# Nature of STEM

Donna Shartzer

Methods of STEM Education/Authentic Data in the STEM Classroom

Dr. Karen Woodruff

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## How does the Nature of Science Speak to Others?

As an eighth grade science teacher, my colleague and I started the year off a few years ago with “Cross-cutting Ideas” like patterns, cause and effect, stability and change, etc. thinking that by isolating these ideas students would have a better understanding of how to investigate questions in science. We discovered that students actually had trouble learning these ideas in isolation without a connection to a particular content. So, I agree with the editorial written by Erin E. Peters-Burton, PhD NBCT, “Is There a “Nature of STEM”?” I've discovered in my classroom and I agree with the author that STEM should be integrated, not taught as separate parts. They should learn that science is a part of their world and that other subjects like math and technology are a natural part of the investigative process. Our middle school also switched to using natural phenomena bundles as a way to help students engage more in the learning process of science that builds knowledge as well as develop a deeper understanding of how scientists, engineers, and others think and understand the world we live in. The NGSS reading material, “Using Phenomena in NGSS-Designed Lessons and Units” describes ways teachers can build lessons by first anchoring the lesson with a natural phenomena that is real-world and somehow personally relevant to students so students will naturally generate their own questions and want to engage more actively in the learning process and the investigation of the phenomena. When students are more connected to the ideas, I’ve discovered students naturally want to problem-solve.

## How Science Instruction has Changed in my Classroom

This year because of the pandemic many students haven't had much exposure to hands-on experience with science. So this year, we are teaching science skills (inference and observation skills) along with STEM using inquiry as a starting point. I started the year off by asking students to construct a paper airplane however they knew best. They could also google it if they wanted to. I left it totally up to them. After they built their airplanes, students tested the performance of their design. As students flew their airplanes we discussed possible variables that affected the plane's flight. I then had the kids all design the same plane and we added a launching system so that they could narrow down the variables they observed the first time around. After discussion again, it was determined what variables they observed and how they could develop testable questions around specific variables. My goal was to try to get them to see that scientists often develop questions from things they observe and wonder about. APPENDIX H – Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards describes this same idea, the appendix states, "[...students should develop an understanding of the enterprise of science as a whole—the wondering, investigating, questioning, data collecting and analyzing" (page 1). Another thing described in APPENDIX H – Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards describes the idea that science is open to change as new discoveries are made. By having students build their own design without any instruction from me, they naturally saw errors in their design and started making adjustments to their design and when we all constructed the same design they continued this same process but focused more on the elements of flight to help their plane fly farther and smoother.

As a teacher, I am constantly evaluating and trying to get students interested in learning the science without getting overwhelmed by the terminology and steps. I used to focus on teaching vocabulary and content prior to any labs, but have found throughout the years, students will learn naturally, the vocabulary and the content, as they explore and experience the scientific ideas. I've also found that retention and transference of the knowledge to their personal world is more concrete. For example, recently in class, I asked students to watch a video about glaciers and sea ice. I asked them what the difference was and why these bodies of ice were shrinking. Next I passed around frozen ice and sea ice and asked students to make qualitative and quantitative observations throughout the class period. As observations were made and recorded, students started asking questions and hypothesizing. One of the observations they made was that the sea ice appeared to be colder and less dense. Through their discussions I observed them make connections to what happens when salt is placed on the road to melt ice and they were starting to naturally plan a way to test out their hypothesis.

## How Does Math Content Overlap with Science Content?

Science and math naturally go together. Math often requires students to problem solve, provide evidence and proof for their answer. In science, students deal with a lot of data that they either collect or research. This data often has to be interpreted and analyzed. In science students also use math formulas and equations to test hypotheses or to help them construct an understanding of scientific ideas. In analyzing the data, students evaluate the data to determine if the data provides evidence for their hypothesis and then they have to communicate this by offering conclusions and connections from the science that they are learning to their own natural world. Math also asks students to build models like graphs to help illustrate their understanding of a math idea. Science also uses data tables and graphs as models to help students to provide evidence of how something works. These models can be used to argue points in discussion or debates, but at the same time help students revise and adjust their hypothesis as data may disprove their hypothesis.

Math also asks students to be precise which is a skill that is also required by scientists. Students learn that if they mismeasure chemicals there could be negative or unintentional reactions that can become unsafe. Precision also occurs with scale and models or just measuring length and distance to build a ramp or catapult. If mismeasurements occur here ramps or other machines may not perform as expected which can lead to frustrations. Therefore science and math have many overlaps in either skills students are using or in just noticing whether the data students collected in an experiment are reasonable. Math helps students justify experimental results.