# CRRAFT PARTNERSHIP

SCHOOL CURRICULUM
PHASE 4

## PHASE 4

BUILDING BLOCKS AND WEAVING CODE

Phase 4 is all about control structures - using creative commands to build more complex algorithms and smarter robots.

## PHASE 4 POWERFUL IDEAS

**Control Structures** | **Representation** | **Debugging**

*for more on these powerful ideas:*

To be successful in computer science, it helps to be able to write code that is more efficient. Even young children can learn to generate code that is more effective and creative. **Control structures** are commands that support more complex coding. In order to engage in **control structures**, children will need to understand different modes of **representation** in coding contexts. Of course, as codes become more complex with **control structures**, the need for **debugging** will increase.

## PHASE 4 LEARNING STANDARDS

PK.AL.CT.10 Identify a problem and attempt multiple ways to solve it, with or without assistance

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

PK.SPC.SA.7 Demonstrate an understanding of rules through actions and conversations.

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

## PHASE 4 GOAL

*Children will become more familiar with patterns and cause and effect by exploring **control structures** - commands or codes that make robots smarter by enabling them, through codes, to run a program based on given parameters (loops, if/then)*

## PHASE 4 MATERIALS

- KIBO Robot
- KIBO Coding blocks
- Weaving Looms
- Weaving Strips
- Robot balls
- Pool noodles
- Modified Kibo-style blocks (over, under, turn around)
- Weaving and gardening materials
- Pattern making materials

# PHASE 4

## BUILDING BLOCKS AND WEAVING CODE

## PHASE 4 OVERVIEW

| Phase 4 Focal Experiences | Phase 4 Small Groups | Phase 4 Centers | Phase 4 Focal Texts |
|---|---|---|---|
| We are Weavers<br>*Use cultural practices to learn about coding and control structures* | Over, Under, Repeat (Pass the Ball)<br>Dance with KIBO<br>Over, Under, If (Pool Noodle)<br>KIBO If/Then | • Art<br>*Weaving, threading materials*<br>• Blocks<br>*trains (to make loops)*<br>• Books<br>*cause and effect, gardening books*<br>• Computer<br>*Algorithm City*<br>• Dramatic Play<br>*Weather wear*<br>• Science<br>*Cause-and-effect materials, gardening*<br>• Puzzles/Games<br>*Pattern blocks; peg boards w/ rubber bands*<br>• Writing<br>*Index cards and trifold paper (to make instructions)* |  *Adi's Perfect Patterns and Loops* (Loops)<br>  *Gabi's If/Then Garden* (If/Then)<br>  *Abuela's Weave* (Weaving as coding)<br>  *How to Code a Sandcastle* (Loops, If/Then) |

## PHASE 4 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****.*

**week 1**

Wrap up Phase 3 Focal Exp, Small Groups, and Centers
Transition to Phase 4
Make connections between Phases

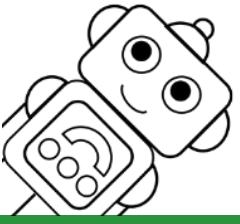
Phase 4
Continue to work with KIBO
Adi and Gabby Books
Small group 1-2
Centers as desired

**week 3**

Phase 4
Continue to work with KIBO
*How to Code...* and *Abuela's* Books
Small Group 3-4
Centers as desired

**week 6**

Phase 4
Phase 4 Focal Experience
Small Groups 3-4
Centers as desired





# PHASE 4

## BUILDING BLOCKS AND WEAVING CODE

## CULTURAL RELEVANCE

### Loops are everywhere!

Look for and discuss instances of looping in children's daily lives and communities. Things like bus routes, a playlist that repeats when finished, and picking up toys to put in their box or basket are all examples of loops!

### Contrasting Conditionals!

It can be easy to find conditionals (if/then) in daily life. But remember that conditionals may be different in some cultures. Where some families may use some IF...THENs [eat broccoli...have ice cream] others will not.

### Coding in Cultures!

There are many practices that are culturally specific, and those that are more general, in which you can see examples of control structures (like loops and if/then conditionals). Loops and patterns can be seen in weaving and hair braiding. More generalized practices that are still culturally significant can be discussed, e.g., conditionals in gardening (IF no rain, THEN water the garden)

## THINGS TO CONSIDER

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

- *Central to control structures are (1) patterns and (2) cause-and-effect relationships. When these emerge, make connections to control structures (e.g., if children notice a bird repeating a call, remind them of loops! Or if children notice plants have wilted after too long in the sun, discuss conditionals!*
- *Phase 4 builds on previous phases, so it is important to make connections to sequences (patterns!) and modularity.*
- *Prioritize group and cooperative work.*

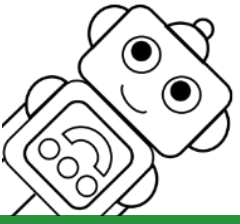
## ESSENTIAL QUESTIONS

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

How can we notice patterns to help us and computers do tasks?

How can learning to weave help us code? How can learning to code help us weave?

How can we make codes more efficient and creative to solve new challenges?





# PHASE 3

SMALL STEPS FOR BUILDING BIG

## PHASE 3 CENTERS

| Center | Materials | Powerful Idea |
|---|---|---|
| **Art** | In art, we can create patterns<br>• Beads, thread, and other materials for threading<br>• Weaving materials for continued exploration<br>• Small paper squares, paint chips, other patterning materials | **Control Structures**<br>**Debugging** |
| **Blocks** | In blocks, we can practice conditionals and loops<br>• KIBO robot and code cubes<br>• Trains, trucks, cars (to do loops)<br>• Large and small blocks to explore cause/effect | **Modularity**<br>**Hardware/ Software**<br>**Control Structures** |
| **Books/ Library** | In books, we can learn about coding connections<br>• If/then and loops books (Gabby, Adi, and Sandcastle)<br>• Gardening and weaving books | **Control Structures**<br>**Representation** |
| **Dramatic Play** | In dramatic play, we can discuss conditionals (if ___ then ____) and be meteorologists<br>• Clothes for varying weather (winter and summer clothes)<br>• Accessories for different weather (umbrellas, sunhat, gloves, sunglasses...) | **Control Structures** |
| **Puzzles and Games** | In puzzles and games, we can discover loops and conditionals in patterns<br>• Pattern blocks, toys, and puzzles | **Control Structures**<br>**Debugging** |
| **iPad/ Computer** | In computer, we can explore control structures<br>• Algorithm City | **Control Structures** |
| **Writing** | In writing, we can write procedurally (instructions)<br>• Index cards and lined paper (instructions, recipes, etc.)<br>• clipboards | **Algorithms**<br>**Representation** |

# PHASE 4

## BUILDING BLOCKS AND WEAVING CODE

## PHASE 4 SMALL GROUPS

Small Group #1 and #2

*Please collect documentation/artifacts for each small group lesson*

# Over, Under, Repeat

**control structures | algorithms**

*Children will work together to build a repeating/looping pattern by passing a ball overhead or under their body*

**Standard: PK.G.A.1** Begin to use relative position words in appropriate context, such as above, below, beside, and between.

Materials Needed:
Ball
Chart paper and markers

Instructional Steps

**I DO** **Explain the idea of passing the ball "over" and "under" and that they will work to build a loop**

**WE DO** **Ask children to decide on which way to pass the ball using "over"/"under" and start coding a pattern together; record**

**YOU DO** **Once code is established, discuss repeat. Have children run "the code" and discuss the pattern and where repeats happen.**

Key Questions

*How will we know which way to go next?*
*What pattern are we repeating? How do you know?*
*Where will our pattern end?*
*What happens if we begin with the other direction?*

Success Criteria

**M**= uses the word "repeat", identifies the pattern, and extends it.
**IP**= passes the ball with the correct direction when they receive the ball.
**NM**=Passes the ball randomly

# Dance with KIBO

**modularity | control structures**

*Children will collaborate to build a program with loops to dance with KIBO.*

**Standard: PK.ETS1.01a**. Use senses to gather, explore, and interpret information.

Materials Needed:
KIBO Robot
KIBO Code Blocks (including begin/end repeat blocks)

Instructional Steps

**I DO** **Model using code blocks to code a dance for KIBO. Introduce repeat block. Discuss the repeat and demonstrate with KIBO**

**WE DO** **Collaborate to build a new program for KIBO to dance. Use of repeat block to have KIBO repeat the dance multiple times.**

**YOU DO** **Children can adjust the number and/or position of repeat blocks and re-run. and act out dance programs with each other.**

Key Questions

*When is it helpful to use a loop in a program?*
*What do the repeat blocks tell KIBO to do?*
*How does KIBO know how many times to complete a loop?*

Success Criteria

**M**= grasp of meaning/function of repeat block.
**IP** = partial grasp of meaning and/or function of repeat block with support.
**NM** = does not understand the meaning/function of repeat block.

# PHASE 4

## BUILDING BLOCKS AND WEAVING CODE

## PHASE 4 SMALL GROUPS

Small Group #3 and #4

*Please collect documentation/artifacts for each small group lesson*

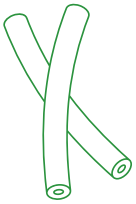
# Over, Under, If**

** - *Collect small group assessment data for all children*

**control structures | debugging**

*With a pool noodle, move over/ under, depending on height and "code" with KIBO-style books*

**Standards:** PK.G.A.1 Begin to use relative position words in appropriate context, such as above, below, beside, and between.



Materials Needed:
Pool noodle
KIBO over/under/turn around blocks
Chart paper and markers

Instructional Steps

**I DO** Discuss if/then from the book. Discuss how they will work together to write an if/then code and show KIBO blocks

**WE DO** Explore if/then statements [if rain, then coat] and relate to current context - if bar is high/low, then what?

**YOU DO** Practice over/under if/then using KIBO-style blocks. Debug as needed

Key Questions

*If I put the bar up high like this what would your body do? How could we make this into a pattern? What would that look like if we were to code it? Which block would go first? What would happen if...?*

Success Criteria

**M**= assesses conditional to respond appropriately (if high, then under, if low, then over).
**IP**= moves body in response to high/low, with support.
**NM**= does not understand or move appropriately even with support

# KIBO If/Then

**control structures | hardware/software**

*Children will explore if/then conditionals but this time, with KIBO.*

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

Materials Needed:
KIBO Robot
KIBO Code Blocks (including begin/end if blocks)

Instructional Steps

**I DO** Discuss conditional statements in daily life and remind about Over/Under/If activity. Introduce KIBO if/then blocks.

**WE DO** Collaborate to develop program using light, spin, near, and beep with the begin/end if blocks

**YOU DO** Adjust number/position of blocks. Discuss and describe the functions and conditionals of KIBO

Key Questions

*What do you do if it is cold/hot outside? What will KIBO will do if we add the BEGIN IF, the LIGHT, SPIN, and the END IF blocks? Why did KIBO SPIN? Why did KIBO BEEP?*

Success Criteria

**M**= understands meaning and function of if/then to program KIBO
**IP**= demonstrates partial understanding of if/then for KIBO with support
**NM**= does not understand if/then, even with support

# PHASE 4

## BUILDING BLOCKS AND WEAVING CODE

## FOCAL EXPERIENCE

# We are Weavers 

**control structures | algorithms | representation |**

*Objective: Children will make connections between the cultural practice of weaving and coding through control structures (loops)*

Materials Needed

Weaving looms and weaving strips

*Abuela's Weave* and/or weaving videos

KIBO-style over/under + KIBO repeat blocks

**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.

**PK.PD.5.** Experiment with handheld tools to develop strength, control, and dexterity of small muscles (e.g., paintbrushes, crayons, markers, lacing, clay, etc.).

**Key Vocabulary:**

- loop
- repeat
- weave
- loom
- pattern
- algorithm
- command

1. **(Re)introduce weaving book and/or watch weaving videos. Discuss how weaving works and what it is for.**
2. **Make connections between weaving and coding by considering observed patterns and repeating loops.**
3. **Use materials to try out weaving and talk about coding connections by us KIBO blocks to program.**

## Engage

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

**"What is weaving? How does it work?"**

After reading or reviewing book:

"Why do people weave?"

"How are the weaves they make used?"

"What did you notice about how they were weaving?"

"Did you see any patterns?"

## Connect

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

**"Weaving is like coding - it uses patterns that repeat like loops!"**

"Weavers have to use patterns to make their textiles. What kind of patterns did you notice?"

"...They went over/under and repeated - like one of the control structures we have been learning about - loops!"

## Explore

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

**"Let's work on weaving together!"**

"Let's work on weaving together. Remember, weaving is a lot like coding. We are going to follow an algorithm to weave."

"You have some colors to choose from. What kind of pattern would you like to make?"

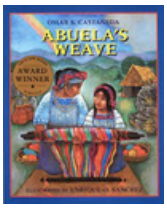
"Let's see if we can spot any repeated patterns or loops. How many times does this loop repeat for the strip? How many colors are in your pattern? How many times does your pattern repeat?"

"Let's use blocks to write a code for your weaving!"

# PHASE 4

## BUILDING BLOCKS AND WEAVING CODE

## PHASE _ TEXT CONNECTIONS

| Text Title | Connection to Phase and Powerful Ideas | Questions (before, during, and after reading) |
|---|---|---|
| *Adi's Perfect Patterns and Loops*   | Adi and Gabi explore **control structures,** and particularly loops, making connections to a mail carriers route and a train's journey, considering how loops can be used to make coding more efficient. | **Before**: I see the word 'loops' on the cover. What do you think loops are? How might they be used?<br>**During**: Where does the loop start and stop? How does the train know what to pick up and drop off?<br>**After**: How are the jobs in the books loops? What makes them loops? Can you think of any other loops you see? |
| *Gabi's If/Then Garden*   | Gabi and Adi continue to explore **control structures,** this time, with conditional if/then codes. The book makes a connection to if/then conditional codes to explore how these types of codes can improve functionality. | **Before**: I see Gabi is in a garden. What are some gardening rules? (make connections to if/then).<br>**During**: When you're in the garden, how would you make choices about what to plant, water, and pick?<br>**After**: At the end of the book, Gabi shows us some foods we can make with if/then (if we have tomatoes, we can make salsa). Can you think of others? |
| *Abuela's Weave*   | Esperanza and her grandmother create a special weave to sell at a festival, making connections between the powerful ideas of **representation, algorithms,** and **control structures** and the cultural practice of weaving. | **Before**:What do you think the book might be about? What do you think this is? [point to textile]<br>**During**: What do you think they are making? How are they making it?<br>**After**: How does weaving work? What do Esperanza and her abuela have to do to weave? How would you create a woven textile? What colors would you use? |
| *How to Code a Sand Castle*   | Pearl is trying to build a perfect sandcastle using her trusty robot but runs into challenges and has to use **debugging** and **control structures** to meet her goal. At the end, Pearl uses **modularity** to bring all the components together and complete her sandcastle! | **Before:** I know we read this before. Someone tell me about what Pearl does in the book.<br>**During:** What is the sequence that Pearl uses to code a sandcastle? What do you notice about the sequence?<br>**After:** Did you notice any if/then or loop statements in Pearl's code. What specific ways did she use loops and if/thens? How are they the same or different from the ways we have used them? |

# PHASE 4

## BUILDING BLOCKS AND WEAVING CODE

## 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 cultural practices that are connected to coding such as weaving, hair braiding, and gardening/agriculture. Look for patterns, loops, if/then conditionals, etc. Talk about how these practices associate with coding and robots.
- Discuss the idea of choice - in coding and in our daily lives. We make choices based on conditions.
- Look for if/then and looping patterns in classroom, home life, and community. Discuss how they relate to computer coding.

## SMALL GROUPS AND CENTER IDEAS

- Provide opportunities for children to explore cause/effect relationships through music! Working with musical instruments is a simple way to explore cause/effect but can be connected to other activities in the phase (e.g., think about playing in a way that uses loops/repeats; explore soft vs loud playing as an if/then)
- Introduce more activities that support pattern recognition, generation, and replication inside and outside.
- Provide opportunities for children to explore KIBO in structured activities as well as in more unstructured free play/centers contexts. Encourage children to think about KIBO functions compared to other robots, especially as it relates to loops and if/thens. Explore other robots' ability (or not) to be coded these ways.

## EXTENSIONS

- Revisit old activities (Phase 1-2) with new knowledge.
  - Explore the program-the-day from Phase 1 but now with loops and if/then. How does it change? How is it made easier?
  - Re-read *If You Give a Mouse..* (or similar book) and use if/then statements to retell the story. What happens if a part of the story is removed?
  - Smart robots - what control structures would they build into their prototypes from Phase 2?

## OTHER TEXTS