**Standards Analysis**

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

ITEEA Standards:

- Standard 1: Students will develop an understanding of the characteristics and scope of technology
- Standard 2: Students will develop an understanding of the core concepts of technology
- Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology
- Standard 5: Students will develop an understanding of the effects of technology on the environment
- Standard 8: Students will develop an understanding of the attributes of design
- Standard 9: Students will develop an understanding of engineering design
- Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving
- Standard 11: Students will develop the abilities to apply the design process
- Standard 13: Students will develop the abilities to assess the impact of products and systems.

NGSS:

ETS: Engineering, Technology and the Application of Science

- ETS1.A: Defining and Delimiting Engineering Problems
- ETS1.B: Developing Possible Solutions
- ETS1.C: Optimizing the Design Solution

CCSSM:

- MP1 - Make sense of problems and persevere in solving them,
- MP2 - Reason abstractly and quantitatively
- MP3 Construct viable arguments and critique the reasoning of others,
- MP4 Model with mathematics,
- MP5 Use appropriate tools strategically,
- MP6 Attend to precision,
- MP7 Look for and make use of structure,
- MP8 Look for and express regularity in repeated reasoning

2. How are these standards similar to each other?

The three standards (Standards for Technological Literacy, Next Generation Science Standards and Common Core State Standards) suggest that an integrative approach to teaching STEM should focus on active learning through engineering problem-based activities focused on pragmatism and the constructs of systems thinking, situated learning, constructivism, and goal orientation theory. The standards engage

students in tasks that require integration across the STEM disciplines and support for the development and application of conceptual knowledge and reasoning.

The CCSSM helps students to use mathematics in applied contexts and identify practices in mathematics that can link to those of science and engineering. The NGSS include practices and core ideas from engineering and technology. The increased focus on applications of math and science concepts, the emphasis on practices in mathematics, science, and engineering, and engineering design as a central aspect of the NGSS all provide strong support for more integration of STEM in math and science curriculum and teaching. Similarly, the *Standards for Technological Literacy: Content for the Study of Technology* (ITEEA 2000) aims engineering design in learning and emphasize the need for students to understand technology's connections to science, engineering, and mathematics.

3. How are they different from each other?

   Based on the design of the standard NGSS differs from other standards (CCSS and ITEEA). Each grade level has specific content standards and cross matched to these standards are science and engineering practices, disciplinary core ideas, and crosscutting concepts. In NGSS, engineering standards are added along with the science standards. Thus, implementing engineering education for K-12 grades. NGSS uses terms that describe common practices of scientist and engineers. These practices become science learning outcomes for students. Learning science concepts, scientific practices and engineering practices are emphasized as key outcomes. The Common Core State Standards (CCSS) for Math's and ITEEA Standards for Technological Literacy were written to help students meet the challenges in their respective fields (Math's and Technology).

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

   Problem solving is the process of finding solutions to difficult or complex issues and Engineering design is form of problem solving used by engineers. It is a process of solving problems by designing solutions and is focused on finding solutions that work and is not tied to a single correct answer. Creativity in problem solving is essential for completing engineering design. STEM education fosters creativity among students to develop better design for the real-life problems.