Kayla Brooks
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# "Standards Analysis" - Due 5/27/20

*This assignment allows you to explore how problem solving and engineering design can be a "unifying" concept/skill across the STEM disciplines. By examining the three standards documents similarities and differences can be made more apparent.*
*I will be looking at my 7th grade CA NGSS standards to see which of them can involve engineering practices.*

1. Which technology education, mathematics, and science standards relate to problem solving or engineering design?

(A.) The 7th grade standard **MS-PS1-6:** Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes is related to engineering design and problem solving. This unit of learning involves Thermal Energy in Chemical Reactions. It includes the engineering standards **MS-ETS1-3** and **MS-ETS1-4.**

Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.

Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.

(B.) The 7th grade standard **MS-LS2-5**: Evaluate competing design solutions for maintaining biodiversity and ecosystem services and includes the engineering standards of **MS-ETS1-2** and **MS-ETS1-3.**

Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.

(C.) The 8th grade standard **MS-PS2-1**: Apply Newton's third law to design a solution to a problem involving the motion of two colliding objects includes the engineering standards **MS-ETS1-1** and **MS-ETS1-2.**

Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.

Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.

I chose to evaluate these three standards because I have worked with them before and I am a middle school science teacher. I wanted to look up standards that would be relevant to what I have taught and will teach in the future. It appears that there are only two 7th grade standards and one 8th grade standard that involve engineering standards as well.

2. How are these standards similar to each other?
Two of the standards involve MS-ETS1-2, and two of them involve MS-ETS1-3. What's interesting about the MS-ETS1-2 standard is that it shows up once in 7th grade and once in 8th grade, Whereas the MS-ETS1-3 standard shows up twice in 7th grade. The one that shows up twice in 7th grade involves "analyzing 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."

3. How are they different from each other?
There is no comparison between the actual topics between the 7th grade standards though, one deals with ecosystem biodiversity and the other with thermal energy in chemical reactions. In one science standard, students would be designing solutions to maintain biodiversity and in the other, designing a device that either releases or absorbs thermal energy by chemical processes.

Also, in the two 7th grade science standards, they each have a different, separate engineering standard. MS-PS1-6 has engineering standard MS-ETS1-4 and the science standard MS-LS2-5 has the engineering standard MS-ETS1-2. With the standard MS-ETS1-2, students would be

signing solutions to how ecosystems could be maintained while looking at all of the constraints of the problem. This would require a lot of research and declarative knowledge about ecosystems to complete correctly. With the standard MS-ETS1-4, students would be actually developing a model and would be trying to optimize the design of it. This would take time and would need several school days to complete if I wanted to have it done thoroughly. It would also require a lot of money/lab supplies that I am not sure would be allowed in our budget.

4. What are your thoughts on engineering design problem solving as a "unifying" concept/skill?

The goal of education is for the learners to transfer what they learn into new situations. With this in mind, incorporating engineering design into my 7th grade science standards would help with a far transfer of knowledge, which leads to more benefits in the long run. Let's take my science standard that involves thermal energy in chemical reactions as an example; students are supposed to explain how some chemical reactions result in something hot, while others result in something cold. If I just explain to them the facts and only provide them with declarative knowledge and move on, I would have missed a great opportunity for my students to make discoveries for themselves. If I would have allowed them to create those chemical reactions by developing their own possible solutions and optimizing their design process, it would have "unified" their knowledge on the topic at hand. This would allow for a moderately structured problem to be presented and would allow me to ask questions which would encourage them to grasp the obvious part of the skill, across many similar problems in different contexts. It would help the students unify their understanding of past concepts learned, such as characteristics of chemical reactions and modeling conservation of mass, to name just a few. With students being given the opportunity to problem solve, they will be able to see the similarities of strategies across different contexts. Though it might be a longer process to include engineering and design into these two 7th grade science standards, the benefits would be nearly endless. With enough time and practice integrating engineering in my middle school science classroom, I could really structure the school year around big projects which would unify multiple concepts at once, and all the while students would be involved, engaged and having fun!