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Standards Analysis

Colorado has their own standards for math, technology, and science. For the most part they align to the Common Core Standards and NGSS, so I will be using them in this paper. Colorado's standards for technology, or computer science, are only for the high school level. Since I work with students in first through eighth grade, I will be focusing on the mathematics and science standards. I chose to look at the third-grade standards for math and science because this represents a good average of the academic ability of the student I work with.

The mathematical practice standards in the Common Core has one standard that could relate to problem solving. The standard states that students will "make sense of problems and persevere in solving them." When problem solving you have to persevere or you never solve it. You also have to know what the problem is and how you would like to solve it (make sense of the problem).

In the Next Generation Science Standards engineering and problem solving are included in many of the required skills. One standard in the Earth and Human Activity section for third grade says students will "make a claim about the merit of a design solution that reduces the impact of weather-related hazards." Students get to use what they know to analyze how natural disasters can be reduced. This could include looking at current technologies used to reduce the impact of natural disasters and coming up with a better idea.

The last three standards in the Next Generation Science Standards are all about engineering and design. The first of these three standards states that students will "define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost." This standard specifically asks students to use an engineering design to produce a possible solution to a problem.

The next engineering standard involves using problem solving to evaluate the efficacy of potential solutions to a problem. Students should be able to "generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem." This standard asks students to not only look at whether or not a solution will work, but to also consider the process required to create the solution and the cost of implementing it.

The final engineering standard deals with "plan(ning) and carry(ing) out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved." This standard pushes students to consider possible revisions to a solution that has been put in place but is not necessarily the most effective, bringing up the point that the design process is ongoing, not just a one-time endeavor.

All three of these standards address problem solving and engineering. They are about the design process and how students use them to construct something that solves a problem of their choosing, and then evaluate the effectiveness of their solution and consider further improvements.

The main difference between the above standards is the academic focus they bring to problem solving. The mathematics standard applies problem solving to math problems. The science standard applies problem solving to a scientific topic. The engineering standards ask students to construct something that will provide a solution to a problem. The similarities in the processes involved make these standards very similar. In each case, students are asked to identify a problem, propose a solution, evaluate the likelihood that the solution will work, evaluate their ability to implement the solution, test their solution to determine whether or not it worked, and repeat the above process until a satisfactory solution is achieved.

The similarities in the standards shows the interrelatedness of multiple subjects within the teaching curriculum. Many teaching opportunities exist that will combine multiple standards and subjects into a single project or lesson. A single engineering project could require students to solve mathematical problems, write a description of their process and results, address a scientific topic and require research into historical solutions to the problem they are addressing.