Computational Thinking

1. Foundational Concepts
   1.1 Understand and recognize different types of data (ISTE 3B, 5B)
       • Understand and recognize structured and unstructured data
       • Understand and recognize different types of data such as text, numeric, data/time, image, and audio
       • Understand and recognize data encoding (ascii, binary, character mapping)
   1.2 Recognize and apply logical reasoning (ISTE 3A, 5B)
       • Recognize and apply Boolean and logical operators
       • Recognize and apply inductive reasoning
       • Recognize ambiguity in a logical reasoning problem
       • Recognize and apply deductive reasoning
   1.3 Explain algorithmic thinking (ISTE 5A, 5D)
       • Explain the purpose of algorithmic thinking
       • Understand the purpose of abstraction and model building
       • Understand the purpose and capabilities of automation

2. Identify and Collect Data
   2.1 Assess data needs and available data (ISTE 3B, 5B, 5C)
       • Identify the data needed to solve a problem
       • Assess relevance of existing data sets
       • Determine the gap between existing data and data needs
   2.2 Understand data quality (ISTE 3B, 5B)
       • Understand validity
       • Understand reliability
       • Explain data cleaning in data sets
   2.3 Collect the data needed to solve a problem (ISTE 1D, 2B, 3B, 3C, 5B)
       • Collect relevant data using existing data sources
         • Including selection of appropriate tools to gather, analyze, and process data
         • Including retrieval of information from a data source, such as a list, a table, an infographic, etc.
       • Choose a method for creating original data sets such as an observation or a survey
         • Including input-validation methods
       • Explain the legal and ethical dimensions of data collection

3. Apply Abstraction
   3.1 Identify patterns in and apply abstraction to data (ISTE 5A, 5B, 5C)
       • Identify patterns in data
       • Organize data using models such as tables, charts, and graphs
       • Sort and filter data by relevant criteria
       • Identify similarities, differences, and subsets in a data set
       • Make predictions by examining patterns
3.2 Recognize, create and interpret abstract models (ISTE 5C, 5D)
   • Recognize an abstract representation, such as a model, variable, function, or procedure
   • Create an abstract model to understand complex systems or facilitate problem solving
   • Interpret a process flow diagram

4. Specify a Solution

4.1 Define and decompose a problem (ISTE 4B, 5A, 5C)
   • Identify an appropriate problem statement based on information provided
   • Define the scope and limitations of a problem
   • Identify decisionmakers, collaborators, and target audience
   • Break down a problem into component parts by using decomposition

4.2 Identify requirements (ISTE 4A, 4B, 6A)
   • Select a design process, such as iterative or incremental
   • Identify prerequisites for a solution
   • Identify the possible outcomes of a solution
   • Choose appropriate tools to develop a solution, such as flow charts, spreadsheets, pseudocode, surveys

5. Automate a Solution

5.1 Use a sequence of steps in algorithms (ISTE 5B, 5D)
   • Create a sequence of steps
   • Evaluate the outcome of a sequence of steps
   • Recognize when to combine steps into re-usable procedures and functions

5.2 Automate repetitive tasks by using iteration (ISTE 5D)
   • Recognize when to use iteration
     • Including when to use nested loops
   • Determine the outcome of an algorithm that uses iteration
   • Create an algorithm that uses iteration

5.3 Use selection statements in algorithms (ISTE 5D)
   • Recognize when to use selection statements
     • Including when to use nesting in selection statements
   • Determine the outcome of an algorithm that uses selection statements
   • Create an algorithm that uses selection statements

5.4 Use variables in algorithms (ISTE 5D)
   • Recognize when to use variables
   • Determine the outcome of an algorithm that uses variables
   • Create an algorithm that uses variables
6. Present and Improve a Solution

6.1 Produce a computational artifact to present a solution to a target audience (ISTE 6A, 6C, 6D)
- Choose an effective medium for communicating a solution to a target audience
  - Including video, flow diagram, pdf, html prototype, chart, infographic, diagram, graph
- Create an original computational artifact to communicate a solution to a target audience

6.2 Collaborate on computational artifacts (ISTE 1C, 7B)
- Interpret a design for a computational artifact
- Critique and provide feedback on a design for a computational artifact
- Incorporate collaborative feedback into a computational artifact

6.3 Perform iterative design on an automated solution (ISTE 1D, 4C, 5C, 5D)
- Create a prototype to evaluate the effectiveness of an automated solution
- Compare the efficiency of multiple possible solutions
- Troubleshoot an automated solution
- Use iterative testing to improve an automated solution