

Engineering Standards Analysis

For this assignment, I will be analyzing the following NGSS Standards:

- MS-PS 1-4. 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.**
- MS-PS 1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.**
- MS-PS 1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.**
- MS-ET S1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**

The reason I selected these standards is that I have used these together for a STEM Engineering project. In this project, they first learn atoms, thermal energy, and chemical reactions. Then they undergo a design challenge where they try to make a thermal cup to keep liquids hot or cold. They fit together really well to address all parts of this project.

PS1-4 is the basic information about atoms, particle motion, and thermal energy. Students add to this understanding in PS1-2 to learn about chemical reactions, when atoms interact. They build on their knowledge of thermal energy to understand endothermic and exothermic reactions. Both of these incorporate different parts of science content knowledge along with the practices of doing science, developing a model and analyzing data. However, even in these two standards there is some engineering involved. As students develop a model, they are building and adjusting to make their models more successful. As students analyzing data about chemical reactions, they are building the same key skills that are used to analyze data about their engineering designs.

ETS1-3 is an Engineering standard. It requires students to analyze data,

overlapping with PS1-2, but now with the purpose of improving their design. This is a critical skill for science and engineering.

PS1-6 bridges between science content and engineering by requiring students to design a device to apply their understanding of thermal energy and chemical reactions. It challenges students to not only know information but use it to create something new. It is not about their declarative knowledge but about how they can really use it in a real context.

Each standard is similar, but with slightly different focus. They all target a different part of this design project. The first two are more focused on the declarative, content knowledge, while the final standard is strictly the engineering process. All four work together to address the complex skills involved in this type of challenge.

Engineering Design is a great way to unify a curriculum. Often engineering problems are based on real world situations, so it is a meaningful application of science content. It gives a purpose to the information students are using. I have included a few projects in my own curriculum, and am working on developing new projects for every unit to make the curriculum truly project based. The goal is for students to be learning information because they see a use for it in their projects rather than because they feel like they need to memorize it for a future test. Students should see the importance of information as it applies to an engineering project. They will care more and remember more because they had an active part of the learning experience.

It also gives students a chance to develop the skills of critical thinking, problem solving, and most importantly learn from failed experiences. Their designs may not work, but they can analyze them to learn why. These skills are much more transferrable to future classes and future jobs than discrete science knowledge.