Lesson Plan: Make Me Move! Measuring with Ozobots
Grades and Contents: 2nd Grade Math

Topic: Measurement and Computer Science

Enduring Understanding

- What you are measuring affects the unit and the tool you will use to measure it.
- You can compare and contrast measurement from one unit to another by measuring an item with both units.
- Programs can be coded in order to complete a task.

Standards

Math

2.MDA.1 Select and use appropriate tools (e.g., rulers, yardsticks, meter sticks, measuring tapes) to measure the length of an object.

2.MDA.2 Measure the same object or distance using a standard unit of one length and then a standard unit of a different length and explain verbally and in writing how and why the measurements differ.

2.MDA.3 Estimate and measure length/distance in customary units (i.e., inch, foot, yard) and metric units (i.e., centimeter, meter).

2.MDA.4 Measure to determine how much longer one object is than another, using standard length units.

Computer Science (Algorithms and Programming Strand starts in 3rd)

Standard 4: Develop a program to express an idea or address a problem. The student will:

3.AP.4.1 Use picture directions to design a series of steps to complete a simple task.

3.AP.4.2 Test a series of directions to successfully complete a simple task.

Academic Language

Vocabulary

- Program
- Algorithm
- Centimeter
- Metric Units
- Meter
- Inch
- Foot
- Yard

Objective/Language Function

- Using the appropriate tools, measure a track using inches and centimeters.
- Explain verbally why and how the two lengths are different for the same pathway.
- Estimate verbally the total length of the Ozobot track and then measure to see how much more you need to add or take away to meet guidelines.

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- Design a track for an Ozobot using a specific number of centimeters/inches incorporating at least 3 different Ozocodes.

Assessment Plan

- Pre-Assessment-
    - Anticipation Guide with questions about self-efficacy and attitudes about programming.
    - Gallery Walk: Post prompts 1-4 on board. Students have 4 post it notes. Students place answers on them first with initials on the back. They then walk around the room to post them on the coordinating anchor chart and see the responses of others:
      (1)The best tool to measure a _____ would be a _____.
      (2)Two units I could use if I wanted to measure the length of a baseball bat would be _____ and _____. These would both work because...
      (3) Robots must be told how to move and what to do. If we had a class robot what steps would it need to take to get to the classroom library from your desk? (You can estimate length of steps.)
      (4) When a person tells a robot how to move using a computer program that is called _____. When a person programs several steps to complete a task that is called an _____.
- Post-Assessment-
    - Students will go back and look at their original answers on the post-it notes. They are allowed to change any answer by writing on the back or putting a new post-it on top of the older one (colored post-its may be helpful here).
    - Students will return to the anticipation guide to note any changes after the lesson.
    - Criteria for Mastery:
      -Students should be able to determine the best tool for measuring an item: (smaller items centimeters or inches, etc)
      - Students still may not be able to understand the total difference between programming and algorithms or the relationship between the two, but they should know that an algorithm is a series of steps and programming is what you do to complete algorithms or tasks.

Materials

- Classroom Set of Ozobots w/materials (red, green, blue, black thick line markers) (1 ozobot per group of 2 or 3 students)
- Legal size white copy paper or white bulletin board paper (large pieces for each group)
- Anchor Chart paper
- Copies of Anticipation Guide
- Tape Measure Yardstick/Unsharpened pencils/Rulers/Meter stick
- 2 different colored post-it notes for each student
- *Randy Riley's Really Big Hit* Read aloud selection
- OzoBot Track Measurement Task Cards
- 2 stopwatches (or a classroom clock with a second hand)

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Teacher Preparation

- The day before the lesson, make sure Ozobots are charged.
- Prepare slide show and/or anchor charts with pre assessment questions.
- Procedure for choosing a partner (or assigned partners).
- Review the Tips/Tricks for working with Ozobots

This lesson introduces the concepts of coding using markers and paper. Students will program the robot to move a certain distance as determined by the task card. It will reinforce measurement concepts for centimeters/inches/etc through authentic tasks. It would be best after an introduction to measurement and several other guided practice opportunities with measurement (specifically measuring centimeters and inches). Due to the number of Ozobots in each kit, students should work in pairs.

To keep students on task, it is helpful to stress that during Makerspace time, they are the experts and need to help each other if they get stuck. The discussion guide is a helpful tool to ensure important concepts are covered. There are suggestions for pre- and post-assessments as a way to measure student learning.

Meat of Lesson

- **Hook**
    1. Have students complete the Pre-Assessment Gallery Walk task upon entering the room. First by writing their answers on a post-it notes, and then taking the time to post their answers on the corresponding anchor chart during a gallery walk. This also gives you and the students time to see the responses of others and serve as a way to activate background knowledge and previous learning.
    2. Have all students return back. Begin by saying,
       "If I asked you all to measure this book (hold up book) with a ruler how would you all know what to do?" *Students share out answers. "*What if I just held up the book and didn't ask you to measure it? Would you know what to do then? Why not? Why would it be even better if I asked you all to measure this book with a ruler using centimeters? "
       Tell students that sometimes items are hard to measure and instructions need to be clear in order for them to measure correctly. Creating clear instructions make it easier for others to follow them and allows for a task to be done Correctly. Algorithms are steps in a series that lead to the completion of task. Everyone that gave instructions on walking the robot just created an algorithm!
    3. Next, Read Aloud: *Randy Riley's Really Big Hit*
        a. Read Text.
        b. Discuss book. (see discussion guide)

    3. Next, show students an Ozobot and then display the list of Ozocodes.
        a. Ask students how they think this Ozobot knows how to move around?
        b. What are the ways that a person can tell the Ozobot what to do? (draw the pattern for a specific movement using the right colors).

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c. Do you think a person could just make a track of nothing but Ozocodes? Why not?
d. How do you think the Ozobot is able to find the ozocodes?(Sensor)

4. Introduction: In the story, Riley use his knowledge of programming in order to make his robot move, gather the materials, and follow the correct steps in order to hit the fireball. Today, we will use our knowledge about measurement in order to design an algorithm for an Ozobot to perform tasks while reaching the finish line of a track. When you are using an ozocode to tell your Ozobot what to do you are CODING/PROGRAMMING. When you use a series of steps to get the Ozobot to complete a task (i.e. hitting a baseball (or fireball) finishing the entire track) you've created an ALGORITHM, which is a series of tasks. There is no wrong way to complete the track on your task card, but there are some things you need to know about the Ozobots in order for them to work for you.

1) Paper must be flat.
2) Black track line must be thick and have NO GAPS. Remember it uses a sensor.
3) Must use the Ozocodes in the right order

- **Brainstorm**
  - Students will need to meet with their partner and get a task card. They will need to read their task card to determine how long their track needs to be and the best measurement tool to use to make sure they achieve that length.
  - Students will then need to review the Ozocode handout (having one copy per partnership will be best) to decide which Ozocodes they want to program their Ozobot to do while on the track.

- **Prototype**
  - Students will use their materials to draw a track for their Ozobot and incorporate at least 3 Ozocodes.
  - Students should be encouraged to try out each code as they go to make sure that it works before continuing to draw an entire track. Students will also need to be reminded about the goal of measuring with units and tools.
  - One students could be the drawer and the other could be the coder to ensure accuracy (for example: draw 10 cm of black line, 1 cm of red, 1 cm green, 1 cm red, and then 10 cm of black line)
  - When students have tested and completed their task card. They should then measure their course using a different unit of measurement. Discuss with their partner why the unit of measurement is different.
  - If time allows, have students use the stopwatches or classroom clock to determine how long it takes their Ozobot to complete their course.
- **Share**
  - Have groups take turns walking to see each others Ozobots run the track or simply viewing their track designs.
  - Ask students as they are showing off their tracks, what went well? What was challenging?
  - Did any parts of their track require a different measuring tool?
  - What measurement unit and tool worked best for their track?

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- **Synthesize**
    - Bring students back together for a final discussion. See discussion guide.
    - As a formative assessment, have students refer back to the pre assessment questions and use their 2nd post it note to add on any "new learning" or make any adjustments to their previous responses.
    - Reflect on any changes on the anticipation guide "after" section.

Supports for Student Learning
Accommodations

- **ELs**- If students need additional support with the read aloud it could be preread at an earlier time and vocabulary could be introduced beforehand. The Ozobot codes are color coded and labeling the code on the final product may be a beneficial task to support learners. Due to the visual and hands on nature of this lesson, there is little written work, but students could be given pictures or word choices for the pre/post assessment blanks.
- **Grade Level adaptations**- depending on grade level, read aloud may need to be adapted (For example: K read:*How Big Is a Foot? Or Measuring Penny!*, for conversion 4th grade read:*How Tall? How Short?How Far Away?*)
- **Advanced students**- Use the blue task cards. Have students measure their track with 2 other units of measurements and label each one on the track. Compare results with another group using blue task cards or discuss with partner alternative programming ways their Ozobot could travel the same track distance faster. Advanced students could also work to incorporate (2-1.1 Identify on a map the location of places and geographic features of the local community (e.g., landforms, bodies of water, parks)) by creating a legend and then labeling cardinal directions for any codes and direction shifts.
- **Additional supports** -- If your students have never used the Ozobots before it may be helpful to take a few minutes a day or two before to model creating lines and ozocodes. This could be done watching a quick video or if time allowed and the kit was available to let them draw a line with one code to have the experience before the lesson. Students with difficulty using fine motor skills could also use printed stickers of the codes to create their track, but those would need to be prepared in advance.

Discussion Guides

- Read Aloud-
    - The story gives us information about Randy, for example, that he isn't very good at baseball. Randy doesn't quit at baseball though, what does that tell us about his character? Can you say a character trait that describes Randy?
    - What is one challenge that Randy is already facing? *Examples may be baseball, fireball, parents, etc.*
    - Randy tries to tell his parents about the fireball, but they don't seem to listen. How does Randy respond when that happens?
    - What did Randy have to end up doing to solve the problem?
    - Can anyone give an example of an algorithm that Randy may have created or followed in order to complete at ask? *Examples may be the code that her used to*

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program the robot to hit the fireball, his steps for creating the robot, the teams steps that they take to swing and hit a baseball, etc.

- Synthesis-
    - Ask any groups that were able to time their Ozobot how long it took for it to complete the course?
    - Why might some bots take longer than others to complete the tracks even if the measurements of the tracks were the same?
    - Were there any Ozocodes that were difficult to incorporate into your track? Why do you think that was?
    - What was challenging about this lesson? What was fun?

More to Explore (Resources)

- Introduction to coding not using the markers see (Blocky)
- Education: Ozobots https://portal.ozobot.com/lessons/detail/ozo-dash-100
- Similar Read Alouds: http://www.chrisvandusen.com/
- Code.org Elementary: https://code.org/educate/curriculum/elementary-school
- SC Computer Science Standards: https://ed.sc.gov/instruction/standards-learning/computer-science/standards/

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