  - Finish by sharing the [\*Design Process Song\*](#)! As you sing the song with the class, share the Anchor Chart for Design Process on the screen.

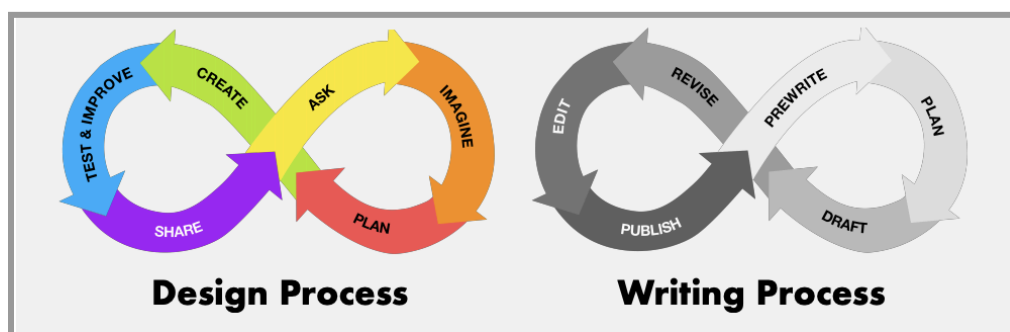
[\*\(to the tune of "Twinkle, Twinkle"\)\*](#)  
[\*Ask and imagine, plan and create.\*](#)  
[\*Test and improve and share what we make.\*](#)  
[\*\(Repeat\)\*](#)

## Lesson 6: Exploring Space

|                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                       | Design Process                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                               | Writing Process, Sequencing, Phonological Awareness, Alphabet and Letter-Sound Correspondence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| PTD                                                                                                                                                                                                                                                                                                                      | Content Creation, Community Building, Collaboration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Palette of Virtues                                                                                                                                                                                                                                                                                                       | Curiosity, Optimism                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Children will be able to...                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• Compare and contrast the writing and design processes</li> <li>• Discuss the characters and story of a book</li> <li>• Plan a goal-directed KIBO project</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Vocabulary                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>• Author: a creator of a product in writing (i.e., book, article, program, etc.)</li> <li>• Value: behavior, attitude, or emotion that someone feels is important (some values might be, for instance, kindness, honesty, learning, or adventure)</li> <li>• Classified: something that is secret</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                      |
| Teacher Preparation                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Get book <a href="#"><i>Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer</i></a>.</li> <li><input type="checkbox"/> Prepare to display the <a href="#">Design Process and Writing Process Anchor Chart</a>.</li> <li><input type="checkbox"/> Prepare to display the <a href="#">VALUES Anchor Chart</a>.</li> <li><input type="checkbox"/> Prepare to display the <a href="#">Solar System Anchor Chart</a>.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 6 Design Journal</a> for children, or have children's <a href="#">Full Design Journals</a> on hand.</li> </ul> |
| <b>Warm Up</b> <ul style="list-style-type: none"> <li>• <b>Read-Aloud</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>○ Read <a href="#"><i>Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer</i></a> together as a class.</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## Opening Tech Circle

- **Design Process and Writing Process** (*Suggested time: 10 minutes*)
  - Explain to children that books, like *Classified*, are created by people, too, and that these **authors** go through a similar process with writing that engineers do when they're designing something. Ask children: *What are your favorite books? Do you remember who wrote those books?*
  - Explain to children the similarities between the Design Process and the Writing Process. Both are creative processes that require imagining, planning, creating, making changes, and sharing. Both engineers and writers (note to children that an author is a type of writer) turn ideas into projects that are shared with others. Ask children: *What other activities require a process (e.g., cooking, painting, getting good at a sport, etc.)?*
  - Display the [Design Process and Writing Process Anchor Chart](#) on the screen.
    - Compare and contrast the Writing Process and Design Process using the anchor chart as a visual aid for children.
  - Ask children: *What are some similarities and differences between engineers and writers?*



## Unplugged Time

- **Values Brainstorm** (*Suggested Time: 10 minutes*)
  - Explain to children that Mary's values from her Cherokee culture played a big part in her work. **Values** are things that are important to us, like kindness or honesty.
  - Mary, for instance, thought it was important to work together with other people on projects. This is something that Mary valued.
  - Display the [VALUES Anchor Chart](#) on the screen.
  - *The first letter of VALUE is V. V is for "Very important." Values are things that are very important to us, such as helping others, having fun, learning new things, or being close with family.* Ask children to think of things that are very important to them. Write down children's answers on a poster board.
  - *The second letter of VALUE is A. A is for "Actions." We just talked about some things that are very important to us. How do we show what's important to us? For example, maybe we feel that kindness is important.* Ask children to reflect on actions that show kindness, or actions that represent another value children identify.

- *The third letter of VALUE is L. L is for “Learn.” Sometimes, we learn what is important to us from other people. Maybe our friends are caring or honest, and we really like that about them. Ask children to share one person in their life that they do or can learn things from, like a teacher, a friend, or someone in their family.*
- *The fourth letter of VALUE is U. U is for “Unique.” We each have different things that are important to us. Maybe some of us love going on adventures to new places, and others like learning new things. Ask children to think about and share the things that are important to them that make them unique.*
- *The fifth letter of VALUE is E. E is for “Experiences.” Our experiences impact what we feel is important to us. For example, think about a time when you were really happy. Why did you feel happy? Thinking about why can help you understand things you value. Feel free to give children an example (e.g., “One time I was really happy was when I spent time with my parents. I was happy because I really value family and spending time with family members.”)*
- Explain to children that we can use what is important to us when we learn new things, like how to program KIBO. For example, if being close to family is really important to us, maybe after school we can share one new thing we learned about KIBO with our family. Or, if we feel that kindness is really important, we can give one classmate a compliment on a program they create.

### Word Time

- **Let’s Explore Space!** (*Suggested Time: 10 minutes*)
  - Explain to children that, as they just discussed, one thing that was really important to Mary was working in teams on projects, like helping to send a space mission to Venus and Mars.
  - Several of the missions Mary worked on were super secret; they were **classified**.
  - Over the next few classes, you’re going to pretend KIBO is a spacecraft, and work on teams on your own secret space mission!
  - Let’s think about different things you could do on your mission.
  - Refer back to the [Design Process Anchor Chart](#). Tell children that one way to plan is brainstorming, or to list many ideas and then select one of those ideas as your final plan.
  - As a class, brainstorm possible secret missions their spacecraft could go on, and have them consider what KIBO blocks they could use to represent their spacecraft.
    - For example, maybe children want to design a spacecraft that goes to the Moon, a galaxy, like the Milky Way, or a planet such as Jupiter or Mars.
  - Encourage children to take one of the ideas you’ve brainstormed and add their own spin on it!
  - If children are unfamiliar with the planets/the solar system more broadly, feel free to show the [Solar System Anchor Chart](#).
  - Tell children that soon they will also learn how to decorate KIBO, so they can create a picture of, for instance, a planet they might like to explore, or a galaxy.

- In their [Lesson 6 Design Journal](#), have children work in groups to write out 1) the name of their secret mission, 2) what will happen in their mission, and 3) the steps they will use to program KIBO to go on the mission. Their final program should contain at least seven blocks, including a beginning and end block.

#### **Closing Tech Circle**

- **What Does “Team” Mean to You?** (*Suggested Time: 5 minutes*)
  - Tell children to think again about the values we all shared together. Remind children that one thing Mary valued is working together with others on a team. Have each child share one word they think of when they hear the word “team.”

## Lesson 7: Collaboration Time

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                               | Algorithms, Design Process, Representation, Debugging                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Writing Process, Sequencing, Editing and Audience Awareness                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Content Creation, Creativity, Collaboration, Community Building                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Curiosity, Generosity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>• Write a goal-directed KIBO program.</li> <li>• Write a KIBO program consisting of the Begin block, the End block, and motion blocks.</li> </ul>                                                                                                                                                                                                                                                                                                                               |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Collaboration: when people work together on a common goal.</li> <li>• Courage: the ability to do something challenging (e.g., sharing thoughts and ideas in a group) in the face of obstacles or fear</li> <li>• Cooperation: working together with others to accomplish something</li> <li>• Communication: sharing information with others to express thoughts, feelings, ideas, etc.</li> </ul>                                                                            |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Get book <a href="#">Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer</a>.</li> <li><input type="checkbox"/> Prepare to display the <a href="#">Three Cs of Collaboration Anchor Chart</a>.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 6 Design Journal</a> for children, or have children's <a href="#">Full Design Journals</a> on hand.</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>Read-Aloud</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Re-read <a href="#">Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer</a> together as a class.</li> </ul> </li> </ul> <p><b>Unplugged Time</b></p> <ul style="list-style-type: none"> <li>• <b>Three Cs of Collaboration</b> (<i>Suggested Time: 10 minutes</i>)</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



- Tell children to think back to our last lesson where we talked about the things that are important to us: our values. Share examples of some of the values that you all discussed together as a class (e.g., honesty, kindness, learning new things, being close to friends, etc.).
- Remind children that one thing Mary valued is teamwork.
- Ask children, *What teams have you been a part of? What are things that made the team work well, or not so well?*
- Tell children that another word for teamwork is collaboration; **collaboration** is when people work together on a common goal, like how Mary worked with other people to send a space mission to Mars.
- Display the [Three Cs of Collaboration Anchor Chart](#).
- Tell children that these three Cs are important for successful teams.
  - **Courage.** Sharing your thoughts and ideas (even if at first you may be afraid to).
  - **Communication.** Listening to each other and being respectful of other teammates' ideas
  - **Cooperation.** Working with everyone on the same goal, even if you might sometimes disagree.
- Ask children, *Can you think of a time when you were part of a team (e.g., sports team, dance team) and used one of these Three Cs? How did you show that C?*
- Explain to children it may be helpful for them to think about these Three Cs as they work with their team on their KIBO programs.

## **KIBO Time**

### **Structured Time**

- **Revisiting Our Plans** (*Suggested Time: 10 minutes*)
  - Tell children that today, they will be working on their secret space mission by programming KIBO.
  - Have children, in groups, return to their [Lesson 6 Design Journal](#). Ask children to think about the space exploration they want to show using KIBO. Ask children: *Are there any blocks you would add or change?*
  - Remind children that the Design Process is a cycle—we can always go back to our plans to test and improve our creations!

### **Expressive Explorations**

- **Designing Our Space Missions** (*Suggested Time: 15 minutes*)
  - In their working groups, children should create a program that shows their space mission!
  - This program should include at least seven blocks, including a begin and end block.
  - Go around and take pictures of each group's program.
    - By documenting children's programs, you will be able to assist children if they do not remember how to re-assemble their program for the next lesson.

**Closing Tech Circle**

- **How Do We Collaborate?** (*Suggested Time: 5 minutes*)
  - Have one child from each team share one thing that went well on their team. Encourage children to use the Three Cs they discussed earlier.
    - You can prompt children by asking questions such as, *Did you feel that you listened to each other's ideas? Did you feel that you could share your thoughts? If not, what could you and/or your team do in the future to help make this happen?*

## Lesson 8: Making Noise

|                                    |                                                                                                                                                                                      |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Representation, Hardware/Software, Algorithms                                                                                                                                        |
| Powerful Ideas of Literacy         | Tools of Communication and Language                                                                                                                                                  |
| PTD                                | Communication, Community Building                                                                                                                                                    |
| Palette of Virtues                 | Open-Mindedness, Generosity                                                                                                                                                          |
| Children will be able to...        | <ul style="list-style-type: none"> <li>Recognize and use the KIBO Beep Block and Sing Block</li> <li>Write a 5-6 block program including the Beep Block and/or Sing Block</li> </ul> |
| Vocabulary                         |                                                                                                                                                                                      |
| Materials                          | <input type="checkbox"/> Read lesson plan.<br><input type="checkbox"/> Prepare to display the <a href="#">Kindness Challenge Anchor Chart</a> .                                      |

### Warm Up

- **Charades** (*Suggested Time: 10 minutes*)
  - Play charades using *feelings* as prompts.
    - Children act out a feeling and other children guess what the child is trying to express (e.g., child has a frown, arms crossed, eyebrows flexed = mad/upset).
    - Give the child a message when it is their turn (e.g., “Show the class that you are happy with your body,” “Show the class that you are sad with your voice (but you can’t say ‘I’m sad,’” “Show the class you’re silly with your face.”)
    - Give each child a turn to be the expressive character!

### Opening Tech Circle

- **Tools of Communication** (*Suggested Time: 5 minutes*)
  - Discuss different ways we can communicate using the prompts below:
    - Are there other ways to express these feelings without just looking at someone's face? (e.g., body movement, words, noises, etc.)
    - How do you know what they’re expressing? (symbols, representation)

- Do their expressions always look the same as yours?
  - Discuss how people can also use tone or volume voice (not words, but the way your voice sounds)!

## **KIBO Time**

### **Structure Challenge**

- **Adding Noise** (*Suggested Time: 10 minutes*)
  - Is KIBO able to talk and express itself? Explain to children that it can't, but KIBO *can* make sounds if we program it to do that!
    - Ask when children have heard sounds from KIBO?
      - Discuss how KIBO makes different sounds when scanning is successful and unsuccessful to let you know if you need to rescan.
  - Introduce children to the orange Beep Block, and the orange Sing Block!
    - Ask children: *What do you notice about these blocks? How are these blocks different from the other blocks we have used? How are they the same?*
    - Scan the program “Begin, Beep, End” using KIBO to demonstrate what this block does. Then, scan the program “Begin, Sing, End” to show what that block does. The Beep Block plays a single “beep” noise while the Sing Block plays a short tune.
      - Ensure that children are listening carefully to hear the beep, and the tune.
    - Rescan the program, this time scanning the middle Beep Block multiple times (e.g., Begin, Beep, Beep, Beep, End). Do the same for the Sing Block.
      - Play the program and have children count out loud the number of times KIBO beeps, and then plays a tune.
      - Explain how the number of times that KIBO beeps, and plays a tune, is the same as the number of times you scanned the Beep Block, and the Sing Block.
  - Ask children to think of the programs they created in their groups that show a journey to space!
  - Ask children: *What are ways you could add the Beep Block and/or the Sing Block to your program? What types of noises or songs would you want your space mission to make?*

### **Expressive Exploration**

- **Free Play** (*Suggested Time: 10 minutes*)
  - Take out KIBOs and blocks and have children engage in free play.
  - During this time, walk around and make sure children can identify the beginning, middle, and end blocks in their KIBO programs.

- By the end of this activity, children should feel comfortable assembling a complete KIBO program with at least 5-6 blocks, including the Beep Block and/or the Sing Block.

**Lesson 8 Check for Understanding:** Check your children's understanding of the new concepts they've just learned. Read each question to the children. Have children hold up 1, 2, or 3 fingers (corresponding to the first, second, or third choice). Stop and re-explain concepts as needed.

### **Closing Tech Circle**

- **Kindness Challenge** (*Suggested Time: 10 minutes*)
  - Select one of the values that children shared in Lesson 6. Kindness is a good example.
  - Display the [Kindness Challenge Anchor Chart](#). (Feel free to adapt this chart based on the values your class identified)
  - Explain to children that they're going to be a part of a challenge this week: The Kindness Challenge! During the week, they will choose one kind thing to do from the chart. Read the options aloud together as a class. They can also think of another kind thing they would like to do.
  - In a circle, have each child share which kindness challenge they are most excited to take on!

## Lesson 9: Decorating Our Spacecrafts

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Design Process, Hardware/Software, Representation                                                                                                                                                                                                                                                                                                                                                                                           |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Writing Process                                                                                                                                                                                                                                                                                                                                                                                                                             |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Creativity, Content Creation, Collaboration                                                                                                                                                                                                                                                                                                                                                                                                 |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Open-Mindedness, Optimism, Generosity                                                                                                                                                                                                                                                                                                                                                                                                       |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>Decorate their robotic creations using arts and crafts materials</li> </ul>                                                                                                                                                                                                                                                                                                                          |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>De-classify: declare to be no longer a secret</li> </ul>                                                                                                                                                                                                                                                                                                                                             |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Get book <a href="#"><i>Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer</i></a>.</li> <li><input type="checkbox"/> Gather materials for KIBO decorating. Suggested materials include KIBO's dry erase boards, construction paper, scissors, tape, and paper or plastic plates.</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li><b>Read-Aloud</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>Re-read <a href="#"><i>Classified: The Secret Career of Mary Golda Ross, Cherokee Aerospace Engineer</i></a> as a class.</li> </ul> </li> </ul> <p><b>KIBO Time</b></p> <p><b>Structured Time</b></p> <ul style="list-style-type: none"> <li><b>Craft Time</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>Tell children that today they will decorate their KIBOs!                 <ul style="list-style-type: none"> <li>Children will use a variety of arts and crafts materials to design structures that will sit on top of their KIBO robots. This means materials need to be attached carefully and cannot be all on one side. Otherwise, the decorations will fall off the robot!</li> </ul> </li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                             |

- Remind children about their sturdy tower challenge in Lesson 5 or about other building experiences and what they learned about making sturdy structures.

***Expressive Explorations:***

- **Decorating Our Spacecrafts** (*Suggested Time: 15 minutes*)
  - Allow children as much creativity as possible in decorating their KIBOs—anything is encouraged as long as every child gets a chance to decorate!
  - There are different ways to decorate with KIBO! Children can decorate using construction paper, scissors, and tape and secure the decorations to the art platforms. Another option is to provide paper or plastic plates that children decorate, and then children can use masking tape to secure the plates onto the art platforms.
  - As children work on their final projects, go around and take pictures of children's KIBO programs and decorated KIBOs.
    - Make sure to leave yourself enough time to do this step!
    - This is also a great opportunity to share children's work with families.

**Closing Tech Circle**

- **Compliment Circle** (*Suggested Time: 10 minutes*)
  - Each group should share their program with the class, telling the class what their mission is and the name of their mission.
  - Explain to children that now they are revealing what their missions are, their missions are **declassified**—they are no longer a secret.
  - After each group shares, one person from the next group will tell the previous group one thing they liked about their program.

## Lesson 10: Find That Bug

|                                    |                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Design Process, Debugging                                                                                                                                                                                                                                                                                                                                                      |
| Powerful Ideas of Literacy         | Writing Process, Editing and Audience Awareness                                                                                                                                                                                                                                                                                                                                |
| PTD                                | Communication, Community Building                                                                                                                                                                                                                                                                                                                                              |
| Palette of Virtues                 | Perseverance, Forgiveness, Patience                                                                                                                                                                                                                                                                                                                                            |
| Children will be able to...        | <ul style="list-style-type: none"> <li>• Define and celebrate the process of debugging</li> <li>• Identify strategies for debugging and editing</li> <li>• Locate errors or “bugs” in KIBO programs</li> </ul>                                                                                                                                                                 |
| Vocabulary                         | <ul style="list-style-type: none"> <li>• Bug: a problem in a computer program</li> <li>• Debugging: to find problems in a computer program and to try to solve the problem in different ways</li> </ul>                                                                                                                                                                        |
| Teacher Preparation                | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan</li> <li><input type="checkbox"/> Prepare to display the <a href="#">Design Process Anchor Chart</a></li> <li><input type="checkbox"/> Recreate <a href="#">Buggy Programs</a></li> <li><input type="checkbox"/> Prepare to display the <a href="#">Strategy List Anchor Chart</a></li> </ul> |

### Warm Up

- **Follow My Lead!** (*Suggested Time: 5 minutes*)
  - Explain to children that you’re going to play a game where you’re going to say one thing, but they have to do something else (e.g., Do something physical, like touching your toes, while saying “touch your ears!” Children will need to touch their ears, not their toes, as that is what you said, not what you did).
  - Try a practice run with children.
    - For example, say “Jump up and down!” while you touch your nose. Here, children will have to jump up and down because that is what you said, not what you did. Or, say “give yourself a hug!” while you touch your head.
  - Do a few more rounds with children. Then, ask children what happened when they didn’t follow the instructions you were giving.
  - Explain to children that thinking about mistakes we may have made is a process programmers also use when they try to find errors in their programs.



- Tell children that it's okay to make mistakes; everyone makes them! That's why "test and improve" are all part of the Design Process. We can always come back to our programs, or our creations, and learn how to improve them! Feel free to display the [Design Process Anchor Chart](#).

### Opening Tech Circle

- **Let's Debug!** (*Suggested Time: 5 minutes*)
  - **Debugging** is a word used in computer science to describe when people find errors in their computer programs and use different strategies to solve the problem.
  - The word "debugging" comes from a computer scientist named Grace Hopper. Back in the 1940s, she found a moth stuck inside the computer (computers used to be that big!), which caused an error in the system. She was able to fix the error by taking out the bug, hence the word "debugging"!
  - Programmers go through the process of debugging to find and fix problems in computer programs.
  - As a class, create a list of strategies for finding bugs in programs using the [Strategy List Anchor Chart](#). Return back to the list to add more strategies when needed.

### KIBO Time

#### Structure Challenge

- **Where's the Bug?** (*Suggested Time: 15 minutes*)
  - Recreate some [Buggy Programs](#) and explain to children what your plan was (e.g., what you want it to do). Then show the children the program and point out a few things that aren't working like you wanted them to (e.g., I wanted KIBO to spin twice, but it is turning twice, so only half way around; I want KIBO to move but it won't go). Have children take turns raising their hand and debugging things in your program.
  - Explain to children that now they have seen some examples of buggy programs, they will create their own buggy program!
  - Give them time to make their own KIBO program with at least one error, or "bug," in it.

### Closing Tech Circle

- **Solving Bugs** (*Suggested Time: 10 minutes*)
  - Have each child show their program to the class and let other children help solve the bug for every program.
  - Add strategies that children come up with to the [Strategy List Anchor Chart](#).
  - Once every child has shared, come up with a celebratory cheer or special high-five whenever a child solves a problem they have been facing. Explain to children that debugging is a process. They may not find a solution the first time

around, but by continuing to try again, checking for hardware/software issues, and asking peers for help, they can work together to solve problems!

## Lesson 11: Lights On!

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Hardware/Software, Representation                                                                                                          |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Tools of Communication and Language                                                                                                        |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Communication                                                                                                                              |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Curiosity                                                                                                                                  |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Use the Lightbulb and Light Block with KIBO</li> </ul>                                            |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                            |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <input type="checkbox"/> Read lesson plan.<br><input type="checkbox"/> Prepare to display the <a href="#">Sources of Light slidedeck</a> . |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>Where Do We Find Light?</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>○ Display images from the <a href="#">Sources of Light slidedeck</a>.</li> <li>○ For the object circled in red for each slide/image, ask children, <i>Is this something that light comes from? Is this a source of light?</i></li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> <ul style="list-style-type: none"> <li>• <b>Light Around Us</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ After going through the slidedeck, ask children <i>What are other sources of light you come across in day-to-day life? What are some differences between where light comes from during the day, versus where it comes from at night?</i></li> <li>○ Tell children that KIBO, too, can be a source of light, if we program it to be. Today, we're going to learn how to use a new KIBO part to shine light!</li> </ul> </li> </ul> <p><b>KIBO Time</b></p> <p><b>Structure Challenge</b></p> <ul style="list-style-type: none"> <li>• <b>KIBO's Light</b> (<i>Suggested Time: 10 minutes</i>)</li> </ul> |                                                                                                                                            |

- Regather children's attention to introduce children to a new KIBO part: the lightbulb!
  - Ask children what they think the lightbulb does?
  - Ask children where they think the lightbulb goes on KIBO?
- Explain to children that the lightbulb needs its own special blocks.
  - Have children guess which blocks KIBO would need to make the lightbulb turn white, blue, or red!
- Point out that all the light blocks are yellow, just like all the movement blocks are blue.
  - Although KIBO does not know the difference between the block colors, we know that the KIBO block colors are important.

### ***Expressive Exploration***

- **Free Play** (*Suggested Time: 10 minutes*)
  - In groups, children will take time to explore the Lightbulb module freely. Remember to use the "Scanner" job cards and switch them often, so that all children continue practicing how to scan the blocks.
  - By the end of this activity, children should feel comfortable assembling a complete KIBO program with at least 6-7 blocks, including a Light Block and the Lightbulb.

### **Closing Tech Circle**

- **Sharing Creations** (*Suggested Time: 10 minutes*)
  - Children share their programs from the free play time. Prompt children to talk about how they used the new Light blocks and Light module during the free play.

## Lesson 12: What's That Sound?

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Control Structures, Hardware/Software, Representation, Debugging                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Powerful Ideas of Literacy         | Literary Devices                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| PTD                                | Communication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Palette of Virtues                 | Curiosity, Perseverance, Optimism                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Children will be able to...        | <ul style="list-style-type: none"> <li>• Distinguish between human senses and robot sensors</li> <li>• Use the KIBO Sound Sensor with its appropriate Wait for Clap block</li> <li>• Understand the difference between sound input and sound output</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Vocabulary                         | <ul style="list-style-type: none"> <li>• Senses: the way humans and animals take in information about the surrounding environment. Humans have five senses: touch, taste, smell, sight, and hearing</li> <li>• Sensor: a special part that helps machines take in information about the surrounding environment; there are sensors that are very much like human senses</li> <li>• Circle: a round, closed shape with no edges</li> <li>• Record: to make something (like a sound) permanent so that it can be played back at a later time</li> <li>• Sound: a type of energy made by vibrations in the air that we can hear</li> <li>• Square: a closed shape with four equal sides</li> <li>• Triangle: a closed shape with three sides</li> <li>• Input: information that a computer receives</li> <li>• Output: information that a computer sends out</li> </ul> |
| Teacher Preparation                | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Open or prepare the <a href="#">Listening Game slidedeck</a>.</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about the KIBO's sensor modules.</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about the Wait for Clap Block and the Sound Sensor.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                          |

### Warm Up

- **What Do We Hear?** (*Suggested Time: 5 minutes*)
  - Play the following sounds from the [Listening Game slidedeck](#) and have children guess the sounds!
  - Engage children in a conversation around which sounds were harder or easier to guess than others.

### Opening Tech Circle

- **Human Senses and Robot Sensors** (*Suggested Time: 5 minutes*)
  - Explain to children that we use our ears to hear **sounds** around us. Just as humans have different **senses** to take in information from our environment (e.g., we can see friends in the classroom, taste ice cream, smell cookies, hear a fire truck, and touch a dog or cat), robots have sensors to do the same.
  - A **sensor** is an added part of a robot that allows the robot to take in information from its environment.
  - Tell children that today, they will learn about the **sound sensor**.

### KIBO Time

#### Structure Challenge

- **Introducing Sound Sensor and Wait for Clap** (*Suggested Time: 10 minutes*)
  - Take out KIBOs and blocks. Show the Wait for Clap Block and the Sound sensor and create an example program together. Run the program, and have children discuss what the robot is doing. When KIBO gets to the instruction “Wait for Clap,” KIBO listens for a sound (using its Sound Sensor!) before it goes to the next block instruction.
  - Tell children that the clap is the sound **input**; KIBO needs to hear the clap using the Sound Sensor before going to the next block.
  - Remember, KIBO follows its instructions in order, so pay close attention to where the Wait for Clap Block is placed in the program. As you demonstrate using the Sound Sensor, ask children to follow along with the blocks so they know when to clap!

## What is the Sound Sensor?

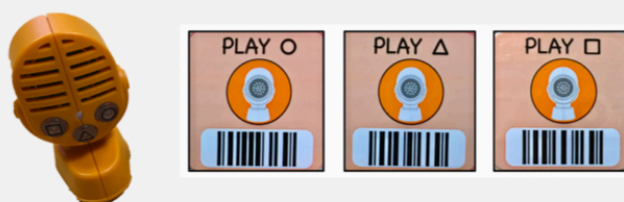
KIBO's **Sound Sensor** is shaped like an ear and senses sounds from the environment. It is programmed using the Wait for Clap block. In the example program, KIBO will turn right, wait for a loud sound (like a clap) before it spins and ends.



- **Introducing the Sound Recorder** (*Suggested Time: 10 minutes*)
  - Then, show children the KIBO Sound Recorder module. Demonstrate with a model program how they can make three different **recordings** by pressing and holding down on the three shape buttons on the module: the **circle**, **square**, and **triangle**. Note that the Sound Recorder must be connected to power by inserting the module into the KIBO body before recording. Additionally, when a sound is being recorded, the Sound Recorder module's light turns blue.
  - Explain to children that the sounds KIBO makes using the Sound Recorder are sound **outputs**.

## What is the Sound Recorder?

KIBO's sound recorder/playback module has three different buttons – square, triangle, and circle—that allows students to record three different short sound clips. Remember to match the shape of the block to the recorded sound!



### Expressive Exploration

#### Free Play (*Suggested Time: 10 minutes*)

- In groups, children should take this time to explore the Sound Sensor and Sound Recorder modules freely. By the end of this free play, children should understand

that when KIBO reads the Wait for Clap block, it knows to only keep going when it hears the noise.

- Children should also understand how KIBO's Sound Sensor is similar to humans' ears and also how they are different. Ask children: *Can KIBO only listen for a clap?* Encourage children to try other noises, like stomping or ringing a bell, to trigger the Sound Sensor!
- Additionally, children should understand the difference between sound input (i.e., KIBO needs to hear the clap using the Sound Sensor before proceeding) and sound output (i.e., children record the specific sounds that they want KIBO to play using the Sound Recorder).

### **Closing Tech Circle**

- **Roses and Buds** (*Suggested Time: 5 minutes*)
  - Each child shares one “rose” (thing that they learned) and one “bud” (thing they want to know more about and are excited about learning).



## Lesson 13: Repeat After Me

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Algorithms, Control Structures, Modularity                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sequencing, Literary Devices                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Content Creation                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Curiosity, Open mindedness                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Identify an AAAA pattern in a KIBO program</li> <li>• Identify an ABAB pattern in a KIBO program</li> <li>• Use the Repeat and End Repeat Blocks in KIBO to create a program with an ABAB repeating pattern.</li> <li>• Recognize that one program output can be represented using multiple approaches</li> </ul>                                                                                                               |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Loop: the action of doing something over and over again</li> <li>• Repeat: to do something again</li> <li>• Pattern: something that happens in a repeated way</li> </ul>                                                                                                                                                                                                                                                        |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about repeat loops and number parameters.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 13 Design Journal</a> for children, or print <a href="#">Full Design Journals</a> for each child.</li> <li><input type="checkbox"/> Print out <a href="#">KIBO Blocks</a>.</li> </ul> |
| <b>Warm Up</b> <ul style="list-style-type: none"> <li>• <b>Five Little Monkeys</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Sing and dance to the song “Five Little Monkeys” as a class. Have the children jump up and down as you sing “little monkeys jumping on the bed”!</li> </ul> </li> </ul> <p style="text-align: center;"> <i>Five little monkeys jumping on the bed,<br/>             One fell down and bumped their head,<br/>             Mama called the doctor and the doctor said,<br/>             No more monkeys jumping on the bed!</i> </p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

*Four little monkeys jumping on the bed,  
One fell down and bumped their head,  
Mama called the doctor and the doctor said,  
No more monkeys jumping on the bed!  
Three little monkeys jumping on the bed,  
One fell down and bumped their head,  
Mama called the doctor and the doctor said,  
No more monkeys jumping on the bed!*

- After singing three verses of the song, discuss with the class the repetitions they observed in the song.
  - What lines did we **repeat** several times?
  - Ask the children to imagine they're teaching their friend the words to the song. Is there an easier way to tell them all the words without repeating the same words so many times? Tell the children that there is! You can tell your friend to say "*One fell down and bumped their head, Mama called the doctor and the doctor said, No more monkeys jumping on the bed!*" three times!

### Opening Tech Circle

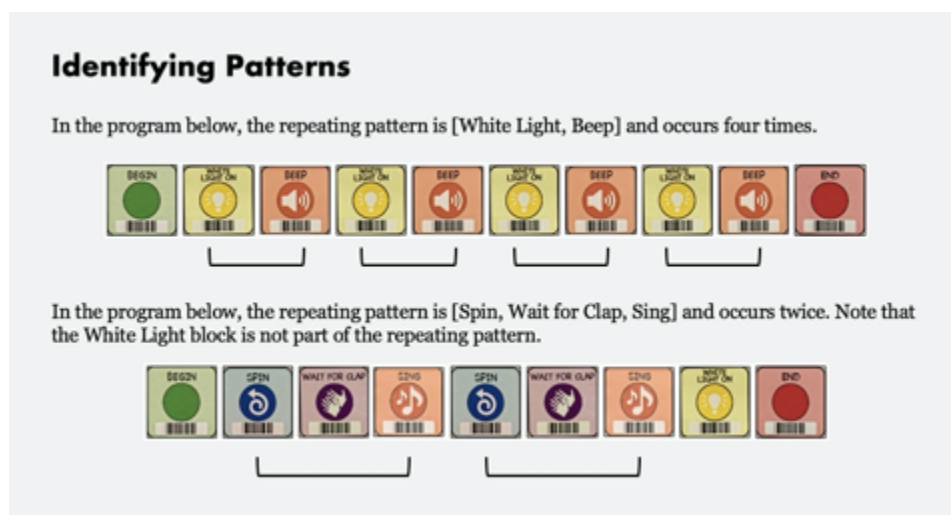
- **Creating Patterns** (*Suggested Time: 10 minutes*)
  - Explain to children that now they're going to work on creating patterns. A **pattern** is something that happens or appears in a regular, or repeated way. For example, when we sang, *Five Little Monkeys*, we repeated, "*One fell down and bumped their head, Mama called the doctor and the doctor said, No more monkeys jumping on the bed!*" three times.
  - Now, let's look at other ways that things repeat.
  - Have children open their [Lesson 13 Design Journal](#). Explain that children should see an image of a cat and a dog. Tell children to write a name for the cat, and a name for the dog. Then, have them write the names of cat and dog under the images for Questions 1, 2, 3, and 4.
    - If a child names the cat Sarah, and the dog Tom, for instance, the answers to the questions would look like the following:
      - Question 1: Sarah, Sarah, Sarah, Sarah
      - Question 2: Tom, Tom, Tom
      - Question 3: Sarah, Tom, Sarah, Tom
      - Question 4: Sarah, Tom, Sarah, Tom, Sarah, Tom
  - When children are finished, ask them, *For the first question, how many times do you see cat? For question #2, how many times do you see dog?*
  - Tell children that we have identified some repeating patterns using cat and dog! Now, we will create patterns using KIBO!

### KIBO Time

#### Structure Challenge

- **Repeating Patterns** (*Suggested Time: 15 minutes*)

- Choose an example of a repeating word or action from the song you read aloud. Then, ask children: *What would repeating look like in a KIBO program? Can we make patterns with the KIBO blocks?*
- Using the printed [KIBO Blocks](#) or the physical KIBO blocks, create a repeating pattern such as: Begin, White Light On, Beep, White Light On, Beep, End.
- Have children engage actively by guessing the repeating pattern. Ask children: *What is repeating in this program? How many times does it repeat?* These two questions are the most important questions we need to answer before introducing the KIBO Repeat Blocks. As a class, come up with several other examples of KIBO programs that have repeating patterns.
- Ask children: *What if instead of two White Light On and Beep Blocks, we wanted to have 100 White Light On and Beep Blocks? What issues might they come across? Is there an easier way to let KIBO know to repeat something?*
- Explain to children that we can use a repeat **loop** to make it easier to scan a KIBO program that has a repeating pattern. Introduce the Repeat and End Repeat Blocks with the number parameters: 2, 3, 4, forever.
- Together with the children, create a sample program with the printed [KIBO Blocks](#) or the physical KIBO blocks that utilizes multiple repeating blocks, such as the pattern below.



- Ask children: *What is repeating in this program? How many times does it repeat? What is the difference between this repeating pattern and the repeating patterns we talked about earlier?*
- Explain that if we want to use a repeat loop to show a pattern with multiple blocks, we have to make the inside of the loop bigger. Emphasize that everything in the repeat loop is repeated, and everything outside the repeat loop is not.
- Remind children how the Begin and End blocks are similar to the front and back covers of a book. Explain that the Repeat and End Repeat are similar and tell stories within the program. Just like with the Begin and End blocks, or like the

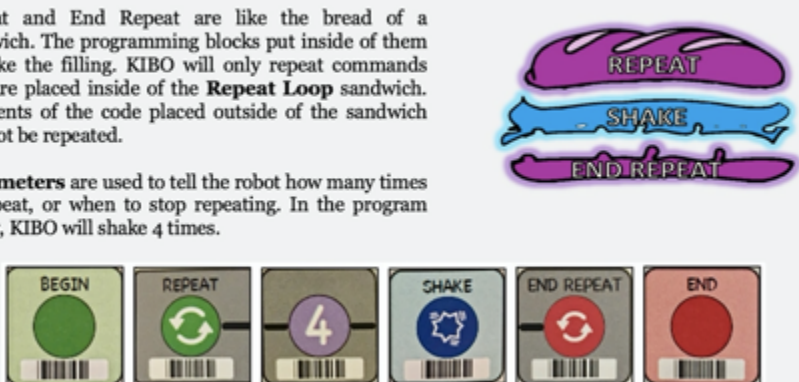
front and back covers of a book, you need both a Repeat and End repeat block in a Repeat loop. Everything within the repeat loop will be repeated.

- You can also think of Repeat and End Repeat like the bread of a sandwich. The programming blocks inside them are the filling.

**What is a Repeat Loop?**

Repeat and End Repeat are like the bread of a sandwich. The programming blocks put inside of them are like the filling. KIBO will only repeat commands that are placed inside of the **Repeat Loop** sandwich. Segments of the code placed outside of the sandwich will not be repeated.

**Parameters** are used to tell the robot how many times to repeat, or when to stop repeating. In the program below, KIBO will shake 4 times.



The diagram illustrates the concept of a Repeat Loop using a sandwich analogy. A 'Repeat' block (purple) and an 'End Repeat' block (purple) form the bread, while a 'Shake' block (blue) is the filling. Below this, a sequence of KIBO blocks is shown: a green 'BEGIN' block, a grey 'REPEAT' block with a circular arrow icon, a purple block with the number '4', a blue 'SHAKE' block with a gear icon, a grey 'END REPEAT' block with a circular arrow icon, and a red 'END' block.

### *Expressive Explorations:*

- **Repeating Free Play** (*Suggested Time: 10 minutes*)
  - Have children get into their KIBO groups and practice creating KIBO programs with different kinds of repeating patterns.
  - If you observe that groups are comfortable creating KIBO programs with ABAB repeating patterns, then encourage them to make the same program using the Repeat and End Repeat Blocks and different number parameters.

**Lesson 13 Check for Understanding:** Check your children's understanding of the new concepts they've just learned. Read each question to the children. Have children hold up 1, 2, or 3 fingers (corresponding to the first, second, or third choice). Stop and re-explain concepts as needed.

### **Closing Tech Circle**

- **Sharing Our Learning** (*Suggested Time: 5 minutes*)
  - In a circle, have each child share one interesting or surprising thing they learned as they made their Repeat Block programs.
  - Children are also welcome to share a challenge they encountered. Other children are encouraged to brainstorm possible solutions.



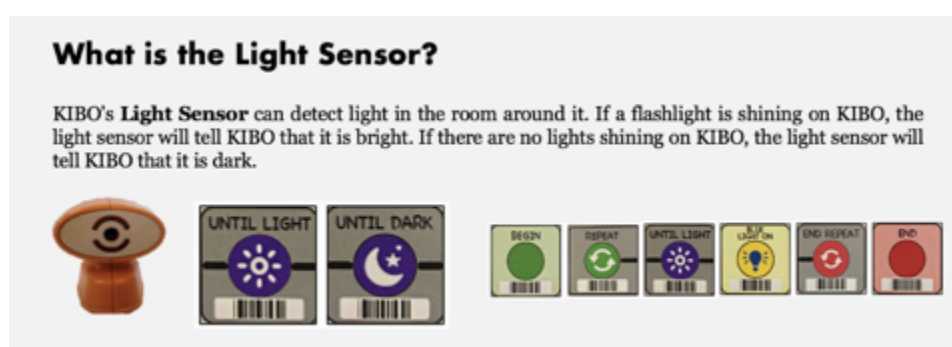
## Lesson 14: Shine a Light

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Control Structures, Representation, Algorithms, Hardware/Software                                                                                                                                                                                                                                                                                                                                                                                             |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Literary Devices, Tools of Communication and Language                                                                                                                                                                                                                                                                                                                                                                                                         |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Collaboration, Communication                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Open-Mindedness, Curiosity                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Compare and contrast human senses and robot sensors</li> <li>• Successfully test a KIBO program using the Light sensor</li> </ul>                                                                                                                                                                                                                                                                                    |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Prepare to display the <a href="#">Different Lighting slidedeck</a>.</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about how to use the light sensor with repeat parameters.</li> <li><input type="checkbox"/> Flashlight for each group of children (ideally three per group).</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>Different Lighting</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>○ Share images from the <a href="#">Different Lighting slidedeck</a>.</li> <li>○ Ask children, <i>How did the objects in the pictures where it's light look different or the same as the objects in pictures where it's darker?</i></li> <li>○ Explain to children that when light shines on objects, it helps us see things.</li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> <ul style="list-style-type: none"> <li>• <b>Sensing Light</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Remind children that just as humans have different senses to take in information from our environment, robots have sensors to do the same, like the Sound Sensor.</li> <li>○ Today, they will learn how KIBO is able to “see” light and dark using a new KIBO part: the Light sensor!</li> <li>○ Explain that KIBO needs special programming instructions to tell KIBO what to do with the information from its Light sensor.</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## KIBO Time

### Structure Challenge

- **The Light Sensor** (*Suggested Time: 15 minutes*)
  - Show children the Light Sensor module. Then Show the Repeat and End Repeat blocks, which are now familiar, and the new Until Light/Until Dark parameter cards.
  - Create two example programs together, one which uses the Until Light parameter and the other with the Until Dark parameter. Run the programs, and have children discuss what the robot is doing in each scenario.



### Expressive Explorations

- **Free Play** (*Suggested Time: 10 minutes*)
  - In groups, children will create programs using the Light sensor. Free play with the sensor will allow children to tinker and explore the sensitivity of the sensor. Children can shine a flashlight to trigger the Light sensor.
  - Emphasize that the Repeat blocks with sensor parameters (e.g., Until Dark, Until Light) mean that KIBO will continue to perform the actions inside of the Repeat loop until the environment changes to the specific parameter.

## Closing Tech Circle

- **Sharing Our Programs** (*Suggested Time: 5 minutes*)
  - Have each group share the program they created during Free play.
  - Encourage children to discuss their program by asking prompts such as:
    - What is your favorite part of your program? Why?
    - Is there anything you would add to/change in your program?
  - After presentations, peers can ask questions about others' projects or provide compliments.

## Lesson 15: Silly Challenge!

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Control Structures, Hardware/Software, Algorithms, Design Process, Debugging, Representation                                                                                                                                                                                                                                                                                                                            |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Literary Devices, Writing Process, Sequencing                                                                                                                                                                                                                                                                                                                                                                           |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Collaboration, Communication                                                                                                                                                                                                                                                                                                                                                                                            |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Curiosity, Open-Mindedness                                                                                                                                                                                                                                                                                                                                                                                              |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>• Successfully test a KIBO program using the Distance sensor</li> <li>• Program KIBO to be part of a “silly challenge.”</li> </ul>                                                                                                                                                                                                                                               |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about how to use the distance sensor with repeat parameters.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 15 Design Journal</a> for each group or have children’s <a href="#">Full Design Journals</a> on hand.</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>Values Challenge Check-In</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Return to the Kindness Challenge you discussed in Lesson 8.</li> <li>○ If children are comfortable, have them share one kind act they did as part of the challenge. Facilitate a discussion with prompts such as: <i>When you did your kind act, how do you think it made others feel? How did you feel? What other kind acts can you think of? Why is being kind important?</i></li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> <ul style="list-style-type: none"> <li>• <b>Silly Challenge Brainstorm</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>○ Tell children that over the next few lessons, we are going to have a silly challenge, where each group will program their KIBO to do something silly that involves movement! That means they will 1) program their KIBO to move, and 2) need to start their program with a “Wait for Clap,” so all KIBOs will start the challenge at the same time!</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                         |



- Split the class up into groups and give each group two pieces of paper. Have each child work in groups to write down one or two silly things they think it would be fun for KIBO to do. Also remind children that just as they decorated their KIBO for their space exploration, they can create decorations for this activity.
  - Some prompt examples might be, “I want my KIBO to go the furthest,” “I want my KIBO to have the most feathers!,” “I want to decorate my KIBO with the most colors!” or “I want my KIBO to make the most turns!”
- Briefly review the prompts that children have added and remove any prompts that do not make sense given the programming blocks (e.g., since there is no “Speed” Block, children cannot indicate they want their KIBO to “move the fastest”). Additionally, remove any prompts that overlap. Ensure that there are enough prompts for each group in the class (each group will select one prompt).
- Take each prompt/challenge and scramble them in a pillowcase, hat, or box. Have each group select one challenge, but tell children that they should keep their challenge a secret. Like some of Mary’s missions to space, their challenge will be classified.
- Then, during the challenge, other groups will have to guess what their challenge was!

### Word Time

- **Making a Plan** (*Suggested Time: 10 minutes*)
  - In their groups, children should use their [Lesson 15 Design Journal](#) to plan how they want KIBO to move during the challenge.
  - Explain to children that they should program their KIBOs to move in any way but include the program instructions that have KIBO wait to hear a clap before it starts moving. Children can choose as few or as many blocks as they would like to put after the “Wait for Clap” block.

### KIBO Time

#### Structure Challenge:

- **The Distance Sensor** (*Suggested Time: 10 minutes*)
  - Introduce the Distance sensor. Create two example programs together, one which uses the Until Near parameter and the other which uses the Until Far parameter. Run the programs, and have children discuss what the robot is doing.
  - Similarly, using the Until Dark and Until Light parameters, create two example programs together, one which uses the Until Light parameter and the other with the Until Dark parameter. Run the programs, and have children discuss what the robot is doing in each scenario.

### What is the Distance Sensor?

KIBO uses the **Distance Sensor** to see how near or far KIBO is from other objects. With Distance Parameters, the Distance Sensor can be used with Repeat Loops to control how KIBO moves.



### Expressive Explorations:

- **Free Play** (*Suggested Time: 10 minutes*)
  - In groups, children will create programs using the Distance sensor, just as they had in a prior lesson with the Light sensor. Free play with the sensor will allow children to tinker and explore the sensitivity of the sensor. Children can place objects in front of the robot, triggering the Distance sensor.

### Closing Tech Circle

- **Star and a Wish** (*Suggested Time: 5 minutes*)
  - Invite children to gather around in a community circle.
  - Going around the circle, each child shares one thing that they like about their program (*Star*). After the last child shares their star, the class goes around the circle in the reverse order (e.g., the last child speaks first, the next-to-last child speaks second, etc.) saying one thing they are looking forward to adding to or changing about their program (*Wish*).

## Lesson 16: What If?

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Control Structures, Representation, Algorithms, Hardware/Software, Design Process, Debugging                                                                                                                                                                                                                                                                                                                                                                                          |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Literary Devices, Sequencing, Editing and Audience Awareness                                                                                                                                                                                                                                                                                                                                                                                                                          |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Content Creation, Collaboration, Community Building                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Generosity, Perseverance                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Identify conditional situations in everyday life</li> <li>• Identify situations that would require an If statement or a Repeat loop</li> <li>• Successfully test a conditional KIBO program using the Distance and Light sensors</li> </ul>                                                                                                                                                                                                  |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Conditional: events that only happen during certain conditions or situations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Get the book <a href="#">What If Everybody Did That?</a></li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about If and End If statements.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 15 Design Journal</a> for each group or have children's <a href="#">Full Design Journals</a> on hand.</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>What If Everybody Did That?</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>○ Read the book <a href="#">What If Everybody Did That?</a> as a class. As you read, pause after each scenario, and ask children “<i>then</i> what would happen?”                 <ul style="list-style-type: none"> <li>■ For example, in the first scenario, at the zoo, where the character is feeding bears human food, <i>then</i> the bears might get unhealthy and sick.</li> <li>■ In the second scenario, at the supermarket, where the character is trying to see how fast his grocery cart will go, <i>then</i> food would be flying around the store and people would get hurt.</li> </ul> </li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> <ul style="list-style-type: none"> <li>• <b>Intro to Conditionals</b> (<i>Suggested Time: 10 minutes</i>)</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

- Reflect on *What If Everybody Did That?* If the character in the story did something that wasn't very thoughtful, like throwing trash out the window, or interrupting during storytime, *then* their actions would affect others.
- This is called a **conditional**.
- Conditionals are events that only happen during certain conditions or situations.

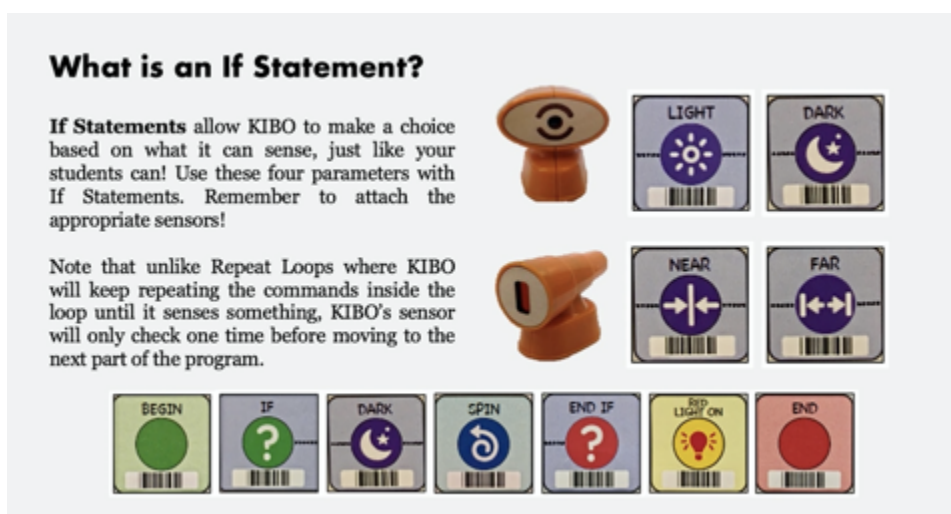
Discuss the following examples:

- What do you check for before you put on a jacket? (If it is cold or raining)
- What has to happen before you speak in class? (The teacher calls on you)
- What has to happen before you eat? (Wash your hands)
- What do you check before the car can go? (The light is green)

## KIBO Time

### Structure Challenge

- **If and End If** (*Suggested Time: 15 minutes*)
  - Introduce to children the If and End If Blocks. Explain to children that If statements allow KIBO to make a choice based on what it can sense (e.g., light, dark, near, far).
  - Similar to Repeat and End Repeat Blocks, If and End If Blocks are like the front and back covers of a book. Or the bread of a sandwich. KIBO will only follow instructions that are inside the sandwich AND if KIBO, for example, detects it is light in a room, or if it is near another object.



### Expressive Explorations

- **Creating the Program** (*Suggested Time: 10 minutes*)
  - Allow children time to explore the If and End If Blocks using the Distant and Light sensors.

- Additionally, based on their [Lesson 15 Design Journal](#), have children work in groups to plan out their *Silly Challenge* KIBO program.
- Go around and take pictures of each group's program. By documenting children's programs, you will be able to assist children if they do not remember how to re-assemble their program for the final showcase. Make sure to leave yourself enough time to do this step, as it can save lots of time and effort in the later lessons!

### **Closing Tech Circle**

- **What If?** (*Suggested Time: 10 minutes*)
  - Explain to children that in the book *What If Everybody Did That?*, the main character thinks about some of his choices (like feeding bears human food!) so that he can make better ones in the future, like giving his mom a hug at the end of the story!
  - Prompt children: *Let's go back to some of the values we talked about in our earlier lessons. What if everybody (insert value here, such as acted kindly)? What do you think the world might look like?* Have each child share their thoughts.

## Lesson 17: Over and Over

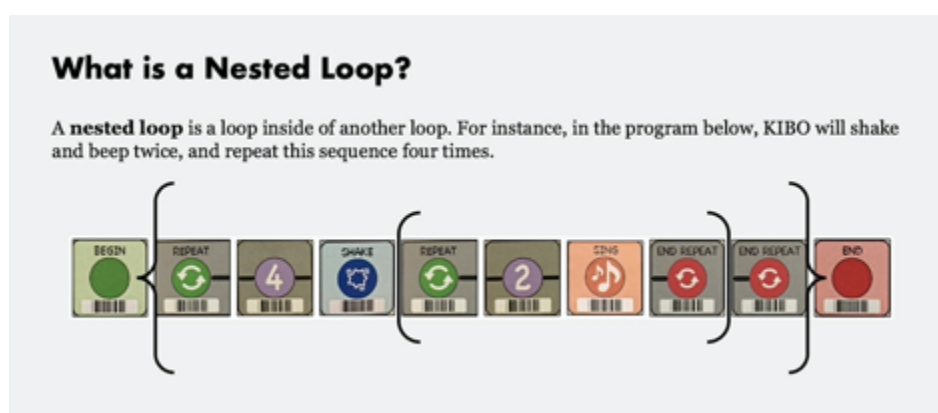
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| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Control Structures, Algorithms, Modularity                                                                                                                                                                                                                                                                                           |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Literary Devices                                                                                                                                                                                                                                                                                                                     |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Content Creation, Choices of Conduct                                                                                                                                                                                                                                                                                                 |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Curiosity, Perseverance                                                                                                                                                                                                                                                                                                              |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>• Identify complex repeating patterns</li> <li>• Create nested loops and statements using the KIBO programming blocks</li> </ul>                                                                                                                                                              |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Loop: something that repeats</li> <li>• Nested loop: a repeating program inside of a repeating program</li> <li>• Nested statement: a statement inside of another statement</li> </ul>                                                                                                      |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Refer to the following <a href="#">video</a> to learn more about how to nest an If statement in a repeat loop.</li> <li><input type="checkbox"/> Get book <a href="#">Hand, Hand, Fingers, Thumb</a>.</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>Hand, Hand, Fingers, Thumb</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>○ Read the book <a href="#">Hand, Hand, Fingers, Thumb</a> as a class.</li> <li>○ Re-read the book, this time asking children to raise their hand (or make another movement) every time they hear repetition. Pause reading, and write the repeated word or phrase on the board.</li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> <ul style="list-style-type: none"> <li>• <b>Different Repetition</b> (<i>Suggested Time: 10 minutes</i>)             <ul style="list-style-type: none"> <li>○ Lead a child-centered discussion about the different kinds of repetition in the book.</li> <li>○ Explain to children how some of the words repeated within a single page, whereas others were repeated across pages. This is an example of how writers use repetition in different ways. Make the connection that KIBO can also use</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                      |

repetition in different ways. KIBO can have repeats within other repeats, ifs within other ifs - these are called **nested loops** and **nested statements**.

## KIBO Time

### Structure Challenge:

- **Nested Loops and Statements** (*Suggested Time: 15 minutes*)
  - **Nested loops** are a way to make even more efficient programs, where parts of instructions are repeated a different number of times.
  - Show an example of a nested loop to children (See an example below). *Ask children: Which blocks are in the **inner** loop? How many times does it repeat? Which blocks are in the **outer** loop? How many times does it repeat?*



- Just like there can be a repeat inside of another repeat, **nested statements** are created using any kind of statement (if or repeat) inside of another statement (if or repeat). Before showing the example of a nested statement with KIBO, have children imagine how an automatic faucet works. Ask children: What happens when you put your hand close to the sensor? Does this happen every time you make that movement? Walk through the scenario with children: Every time (repeat forever) you move your hands close to the sensor (if), the water runs (end if) (end repeat).
- Demonstrate another example with a stoplight. Ask children: What do you do if the light turns green? If the light turns yellow? If the light turns red? Explain to children how they could use multiple if statements to demonstrate how a driver would make a decision depending on the color of the stoplight.

## What is a Nested Statement?

A **nested statement** is any statement inside of another statement. This could mean a repeat loop inside of an if statement, an if statement inside of a repeat loop, an if statement inside another if statement, etc. You can have as many nested statements in a program as you'd like, but make sure that each statement has its appropriate start and end block! For example, when the program below is running, KIBO will shake every time it senses that it is near something.



### Expressive Explorations:

- **Free Play** (*Suggested Time: 10 minutes*)
  - Children can freely explore and create KIBO programs using nested loops and/or statements.
  - If children are having difficulty with nested loops, encourage them to create nested repeat programs consisting of both a Repeat Loop and a Repeat Forever Block.

**Lesson 17 Check for Understanding:** Check your children's understanding of the new concepts they've just learned. Read each question to the children. Have children hold up 1, 2, or 3 fingers (corresponding to the first, second, or third choice). Stop and re-explain concepts as needed.

### Closing Tech Circle

- **Small-group Share** (*Suggested Time: 10 minutes*)
  - Children share their programs in small groups.
  - Review sharing procedures.
    - E.g., listening while others are presenting, asking questions about others' projects, or providing compliments to peers.



## Lesson 18: Ready, Set, Go!

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Control Structures, Representation, Algorithms, Hardware/Software, Design Process, Debugging                                                                                                                                   |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Literary Devices                                                                                                                                                                                                               |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Creativity, Community Building, Collaboration                                                                                                                                                                                  |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Curiosity, Optimism                                                                                                                                                                                                            |
| Children will be able to...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Revise and finish a “silly challenge” program</li> <li>• Decorate their robotic creations using arts and crafts materials</li> </ul>                                                  |
| Vocabulary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                |
| Teacher Preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <input type="checkbox"/> Read lesson plan.<br><input type="checkbox"/> Gather KIBO Project documentation photos from lesson 16.<br><input type="checkbox"/> Open or prepare the <a href="#">Freeze Dance Music slidedeck</a> . |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>Silly Time!</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Using <a href="#">Freeze Dance Music</a> or your preferred classroom music, play Freeze Dance. Freeze Dance is a great game to get children moving and engage their creativity.</li> <li>○ When music plays, children dance and when the music <i>pauses</i>, they must freeze, and do something silly! As the teacher, control the music and press pause periodically to make children freeze. Remember to reinforce class norms around safety and being cautious with bodies.</li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> <ul style="list-style-type: none"> <li>• <b>Adding to Our Programs</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Explain to children that today they will finish working on their <i>Silly Challenge</i> programs, including decorating KIBO.</li> </ul> </li> </ul> <p><b>KIBO Time</b><br/> <i>Expressive Explorations</i></p> |                                                                                                                                                                                                                                |

- **Revisiting the Program** (*Suggested Time: 10 minutes*)
  - Children can continue programming their “Silly Challenge” program. Encourage children to incorporate a nested loop or statement in their program.
    - Be sure to document children’s KIBO programs with photographs.
- **Decoration Time** (*Suggested Time: 15 minutes*)
  - Have children use crafting materials to decorate each of their KIBOs. Allow children as much creativity as possible in doing this—anything is encouraged as long as every child gets a chance to decorate!
    - As mentioned earlier, there are different ways to decorate with KIBO! Children can decorate using construction paper, scissors, and tape and secure the decorations to the art platforms. Another option is to provide paper or plastic plates that children decorate, and then children can use masking tape to secure the plates onto the art platforms.
  - As children work on their final projects, go around and take pictures of children’s KIBO programs and decorated KIBOs.
    - Make sure to leave yourself enough time to do this step!
    - This is also a great opportunity to share children’s work with families.

### **Closing Tech Circle**

- **Ready, Set, Go!** (*Suggested Time: 10 minutes*)
  - Put down one piece of tape on the classroom floor to mark the “starting line” (there is no need to indicate a “finish line;” a starting point may simply be useful in helping children see all KIBOs together).
  - When groups are done with their programs, have each group place their KIBO at the starting line, and say, “Ready, Set, Go!” After the class says “Go,” all children should clap so that their programs start! Once all KIBO programs have run, cheer together as a class!
  - Now, have each group run their program one at a time and have the other groups guess what their challenge/prompt was (e.g., “make the most turns,” “spin around the most,” “have the most colors”)!

## Lesson 19: Granny Went to Market

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Algorithms, Design Process                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Powerful Ideas of Literacy         | Sequencing                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| PTD                                | Collaboration, Content Creation, Community Building                                                                                                                                                                                                                                                                                                                                                                                                    |
| Palette of Virtues                 | Open-Mindedness                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Children will be able to...        | <ul style="list-style-type: none"> <li>• Order the events of a story in a logical sequence.</li> <li>• Plan a project using a graphic organizer</li> </ul>                                                                                                                                                                                                                                                                                             |
| Vocabulary                         | <ul style="list-style-type: none"> <li>• Scenes: one part of a whole story</li> <li>• Culture: a pattern of behavior shared by a group of people. Different things can make up a culture, such as language, food, clothing, music, religion, and beliefs</li> </ul>                                                                                                                                                                                    |
| Teacher Preparation                | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Get book <a href="#">My Granny Went to Market</a>.</li> <li><input type="checkbox"/> Print out the <a href="#">My Culture Handout</a> (one per child).</li> <li><input type="checkbox"/> Print <a href="#">Lesson 19 Design Journal</a> for each group or have children's <a href="#">Full Design Journals</a> on hand.</li> </ul> |

### Warm Up

- **My Granny Went to Market** (*Suggested Time: 10 minutes*)
  - Read [My Granny Went to Market](#) together as a class.

### Opening Tech Circle

- **Order of Events** (*Suggested Time: 10 minutes*)
  - Review the order of events in the story *My Granny Went to Market*. Show examples from the book.
  - Pick 3 **scenes** to talk about and ask children where they belong in the story - beginning, middle, or end.
    - Have children place the events in order. Ask what would happen to the story if we rearranged the story so that the middle scene was first, or the first scene was last.

### Word Time

- **What Is a Culture?** (*Suggested Time: 15 minutes*)

- Explain to children that in the book, on her magic carpet, Granny explored different parts of the world. On the carpet, she flew to China, Kenya, India, and Mexico. On her travels, Granny explored different **cultures**.
- Ask children: *What do you think the word “culture” means?*
- After a few children share their thoughts, explain to the class that a person’s culture has to do with how someone celebrates, speaks, dresses, eats, and lives.
- Tell children to think back a few lessons ago to when we created a list of languages we speak (feel free to display this list). Explain to children that the languages we speak are part of our culture.
- Tell children that each culture is unique. Just like *we* are all unique!
- Tell children that, now, they are going to describe some of the things that make them special and unique, like the things they celebrate, how they dress, where they live, and, as they talked about a few lessons ago, what they value. Tell children that values are part of our cultures.
- Pass out the [My Culture Handout](#) and give children a few minutes to fill it out.
- Reconvene as a class. Tell children now that they have thought about what makes them unique and their own culture, they are going to think about other cultures and places around the world they want to learn about.
- Explain to children that now, they will pretend they are Granny from the book and that they have their own magic carpet that can take them anywhere in the world!
- In groups, have children decide on a place somewhere in the world they would like to learn more about. It is recommended to have no more than 3 children per group.

- **Our Magic Carpet Journey** (*Suggested Time: 10 minute*)

- In their same groups, children will write a story about their Magic Carpet Journey in their [Lesson 19 Design Journal](#).
- They will write or draw three actions or events that will happen on their journey. Encourage children to think about what they want to happen at the beginning of their journey, the middle, and the end.
  - For example, maybe children want Granny to go on a magic carpet ride to France to see art like the *Mona Lisa*, the Eiffel Tower, and have a croissant to eat!
  - Or maybe Granny wants to go to Japan to see ancient temples, walk in the beautiful forests, and try some traditional Japanese food.
- For each event, ask children: *What blocks make sense for this event/action?* For example, to show that Granny is happy, they could program KIBO to beep or sing.
- As children are working on their Design Journal, encourage them to physically explore all the different programming blocks they have learned and try making different programs.
- Remind children that they will have a chance to decorate KIBO to show where in the world they are traveling to!

### **Closing Tech Circle**

- **Sharing Our Cultures** (*Suggested Time: 5 minutes*)

- In a circle, have each child share 1) based on the handout they filled out, one thing that makes them special and unique, and 2) a place they would like to travel to and what they want to learn about there.

## Lesson 20: Your Final Project I

|                                    |                                                                                                                                                                                          |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Representation, Design Process, Algorithms                                                                                                                                               |
| Powerful Ideas of Literacy         | Sequencing, Writing Process                                                                                                                                                              |
| PTD                                | Communication, Collaboration, Content Creation                                                                                                                                           |
| Palette of Virtues                 | Curiosity, Open-mindedness                                                                                                                                                               |
| Children will be able to...        | <ul style="list-style-type: none"> <li>• Begin programming their final projects.</li> </ul>                                                                                              |
| Vocabulary                         |                                                                                                                                                                                          |
| Teacher Preparation                | <input type="checkbox"/> Read lesson plan.<br><input type="checkbox"/> Have children's completed <a href="#">Lesson 19 Design Journal</a> pages and <a href="#">My Culture Handout</a> . |

### Warm Up

- **One Sentence Story** (*Suggested Time: 10 minutes*)
  - Explain to the children that a one sentence story is when each child gets to tell one piece of the story. Model it for the class (either with co-teachers or if only one teacher, narrate before each line that it's a different person talking (e.g., "Then Jimmy says... Then Kayla says...")).
  - Teacher starts the story with "Once upon a time there was a programmer."
  - Children go around and each add one sentence to the story, ultimately ending up with one story from the class.

### Opening Tech Circle

- **Re-Reading My Granny Went to Market** (*Suggested Time: 5 minutes*)
  - As a class, re-read [My Granny Went to Market](#).

### KIBO Time

### ***Expressive Explorations***

- **Story Planning** (*Suggested Time: 20 minutes*)
  - Have children work in groups to create their KIBO program using their graphic organizer, while also physically exploring the programming blocks. Make sure children remember to think about the connection between the blocks they choose and the three parts of their magic carpet journey identified in the last lesson!
  - Children's final projects should incorporate at least 10 blocks, use both the Sound Sensor and Light bulb, a Repeat Block, an If Block, and at least one nested statement or loop. Encourage children to be as creative as possible while still being intentional about which blocks they choose.
  - Go around and take pictures of each group's program. By documenting children's programs, you will be able to assist children if they do not remember how to re-assemble their program for the final showcase. Make sure to leave yourself enough time to do this step, as it can save lots of time and effort in the later lessons!

### **Closing Tech Circle**

- **Our Cultural Values** (*Suggested Time: 10 minutes*)
  - Have children take a look at the [My Culture Handout](#) they filled out from the previous lesson.
  - Lead a child-centered discussion around the following prompt: *Look at some of the values you added to the handout. How do you think your culture and what makes you unique has to do with what you value?*

## Lesson 21: Your Final Project II

|                                    |                                                                                                                                                                                                                                    |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Design Process, Representation                                                                                                                                                                                                     |
| Powerful Ideas of Literacy         | Writing Process                                                                                                                                                                                                                    |
| PTD                                | Collaboration, Content Creation, Community Building                                                                                                                                                                                |
| Palette of Virtues                 | Open-mindedness, Optimism                                                                                                                                                                                                          |
| Children will be able to...        | <ul style="list-style-type: none"> <li>Decorate their robotic creations using arts and crafts materials</li> </ul>                                                                                                                 |
| Vocabulary                         |                                                                                                                                                                                                                                    |
| Teacher Preparation                | <input type="checkbox"/> Read lesson plan.<br><input type="checkbox"/> Gather materials for KIBO decorating. Suggested materials include KIBO's dry erase boards, construction paper, scissors, tape, and paper or plastic plates. |

### Warm Up

- **Guess Who?** (*Suggested Time: 5 minutes*)
  - Play a game of *Guess Who*?
  - If you know the children well enough then pick one in the classroom and give hints about them.
  - Or use characters from one of the books.
    - E.g., Mary – loves working on teams, teaching, outer space
    - E.g., Granny – loves travel, learning about different cultures, collecting things

### Opening Tech Circle

- **Character Creation** (*Suggested Time: 5 minutes*)
  - Tell children that today they are going to decorate their KIBO to represent Granny, from the story, and the place the Granny is traveling to.
  - Explain to children that when we decorate KIBO, we can use different details to represent our character, like what they look like or things they like.



## **KIBO Time**

### **Structure Challenge**

- **Creation Guide** (*Suggested Time: 5 minutes*)
  - Remind children of the many different ways to decorate with KIBO! Children can draw or write on the dry erase boards and secure them using the flagpole module. Another option is to decorate using construction paper, scissors, and tape and secure the decorations to the circular or rectangular art platforms. And a third option is to provide paper or plastic plates that children decorate, and then children can use masking tape to secure the plates onto the art platforms.
  - **Remind children that we cannot glue anything to KIBO or write or draw directly on KIBO.**

### **Expressive Explorations**

- **Decorating KIBO** (*Suggested Time: 20 minutes*)
  - Have children use crafting materials to decorate each of their KIBOs to resemble their characters. Allow children as much creativity as possible in doing this—anything is encouraged as long as every child gets a chance to decorate!
  - As children work on their final projects, go around and take pictures of children's KIBO programs and decorated KIBOs.
    - Make sure to leave yourself enough time to do this step!
    - This is also a great opportunity to share children's work with families.
  - To help children test their decorations with KIBO, you can add a testing station in the corner of the classroom, where children can scan a program and make sure the decorations are securely attached.

## **Closing Tech Circle**

- **Create Your Own Values Challenge** (*Suggested Time: 5 minutes*)
  - Remind children of the Kindness Challenge you all did as a class in Lesson 8. Each person chose one kind thing they wanted to do during the week. Now, explain to the class that you're going to choose another value that you all as a class feel is important (recall the discussion around class values in Lesson 6). Examples might be honesty, curiosity, patience or perseverance (see inspiration from the Palette of Virtues [here](#)).
  - Then, as a class, brainstorm different things that you can do during the next week related to that challenge!

## Lesson 22: Your Final Project III

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Design Process, Algorithms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Writing Process, Sequencing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Content Creation, Creativity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Honesty, Generosity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Children will be able to:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>Recall KIBO skills learned throughout the curriculum.</li> <li>Test both hardware and software elements of final projects</li> <li>Give and receive constructive peer feedback using the “2 Stars and a Wish” prompt</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Vocabulary:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Teacher Preparation:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Have children’s completed <a href="#">Lesson 19 Design Journal</a> pages.</li> <li><input type="checkbox"/> Camera (e.g., on a phone)</li> <li><input type="checkbox"/> Read through the <a href="#">Show What You Know Information Sheet</a>.</li> <li><input type="checkbox"/> Print one copy per child of the <a href="#">Show What You Know Response Page</a>.</li> <li><input type="checkbox"/> Open the <a href="#">Show What You Know Teacher Slides</a> and read through them on a new tab before class starts.</li> <li><input type="checkbox"/> Locate <a href="#">Show What You Know Answer Key</a> to score results.</li> </ul> |
| <p><b>Show What You Know!</b> (20 minutes)</p> <ul style="list-style-type: none"> <li>Start off class with a quick check-in of the children’s knowledge. This is the summative assessment for the curriculum. Hand out a copy of the <a href="#">Show What You Know Response Page</a> or booklet to each child and project the <a href="#">teacher slides</a> on the board. Read each question aloud and give children about 2 minutes per question. For more information see the <a href="#">Show What You Know Information Sheet</a>.</li> </ul> <p><b>KIBO Time</b></p> <p><i>Expressive Explorations</i></p> <ul style="list-style-type: none"> <li><b>Programming the Final Project</b> (Suggested Time: 20 minutes)</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

- Children will work on their projects. By the end of this session they should be finished with their projects.
- Encourage each child to include at least ten blocks, use at least one sensor, a Repeat Block, an If Block, and at least one nested statement or loop.
- To help children test their decorations or programs, add a testing station in the corner of the classroom, where children can scan their program and make sure their decorations are securely attached.
  - Provide additional masking tape or yarn so that children can reinforce any parts of their decorations that are not securely attached.
- Make sure to take pictures of childrens' final programs so that they can recreate the programs for Lesson 23.

### **Closing Tech Circle**

- **2 Stars and a Wish** (*Suggested Time: 5 minutes*)
  - In pairs or small groups have children discuss their projects using the 2 stars and a wish feedback prompt:
    - 2 stars are two things that went well
    - 1 wish is one thing they want to do better

## Lesson 23: Project Showcase

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science | Design Process                                                                                                                                                                                                                                                                                                                                                                                                            |
| Powerful Ideas of Literacy         | Writing Process                                                                                                                                                                                                                                                                                                                                                                                                           |
| PTD                                | Community Building                                                                                                                                                                                                                                                                                                                                                                                                        |
| Palette of Virtues                 | Curiosity, Optimism                                                                                                                                                                                                                                                                                                                                                                                                       |
| Children will be able to...        | <ul style="list-style-type: none"> <li>• Speak and express themselves in front of the class through guided questions from a teacher.</li> <li>• Share their final KIBO creations.</li> </ul>                                                                                                                                                                                                                              |
| Vocabulary                         |                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Teacher Preparation                | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Open the <a href="#">ABCs of Cultural Dance video</a>.</li> <li><input type="checkbox"/> Open documented project pictures from Lesson 22.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 23 Design Journal</a> for each child or refer to <a href="#">Full Design Journal</a>.</li> </ul> |

### Warm Up

- **Dance and Culture** (*Suggested Time: 5 minutes*)
  - Play the [ABCs of Cultural Dance video](#) to show dances from around the world to children. Encourage children to follow the moves and dance along!

### Opening Tech Circle

- **Final Preparations** (*Suggested Time: 10 minutes*)
  - Use the documented pictures from Lesson 22 to have children recreate their final programs. Then, ask children to scan the programs using their KIBOs. If you disassembled KIBO's decorations from the previous lesson, reattach them before the final showcase! Children should showcase their program by scanning it but do not need to present their program blocks.

### KIBO Time

- **KIBO Project Showcase** (*Suggested Time: 20 minutes*)
  - During the final presentations, children will present their Final Project Character Organizer sheet and their decorated KIBOs in action. Feel free to invite parents and administrators for this final showcase! Children can share their projects altogether in a technology circle, or as a gallery walk, in which half of the children walk around the classroom to each project while the other half present their projects. Then the two groups switch. Children should share:
    - their robots and decorations
    - why they chose the features they did for their robot
    - the final program and what each block and module represent
    - anything that was hard, easy, surprising, interesting, etc. about the process
  - Take pictures/videos of children's final projects and KIBO programs to share with families and school/community members!

### Word Time

- **Lesson 23 Design Journal** (*Suggested Time: 10 minutes*)
  - In their [Design Journals](#), children will write a reflection to answer the prompts:
    - Write about something you learned...
    - Write your favorite part about the magic carpet ride you programmed...

### Closing Tech Circle

- **The Future of Programming** (*Suggested Time: 10 minutes*)
  - Applaud and compliment children for all their great work on their final projects and throughout this class.
  - Discuss the future of programming with the whole class using these guided questions:
    - What is their favorite thing that they have learned with KIBO?
    - What project would they like to work on next? Or what skill would they want to learn next?
    - Looking beyond KIBO, what piece of technology would they want to help invent or program?
  - Explain that now that they have finished these lessons, they are the future of programming! As they grow up they will continue to learn how they can take the ideas in their brains right now and make them real!

## Lesson 24: Our Coding Community

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Powerful Ideas of Computer Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Design Process                                                                                                                                                                                                                                                                                                                                                   |
| Powerful Ideas of Literacy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Writing Process                                                                                                                                                                                                                                                                                                                                                  |
| PTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Collaboration, Community Building, Communication                                                                                                                                                                                                                                                                                                                 |
| Palette of Virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Gratitude, Generosity                                                                                                                                                                                                                                                                                                                                            |
| Children will be able to:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• Recognize help they received and gave to others.</li> <li>• Express gratitude through a thank-you card.</li> </ul>                                                                                                                                                                                                      |
| Vocabulary:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>• Gratitude: being thankful</li> </ul>                                                                                                                                                                                                                                                                                    |
| Teacher Preparation:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li><input type="checkbox"/> Read lesson plan.</li> <li><input type="checkbox"/> Print one copy per child of the <a href="#">Thank you cards</a>.</li> <li><input type="checkbox"/> Print <a href="#">Lesson 24 Design Journal</a> for each child or have children's <a href="#">Full Design Journals</a> on hand.</li> </ul> |
| <p><b>Warm Up</b></p> <ul style="list-style-type: none"> <li>• <b>What Went Well Today</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Each child goes around and says one thing that has been good about their day and why it was good.</li> <li>○ You can start the activity by saying what was good about the day for you (e.g., “This morning, I talked to my mom on the phone. That was good because I’m really close with my family.” or “I took a walk today. That was good because I love being outdoors and it made me feel happy.”)</li> </ul> </li> </ul> <p><b>Opening Tech Circle</b></p> <ul style="list-style-type: none"> <li>• <b>Helping Others</b> (<i>Suggested Time: 5 minutes</i>)             <ul style="list-style-type: none"> <li>○ Discuss how children may have helped each other and needed help during projects or activities. Working together and supporting each other is part of being a coding community and is how programmers work together. Discuss the importance of <b>gratitude</b> and how it’s important to show appreciation and thank</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                  |

the people who help you. The warm-up story activity wouldn't be the same if all of the children didn't contribute to the story.

### Word Time

- **Collaboration Web** (*Suggested Time: 10 minutes*)
  - Have children create a collaboration web in the [Lesson 24 Design Journal](#).
    - Children should write their name in the center, and write the names of people who helped them in the surrounding boxes. Children can then draw a line from their center circle to the other names.
  - As an alternative activity, display a classroom collaboration web on the wall with pictures of children and have children draw lines or attach yarn to the pictures of other children who helped them. Children should start thinking about who helped them with their projects prior to coming up to the board.
- **Thank you cards** (*Suggested Time: 10 minutes*)
  - Children will decide on two classmates who helped them and write them thank you cards.

### Closing Tech Circle

- **Showing Gratitude** (*Suggested Time: 10 minutes*)
  - Children will deliver thank you cards to classmates.