The Nature of STEM

a. In my 5th year of teaching, I can say that I use the 8 Standards of Mathematics Practice frequently in my teaching. One of my favorite standards to use is Modeling with mathematics. This year I teach only geometry, students have to be able to see the structure before being able to find the height, volume or surface area of it. They must also be able to touch and feel the solids to ensure that the formulas that are given work and they are not made up. This week we are studying surface area and volume of regular solids. I gave my students a net of a pyramid to cut out and form. Then in groups' of three students, they had to form another regular object with their 3 pyramids. This object was a rectangular prism, they then found the volume of it. They had to conjecture about the formula for a pyramid since the volume of a pyramid is 1/3Bh, most groups could see that it took three pyramids to make one prism whose formula for volume is Bh. This led to finding the volume of each and proving that the formula was correct. This activity encompasses a lot of the standards of mathematics. Reason abstractly students had to think out of the box on ways to form a new object with the three pyramids. Construct viable arguments and critique others' reasoning, within their groups' students, had to listen and argue with each other what their conjecture should be or what formula would work. Attend to precision, when students were asked to solve the volume of both their measurements had to be precise for the volume of the 3 pyramids to equal the area of the rectangular prism. Look for and make use of structure, students had to think about the solids we had discussed and compared that to parts of the pyramids to make a structure. Even though I didn't think about the standards when developing this activity, it still included 5 out of the 8 mathematical standards. I think this mainly because the standards are written about how math is supposed to be. Students must be able to think, reason, model, use appropriate tools to precision to be proficient in mathematics at a high school level. The 3 standards that were not included in this lesson were to Make sense of problems and persevere in solving them, Use appropriate tools strategically, and look for and express regularity in repeated reasoning. In my class, I use these more when practicing a standard that I have taught rather than during the introduction phase. We just left our trigonometry unit which was all about using appropriate tools strategically, not only the trig functions themselves but also the calculator know whether it should be in radians or degree mode was very difficult for students to grasp. This a basic understanding of how I use mathematical practices to teach mathematics in my classroom.

b. Knowing the Nature of Mathematics and keeping them in mind when planning and designing lessons will help understand not only how to complete math but also the what, when and why that is sometimes left out in mathematics. For example, the quadratic formula is given to students when they are unable to factor, but we don't discuss where it's derived from, why it works, how it works, what it actually does. As teachers, we just say use this when there is nothing else that is working. Thinking about these 8 Mathematical Practices will help me better prepare students to use their tools, knowledge, and skills appropriately in the future. The nature of mathematics is more about thinking and making sense of problems not just being able to solve problems but explain how to solve and why to solve in that manner. One place in which I need to use the standard of attending to precision is something I struggle with. Students completing work with pi drives me insane, the directions will say use pi or it will say use 3.14. I explained the difference so many times that now I just say yes that's the answer you just didn't read the directions and use the appropriate pi. I need to slow down here and be sure that students know what to use and when to use it instead of getting made and ignoring the situation students may not see a difference now, but one day them might become an engineer who needs to use 30 digits of pi not just 3.14 and it could lead to failure in their projects. Also with this standard, I am bad about leaving the units off. I know that Science, Technology and Engineering people all probably would be appalled. I need to be better at this and make my students do it as well to help them understand and make sense of the problems. Another standard that my students and I need to work on makes sense of the problems and persevere in solving them. Sometimes we get in a hurry, complete a word problem and just write the answer down. I need to make students write the answer in terms of the problem. They have gotten in the habit of multiple choice answers having only the numerical answer instead of referring back and making the answer fit the questions. Example: Johnny is building a swimming pool he wants it to be 100ft long by 8ft wide and 10ft deep. How much water will he need to fill the pool? Most answers would be "80000". But students should put that make and make sense of the problem with an answer like this "Johnny will need 80,000 cubic feet of water to fill his swimming pool up completely." I know its not much difference but it would give students a purpose instead of just an answer. These are two easy changes that I must make to ensure students have a deeper understanding of mathematics based on the Nature of Mathematics.

c. The second document I chose for my different disciplines was the Nature of Science. I think math is a tool used in science all the time you can't have one without the other. Before looking at the Nature of science, I thought they would be very similar and easy to compare to the Nature of Mathematics Standards. After reading through the nature of science though I realized there are only 4 out of the 8 understandings that are used in mathematics regularly. They are as follows: Scientific Investigations use a variety of methods, Scientific knowledge is based on Empirical Evidence, Science is a way of knowing, and Science addresses questions about the natural and material world. The standard that I feel matches with math the most is that Science addresses questions about the natural and material world. This is because most questions in mathematics are actually questions in science as well they both use math to think and solve these problems. In science you have to know how to solve the volume of the swimming pool before you know how much chemical to mix with it, you also must know percentages and conversions to correctly complete the project. That all use a scientific phenomenon that is solved by using math. The second standard that I think overlaps with math is scientific investigations use a variety of methods this matches with the math standard that says use appropriate tools strategically. Yes science says uses a variety and math say use appropriately but they mean the same in my opinion. When you use multiple strategies in science to determine precision in a problem is the same way that 5 students can all use a different strategy to solve a problem but to them, the most appropriate one is the way in which they think the clearest. The last standards I put together because they are very similar. Scientific knowledge is based on Empirical Evidence and Science is a way of knowing because in mathematics and in science you must gather evidence and provide proof that the idea works and test if it works in all cases before it becomes a theorem or definition or postulate the same process happens in science you must provide evidence and show that it works for all cases before you can conclude you hypothesis being true or false. I was correct in some parts that I thought they would be the same and that math is a tool used in science to solve problems. But there is still a lot of basic understandings of the nature of science that are no were near overlapping in mathematics.