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