KIBO Bowling

(Beginner, 20 minutes)

Cross-curricular connection: **Measurement (Math)**
Special KIBO Parts: **None**

Overview:

Crash! How far does KIBO have to move to get from the start of the bowling lane to the pins? In this activity, KIBO will become a programmable bowling ball. You can create a single straight lane or create a more complicated path that KIBO must travel to the pins.

Learning Goals:

Students use **estimation** and **measurement** to create a program to travel the length of the lane. Students will **test** how far a single forward block carries KIBO, then **improve** their programs using the **Engineering Design Process**. They can engage with **control structures** through the use of the REPEAT block.

Materials (and Equipment):

- KIBO blocks and parts limited to:
  - Motion blocks, REPEAT with number parameters
  - Wheels and motors
  - Optionally, spacers, stage supports, art stage platforms, and Building Brick Extension Sets (to provide options for making KIBO a bigger "bowling ball")
- A collection of objects to serve as "bowling pins." (If you don't have toy bowling pins, try plastic water bottles, plastic cups, or foam blocks.)
- Masking tape for marking out the lane
- Equipment: Kid-friendly measuring tape

Station Setup:

The station consists of just the "bowling lane", divided into several distinct areas:

- A setup/staging area, where students program KIBO and start their travel down the lane.
- The bowling lane itself, clearly marked out (e.g. with masking tape). Create a clear start line. Also create edges or a central path, to indicate how KIBO should travel. The path doesn't need to be straight; an L-shaped path can introduce an extra challenge.
- The target pins are set up at the opposite end of the alley.

Decoration and signs:

- Designate the alley area clearly. Consider including measurements in the alley itself (a mark on the tape every foot; or a measuring tape extended alongside the alley).
- It can be helpful to include an image of the pins as they should be set up, to facilitate cleanup.
- Vocabulary sign: **measure**, **estimate**.

Materials: Clearly identify what materials can be used as pins.

Project Facilitation Suggestions:

Introduce this station in a whole-class circle. Explain that the students will need to create a program to make KIBO travel from the start of the alley to the end. They will need to estimate, measure, and experiment to determine how many FORWARD commands are needed to reach the pins. If their KIBO doesn't reach the pins, they need to try again from the starting line, just like in real bowling! They'll need to reflect on what didn't work, then modify their program to try again.

Get active! Use the KIBO Says cards, or just spoken commands ("forward", "turn right", etc.) to direct the students around the room as if they were the bowling balls.

There are several ways to make KIBO travel longer distances: using multiple FORWARD blocks, using the REPEAT command, and scanning the same FORWARD block multiple times. For more experienced KIBO students, include a refresher on the use of REPEAT loops if appropriate. For younger students or those newer to KIBO, provide multiple FORWARD blocks at the station. Demonstrate use of the measuring tape as an inquiry tool for evaluating how many forward movements are required to reach the pins.

The following exploration prompts can keep students on track:

- How far does KIBO move with a single FORWARD command?
- If KIBO didn't reach the pins, why not? Did it not travel far enough? Did it turn the wrong direction?
- Can you change the program or build onto KIBO to make KIBO knock down more pins once it reaches them?

Suggested Modifications or Variations:

You can provide a score-keeping sheet so groups can track how many tries they took to reach the pins, and how many pins they knocked down.

Academic Standards Addressed:

Whole-Classroom Connections	This activity station would work well during a whole-class math unit related to estimation and measurement.
Common Core Math Standards	CCSS.MATH.CONTENT.1.MD.A.2: Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. CCSS.MATH.CONTENT.2.MD.A.1: Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
Next Generation Science Standards	K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.