

Akin Engineering Design Standard Comparison

Have you ever taken the time to examine how science, technology, engineering and mathematics standards intertwine and overlap? Not many people have the time to dig deeply into each standard and see how they interact, unless they have been trained to look for the cross-curricular patterns. I have been very fortunate to work in a building with older teachers who have worked in education for many years. They have seen many different curriculums and teaching methods come and go. The main theme they talk about is how the standards change and adapt, but the core lessons we want our students to know do not. After my fifth year of teaching, I have found that it is easier to teach students in a thematic unit where all the subject aligns to the topics and standards you are teaching. Student draw more connections, explain in detail and problem solve with higher order thinking skills while learning in this method. Problem solving and engineering design are what connect the students to having meaningful hands on learning experiences that allow the students to retain and use the information they have learned in real life applications.

Examining the 3rd Grade NGSS, CC Mathematics, WI Technology Standards allowed me as a teacher to break down and draw connections that would allow my students to learn more in a cross-curricular setting. One of my favorite units to teach my 3rd grade students has been to teach motions and stability, forces and interactions. In the NGSS, 3-PS1-4, it has students perform many tasks. Each of these tasks draw on both prior knowledge and being able to problem solve. The standard asks if students are able to: plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object; make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion; ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other; and define a simple design problem that can be solved by applying scientific ideas about magnets. Each standard asks student to perform a task from the depth of knowledge format.

The NGSS show us key terms in 3rd grade CC mathematics. Some of these skills they have had previous learning and knowledge in such as if an object is balanced by the weight of the object, measurement, patterns, and designing simple problems. MP.2 asks for students to be able to reason abstractly and quantitatively. MP.5 has students use appropriate tools strategically. 3.MD.A.2 is where students demonstrate they can measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. The authors of the standards even thought to help a teacher draw connections to

science by including terminology words like beaker. 3.MD.A.2 shows use that students will need to use an engineering design to solve the problem because it is a multi-step problem that needs to be solved. First a student will need to figure out what they know about the given terms like mass or volume. Then they will need to figure out what algebraic equations they will use. This would then be followed up by designing a word problem and solving how they would use drawings to demonstrate this. A teacher could easily work during “science time” to incorporate a math standard using an engineering design.

When you look at the Wisconsin Technology and standards, BB1.b shows that students need to analyze and use tools and materials. When you think of technology, instantly computers come to mind, but technology can also be the tools we use. A teacher would have to model some ways this would correlate to both the NGSS and CC Mathematics. One of these ways would be for students to design and engineer how they would balance two objects using non-conventional items. For instance, using a specific amount of students’ shoes to balance a weight. Students would be working with weight, balance and problem solving. Students may draw conclusions where they find patterns in their work and are able to replicate the experiments quicker with alternate materials.

Does the correlation of standards always work in a classroom? The answer would be no. Some standards are not able to be aligned, not because of the content, but because of a student’s prior knowledge and modeling. A teacher may need to take a specific math or science skill and go back to basics to teach this. Sometimes the students may have learned a concept incorrectly and need to go back to that concept and remodel their learning.

Before this class, I had never heard of engineering design problem solving. I realize now, that some of the ways I teach and solve problems use this method. Declarative knowledge and procedural knowledge are addressed by engineering design problem solving. While reading through Kirkley’s paper, the PLATO system principals are very helpful to a teacher on how to teach using declarative and procedural knowledge in order to raise up the next generation of thinkers. One point, *Use contexts, problems and teaching styles which will build interest, motivation, confidence, persistence and knowledge about self, and reduce anxiety*, shows how we need to get to our students levels in order for them to learn an understanding of problem solving first (Kirkley, 2003)

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