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Nature of STEM

The nature of science is often referred to as how people explain the different events that happen in the natural world. As science teachers it is our responsibility to help students gain the background knowledge to develop an understanding of how the events in nature happen. As stated in the article *Tenets of the Nature of Science*, “Sometimes we assume that students will learn about the nature of science just by doing scientific investigations. This is no more valid... We need to explicitly teach about science as well as teach science content and do science” (p. 1). The Next Generation Science Standards (NGSS) includes a matrix of eight categories to guide teachers in enhancing students' basic understanding of the nature of science.

This next year I will be teaching various high school science classes, so I know I will be addressing many of the tenets that I have read about, but I will discuss some that I have taught with my middle school students in the past. One of my favorite lessons is teaching force and motion to my seventh graders. I generally start with a refresher about Newton's Three Laws of Motion and then the students do several activities to learn and gain a better understanding about the different formula’s for speed, velocity, momentum

and acceleration. The students final project for this unit is to design a vehicle that will travel across the floor on its own energy. I give my student's a variety of materials to use, such as, lids, straws, skewers, cardboard, balloons, rubber bands, and so forth, with little direction the student's start working. This is one of my favorite activities because all students know that the vehicle needs to move, and most use wheels, but then they have to decide how to make it move without them pushing it. I love it when they think they have it all completed and they go and test the vehicle and it does not move, or goes backwards, or even flips over because it is so light. This lesson is based on many of the tenets of science, the empirical nature because all my students have observed a car and how it works but figuring out how to make one move is the creative nature of science. This lesson allows the students to investigate, question, wonder why it did or did not work and go back and do a redesign as many times as needed then hopefully, they collect data and analyze their results. Once everyone has completed the project we meet back as a class and share the data and discuss what they learned from doing this activity. This lesson is tied to the Nature of Science crosscutting concepts of Scientific Models, Laws, and Theories Explain Natural Phenomena listed in Appendix H of the NGSS (p. 4).

I hope to enhance my teaching to address the tenets of science addressed in Appendix H- Understand the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards, this next school year. As I stated

earlier, I will be teaching High School for the first time and I am excited that I am taking this class. I have already been viewing many of the phenomenon lessons that are listed on the Wiki resources for Engaging Phenomena page. The site that I am most excited about using this next year is The Wonder of Science. I like how it is broken down by grade level and science topic. It also has a link to the NGSS, which will be helpful when writing lesson plans and making sure I am covering all the standards for each class. Another aspect of the site is that it also has an engaging video that can be used as an attention grabber and provoke scientific thinking by the students. Another reason I plan to incorporate this site into my planning is the uncertainty of how school will be taught this fall, in person, virtual or both, with the videos and links to other videos that are on The Wonder of Science site hopefully it will make teaching virtually easier. I think my understanding of the nature of science is always changing, the longer I teach I feel I learn more about the way students learn and more about how science changes. I have been teaching long enough that I taught my students that there are nine planets in our solar system to now only eight and trying to explain that with the development of technology and gaining a deeper understanding of the world around us that sometimes what science once thought was truth can change as new evidence is found. As stated in Appendix H “Science is the pursuit of explanations of the natural world, and technology and engineering are means of accommodating human needs, intellectual curiosity and aspirations” (p. 2).

The Nature of Science and the Nature of Math are two content areas that overlap with each other. I have always told my students that it is hard to do science without math. In science the students must explain their thinking or reasoning why they believe something happened the way it did or why the sky is blue? When I taught math, I also had my students explain their thinking in math. They might be able to get the answer but explaining how and why it is correct can be difficult for the student. This is the same in science, they might get the correct answer to a hypothesis or question, but if they do not know why, did they actually learn anything? As stated in *Standards for Mathematical Practice* article, "They (students) justify their conclusions, communicate them to others, and respond to arguments of others...Mathematically proficient students are also able to compare the effectiveness of two plausible arguments" (p. 2). Being able to justify their conclusions is a good practice for both math and science students to communicate what they have learned. When teaching lessons on calculating the different formulas related to force and motion math is an important part of this science lesson. Collecting data to create data tables and graphs is another way that math and science are incorporated together. One of my favorite lessons in chemistry to teaching balancing chemical equations, I know that teaching high school chemistry will require the students to use higher reasoning skills of mathematics than my middle school students used. Learning more about the nature of STEM and how all the disciplines work together hopefully will help me teach my students to gain an

understanding about why they are learning a specific topic and how it is related to the world around them.

References

"Appendix H- Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards." *The Nature in Science*, NGSS, Apr. 2013, www.nextgenscience.org/sites/default/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf.

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"Tenets of the Nature of Science." *Science Learning Hub*, 7 Oct. 2011, www.sciencelearn.org.nz/resources/413-tenets-of-the-nature-of-science.