

Nature of STEM

Victoria Schneider

Methods of STEM Education

Dr. Karen Woodruff

September 27, 2021

Libraries strive to be the hub for learning in K-12 schools and Library Media Specialists focus on collaborating with all disciplines and are aware of standards across disciplines. The American Association of School Librarians (AASL) new national school library standards contain crosswalks for the International Society for Technology in Education (ISTE), Code with Google's CS First Curriculum, and the Next Generation Science Standards (NGSS), as well as a crosswalk with Future Ready Librarians building from shared foundations and competencies.

My 21st Century Skills classes have focused on skills students need to progress through their lives based on the overwhelmingly infused daily use of technology. Critical thinking and problem-solving in regards to effective oral, written, and multimedia communication as they access and analyze information has been the basis of my classroom. Research skills and the application of Google Workspace have been the predominant focus of most of my lessons. The transition to the project or problem-based learning, incorporating additional activities into my classroom was a logical next step to learning. True collaboration with other teachers in my building is a struggle due to my schedule with the addition of intervention and reinforcement classes in the media center.

This year I have implemented real connections to STEM by adopting the CS Discoveries Curriculum through code.org. In the first lesson presented, Intro to Problem Solving, I had 100 percent engagement throughout the lesson in building a paper tower; students had to collaborate and communicate with their classmates to solve a problem and then iteratively improve their solution by identifying different strategies. Students had to be imaginative and creative when designing their towers to improve their design to meet the requirements requested as "engineers". Once complete, they were able to determine the steps of the problem-solving process and how each strategy helped them determine solutions.

Peters-Burton (2014) suggests that the nature of stem (NOSTEM) is the overlap across all four subjects of science, technology, engineering, and mathematics. While they may have rather

distinct definitions, they all depend on iterative cycles of inquiry. From the article, *Productive thinking in middle school science students' design conversations in a design-based engineering challenge* (Aranda et al., 2020) posits that student's design conversations and decision-making becomes visible as they move through the design process which will lead to a higher level of thinking, where students defend and justify choices as they evaluate information. Engaging in the redesign is imperative to help build high-level thinking processes so that students may reflect. Using anchor phenomena at the beginning of a unit or lesson can enhance learning because students will begin making decisions or creating answers to problems; the cognitive complexity in lessons increases. By placing phenomena ahead of the lesson, the experience will create an understanding as the material is explained. Memorization will play less of a role because just answering a question does not prove any amount of understanding or application.

Content from my classroom will overlap seamlessly with engineering or science. Much of our 21st Century Skills material require students to participate in the inquiry-based process; this is a simple step to emphasizing iterative, open-ended problem solving with scientific analysis using an engineering design. The Nature of Science (NOS) as defined by Peters-Burton (2014), note there are guidelines scientists agree upon to investigate the natural world. The Nature of Engineering (NOE) includes a cyclical or highly iterative process, but both have a logical extension into 21st Century Skills material. NGSS asks students to engage with new knowledge using evidence to investigate questions; information and media literacy are essential in building knowledge in other disciplines.

References

Aranda, M. L., Lie, R., & Selcen Guzey, S. (2020). Productive thinking in middle school science students' design conversations in a design-based engineering challenge. *International Journal of Technology & Design Education*, (30)1, 67-81.

<https://doi.org/10.1007/s10798-019-09498-5>

NGSS Lead States. (2013). *Next Generation Science Standards : For States, By States*. National Academies Press.

Peters-Burton, E.E. (2014). Is There a “Nature of STEM”? *School Science & Mathematics*, 114(3), 99-101