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Standards Analysis
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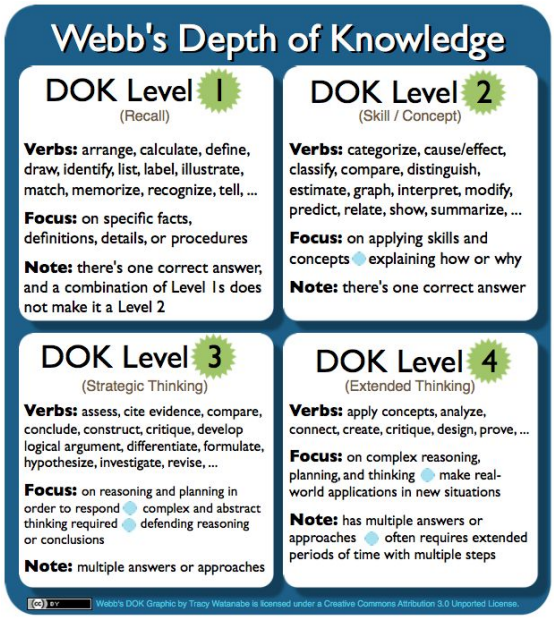
Engineering design and problem-solving can be a unifying way to develop cohesive and integrated science, technology, and math units in the elementary classroom. As the goal of the STEM subjects is to create an integrated and more in-depth learning experience, I propose that linking these subjects using problem-solving, engineering, as well as project-based learning, is the key to a successful STEM classroom.

Many of the science, technology, and mathematics standards require analytical thought and reasoning skills that are characteristic of problem-solving, engineering practices and project-based learning. In the chart below, I've taken some of the verbiages from the elementary standards (with a focus on 3rd-5th, where applicable) to compare similarities and differences of the problem-solving requirements in many of these standards:

NGSS	NCTM	CCSS	ITEEA
analyze and interpret data *apply* *compare multiple solutions* *conduct an investigation* *construct viable arguments* *construct* *design, test, and revise a device* *develop models* *use patterns to predict* *make a claim about the merit of a solution* *represent data in tables and graphs*	*analyze* *analyze patterns* *apply* *create and describe* *design investigations* *develop arguments* *identify and build* *investigate* *extend patterns* *make and test conjectures* *model* *predict* *propose and justify conclusions and predictions* *sort and classify* *use models*	*analyze* *classify* *compare* *construct viable arguments* *explain patterns* *generalize* *generate patterns* *interpret data* *reason abstractly and quantitatively* *solve real world problems*	*apply the design process* *assess impact of products and systems* *use biomedical, medical, agricultural, manufacturing, construction, energy & power, transportation, communication, and information technologies*

What's interesting to note when lining up these similarities in problem-solving and engineering terminology is not only repeated verbiage and concepts like analyzing, interpret, construct viable arguments, and various applications of patterns but also to see where many of these fall on Webb's Depth of Knowledge Chart:



Some of the above problem-solving skills fall within the DOK level 2 (compare, interpret, predict), but many fall into the more complex DOK Level 3 or 4 range (construct, develop logical arguments, investigate, apply concepts, analyze, design). The most notable difference amongst these standards would be the technology standards that call for the application of specific technologies (medical, biomedical, agricultural, etc.)

These STEM subjects left unintegrated, run the risk of existing solely at Webb's DOK 1, where student requirements end at the basic recall of facts, procedures, and definitions. When integrated well, using problem-solving, engineering, and project-based learning as the catalyst for real-world solution seeking, these subjects come to life, and these standards can be applied effortlessly.

Engineering design and problem-solving both require the strategic and extended thinking in the above chart. Because of the focus on real-world problem solving these necessitate, I believe these are the perfect way to unify the STEM subjects.

Through extensive research and training in project-based learning through The Buck Institute, I see more of a reason for this methodology of learning than ever. The depth required throughout all of these standards makes a strong case for PBL as the approach that can integrate all of these STEM subjects in a seamless way, using problem-solving as the focus.

Works Cited

Common Core Math Standards http://www.corestandards.org/Math/
ITEEA Standards for Technological Literacy
https://www.iteea.org/File.aspx?id=67767&v=691d2353
Next Generation Science Standards http://www.nextgenscience.org/overview-dci
National Council of Teachers of Mathematics http://standards.nctm.org/
Webb's Depth of Knowledge Chart:
https://courses.lumenlearning.com/educationx92x1/chapter/webbs-depth-of-knowledge/