4.AP.3 Algorithms and Programming

> *The student will use the iterative design process to create, test, and debug programs containing sequencing, loops, variables, user inputs, and conditional control structures in a block-based programming tool. (a) Create and test programs that consist of sequencing, loops, variables, user inputs, and conditional control structures. (b) Create and use variables to store and process data. (c) Trace and predict the value of variables that change over the course of the program's runtime. (d) Analyze and describe program results to assess validity of outcomes. (e) Revise and improve programs to resolve errors or produce desired outcomes.*

Understanding the Standard

Programmers review the sequence of steps of their algorithms to determine if they work accurately and efficiently. Elements of an algorithm appropriate for fourth grade include sequencing, events, loops, conditionals, and variables. The design and implementation of each algorithm should adhere to program requirements, accuracy in execution, and usability. If the algorithm is not working as intended, students should work out possible solutions to implement which may include adding, deleting, rearranging, or changing a step.

Term	Definition
Debug	Find and fix problems in a program.
Event	Something that causes a portion of a program to run (e.g., a mouse click).
Loop	A set of actions repeated until a condition is met.
Sequence	An ordered set of instructions.
Variable	Programming element that can hold a value.

Prerequisite Knowledge

Students should approach this standard with some experience with composing interactive programs that include loops, events, and conditional control structures. They build on this knowledge in fourth grade by writing more complex programs with additional loops, events, conditional statements, and variables. To support debugging, students need to have experience with double-checking their work, creating step-by-step instructions, and editing.

Integration Opportunities

Math 4.CE.4 Create a decimal shopping spree game program to calculate the total cost of their shopping, add decimal prices together, apply discounts, and ensure the cost stays within a budget, while debugging and iterating their project.

English 4.w.1b Students use a block-based programming tool to create, test, and debug a program to retell or alter a familiar story.

Physical Education 4.1d Have students collaborate to create a jump rope challenge with a scoring system. Then, they work in groups to create a jump rope routine that includes sequencing and repetition. Students perform, revise, and improve their routines to maximize the points received.

Visual Arts 4.16b Create and test a program as a craft technique to create artwork.

Summary of a Lesson

Working in pairs, students will design an interactive scene in Scratch or a similar block-based program using

pared-down directions from the teacher. The directions should include only what is required in the scene (e.g characters, actions, and setting) and the intended outcome (what should happen at the end of the scene). Students should have multiple opportunities to plan, create, review, and correct any part of their designs to meet the program requirements. Students will then work with another partner pair to review and offer feedback on their designs.