Standards Analysis

Developing students that are effective and creative problem solvers is a cross-curricular goal across all grade levels. As such, problem solving and engineering are described in educational standards of a number of different organizations. As a high school math, engineering, and robotics teacher, I have to be aware of a variety of standards. The Common Core State Standards (CCSS) in math is the key resource I use as math teacher. In my STEM classes, the American Society for Engineering Education (ASEE) and the International Society for Technology Education (ISTE) help giving guidance o the classes I teach.

In the CCSS, there is a strong focus on problem solving throughout the document. This is especially prevalent in the mathematical practice part of the standards. The practice standard that stands out is MP5 which involves using appropriate tools strategically. This is a broad standard that describes the ability to determine the most effective way to solve a problem as well as being able to plan and execute a plan. It is a standard that is not only relevant in math but across all STEM subjects.

Being an engineering organization, the ASEE standards would naturally be focused on the specific subject matter. However, part of the standards attempts to make a connection across disciplines. Dimension 2 of the standards discusses the procedural and declarative knowledge that should be demonstrated by a student that is able to connect engineering to science, technology, and mathematics.

Finally the ISTE standards lay out what a 21'st century, technology-competent student should be able to do. There are 7 key standards, with sub standards for each one. Problem solving and engineering is the focus of standard 4, called 'innovative designer.' This standard focuses on using the design process to solve problems. It also describes the mindset needed to solve abstract, open-ended problems.

Hopefully, the connection between the specific standards from the three organizations mentioned is clear. Plenty of other examples could be found that shows how problem solving, and engineering is an important aspect of all three standards. All three standards try to describe the need for students to think creatively and abstractly while using a wide range of tools to solve problems. As educators, it is also important, perhaps, to be mindful that standards that are outside ones own direct subject matter can offer valuable insight on teaching and learning. For instance, the ISTE standards try to go beyond the specific subject matter in order to define the competencies for a 21'st century learner.

Despite their similarities, each organization has different goals and motivations in laying out their standards. For instance the CCSS aim to develop a baseline of mathematical knowledge that students should know at grade level. The CCSS practice standard mentioned above about using tools strategically, is first and foremost a reference to the mathematical tools that would help students become better problem solvers. On the other hand, the ISTE standard for innovative designer, offers a broader implication for learning. Similarly, the ASEE standards for seeking connections of engineering in science and technology, focuses on how the more specific realm of engineering ties into the broader educational spectrum.

As a unifying concept, engineering design problem solving offers an important link across the curriculum. 'Why do we have to know this' is a common question in a classroom. Engineering design problem solving is one way that could help bring relevance to the content. Instead of producing work that gets graded and filed away, engineering design problem solving, encourages students to integrate their understanding for a specific purpose. It also has the potential to create an engaging context that cannot be done with direct instruction. Perhaps that is why it is a part of many different standards across different content areas.

Sources:

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). Common Core State Standards for mathematics: Process Standards http://www.corestandards.org

The Corporate Member Council – K-12 STEM Guidelines for All Americans (2008). American Society for Engineering Education (ASEE).

International Society for Technology in Education. (2000). ISTE national educational technology standards (NETS). Eugene, OR :International Society for Technology in Education