

# SCHOOL-WIDE STEM CHALLENGE

## DEBUGGING AN ALGORITHM

### Stage 1 – Desired Results

**Established Goal(s):**

**ISTE Standards for Students**

Digital Citizens

Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal, and ethical.

2b. Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.

Computational Thinker

Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

5a. Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

5d. Student understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

**Understanding(s):**

*Students will understand...*

- We can learn from our failures (aka “fail forward”)
- Success requires perseverance
- We can use an algorithm to solve a problem or achieve a goal.

**Essential Question(s):**

- What do good problem solvers do when they get stuck?
- What are the fundamentals of computer programming?
- How are algorithms used in coding?
- How can you use computer programming to complete a task?

*Student will know...*

- Basic coding skills
- Computer science vocabulary (algorithm, sequence, events, loops, conditionals, etc. based on grade level)
- The design process (Plan, Test, Reflect, Revise)
- What it means to “de-bug” an algorithm

*Students will be able to...*

- Create an algorithm to solve a problem or achieve a goal
- Proofread and edit an algorithm to “de-bug”

# SCHOOL-WIDE STEM CHALLENGE

## DEBUGGING AN ALGORITHM

### Stage 2 – Assessment Evidence

This is a school-wide STEM Challenge. Grade levels will have different, age appropriate coding challenges.

**Performance Task for 2<sup>nd</sup>/3<sup>rd</sup> grade:**

**G(oals):** Design a maze. Program your Ozobot robot to complete the maze with your algorithm.

**R(ole):** Computer Programmer

**A(udience):** Parents and other students at the school-wide STEM night

**S(ituation):** You are a renown computer programmer and have been asked to complete a maze by programming an algorithm for your Ozobot robot.

**P(roduct):** Your algorithm and ozobot performance of navigating the maze.

**S(tandard):** A rubric that will assess the success and complexity of the algorithm. Also, a video of the child explaining the steps of the algorithm and how it works.

**Other Evidence:**

- Student “Fail Forward” journal that documents the process of designing the algorithm and steps taken to “de-bug”
- Student self-reflection at the end of project
- Student self-assessment on 4 C rubric that measures critical thinking, communication, collaboration and creativeness.
- Class discussions

### Stage 3 – Learning Plan

**Learning Activities:**

W = Help the students know Where the unit is going and What is expected. Help the teacher know Where the students are coming from (prior knowledge, interests)?

H =Hook all students and Hold their interest?

E = Equip students, help them Experience the key ideas and Explore the issues?

R = Provide opportunities to Rethink and Revise their understandings and their work?

E = Allow students to Evaluate their work and its implications?

T = Be Tailored (personalized) to the different needs, interests, and abilities of learners?

O = Be Organized to maximize initial and sustained engagement as well as effective learning?

Day 1

1. Introduce essential question and discuss: What do good problem solvers do when they get stuck? How do you feel when you get stuck? What do you do? **H**
2. Show video of a robot and ask “How does the robot know what to do?” Think-Pair-Share and then discuss as a class. Introduce the idea or review the term algorithm and post the vocabulary card in the classroom. **H**
  - a. Side note: students should have prior knowledge of what an algorithm is, along with other basics of computer programming from the Code.org curriculum.
3. As a way to better understand algorithms, play Rosy the Dog game. Students take turns laying down picture cards that have basic commands (up, down, left, and right) in order to give directions to the

# SCHOOL-WIDE STEM CHALLENGE

## DEBUGGING AN ALGORITHM

classmate who is pretending to be Rosy on how to get to her bone. **E**

4. At the end of the activity, bring groups back to the carpet and revisit the essential question. Ask them what problems did they encounter and what did they do when they got stuck. **E**

### Day 2

5. Ask the essential questions: How are algorithms used in coding? How can you use computer programming to complete a task? **E**
6. Explain design challenge: that they will work together with a partner to program an algorithm for their ozobot so that it can complete the maze. **W**
7. Demonstrate how to use block coding on ozoblocky.com and give them time to tinker and play on the website (10 or so minutes). **E**
  - a. Keep in mind digital citizenship standard 2b as students use online coding platform
8. Give them a simple puzzle to write an algorithm for. Have them think-pair-share their idea for an algorithm with their partner then together pair-program it on ozoblocky and test it out. **E**
  - a. Have several levels of simple mazes, ranging in complexity for pairs to work through at their own speed (differentiation). **E, T**
  - b. Remind students of their responsibility to engage in positive and safe behavior while using their ozobots and personal devices (ISTE Student Standard 2b.)
9. Come back to the carpet at the end of the lesson and talk about the term "Fail Forward". Ask the students how they feel when they fail to accomplish a task or encounter a problem. Explain that we can learn from our mistakes. Whenever we get stuck it doesn't mean we should give up. In fact, we can learn from those mistakes and use them to move forward. So really "failing" is just one of the stepping stones on the way to success (aka "fail forward"). **E, R**

### Day 3

10. Review what an algorithm is (refer to Rosy the Dog game and also the algorithms they created to have their ozobots complete the mazes the previous day).
11. Review the design challenge and let students work on designing their own maze with a partner. **W, E**
12. As a class go over the Algorithm rubric and 4 C self-assessment so students understand expectations. **W**
13. Teacher direct instruction: teacher shows students a maze he or she created. Then the teacher shows them the algorithm she designed on ozoblocky. She models how to test the algorithm (that has "bugs" planted on purpose). When the ozobot runs into a problem, the teacher can stop and model how to fill out the "Fail Forward" journal that has you reflect on the problem you encountered and your ideas on how to fix it. After documenting her ideas in her journal, she returns to ozoblocky to fix or "de-bug" the algorithm and test it again. **E**
14. Students do pair-programming on ozoblocky to design an algorithm for their ozobot to complete the maze they created. They can test it out as they go. When they hit a "bug" they must stop and reflect in their "Fail Forward" journal before they can try and fix the algorithm online. **E, R**
15. At the end of the work time bring the students back to the carpet and let them share about their experiences. Refer back to the essential question: what do good problem solvers do when they get stuck? Also make sure to revisit the idea of "failing forward". **R**

### Day 4-5

16. Students will most likely need several days to continue working on creating their algorithm with their partner and "de-bugging" it as they go. Continue to check in on the essential questions and give students time to reflect on how they are "failing forward". **E, R**
  - a. For students who finish early, encourage them to work towards a 4 on the algorithm rubric by adding complexity to their algorithm (adding lights, noise, speed to their algorithm). **T**

## **SCHOOL-WIDE STEM CHALLENGE**

### **DEBUGGING AN ALGORITHM**

- b. Pull students when they are done with their algorithms and film them explaining the different steps to check for understanding and document learning.

Day 6

- 17. When students have completed their algorithm (or you have reached the timed limit you can spend on the design challenge) have students reflect and evaluate their work. **E-2**
  - a. Student Self-Reflection worksheet
  - b. Student Self-Assessment on the 4 C's

\*Students will showcase their ozobot navigating their maze at school-wide STEM night.