1.AP.3 Algorithms and Programming

> The student will use the iterative design process to construct, test, and debug algorithms that include sequencing and an event. (a) Discuss and describe the concept of debugging. (b) Analyze and explain the results of an algorithm. (c) Revise and improve an algorithm to produce desired outcomes.

Understanding the Standard

Debugging is essential to the iterative design process, where we continuously test, refine, and improve algorithms. It involves finding and fixing errors in a program or algorithm to ensure it works as intended. By checking the sequence of steps and identifying any issues, students can make necessary changes, such as adding, deleting, rearranging, or changing a step in order to obtain the intended outcome. This iterative design approach helps students develop problem-solving skills and create effective algorithms. Once students clearly understand the issues or improvements needed, they can revise and refine an algorithm to achieve the intended outcome. In first grade, students should practice examining their algorithms "line by line" to ensure that each step has the expected outcome. Students should also develop a habit of retesting their algorithms each time they make a change to better understand the effects of each step.

Term	Definition
Algorithm	A list of steps to finish a task.
Debug	Find and fix problems in a program.
Program	An algorithm that has been coded into something that can be run by a machine.

Prerequisite Knowledge

To engage with this standard, students need to have an understanding that a set of instructions is followed to achieve a desired result.

Integration Opportunities

History 1.1f Students will compare the outcomes of an algorithm to cause-and-effect relationships.

Math 1.PFA.1 Create an algorithm to build a square pattern using colored blocks or other objects, testing the arrangement to ensure accurate square formation; discuss any errors, apply debugging strategies to refine the algorithm, and extend the pattern by increasing the number of squares.

Physical Education 1.1 a,f,g Plan and create step-by-step instructions for skilled movements (galloping, leaping, skipping, etc) that can be broken down into smaller repetitive parts. Have groups test and refine the instructions.

Summary of a Lesson

Give each pair of students an envelope that contains 5-8 images describing a routine from their school day with sentences at the bottom that summarize what is happening in the pictures (image examples: student waving to a caregiver, sitting on the school bus, entering the school, high-fiving their teacher, a student at their cubby area). Students work to put the story into order. One student takes the images out of the envelope and sets them on the desk in the order they are pulled out. Once all five images are face up and in a line, the students read through the story in front of them. Taking turns, each student moves an image until the sequence is assumed correct. At that point, one student speaks through the set of instructions while the other student listens and checks the work. If there is an image that is out of order, the students debug the sequence and go through the process again. Trade envelopes with another group and have students complete this individually.