5.AP.1 Algorithms and Programming

> *The student will apply computational thinking to identify patterns, make use of decomposition to break down problems or processes into sub-components, and design algorithms. (a) Identify patterns and repeated steps in an algorithm, problem, or process. (b) Decompose a problem or process into a subset of smaller problems or groups of sequential instructions. (c) Abstract relevant information to identify essential details. (d) Design an algorithm to solve a problem.*

Understanding the Standard

Computational thinking involves four components: decomposition, pattern recognition, abstraction, and algorithm design. Students should be further practicing and strengthening their skills in categorizing, decomposing, and identifying patterns. Students can analyze and evaluate programs by breaking down large problems into subproblems, or sub-components. Breaking down a large problem or task into smaller, more manageable chunks is called program decomposition. Decomposition helps in developing a program by allowing team members to focus on one part of the problem at a time or work on different parts of a program at the same time and add the smaller components together to complete a task. In fifth grade, students will use abstraction to determine which details of a process are relevant to the outcome of the process, so that they may use only necessary details in their algorithms.

Term	Definition
Algorithm	A list of steps to finish a task.
Subproblem	A smaller problem that is part of a larger problem.
Decompose	Breaking a complex problem into parts that are easier to understand and solve.
Abstract	To consider an idea apart from application to a particular instance.

Prerequisite Knowledge

To engage with this standard, students should have experience using graphic organizers such as mind maps or flow charts. Students will also draw on experiences following step by step instructions and delegating group responsibilities.

Integration Opportunities

Science 5.1c Organize simple data sets to reveal patterns that suggest relationships and use the process of abstraction to remove irrelevant data in a data set.

Math 5.CE.4 Build an algorithm for solving a math problem that simplifies a given expression using the order of operations.

Physical Education 5.1b Have students design an algorithm for a gymnastics sequence, breaking down elements of the sequence to improve changes of direction, transitions, balance, shape, and flow.

English 5.w.3b Design an algorithm for self- and peer-editing student writing. Include steps such as find and correct errors in capitalization/ spelling/punctuation, ensure subject/verb agreement, identify transitions, etc.

Summary of a Lesson

Have the class brainstorm a list of common everyday problems encountered at school or home (e.g. running late for school, cleaning your room, finishing homework, etc). In groups of 3, students will select one of the problems from the board to decompose, identifying smaller problems, causes, and possible solutions. Encourage groups to focus on separating out the steps and details that are essential to solving the problem as they collaborate to create an infographic to illustrate and share their solutions in a step-by-step process.