

Standards Analysis

Soyoung Chon

In my role as an enrichment teacher and coordinator for the Gifted and Talented Program in grades 3 to 8, my familiarity with my school's core curriculum is somewhat limited. To evaluate the alignment of technology education, mathematics, and science standards with problem-solving and engineering design, I used the NJ Newark Archdiocese's Curriculum Maps (<https://catholicschoolsnj.org/curriculum-mapping-2>), which my school follows. For assessing mathematics standards, I referenced the Common Core State Standards for Mathematics (CCSS-M), as they are prominently integrated into the Math Curriculum Map. Regarding technology standards, I consulted the Archdiocese's most recent Technology Curriculum Map. In the absence of an updated Science Curriculum Map, I turned to Next Generation Science Standards (NGSS) for my analysis of science standards. During this analysis, I identified several standards closely associated with problem-solving and engineering design:

- **CCSS-M Mathematical Practice Standards**, including *MP.1 (Make sense of problems and persevere in solving them)*, *MP.4 (Model with mathematics)*, *MP.5 (Use appropriate tools strategically)*, *MP.6 (Attend to precision)*, *MP.7 (Look for and make use of structure)*, and *MP.8 (Look for and express regularity in repeated reasoning)*, emphasize fundamental problem-solving skills such as approaching problems, using mathematical models for real-world problem-solving, strategic use of tools, reasoning precisely, recognizing mathematical structures, and identifying patterns. These skills are essential for both mathematics and engineering design.
- **Technology Curriculum Maps Standards**, such as *Creativity and Innovation*, *Communication and Collaboration*, *Research and Information Fluency*, and *Critical Thinking, Problem Solving, and Decision Making*, directly relate to problem-solving and engineering design thinking, as they encourage creativity, collaboration, research, and critical thinking skills.
- **NGSS Science and Engineering Practices**, including *Engineering Practices from 1 to 8*, emphasize problem-solving and engineering design throughout. These practices guide students in asking questions, using models, planning and conducting investigations, analyzing data, using mathematics, constructing explanations, engaging in argumentation, evaluating, and communicating information, all of which are very closely connected to problem-solving and engineering design.

These math, science, and technology standards share similarities as they emphasize the importance of problem-solving skills in real-world contexts. They also encourage interdisciplinary thinking by integrating math, science, technology, and engineering to comprehensively address complex issues. These standards promote inquiry-based learning and

problem-solving skills in engineering design, enabling students to question, explore, analyze, and communicate effectively. Consequently, they prepare students to generate effective solutions for real-world problems and address everyday challenges in their surroundings.

While these standards share these similarities in their educational approach and skill development, they also differ in terms of subject focus and specific content. CCSS-M centers on mathematics, NGSS on science and engineering, and Technology Curriculum Map Standards on technology and digital literacy. CCSS-M and NGSS are specific to their respective subjects, whereas Technology Curriculum Map Standards encompass a broader range of topics and skills related to technology education. While all promote interdisciplinary connections, NGSS places a stronger emphasis on integrating science and engineering across subjects.

Engineering design problem-solving is a unifying skill that cut across specific subject boundaries, encompassing mathematics, science, and technology education. This holistic educational approach provides students with comprehensive problem-solving skills, applicable to real-world challenges. Engineering design requires a deep understanding of science, math, and technology to craft practical solutions. For example, in a school garden project, students use math to calculate precise plant water requirements, apply scientific knowledge to soil and plant hydration, and employ various technologies to develop an innovative watering system. This interdisciplinary problem-solving illustrates the central role of engineering design in creating real-world solutions, highlighting its ability to bridge subject areas while emphasizing its practical utility.