UNIT 3

SMALL STEPS FOR BUILDING BIG

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

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

EQ I

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

EQ II

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

EQ III

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.

MATERIALS

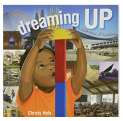
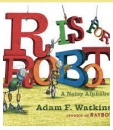
(see materials list)

1. Kibo Kit
2. Robot Mouse
3. Botley/TaleBot Robots
4. Robot books
5. Architecture/Design books
6. White board/markers
7. Snap Cubes
8. Road Signs
9. Maps
10. Directional Cards
11. Building Materials and Loose parts

LEARNING OUTCOMES

- **PK4.I.A.4** Child shows initiative in trying new activities and demonstrates perseverance when attempting to overcome obstacles or challenges
- **PK4.I.C.4** Children increasingly interact with peers during cooperative play scenarios that share a common plan and goal.
- **I.C.5.** Child initiates problem-solving strategies and seeks adult help when necessary.
- **PK4.V.E.3** Child recognizes, duplicates, extends, and creates patterns.
- **PK4.V.C.3** Child demonstrates use of position words.

UNIT 3 OVERVIEW

Unit 3 Focal Experiences	Unit 3 Small Groups	Unit 3 Centers	Unit 3 Focal Texts
Robot City *Collaborate to build a city in which robots work together*	My name is KIBO How far does robot go? Design/Build a City Hokey Pokey	Art • city pictures, materials to make cities Library • design/architecture books Blocks • directional cards, popsicle sticks, people and cars Computer/Tablets • Bee-Bot, Starfall Dramatic Play • Community helper dress-ups, maps Puzzles/Games • More challenging puzzles Writing • Map and sign making materials	 *How to Code a Sandcastle* (sequences, loops, if-then else)  *And the Robot Went* (sequencing, algorithms, design process, modularity)  *Dreaming Up* (Design process, modularity)  *R is for Robot* (sequencing, algorithms, design process)

UNIT 3 TIMELINE

Each Tex:CS Unit lasts approximately 6 weeks. Units can and should overlap or be extended or shortened as needed in your classroom. This timeline is a ***suggestion****.*

week 1

Unit 3
Introduce focal robot (Kibo)
Small group 1-2
Centers as desired

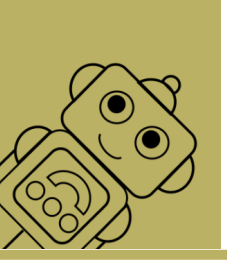
week 3

Review/revisit Phase 2 Focal Exp,
Small Groups, and Centers
Transition to Unit 3
Make connections

Unit 3
Continued explorations
Books with modularity
Small Group 3-4
Centers as desired

week 6

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



CULTURAL RELEVANCE

Big tasks, small steps

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.

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.

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 unit

- 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.

UNIT 3 CENTERS

Center	Materials	Powerful Idea
Art	In art, we can make plans for how to build cities. • Various real images of buildings and signs (road signs, building signs) • Laminated pictures from books children have read • Design process poster • Various art materials like (paper, glue, tape, scissors, markers etc) to create plans for cities and designs for KIBO stage	Design Process
Blocks	In blocks, we can explore building structures for cities. • laminated directional cards, Various real images of maps and cities. • Various loose parts & recycled materials for structure building. • Toy cars, people, etc. • Popsicle sticks for a road outline for KIBO • KIBO robot. • Bin for children to share materials and plans made in art to use in construction zone.	Modularity Algorithms
Books/ Library	In the library, we can read books about robots, cities, and buildings. • Books on building (Dreaming Up) • Books on machines and maps (R is for Robot) • Books on road signs/shapes. • Books on cities and different buildings and materials (Mapping my Town)	Design Process Representation
Dramatic Play	In dramatic play, we can think about our community. • Robot dress up materials • Community helper outfits to fit into creating a city theme. • Maps	Representation Modularity
Puzzles and Games	In puzzles and games, we can use modularity to break down complex tasks. • Harder puzzles that include an outer part and an inner part. • Board games like Robot Turtles, Code and Go Robot Mouse game.	Modularity Debugging
Computer/ Tablets	In computers/tablets, we can design cities and make maps. • Games that include shapes and building • Starfall, Bee Bot online (community map, country roads)	Modularity Representation
Writing	In writing, we can write stories, write books, and write directions • Paper and copies of directional cards • Book making materials • Story sequencing pages	Representation

SMALL GROUP #1

My Name is KIBO

hardware/software | modularity

Please collect documentation /artifacts for each small group lesson

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

Learning Outcome: PK4.I.C.4 Child increasingly interacts with peers during cooperative play scenarios that share a common plan and goal

Materials Needed

- KIBO Robot
- Code Blocks
- *And the Robot Went* book

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.

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

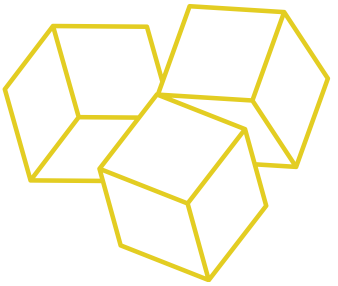
- What do you think the BEGIN/END blocks do or mean?
- How do we communicate with KIBO what we want our program to be?
- What do you think the (FORWARD/BACKWARD/SHAKE) blocks do or mean?

Collect small group assessment data for all children

SMALL GROUP #2

How Far Does Robot Go?

debugging | representation



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

Learning Outcomes: **PK4.V.D.1** *Child recognizes and compares heights or lengths of people or objects.*

Materials Needed

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

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

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?

SMALL GROUP #3

Design Robot City

design process | modularity

Please collect documentation /artifacts for each small group lesson

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

Learning Outcome: PK4.IV.B.1 Child discusses and contributes ideas for drafts composed in whole/ small group writing activities.

Materials Needed

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

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

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...?

SMALL GROUP #4

Hokey Pokey

modularity | representation

Please collect documentation /artifacts for each small group lesson

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

Learning Outcomes: PK4.V.E.3 *Child recognizes, duplicates, extends, and creates patterns*
PK4.V.C.3 *Child demonstrates use of position words*

Materials Needed

- KIBO
- Coding blocks
- White board/dry erase marker

Success Criteria

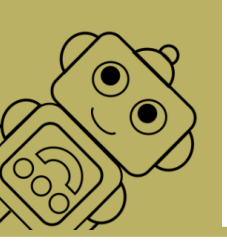
M= Student work collaboratively to recall the function of each coding block, make decisions about which blocks represent Hokey Pokey movements, program KIBO, and debug as necessary
IP= Student are engaged in some parts of recalling, decision-making, coding, and debugging
NM=Student are not fully engaged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

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?



Materials

- *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)

FOCAL EXPERIENCE

modularity | debugging | design process

Robot City

Objective: 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.

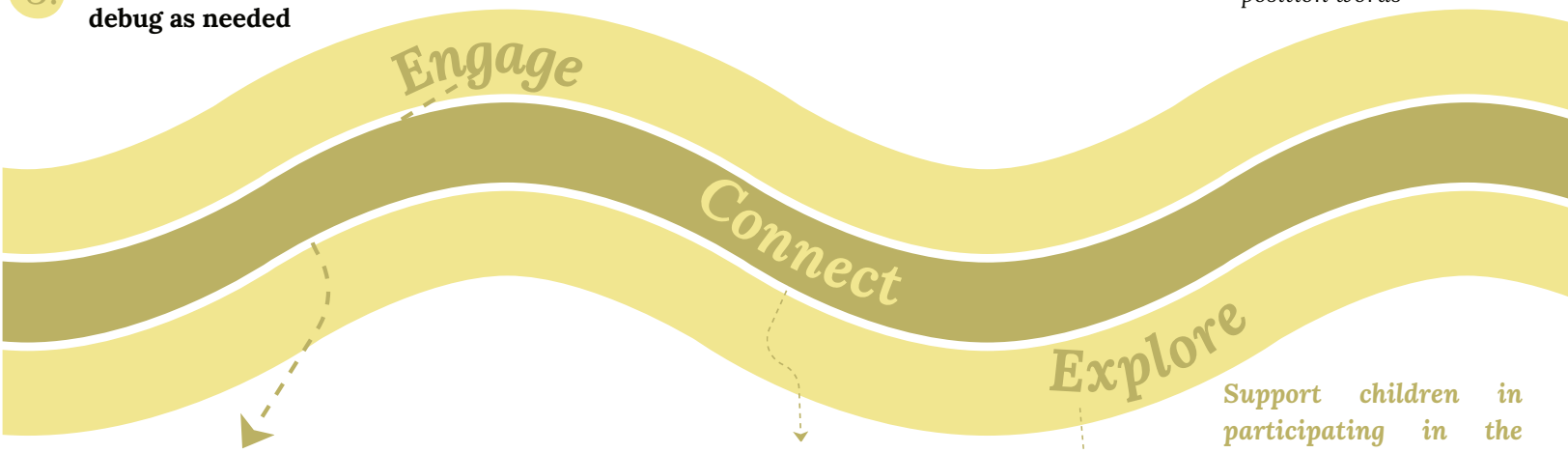
1. **Read/review book in which robots solve problems. Discuss local problems that could be solved**
2. **Review city plans; build part of city, with small groups; program KIBO to move in city to solve problems**
3. **Combine parts of city to create whole; run KIBO sequences to interact with the city, debug as needed**

Learning Outcomes

PK4.I.C.4 *Child increasingly interacts with peers during cooperative play scenarios that share a common plan and goal*

PK4.V.E.3 *Child recognizes, duplicates, extends, and creates patterns*

PK4.V.C.3 *Child demonstrates use of position words*



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

- **"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?"

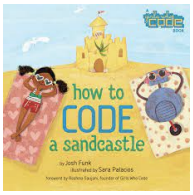
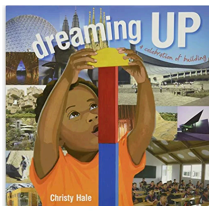
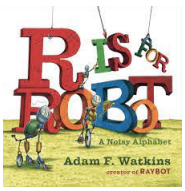
Support children in participating in the activity. Ask questions and help make connections

- **"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?

Key Vocabulary

- **modularity**
- **design/designer**
- **problem solving**
- **interact**
- **debug**
- **modify**

UNIT 3 TEXT CONNECTIONS

Text Title	Connection to unit and Powerful Ideas	Questions (before, during, and after reading)
How to Code a Sandcastle 	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 see Pearl and a robot on the cover of this book. What do you think Pearl and the robot are going to do? **During:** Hmm. What does code mean? How can we code a robot? What do you think Pearl needs to do to code her robot? **After:** 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?
And the Robot Went 	Starting with a box of parts, characters collaborate to assemble the Robot. Characters use **algorithms (sequencing)** and **modularity** during each step of the **design process** until they have built the Robot!	**Before:** Let's look at the cover. I wonder what this book is about. What do you think this book will be about? **During:** What do you think is going to happen next? What happens after...? **After:** What would you do if you found a robot? Where do you think the robot went?
Dreaming Up 	Illustrations and photographs showcase the way children's play and engagement in the **design process** is reflected in the architecture we see around the world. Ideas of **modularity** are reflected in the way designs can start small and become something big!	**Before:** It looks like this child is building with blocks. What do you like to build with? **During:** Wow! Look at that building. What kind of buildings have you seen before? **After:** What can we use in our classroom (or in our homes) to design and build buildings? What kind of buildings would you design/build?
R is for Robot 	Noisy robots use **algorithms (sequencing)** and the **design process** to build the alphabet.	**Before:** 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. **During:** What are these robots doing? What is happening in this picture/what do you notice? **After:** 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?

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 Tex:CS program, but could be used in this unit

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 Robot Mouse and Talebot, and how Kibo understands different symbols (i.e., representation). Compare input functions (Mouse/Talebot = buttons; KIBO = blocks).
- 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 constructing buildings.
- 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.
- Use blocks and other materials to make structures for robots to navigate under, around, over, and through

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 Unit 4)
- Class party- each small group is responsible for different parts of the party (snacks, decorations, games, etc.)

OTHER TEXTS