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STEM in Elementary Ed

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Nature of Mathematics

The stigma surrounding K-12 mathematics has caused generations of individuals to resist change, improvement, and confidence in the subject. In the state of New Jersey, the elementary and middle school model of mathematics education is entering a realm of student accountability and growth mindset. The "workshop model," as it is referred to, goes beyond solving equations and provides students with the skills necessary to operate in everyday life. As a science teacher, I have been challenged with the task to target mathematics standards in my classroom. Currently, my lesson plans are focused on the NGSS science and engineering standards. Although many of my lessons involve math, I always let the students work together to complete calculations, frankly because math overwhelms me. However, after reading the "Executive Summary, Principles and Standards for School Mathematics," and Appendix L of the NGSS standards, I realized that being purposeful in my use of mathematics is simpler than anticipated.

Appendix L of the NGSS standards clearly outline the connections to Common Core State Standards for Mathematics. The mathematical connections are broken down based on grade level when a topic is introduced or reviewed. My district's science curriculum includes analyzing and interpreting data and using mathematics and computational thinking to incorporate math into the science and engineering practices. In my classroom, inquiry and investigation based lessons always require students to analyze and interpret data, whether qualitative or quantitative. To further integrate mathematics into these types of lessons I will refer to the guide on condensing

practices. To strengthen my data analysis based lessons, I aim to apply concepts of statistics and probability to science and engineering based questions and investigations. Likewise, to reinforce the use of mathematics and computational thinking, I aim to apply concepts of algebra to science and engineering questions and investigations. This will allow for solid connections to be made between math and science, primarily because most of my students take Algebra I and Algebra II in the 8th grade.

The specific mathematics standards frequently used in science education are MP.2. Reason abstractly and quantitatively, MP.4. Model with mathematics, and MP.5. Use appropriate tools strategically. The MP.2. standard directly relates to our method of assessment, a CER. A CER is a Claim, Evidence, Reasoning assessment in which students record observations, collect data, and conduct research to support their claim using evidence and scientific reasoning. Students are expected to use data collection and analysis as their primary evidence and additional research as their scientific reasoning.The MP.4. standard was not featured as obviously in my classroom in the past, until I took Endeavor's Astronomy Course. After taking this course I increased the use of modeling with mathematics when addressing concepts like scale and proportion. This was accomplished by using the real data websites provided by NASA and NOAA. The MP.5. standard is not used explicitly but closely relates to the use of science and engineering practices. Using appropriate tools strategically to learn mathematics aids in investigation of concepts through the science and engineering practices. Narrowing my expanded use of mathematics in my science classroom to these three standards will surely enhance the educational experience for my students.

Another factor which provided additional clarity on the use of mathematics in science, was the breakdown of mathematics concepts and process standards. The concept standards I aim

to focus on are data analysis, probability, and algebra. These content standards are featured throughout the middle school algebra and algebra II curriculum guides for my school district. After reviewing the processing standards, I realized that most of them are featured in science education as well. The processing standards include problem solving, reasoning and proof, communication, connections, and representations. In my science classroom, students investigate a problem or topic, connect prior knowledge, research and represent their findings in a numerical or visual model, and then communicate their findings. These process standards are nearly identical to the science and engineering practices.

The six principles of mathematics in schools include equity, learning, curriculum, teaching, assessment, and technology. Each principle relates to multiple subject areas like science, engineering, and technology. In mathematics, technology is essential and influences the mathematics that is taught. The development of new technology has a direct influence on the problem solving standard of mathematics because of the constant innovation and the assembly of new products. These new products aid in mathematical efforts to calculate, improve the efficiency of design, and assess the positive and negative components of developmental technology. Another area of mathematics that directly relates to technology is reasoning and proof. In technology, inventions and innovations are the result of goal directed research. These inventions and innovations are made possible through the identification of patterns, regularities, and structure in mathematics and the real world. The final connection being made between the nature of technology and mathematics is communication and creativity. In technology, creativity and communication inspires innovation. This leads to improvements to existing products and the creation of new products. In mathematics, creativity is demonstrated in representations of

numbers, symbols, and displays. Mathematics is communicated through reflection, refinement, and discussion, thus leading to technological innovation.

Works Cited

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