Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013)

MS-PS1-4 Matter and its Interactions
https://www.nextgenscience.org/pe/ms-ps1-4-matter-and-its-interactions

The chart below makes one set of connections between the instructions outlined in this article and the NGSS. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

Dimensions	Classroom Connections
Science and Engineering Practices	
Analyzing and Interpreting Data ● Analyze and interpret data to determine similarities and differences in findings.	● Students analyze and interpret data when they place different amounts of water into a water reservoir.
Developing and Using Models ● Develop a model to predict and/or describe phenomena.	● Students develop a model of particle movement to explain changes when the water is mixed.
Disciplinary Core Ideas	
PS3.A: Definitions of Energy ● Temperature is not a direct measure of a system's total thermal energy. The total thermal energy of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material.	● Students use a water reservoir and various amounts and temperatures of water to investigate the question: What has more thermal energy: a beaker with 100 mL of boiling water (100 ^{o}C) or a 10-gallon fish tank at room temperature (~23 ^{o}C)?
Crosscutting Concepts	
Cause and Effect ● Cause and effect relationships may be used to predict phenomena in natural or designed systems.	● Students analyze data to determine the effect of adding various amounts and temperatures of water to a system.

Building Towards Performance Expectation

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]