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Nature of STEM

Methods of STEM Education

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In my profession as a middle school science teacher my primary focus is Nature of Science. The eight tenets addressed in Appendix H from NGSS are a clear perspective as to the

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direction of the learning outcomes per grade band. As a 6th grade teacher I find myself floating between ensuring that the students have mastered their performance expectations from grades 3-5 and getting the necessary progress on the performance expectations for the middle level grade expectations. With all science instruction, it is imperative that students are exposed to all tenets during instruction in order to achieve full mastery of the NGSS standards.

I currently address these tenets by starting my focus on what good evidence is, how to find appropriate evidence and how to explain that evidence. The tenet, Scientific Knowledge is Based on Empirical Evidence, is one of the tenets that I like to focus on with my students, without the skills to construct evidence, it is difficult to understand science as a whole. The learning outcome for this tenet is “Science knowledge is based upon logical and conceptual connections between evidence and explanations. Science disciplines share common rules of obtaining and evaluating empirical evidence.” (NGSS, 2013)

In order to achieve the learning outcome of Scientific Knowledge is Based on Empirical Evidence, other tenets are needed during instruction. In my classroom, I tend to combine this tenet with Scientific Investigations Use a Variety of Methods and Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena. These two tenets focus on the science of observations and phenomena to explain a given concept. In middle school, a large focus on learning is put back on the students to ask questions and investigate based on their own observations of a given scientific concept. This skill of making scientific observations leads to students being able to use that evidence in order to support a claim to explain the phenomena.

After reviewing the eight understandings of the nature of science, it appears to me that the tenets that can enhance my teaching are the tenets that are closely related to the cross-cutting concepts.

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One of the areas that I need to enhance as an educator is Science Addresses Questions About the Natural and Material World. I often overlook that students do not have this concept in their minds, or in some cases are against science as explanation to many events in nature. Although my teaching focuses on observation and evidence, I do not teach students that not all phenomena can be explained through science.

Another area that could enhance my teachings are Science is a Human Endeavor and Science is a Way of Knowing. I focus so much on getting my students to understand the standards and curriculum that I overlook the understandings that students need to have about science as a whole. Students need to understand that science is a universal language shared with people and scientists across the world. The ideas and knowledge we have here in Delaware, is the same ideas and knowledge as someone in Asia. It is a really important concept for all students to know and I should communicate that idea better to my students by possibly reviewing journals from other countries or a pen pal with students in other places. Students also need to see scientists as all genders, ethnicities and careers. When children picture a 'scientist', they typically picture Einstein or a white male wearing a lab coat. One thing that I could do is to introduce the scientist responsible for different discoveries in their lives and allow the students to see that anyone can be a scientist.

Upon reviewing the principles and standards of mathematics, I have come to the conclusion that there is an overlap in the science understanding and the content standards and process standards for mathematics. Those overlaps are in the areas of measurement, data analysis and probability, and reasoning and proof.

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In the area of measurement, this standard reminds me of the understanding of Scientific Investigations Use a Variety of Methods, where one of the learning objectives has students using a variety of methods and tools to construct measurements in order to come to a conclusion or make a quantitative observation of a given idea. This concept is the same in mathematics, students must be able to master the skill of measurements and units in order to apply that knowledge and skill in science.

Data analysis and probability relates to Scientific Knowledge is Based on Empirical Evidence and Scientific Knowledge is Open to Revision in Light of New Evidence, where analyzing data is imperative in the understanding and communication of evidence. Scientific findings, much like mathematical findings can come in many forms such as in charts, graphs and readings. “Additionally, it emphasizes learning appropriate statistical methods to analyze data, making inferences and predictions based on data, and understanding and using the basic concepts of probability” (National Council of Teachers of Mathematics , n.d.) In science, it is the same idea, analyze data to ask questions, or come up with a conclusion.

Scientific Knowledge is Based on Empirical Evidence and Reasoning and proof, ultimately asking the students to do the same things. Students must investigate, evaluate and use evidence in order to effectively prove the claim. I have students communicate their knowledge and understanding of a given question or concept by writing a C.E.R, claim, evidence, reasoning. In this communication the student proves their claim by providing accurate and relevant evidence and supports their evidence with reasoning.

References

APPENDIX H – Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards . (2013, April). Retrieved from <https://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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National Council of Teachers of Mathematics . (n.d.). Principles and Standards - National Council of Teachers of Mathematics. Retrieved from <https://www.nctm.org/Standards-and-Positions/Principles-and-Standards/>