

Robot Creatures & their Behavior, Part I

KT06 Cubelets in the Classroom, 40 minute activity

This lesson plan can be used as an introduction to robotics and presents the basic components of robots (sense, think, act) in a fun, hands-on, and experiential way. The deeper objective of these activities is to leverage students' engagement in understanding and building robots with Cubelets to evoke natural curiosity about what their robots **do** and how they act. While students observe and understand behavior they build scientific skills relevant to biology, psychology, robotics, and artificial intelligence and develop general critical thinking ability related to scientific inquiry, categorization, considering properties and characteristics, and prediction.

For each class/group, this lesson plan includes 2 segments:

Each segment is suggested to last 20 minutes in order to comprise one class of about 40 minutes. .

1. An “unplugged” introduction to new vocabulary or concepts and allowing kids to learn the basics of robotics
2. A hands-on exploration of robotics components, sensing, behavior, and cataloguing inputs/stimuli using Cubelets

Each segment is suggested to last for 20 minutes, with two segments comprising a 40 minute class. Where a class period affords less than 40 minutes, we suggest increasing time for each segment and using Part 1 as a single class and Part 2 as a single class activity the next day.

While these lesson plans have suggested age levels, it is also possible to use the younger grade activities as a ramp up to older students; e.g. use the 4 years old - 8 years old activities to ramp up and extend a lesson plan for a group of 9 year olds to last for more than one class. Similarly, the activities suggested for older students can become a way to expand on challenges presented to younger learners if there is time and interest.

Introduce each group to the task of being Robot Investigators

“I have these robot blocks and you can make different robot creatures with them. Today, we’re going to use some of the scientific techniques of biologists, psychologists, and anthropologists to investigate and understand the robots we make and test. Our robots will do different things and behave in different ways. You’ll learn to collect data and keep track of what they do, and also the things we do that they react to to try and better understand our robots.

First, let’s play a game that will help us better understand some robot basics, start thinking about what things we might want to investigate when we build our robots, and learn some new scientific vocabulary. “

Part I: Unplugged Robots Game

Materials: tape, envelopes, paper clips, plastic bag, objects of different masses, radio/MP3 player and speakers

Teams of one, two, or three children act as a robots to complete a task by sensing-thinking-acting with restricted parameters/senses/actions. Goals can be simple such as retrieving a box. Multiple “paths” and robots can play at once in order to make this a short introduction. Alternatively, have children take their turns one at a time while others record data and notice how magnitude of responses can correlate to magnitude of input/stimuli.

Basic rules

1. Anywhere off the line is “hot lava!” (or an “out”)
2. “Robots” or “Robot teams” can only move forward when sensory input indicates (“sense” agreed upon beforehand. See below)

| Sense Examples: | Information conveyed: |
|-----------------|--|
| Mass | Student is given items of various masses. Heavier items produce more response. (Can be made invisible by putting items in a bag/pillowcase) |
| Number | Student is given chains of paper clips: 3, 4, 5, 6 . . . long. The more they get the greater the magnitude of reaction. (Can be made invisible by placing them in an envelope) |
| Noise/Sound | Student is given noise stimuli; e.g. music. Can be made invisible with an MP3 player/headphones |

Suggested age variations/progression:

- **4 years old to 8 years old:** 1 player per path, multiple paths for each child so all students are engaged. If time allows to expand this game, first try two players (one as Sense and one as Act) and then using different sense inputs and stimuli.
- **8 years old to 11 years old:** Using two players and adding more senses and “secret senses.” Have teammates/group try to deduce what the “sense” is/what is being reacted to and ask, “What was the magnitude of that response? Big, medium, or small?”
- **11 years old and up:** Expand to 3-players adding an additional sense or the Think robot component. As an additional challenge, introduce behavioral observation and data collection to students who are not having a turn on the robot team in order to practice scientific observation.

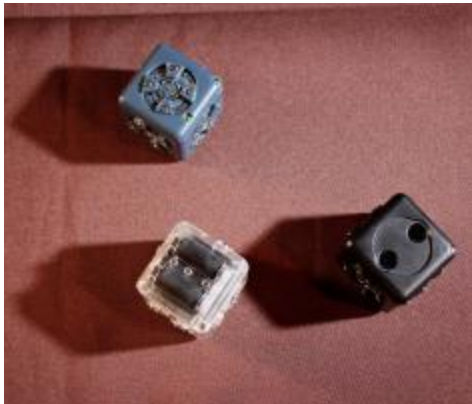
Concepts presented: Behavioral observation, deductive reasoning, amount, parameters
Vocabulary: Sense, input, stimuli, magnitude, observation, behavior, amount, parameters,

Part 2: Initial Cubelets exploration of behavior observation

In order for students to form theories about the sense component of their robot they must investigate presenting varying input and stimuli to the sense Cubelet. Students practice observing behavior and build understanding of different magnitudes of stimuli/input and their correlation to reaction or output.

Materials: KT06 kits, groups of 1-4 students using each kit. Initially all groups use only the Distance, Drive, and Battery Cubelet and investigate "what this robot is sensing/reacting to?"

"Remember, robots must have sense and act components. Every robot also needs power. So, to start, I'm going to give each group 3 Cubelets: A Battery Cubelet, a black sensing Cubelet, and a clear action Cubelet that drives. Investigate how many different robot behaviors you can make. and move these Cubelets all around into different configurations. What do you think this robot is sensing? Can you make a theory and then try different ways of testing it?"



Suggested age variations/progression:

- **4 years old to 8 years old:** Ask students to demonstrate their different robots/behaviors and prompt them to try different things to get the robot to react. "What makes it move? What have you tried? What could this mean?"
- **8 years old to 11 years old:** Starting with the Distance, Drive, and Battery Cubelet have students keep their own count of varying behaviors and suggest that how the robot moves is a way of keeping track of unique reactions. Students should consider how their choice of inputs/stimuli can tell them more about what makes this robot react. Students will often use their hands over the sensor, and this can lead them to conclude that the black Cubelet is sensing heat or people but if they also use other objects and are challenged to consider what causes the robot to move **faster** or **slower** in any direction this helps direct their investigations towards considering distance.
- **11 years old and up:** As above. As students get more sophisticated in investigating the different robots, prompt them to notice how small changes in the arrangement of an individual Cubelet direction or configurational change will result in different responses and reactions.

Concepts presented: data collection, scientific process/inquiry, theory

Vocabulary: sense, stimuli/input, reaction/output, behavior, amount, faster, slower, theory