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The E in STEM: Meaningful Content for Engineering
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Standards Analysis

When looking at the 2nd grade Common Core Math Standards, two that lined up with engineering design were:

- **CCSS.MATH.CONTENT.2.OA.A.1:** Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
- **CCSS.MATH.CONTENT.2.MD.A.2:** Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

These standards require students to work on their cognitive thinking abilities. They are working through their understanding and thinking when tackling 2 step word problems, and they need to take their time in order to follow the steps to solve the problem. With the measurement standard, students need to carefully use two different units of measurement, which requires them to look at objects in different ways. The comparing and contrasting that they do in measurement transfers over to engineering design, since students need to think about problems in different ways and compare results.

When looking at the 2nd grade Next Generation Science Standards, three that lined up with engineering design were:

- **2-PS1-1:** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- **2-LS2-1:** Plan and conduct an investigation to determine if plants need sunlight and water to grow.
- **2-LS2-2:** Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

The verbiage and actions in these standards relate to engineering design. In engineering design, students need to create an experiment/prototype and test to support their hypotheses. In these standards, students need to plan and conduct an investigation, just as they do in the engineering design process.

When searching for technology standards in New Jersey, I encountered a bit of an obstacle. Under NGSS, I found a section called K-2-ETS1 Engineering Design. Under that heading, I found two standards that lined up with engineering design:

- **K-2-ETS1-1:** Ask questions based on observations to find more information about the natural and/or designed world(s).

- **K-2-ETS1-1:** Define a simple problem that can be solved through the development of a new or improved object or tool.

Although these standards are applicable to the engineering design process, we don't use these standards in my district. I went through our curriculum and found some technology standards that we use from the New Jersey Core Curriculum Content Standards, and a standard that I found that aligns with engineering design was:

- **8.2.2.A.5:** Collaborate to design a solution to a problem affecting the community.

The K-2-ETS standards line up perfectly with the engineering design process, as they basically align with most of the procedure. Students ask a question, imagine and plan a solution, and then create and test to solve their problem. When I look at the technology standards that we use in my district, I can see that this standard also encourages students to image, plan, and create in order to solve a problem or answer a question. Although my school doesn't use the K-2-ETS standards, I could see myself incorporating them into the classroom since they are relevant, state specific, and fall under NGSS.

These standards are all similar to each other because students are thinking about problem solving as they answer questions. All of the standards require metacognition skills, from the asking and planning stages to testing and asking again upon reflection. The science, math, and technology standards all align with the engineering design process steps and push students to think, plan, and reflect.

When it comes to differences, the math standards stand out the most. Although these standards have students work on thinking and problem solving, they are very specific to math skills. These are skills that need to be taken from the math context and applied to the engineering design process. In the math standard, students measure an object with two different units of measurement and are comparing those results. In the engineering design process, students might not necessarily be working on measurement. For example, maybe they would need to take that comparative ability and reflective knowledge in order to compare one test design that they created to another. These standards have the practices that students need in the engineering design process, but they are applied through different lenses.

I always use the engineering design process in my classroom as a STEM project that blends subjects together, but after seeing the K-2-ETS standards, it is even more apparent that this process unifies all of the skills and concepts that students learn. They use ideas and concepts from math, hands-on problem solving from science, and collaboratively design solutions from technology. All of these schools of thought come together in the engineering design process, where we have students emphasize metacognitive thinking and problem solving.