5.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, nested conditional control structures, and two-way branching conditional control structures in a block-based programming tool. (a) Use accurate terminology to describe and explain the iterative design process. (b) Create and test programs that consist of sequencing, loops, variables, user inputs, nested conditional control structures, and two-way branching conditional control structures. (c) Trace and predict outcomes of programs. (d) Analyze and describe program results to assess validity of outcomes. (e) Revise and improve programs to resolve errors or produce desired outcomes.

Integration Opportunities

History Skills USI i Create, revise, and test programs that show an understanding of content.

Science 5.8c Create a program to identify the steps of the rock cycle including all of the identified components (sequencing, loops, variables, etc.)

Visual Arts 5.12f Patterns appear in artwork as well in programs. Design a program that uses loops to create a piece of artwork.

Math 5.MG.3 Create a quiz program that uses user inputs and nested conditionals to test knowledge of angle measurement and triangle classification, providing hints based on responses and including a loop for multiple rounds of practice.

Physical Education 5.1a Have students use the iterative design process to invent new small-sided games that include a point system, movement skills, and sequencing. Have students regularly review and revise to resolve problems.

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.
Conditional (if-statements)	A set of actions that only runs if a condition is met.
Variable	Programming element that can hold a value.

Prerequisite Knowledge

Students should approach this standard with experience in composing interactive programs that include 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.

Summary of a Lesson

In pairs, students will practice creating programs that include conditional statements and variables using Scratch (or a similar block-based program). The conditionals should focus on a sprite (character) and include sound, movement, and animation. Students will then build a narrative around the sprite by expanding the program to include additional backgrounds and sprites with their own algorithms. Students will map out their scenes using flowcharts and use this to work collaboratively to debug any part of the algorithm that is not working as intended.