

## Marble Empire Learning Activity #8:

### Debugging Marble Empire

#### Summary:

In this activity, children will learn computer science vocabulary and practice fixing Marble Empire setups that don't work as intended.

#### Reference Standards:

Next Generation Science Standards:

[K-2-ETS1-3](#)

Common Core Standards:

[MP.5](#)

#### Learning Goals:

1. Learn the terms **bug** & **debug**.
2. Identify bugs in a system and create solutions to fix them.

#### Materials and Setup:

Before beginning, create a Marble Empire run that has "bugs." In other words, create a Marble Empire that doesn't work as it's supposed to. To do this, you can include Ramps that don't connect, Funnels that aren't above the right elements, and dead ends that stop the Sphere from continuing. Include 3-5 bugs. Set extra Marble Empire pieces aside that the child can use to debug the run. Pro tip: It is much easier to construct a standard Marble Empire set that is working, then change a few pieces to create the "bugs" after completing.

#### Part One: Learning About Bugs

1. Explain to the child that in this activity, they will be acting like computer programmers fixing a program. Tell them that a computer program is similar to a

Marble Empire. Computer programs do things using information that are put into them. Similarly, Marble Empire setups are designed to get the Sphere to the end once you place it at the beginning.

2. Have the child test the buggy Marble Empire by placing the Sphere at the beginning and seeing what happens. Explain that when a computer program doesn't work as desired, the problem is called a **bug**. Finding and removing the bug is called **debugging**.
3. Tell the child that their task today is to **debug** the Marble Empire. Emphasize that in computer programming and in life, things do not always work as anticipated on the first try. It is important to be **persistent** when solving problems.

## Part Two: Debugging

1. To begin debugging, help the child find all of the bugs in the Marble Empire. Tell them that to help debug, they can start the Sphere at different points in the "program." This allows them to find the bugs that the Sphere will encounter once the first bug is fixed.
2. Once the child has identified all of the bugs, allow them as much time and pieces as they need to fix them all to get the Sphere to the end.
3. Make sure to offer plenty of congratulations when the child solves a bug.
4. When they have fixed all the bugs, have a discussion with them about the experience.
  - a. Were there any times they felt like giving up? How did they make it through?
  - b. Was the process easier or more difficult than they expected?
  - c. What was a moment of insight they had during the process?

## Assessment

1. Was the child able to persevere and solve all of the bugs in spite of the difficulty?
2. Were there any bugs that the child was not able to find the correct piece to replace? What did they do?