Standards Analysis

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Standards Related to Problem Solving or Engineering Design

Common Core State Standards for Math:

- CCSS.MATH.CONTENT.3.OA.D.8
  Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

- CCSS.MATH.CONTENT.3.OA.D.9
  Identify arithmetic patterns (including patterns in the addition table or multiplication table) and explain them using properties of operations.

- CCSS.MATH.CONTENT.3.MD.A.1
  Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

- CCSS.MATH.CONTENT.3.MD.D.8
  Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Next Generation Science Standards

- 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

- 3-5-ETS1-2: 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.

- 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects or a model or prototype that can be improved.

Pennsylvania’s Standards Aligned System (SAS)

- Standard - 3.4.3.C1
  Recognize design is a creative process and everyone can design solutions to problems.

- Standard - 3.4.3.C2
  Explain why the design process requires creativity and consideration of all ideas.

- Standard - 3.4.3.D1
Identify people’s needs and wants

Similarities

These standards are similar to each other because they all involve defining a problem and finding ways to solve it. They require creative thinking, planning to determine the best method to solve the problem, and then testing the solution to see if it works. All these standards involve math, science, and technology in some way and are all at the same third-grade level. Some type of design process or mathematical process is needed to analyze the problem and determine the best steps to take to find a solution.

Differences

Some of these standards are in the area of math, while others are science. Most of the math problems seem to be related to word problems and math concepts, while the science topics are more related to real-world applications and phenomena. Math can often be more focused on the computation, while science uses more of a discovery approach. Many of the math standards describe specific math skills such as determining the area or finding an equivalent fraction. Some of the science standards are less specific such a designing a problem.

Thoughts on Engineering Design Problem Solving as a “Unifying” Concept/Skill

Engineering design problem solving is a unifying skill. It integrates the knowledge from both the math and science disciplines and creates opportunities for critical thinking and problem solving. Engineering design provides the opportunity for students to work together and collaborate to solve problems. It allows students to use the math theories, make calculations, create hypotheses, and use scientific and mathematical reasoning to solve real-life problems. Engineering design reflects the way that engineers solve problems which unifies various

disciplines including math, science, and technology. It allows students to brainstorm, problem solve by trying the ideas, use mistakes as learning experiences to improve upon, and then test new things. When math and science are used together such as in engineer design problems solving, the results can be very meaningful and effective for students.

References

Common Core State Standards Initiative K-12 Standards Development Teams. Retrieved June 2, 2019, from: http://www.corestandards.org/Math/Practice/

NGSS Lead States. (2013). Next Generation Science Standards: For States, By States. Washington, D.C.: The National Academies Press.

Pennsylvania's Standards Aligned System (SAS). Retrieved September 5, 2019, from https://www.pdesas.org/Standard/View#