Nature of Stem

I have chosen the nature of science as my primary focus of exploration in this project. As I am not a teacher by profession, I will reflect on my own experience as a science major many years ago with respect to the tenets of science, as well as consider how the Next Generation Science Standards can make the experience more engaging and exciting for students today.

The focus of my education was on acquiring the knowledge of the particular subject matter that was being disseminated by my teachers or professors. We would frantically take notes and then memorize the facts, only to regurgitate them back to the teacher on quizzes and exams. The more facts you remembered, the higher was your grade.

There was some scientific investigation done in the laboratory, but the goal was not to always answer a question. It was to learn how to follow a structured format and to become comfortable with laboratory equipment such as pipettes and centrifuges.
Empirical evidence gathered while performing the experiment was important to the write up of the experiment, so much so that most labs were done in pairs, with one person performing the lab and the other observing and gathering the empirical information.
Often in the discussion of the lab write up one would pay attention to the cause and effect relationship that had occurred in the experiment and its relationship to a scientific law.
At no time were the crosscutting concepts stated in Appendix H ever deemed important to the science experience.

As well, science, as most subjects, were taught in isolation of each other.

The Next Generation Science Standards represents a refreshing way of teaching science to children, with its emphasis on exploration and understanding of phenomena and scientific concepts. It allows students to think, collaborate and test their ideas. It emphasizes the need to choose topics or phenomena to explore that have relevance to the students so that they can be instantly engaged. It builds on their natural curiosity.

It also does not teach science in isolation but encourages integration with technology, mathematics and engineering. It utilizes a wholistic approach to solving problems and encourages creative solutions and discovery from the student. The teacher acts more like a guide than a “dispenser of information”. The students are active participants and guide the teacher as to where they want to go.

I think it can be anxiety provoking for a teacher initially, as some of the control is relinquished to the student, but the learning process is so enriched that the risk is worth it.

In order to enhance the teaching of all the tenets, I believe the set up and environment in the classroom is very important. Stations for exploration can be set. Collaboration can be encouraged where every idea is welcome. As well, establishing an environment that encourages discovery, that is safe to ask even “ silly “ questions is very important so that students will risk take and think “out of the box”.

Thinking and understanding of the nature of science is dynamic. Science is never static. Exploration and discovery are always presenting new information that may build on what we already know, or completely dispute a finding we have today with something new tomorrow. Absolutes do not exist in science.

For example, in the !970's, margarine was disputed to be safe and better for heart health than butter. Not anymore! We now know that trans fats that are contained in margarine can be deadly. Scientists now believe butter is better for you, even if it has saturated fat.
To teach students that science is dynamic keeps it open ended and allows the student to understand that possibilities are endless. What could be more exciting!

Mathematics is another area of STEM education that can overlap with the tenets of the nature of science. Once again, when I was a student, the emphasis was not made on comprehension but the memorization of specific formulas and knowing when to use each one of them. The better one was at this skill, the higher was one's mark.
Now, according to the Standards for Mathematical Practice, there has been a shift. Comprehension rather than just learning a fact is most important. This concept is the crux of the tenets of science as well.

In both Science and mathematics, tools are utilized to gather information and data. Often mathematical tools are used in the scientific exploration as well as those specific to science.

Another point of emphasis that is present in both is that conclusions that have been derived are not static. As more information is discovered or becomes available, conclusions can be modified or changed. Both science and mathematics are viewed as dynamic.

As well, both areas stress the concept that knowledge is built upon more knowledge. We are always learning.