

Reflecting on the Nature of Mathematics and STEM Instruction

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My primary focus of exploration is on the nature of mathematics. My ultimate goal as a math teacher is for my students to approach any problem in life with resourcefulness. My hope is if my students are able to meet the standards for mathematical practice, then they will also meet my ultimate goal of developing into resourceful individuals. Although I strive towards this goal, I'm afraid that too many students are leaving my school without these standards being met.

Kentucky schools use the standards for mathematical practice and I know my lessons have addressed each to some degree. Unfortunately, I do not believe I have incorporated them as effectively as desired. For example, this year I have improved at making connections within my content. "When students connect mathematical ideas, their understanding is deeper and more lasting, and they come to view mathematics as a coherent whole" (National Council of Teachers of Mathematics, 2000, p. 4) Such as I have a lesson that makes connections between dilations in a transformations unit to a similarity unit. For this lesson, students play a desmos activity about mini golf where they dilate a point (a golf ball) to a specific distance away (the hole). They think they are playing a game until the scale factor of their golf club changes and they must consider the effect a scale factor has on one or more distances. The activity ends with the golf course disappearing, leaving only lines and points on a graph. Students realize that what they were dilating was actually creating similar geometric figures. Lessons such as this mini golf activity lead me to believe that students have made connections in my class this year, but I wish every lesson could be this successful.

My school has focused on higher order questioning this year. As a result, I think this has improved our students abilities to communicate and reason. Upon looking for new ways to support these academic conversations, I learned about dead words. I realized that I may have

unintentionally hindered my students' abilities to attend to precision. When I used specific terminology incorrectly, I was teaching them to use it incorrectly as well. Since learning about this, I have been more intentional about how I use words interchangeably.

Incorporating the standards of mathematical practice to a desired level of effectiveness can be challenging, particularly for students to use phenomena as a base for their thinking and learning. In order to make phenomena as a base for their thinking and learning effective, I need resources that maintain students' interest and curiosity. However, some mathematical concepts are easier to relate to students' daily lives than others.

Discovering new resources that promote curiosity would continue to enhance my instruction. This course has provided several resources that I hope will help. Resources such as teachingengineering.org's lesson bank provide so many great lessons that are based on phenomena, incorporate technology, and encourage curiosity. Although the site isn't strictly a math site, it helps me embed other STEM disciplines in my instruction. These lessons naturally integrate each mathematical practice so students can reason abstractly, collaborate with others, and use various tools to model real world situations. Instructional resources such as these are thought provoking and support my desire to address other disciplines.

As I learn to incorporate cross disciplinary resources, it's easier to see how the STEM content areas overlap. One of the tenets of science focuses on creativity and imagination. In the past, creativity was not something that crossed my mind in regards to studying math or science. However, as the science article states "imagination and creativity are needed in every aspect of a scientist's work – making sense of observations, making the creative leap from data to possible explanation, coming up with new ideas, designing investigations and looking at old data in a new light" (Tenets of the Nature of Science, 2011). I have learned that it takes some creativity to

develop a path for solving problems in math appropriately. The first mathematical practice states that when problem solving, students must “monitor and evaluate their progress and change course, if necessary” (KY Mathematics Standards, 2019, p. 13). I believe this skill takes a creative thinker just as the tenet of science deems necessary as well.

The subjective and theory-laden nature of science tenet refers to the bias that must be overcome from the natural flaw of human theory. “Science tries to overcome this lack of pure objectivity through the scientific community, which scrutinises scientific work and helps balance individual scientists’ leanings” (Tenets of the Nature of Science, 2011). This principle can be seen in the mathematical practice that involves students being able to construct viable arguments and critique the reasoning of others. In modern times, people are exposed to all types of information, unfortunately this information can be false or misconstrued. Students need critical thinking skills to develop new ideas so they do not become susceptible to misinformation.

The empirical nature of science is supported by the mathematical practice of using appropriate tools strategically. Researchers must use tangible tools to make observations about the world, just as mathematicians must use various tools to explore problems. In order for students to effectively explore new concepts they must be able to use these skills appropriately across disciplines.

I am a mathematics teacher, but I am quickly learning that I can’t be limited to just my content area. Embedding multiple disciplines within my instruction will enhance each mathematical practice and support my ultimate goal of developing thriving, resourceful students.

References

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