The primary focus for the nature of science is to answer a question posed in society, specifically a question that can help society in some way. These questions can range from health and safety to ways one can simplify the lives of people everywhere. Scientists create a systematic process to collect observations, inferences, and empirical evidence in order to provide concrete evidence in support of or against the question(s) being asked. Throughout the nature of science processes discussion of the systematic steps taken by scientists are usually defined and adhered to religiously to insure accuracy and integrity. These steps, their resulting data, and the conclusion will be published for peer review. This is a critical part of the nature of science as bias and authenticity are weeded out during peer review. Ultimately the research is critiqued and certified by the scientific community and its lessons are available to all to learn from, adapt, and expand upon. " Together they have the capacity to describe complexity and interactions-that everything humans can discover about the world around them helps to better refine ideas and tools to shape the world- and the more accurately we can anticipate benefits, costs and risks to shaping the world, the more harmoniously we can live in the natural world." (Burns, n.d.)

It is important to recognize that Scientists work as a community sharing their knowledge and ideas with each other in an effort to help expand knowledge and solve problems world wide. Because of this approach, the nature of science is considered to be tentative, ever changing, and never finished. Scientists recognize that as they search for answers; they know new questions will emerge, new technologies will be created and what was once believed could completely change and must begin again seeking the answer to the same question. (Burns, n.d.)

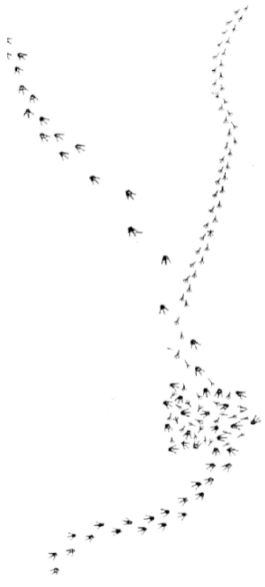

Figure 1

As a science teacher, my focus is on the Nature of Science is to show students that we use science as a tool to ask and answer questions/problems pertaining to the world around us. My opening unit seeks to define science and the key skills needed to be a good science investigator as well as what is needed for a valid and thorough investigation. I begin by defining the difference between observations and inferences, ensuring that they understand the difference and how to tell if they are making an observation or an inference. The culminating test is Figure 1. ; broken into three separate images the students have to list several observations about each of the segments and inference what could be happening in this scenario. What they observe and infer changes from segment 1 -3. With more and more of the image shared it emphasises the need for observing the whole picture and how we will always need to be flexible as new information becomes available. Once they see the entire image they must reflect on how their observations and inferences changed as more information is revealed.

Understanding what is real science versus pseudoscience is also something I address in this section. We evaluate different branches of content which often, sometimes erroneously, fall under the umbrella of science. Topics such as astronomy, paleontology, palmistry, biology, as well as other such topics are defined and compared to what actually is the definition of science. I teach that science must be consistent, observable, natural, predictable, testable, and tentative; we then review our topics and establish which ones are science and which ones are pseudo science. This leads nicely into ethics and how it is important for scientists to be unbiased working for the common good and not where the money is, however hard that may be.

I end the unit with a brief rundown of experimental design and how variables and data are necessary in science to help solve our questions/ problems being asked. As a culminating project they are given a random magazine advertisement stating a claim. Example being acne cream claiming to rid you of acne or specialized shampoo claiming to maintain your dyed hair color longer. They must research the claim the ad is making. How would a research scientist test this claim? What kind of data is needed in order to agree with the ad? What kind of hypothesis would work with the claim? The students must use what we have learned about proper scientific investigation as well as methods of product testing research they have to conduct to write a formal lab report highlighting what is NEEDED in order for the claim to be valid rather than presenting data they collected.

I recognize that my lesson surrounding the nature of science deals with the traditional look at the scientific method. This in itself is erroneous as it shows the method in a streamline step 1, step 2, step, 3 approach. When in actuality the scientific method is more fluid and dynamic jumping around from one area to the next based on the information that is gathered during the research/experimentation of the question/problem. While this topic is still a good lesson, I question if it really lends itself to math, technology or engineering integration. If I incorporate the nature of science using energy in an ecosystem, more possibilities become accessible. One of the tenets of the nature of science is how tentative science is and how it changes with advancements in technology. This is also expressed in ecological food webs. Organisms are carnivores, herbivores, and omnivores meaning they can eat a variety of meats and plants in their area. This is based on supply and demand; if it is there to eat it will be eaten, if it is not, then something else will be eaten in its place. Organisms eat from a buffet rather than a single meal option.

If I focused on food webs/chains and how energy flows through ecosystems students could research a variety of organisms identifying their eating habits, tying them into their chosen habitats and adaptations. Correlations can be made between seasons, food availability and population sizes integrating mathematics into the students research. From their research students could derive a question using technology/engineering to gain the needed information. Critter cams or robotic devices that can enter into the habitat undetected/undisturbed capturing species

interactions or population information could be designed for their specific problem they are interested in solving.

As a source for inspiration students could explore organizations actually using this style of data collection in many habitats around the world, explore.org/livecams, for example. This organization provides examples of critter cams all over the world where students can see them in action capturing the day to day happenings of different ecosystems around the world. Zooniverse, is an amazing online research group, allowing volunteers of all experience levels to conduct real research with real research scientists globally. This would allow the students to gain knowledge and practice for their own projects, helping them make realistic goals.

While my original lesson is engaging I never really get good results. Knowledge of the testing process is low among my high school students so we must spend time on different styles of research testing and without actual experience with these different testing styles . I also feel that it does not really lend itself to the addition of math, engineering or technology. Switching my topic could help with time management of the unit as well.

I chose to investigate the nature of technology and its similarities to the nature of science. After reading *Standards for Technology Literacy* published by the International Technology Education Association (ITEA) it was easy to identify many ways in which the nature of science and technology overlap. Right off the bat it is apparent how Science uses technology and advancements in technology to further scientific knowledge. Microscopes are commonly used in high school science classes so we discuss the invention of the microscope and its many evolutions. More importantly we discuss the world of microbes that were discovered because of this technology. We even discuss something as simple as tweezers and how this is a common tool in scientific investigation but it was developed and evolved from something crude and simple to what it is today, used during medical procedures and dissections all over the world.

The International technology education association also states that technology is created and used rapidly and that “The nature and development of technological knowledge and processes are functions of the setting.” (Wulf, 2007) Science has many branches, many under the umbrella of medicine, but others are unique; geology or astronomy for example. These branches of science have their own tools and technologies needed to assist in their research. Telescopes, hammers, brushes, light filters etc. I discuss with my ocean students the development of the sextant and the chronometer. Technology which helped early astronomers with star and constellation identification, later used for navigation purposes; helping mariners explore the world's oceans and then get back home again. Without their invention and understanding of the information they provide our modern day GPS would not be possible. I was not shocked to find that the nature of technology like science, revolves around solving problems

The idea of a system and the necessity for all parts working together for the common good. Science is littered with this idea as well. Our district is one to one so we all have ipads. The students have no idea what the inside of an ipad looks like or really how it works; they just understand that when they touch the screen they can command it to do whatever they want. Likewise the students struggle to see the intricate parts of the soil they walk upon every day. It is my job as a science teacher to highlight those intricacies to them so they understand how they all work together creating an environment in which all others can exist. The nature of technology does the same. That ipad my students are working on is made up of tiny parts all working together to create this piece of technology and all the power it holds. Science and technology work hand in hand and should be recognized in our teaching as such.

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