

## Math

8.G.6 Explain a proof of the Pythagorean Theorem and its converse.

8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in realworld and mathematical problems in two and three dimensions.

8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

## Science

E.8.9B.1 Research and map various types of natural hazards to determine their impact on society.

E.8.9B.2 Compare and contrast technologies that predict natural hazards to identify which types of technologies are most effective.

E.8.9B.3 Using an engineering design process, create mechanisms to improve community resilience, which safeguard against natural hazards (e.g., building restrictions in flood or tidal zones, regional watershed management, Firewise construction).

## Technology

AP.2.8 Systematically test and refine programs using a range of test cases. [PROGRAM DEVELOPMENT] (P6.1) Test cases are created and analyzed to better meet the needs of users and to evaluate whether programs function as intended. At this level, testing should become a deliberate process that is more iterative, systematic, and proactive than at lower levels.

AP.2.8a Students will test programs by considering potential errors, such as what will happen if a user enters invalid input (e.g., negative numbers and zero instead of positive numbers).

Which technology education, mathematics, and science standards relate to problem solving or engineering design? Most standards throughout these three content areas relate to problem solving. I pulled standards that were as far apart as possible. However, the ties to problem solving and or engineering design are unavoidable. For each of these standards the learner must have a system to find the solution. Engineering design and or problem solving are a universal process used by anyone that needs a solution. The only standards that would not involve some form of problem solving are Depth of Knowledge (DOK) 1 which is equivalent to the knowledge level of Bloom's. Any standard regardless of content requires the learner to identify the problem, pose a potential solution, test the solution, evaluate the result, and then start over if necessary.

How are these standards similar to each other? • How are they different from each other?

These standards are similar in that they all have real world applications. They are also similar because they require the learner to apply knowledge outside of theory. The science and technology standards also require information outside of the content area to fulfill the standard. These standards are worlds apart based upon the background knowledge and skills needed to arrive at an answer but the journey is the same...a process that involves gathering information needed to solve the problem, applying the information, evaluating the results...problem solving.

What are your thoughts on engineering design problem solving as a “unifying” concept/skill? I truly believe that science, math, and STEM should be taught as one course with each set of standards centered around an engineering project. I believe students struggle with problem solving because there is not a “big picture” on which to focus. Many students, in my opinion,

lack the motivation to just find the answer to a question. However, if they needed to find the answer to a question in order to move to the next step to solve a bigger problem: the question now has meaning. I believe engineering design is not only the “unifying” concept/skill but is also the missing ingredient to motivate our students to problem solve and truly learn concepts as they apply them to solve a bigger picture/project. Teach graphing as students track a declining population of a species. Students research potential reasons for the decline and write code to evaluate variables on how to stop the decline. This lesson would satisfy standard requirements in all three content areas for my state. Students are learning content while focused on how to stop the decline of a species. Sounds wonderful but why is it not a reality? I also believe there are not many teachers with the background knowledge to teach across curriculums while others simply do not want to put forth the effort. Throughout this program I have written plans and tried to make implementing as easy as possible for our math and STEM teachers with little success. One teacher was uncomfortable with the science content on one lesson and would not get on board while another was worried about getting the supplies for students to complete the project. To sum it up, I think part of the answer to improving America’s declining position in the world as innovators, inventors, researchers, and thinkers in general is engineering design.