



# CRRAFT PARTNERSHIP

SCHOOL CURRICULUM  
PHASE 3

## PHASE 3

SMALL STEPS FOR BUILDING BIG

Phase 3 is all about doing BIG things by using **modularity** - breaking tasks into smaller units and combining those units.

### PHASE 3 POWERFUL IDEAS

**Modularity** | **Debugging** | **Algorithms**  
*for more on these powerful ideas:*



You can help your students understand using **modularity** to solve big problems. We can break complex tasks into simpler and more manageable units or steps. Then, we can combine those steps.

In computer science, **modularity** helps programmers focus on one small part in **algorithms** at a time. Approaching problems this way provides opportunities for **debugging** -- identifying and solving problems is more straightforward when focusing on smaller steps rather than the whole problem.

### PHASE 3 LEARNING STANDARDS

PK.AL.SR.6 Persist in solving a problem or question, with adult prompting  
PK.AL.SR. 7 Reflect and plan a logical series of steps to accomplish a task such as writing a message, completing a puzzle, drawing a picture, or building a block structure

PK.AL.CB.14 Demonstrate a willingness to collaborate with others to solve a problem.  
PK.AL.CT.10 Identify a problem and attempt multiple ways to solve it, with or without assistance.

### PHASE 3 GOAL

*Children will understand that they can do big things (like solving complex problems in their community) using **modularity** and breaking tasks and challenges into smaller pieces.*

- Kibo Kit
- Code & Go Mouse
- Code-a-Pillar
- Other robots
- Robot books
- Architecture/Design books
- White board/markers
- Snap Cubes
- Road Signs
- Maps
- Directional Cards
- Building Materials and Loose parts

### PHASE 3 MATERIALS





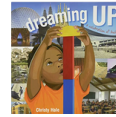
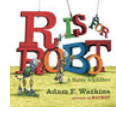
# CRRAFT PARTNERSHIP

## SCHOOL CURRICULUM

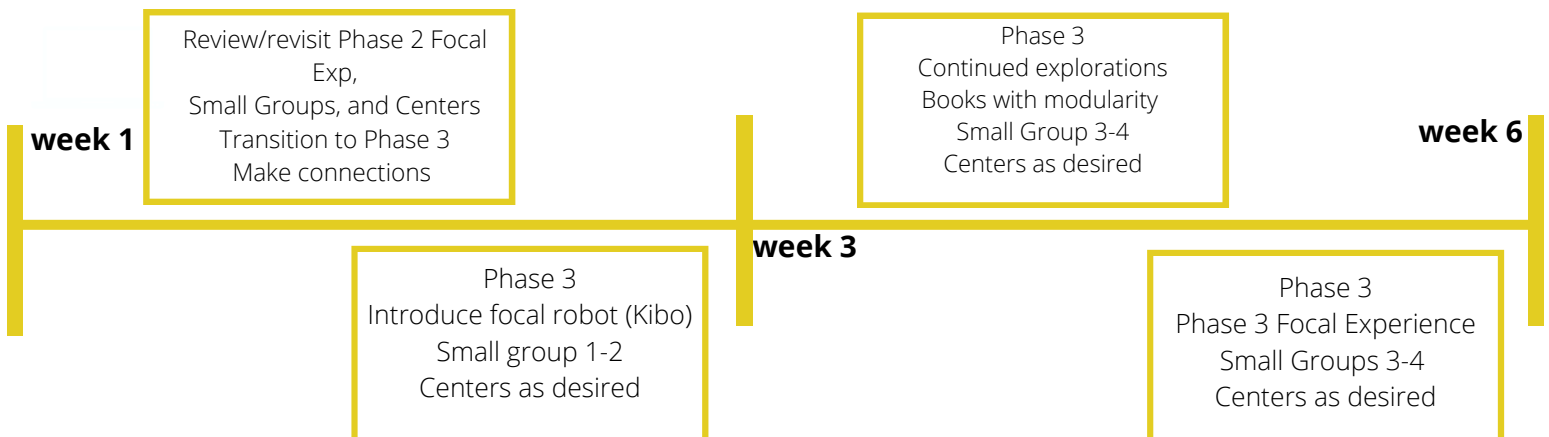
### PHASE 3

#### SMALL STEPS FOR BUILDING BIG

### PHASE 3 OVERVIEW

Phase 3 Focal Experiences	Phase 3 Small Groups	Phase 3 Centers	Phase 3 Focal Texts
<p><b>Robot City</b></p> <p><i>Collaborate to build a city in which robots work together</i></p>	<p>My name is KIBO</p> <p>How far does robot go?</p> <p>Design/Build a City</p> <p>Hokey Pokey</p>	<ul style="list-style-type: none"> <li>Art <i>city pictures, materials to make cities</i></li> <li>Book Nook <i>design/architecture books</i></li> <li>Construction <i>directional cards, popsicle sticks, people and cars</i></li> <li>Computer <i>Bee-Bot, Starfall</i></li> <li>Dramatic Play <i>Community helper dress-ups, maps</i></li> <li>Puzzles/Games <i>More challenging puzzles</i></li> <li>Writing <i>Map and sign making materials</i></li> </ul>	<p> <i>How to Code a Sandcastle</i> (sequences, loops, if-then else)</p> <p> <i>And the Robot Went</i> (sequencing, algorithms, design process, modularity)</p> <p> <i>Dreaming Up</i> (Design process, modularity)</p> <p> <i>R is for Robot</i> (sequencing, algorithms, design process)</p>

**PHASE 3 TIMELINE** *Each CRRAFT phase lasts approximately 6 weeks. Phases can and should overlap or be extended or shortened as needed in your classroom. This timeline is a **suggestion**.*





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#### CULTURAL RELEVANCE

##### Let's get cooking!

Cooking is connected to modularity & cultural relevance as it reflects the combination of small parts towards a larger goal and important cultural practices.

Discuss different ingredients, processes, and practices unique to children and families in your class.

Discuss how routines are connected to modularity. Small steps have to be combined towards one big goal when making dinner or getting ready for bed. Consider how there might be differences in how steps come together.

##### Big tasks, small steps

##### Tell me a story!

Many cultural backgrounds have rich oral storytelling traditions. Narratives often include many parts and components of a large story, perfectly reflecting modularity. Discuss the "parts" (characters, setting, plot) of books and stories and how they come together to make a whole story.

#### THINGS TO CONSIDER

Note: These are tips and tricks to get the most out of the phase

- Use a playground, not a playpen approach.
- Encourage children to think through problem-solving steps in order to make connections to modularity in any context!
- As much as possible, create space and time to return to projects that children are working on.
- Prioritize group and cooperative work. Encourage children to share about their cultural practices with their peers.

#### ESSENTIAL QUESTIONS

Note: These are not questions to answer, but thematic questions that underlie the phase.

How can big tasks, challenges, and problems be broken down into smaller pieces?

When solving a big task, challenge, or problem, what do we do when something goes wrong?

How do we put sequences together to solve big tasks, challenges, or problems?



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#### PHASE 3 CENTERS

Center	Materials	Powerful Idea
<b>Art</b>	<p>In <u>art</u>, we can make plans for how to build cities.</p> <ul style="list-style-type: none"> <li>• Various real images of buildings and signs (road signs, building signs)</li> <li>• Laminated pictures from books children have read</li> <li>• Design process poster</li> <li>• Various art materials like (paper, glue, tape, scissors, markers etc) to create plans for cities and designs for KIBO stage</li> </ul>	<b>Design Process</b>
<b>Construction Zone</b>	<p>In <u>Construction Zone</u>, we can explore building structures for cities.</p> <ul style="list-style-type: none"> <li>• laminated directional cards, Various real images of maps and cities.</li> <li>• Various loose parts &amp; recycled materials for structure building.</li> <li>• Toy cars, people, etc.</li> <li>• Popsicle sticks for a road outline for KIBO</li> <li>• KIBO robot.</li> <li>• Bin for children to share materials and plans made in art to use in construction zone.</li> </ul>	<b>Modularity</b> <b>Algorithms</b>
<b>Books/ Library</b>	<ul style="list-style-type: none"> <li>• Books on building (<i>Dream It Up</i>)</li> <li>• Books on machines and maps (<i>R is for Robot</i>)</li> <li>• Books on road signs/shapes.</li> <li>• Books on cities and different buildings and materials (construction).</li> </ul>	<b>Design Process</b> <b>Representation</b>
<b>Dramatic Play</b>	<ul style="list-style-type: none"> <li>• Robot dress up materials</li> <li>• Community helper outfits to fit into creating a city theme.</li> <li>• Maps</li> <li>• Preparing foods from different cultures</li> </ul>	<b>Representation</b> <b>Modularity</b>
<b>Puzzles and Games</b>	<ul style="list-style-type: none"> <li>• Harder puzzles that include an outer part and an inner part.</li> <li>• Board games like Robot Turtles, Code and Go Robot Mouse game.</li> </ul>	<b>Modularity</b> <b>Debugging</b>
<b>iPad/ Computer</b>	<ul style="list-style-type: none"> <li>• Games that include shapes and building</li> <li>• Starfall, Bee Bot online (community map, country roads)</li> </ul>	<b>Modularity</b> <b>Representation</b>
<b>Writing</b>	<ul style="list-style-type: none"> <li>• Paper, pencil, various materials to help create maps for their city to design before building</li> <li>• Materials for students to create road signs and building signs to attach to buildings created in construction zone, Including word cards and pictures.</li> </ul>	<b>Representation</b>



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### PHASE 3 SMALL GROUPS

## My Name is KIBO

hardware/software | modularity

*Students will explore KIBO and its functions and code blocks and begin programming with KIBO.*

**Standards:** PK.ETS2.01a. Recognize that tools have specific characteristics that determine their use.



#### Materials Needed:

KIBO Robot  
Code Blocks  
And the Robot Went book

#### Instructional Steps

**I DO**

**Introduce KIBO and blocks - what it is and what does it do? Introduce new robot and review its functions; model programming**

**WE DO**

**Students and teacher collaborate to program KIBO by adding blocks to the code and enact**

**YOU DO**

**Students construct their own program for KIBO while teacher facilitates**

#### Key Questions

What do you think the BEGIN/END blocks do or mean?  
What do you think the (FORWARD/BACKWARD/SHAKE) blocks do or mean?  
How do we communicate with KIBO what we want our program to be?

#### Success Criteria

**M=** Student describes robot components and functions, identifies steps to program KIBO, collaborates to explore KIBO.  
**IP=** Student describes some robot components and functions, identifies steps to program KIBO, collaborates to explore KIBO.  
**NM=** Student follows along, imitates and observes.

## How Far Does Robot Go?

debugging | representation

*Students will program robots and measure the distance of robot travel using snap cubes.*

**Standards:** PK.MD.A.1 Describe measurable attributes of a single object, such as length, width, height.



#### Materials Needed:

Snap Cubes  
Robot Mouse or KIBO blocks (forward, backward)  
Stop sign  
White board and markers or Chart paper

#### Instructional Steps

**I DO**

**Introduce Unifix cubes - what will they be used for? Model how to use Unifix blocks to measure a short distance**

**WE DO**

**Students and teacher collaborate to make predictions and plan for measuring distance**

**YOU DO**

**Students will work in pairs to create a path for their robot to test. They will measure the path with snap cubes**

#### Key Questions

How many cubes do you think it will take to get the robot to travel to the stop sign?  
Which of these paths is the longest/shortest?  
How many blocks did it take for your robot to get from point A to point B?

#### Success Criteria

**M=** Student independently predicts, solves, & measures w/ cubes  
**IP=** Students predict, solve problems, and measure with cubes with teacher assistance/prompting.  
**NM=** Students need peer and teacher assistance/prompting to make predictions, solve problems, and measure with cubes



### PHASE 3

#### SMALL STEPS FOR BUILDING BIG

### PHASE 3 SMALL GROUPS

## Design Robot City

**design process** | **modularity**

*Students will work collaboratively to design and build an interactive robot city.*

**Standards:** PK.AL.SR.7 Reflect and plan a logical series of steps to accomplish a task such as writing a message, completing a puzzle, drawing a picture, or building a block structure.



#### Materials Needed:

White board/dry erase markers and writing materials  
Building materials  
Coding blocks  
Picture books  
Design Process poster

#### Instructional Steps

**I DO**

Use the design process to guide students through designing and building their city. Model programming KIBO to navigate the robot city.

**WE DO**

Students and teacher collaborate to write a code for KIBO to travel to a specific location in their city.

**YOU DO**

Students collaborate to design and build their city. Students problem solve and debug as needed to help KIBO travel to the target location.

#### Key Questions

What city do we want to build?  
What materials will you use to build your city?  
What placed do we want in our city?  
How will KIBO get to...?  
How will KIBO get from...to...?

#### Success Criteria

**M**= Student work collaboratively to design/build a city, decide how they want KIBO to interact with the city, and follow long when programming KIBO.  
**IP**= Student are engaged in some parts of planning, designing, and programming  
**NM**=Student are not fully engaged in planning, designing, and programming

## Hokey Pokey

**modularity** | **representation**

*Using knowledge of the KIBO coding blocks, students will program KIBO to perform the Hokey Pokey.*

**Standards:** PK.AL.CT.9 Demonstrate an awareness of connections between prior and new knowledge.



#### Materials Needed:

KIBO  
Coding blocks  
White board/dry erase marker

#### Instructional Steps

**I DO**

Explain the Hokey Pokey; and explain to students that you will use the coding blocks to teach KIBO the Hokey Pokey.

**WE DO**

Students and teacher review the KIBO coding blocks together, and discuss the function of each coding block.

**YOU DO**

Students translate each line of the Hokey Pokey into KIBO's coding language. They will scan the blocks, test, and debug as needed.

#### Key Questions

How do we make KIBO...put whole self in/out, shake, etc.?  
How will KIBO understand?  
Is there anything we need to debug?  
What do we need to change?

#### Success Criteria

**M**= Student work collaboratively to recall the function of each coding block, make decisions about which blocks represent Hokey Pokey movements, program KIBO, and debug as necessary  
**IP**= Student are engaged in some parts of recalling, decision-making, coding, and debugging  
**NM**=Student are not fully engaged in recalling, decision-making, coding, and debugging





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#### FOCAL EXPERIENCE

## Robot City



**modularity** | **debugging** | **design process**

*Goals: Students will collaborate to build a big, robot city by constructing and combining smaller parts of the city which they guide KIBO through by developing and combining programs.*

#### Materials Needed

*R is for Robot, How to Code a Sandcastle* or other problem solving robots book  
KIBO robot and blocks  
Building materials and city designs (SG#3)

#### **Standards**

**PK.AL.CB.14** Demonstrate a willingness to collaborate with others to solve a problem.

**PK.AL.SR.7** Reflect and plan a logical series of steps to accomplish a task, such as writing a message, completing a puzzle, drawing a picture, or building a block structure.

- modularity
- debug
- problem solving

#### **Key Vocabulary:**

- design/designer
- interact
- modify

1

**Read/review book in which robots solve problems. Discuss local problems that could be solved**

2

**Review city plans; build part of city, with small groups; program KIBO to move in city to solve problems**

3

**Combine parts of city to create whole; run KIBO sequences to interact with the city, debug as needed**

## Engage

*Connect to children's prior knowledge and introduce key concepts*

**"How can we use a robot to make life better for people who live in our city?"**

After reading or reviewing book, ask: "What are ways the robot helped solve problems?"

"What kinds of problems have we noticed?"

"Remember, we designed cities! How can we work together to build a city? And how can KIBO help us?"

*Link initial ideas to computer science ideas and prepare children for activity*

## Connect

**"Let's write a program for KIBO to move around the city and help."**

"Think about how you want KIBO to move in the city. What can KIBO do to help with problems?"

"How can we take this step by step to solve the problem? What should we do first, next, last?"

## Explore

*Support children in participating in the activity. Ask questions and help make connections*

**"Let's fit our parts of the city together [once all groups have had a chance to create and work with KIBO in their city]"**

"What kinds of problems can KIBO help solve?"

"Is KIBO moving in the city like you wanted? What do we need to change or debug?"

"Do our city designs work for KIBO? How can we modify?"  
"What other problems can KIBO solve?"



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### PHASE 3 TEXT CONNECTIONS

Text Title	Connection to Phase and Powerful Ideas	Questions (before, during, and after reading)
<p><i>How to Code a Sandcastle</i></p> 	<p>Pearl is trying to build a perfect sandcastle using her trusty robot but runs into challenges and has to use <b>debugging</b> and <b>control structures</b> to meet her goal. At the end, Pearl uses <b>modularity</b> to bring all the components together and complete her sandcastle!</p>	<p><b>Before:</b> I see Pearl and a robot on the cover of this book. What do you think Pearl and the robot are going to do?</p> <p><b>During:</b> Hmm. What does code mean? How can we code a robot? What do you think Pearl needs to do to code her robot?</p> <p><b>After:</b> We can code robots to make them do what we want. What do you want robots to do? How can we use robots to help us?</p>
<p><i>And the Robot Went</i></p> 	<p>Starting with a box of parts, characters collaborate to assemble the Robot. Characters use <b>algorithms (sequencing)</b> and <b>modularity</b> during each step of the <b>design process</b> until they have built the Robot!</p>	<p><b>Before:</b> Let's look at the cover of this book. I wonder what this book is about. What do you think this book will be about?</p> <p><b>During:</b> What do you think is going to happen next? What happens after...?</p> <p><b>After:</b> What would you do if you found a robot? Where do you think the robot went?</p>
<p><i>Dreaming Up</i></p> 	<p>Illustrations and photographs showcase the way children's play and engagement in the <b>design process</b> is reflected in the architecture we see around the world. Ideas of <b>modularity</b> are reflected in the way designs can start small and become something big!</p>	<p><b>Before:</b> It looks like this child is building with blocks. What do you like to build with?</p> <p><b>During:</b> Wow! Look at that building. What kind of buildings have you seen before?</p> <p><b>After:</b> What can we use in our classroom (or in our homes) to design and build buildings? What kind of buildings would you design/build?</p>
<p><i>R is for Robot</i></p> 	<p>Noisy robots use <b>algorithms (sequencing)</b> and the <b>design process</b> to build the alphabet.</p>	<p><b>Before:</b> R is for Robot. What other words do we know that begin with the letter R? A noisy alphabet. I wonder what that could mean.</p> <p><b>During:</b> What are these robots doing? What is happening in this picture/what do you notice?</p> <p><b>After:</b> Where else can we find the alphabet? The robots worked together to build an alphabet. What kinds of things can we build if we work together?</p>





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### OTHER POSSIBILITIES

*This list contains other possibilities and extensions, small groups and centers, and large group opportunities that were not developed as a part of the CRRAFT program, but could be used in this phase*

### LARGE GROUP IDEAS

- Read focal texts or watch videos about how robots interact with people and things to do jobs, how it is important to break down complex jobs into smaller, more manageable tasks, and about how robots can help improve people's lives and communities (including helping to build).
- Introduce children to Kibo, including how the hardware/software works differently from the Code-a-pillar and robot mouse, and how Kibo understands different symbols (i.e., representation).
- Write a code for building a tower to introduce representation.

### SMALL GROUPS AND CENTER IDEAS

- Continue building robots from recycled materials/loose parts. Encourage children to search for different 3-dimensional shapes from recycled materials at home and bring them in for building (C4L building shapes)
- Use unifix cubes to plan how long a robot should travel and incorporate conversations about measurement and length. Unifix cubes can also be used to measure how far a robot traveled after it moves from one location to another (C4L length and measurement).
- Use blocks and other materials to make structures for robots to navigate under, around, over, and through (C4L building shapes).

### EXTENSIONS

- Design and create decorations for KIBO's art stage. Each small group creates a different part and the parts will go together for one design.
- Create new dances, step by step, for KIBO to perform (also in Phase 4)
- Class party- each small group is responsible for different parts of the party (snacks, decorations, games, etc.)

### OTHER TEXTS

