

Nature of STEM Assignment  
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Primary Focus

Because I have been a high school mathematics teacher for over 15 years, my primary focus for the “Nature of” exploration is the Nature of Mathematics. When determining the nature of mathematics teaching it is imperative to examine the Principles and Standards for School Mathematics. According to the Executive Summary, “Principles and Standards for School Mathematics is a guide for focused, sustained efforts to improve students’ school mathematics.”

How Nature of Math Tenets are Currently Addressed

There are six Principles listed in the document: Equity, Curriculum, Teaching, Learning, Assessment, and Technology. Here is how I address these 6 tenets in my classroom:

*Equity:*

“All students, regardless of their personal characteristics, backgrounds, or physical challenges, can learn mathematics when they have access to high-quality mathematics instruction. Equity does not mean that every student should receive identical instruction. Rather, it demands that reasonable and appropriate accommodations be made and appropriately challenging content be included to promote access and attainment for all students.”

I have a broad spectrum of students that come into my classroom. Some of these students are highly gifted in the area of mathematics while others struggle with a great deal of the content. And, of course, I have the students that cover the middle ground. In order to reach each student, accommodations need to be made. Gifted students receive accommodations like enrichment, acceleration, or independent study. Struggling students may get extended time, alternate assignments, or extra attempts at assessments.

*Curriculum:*

“In a coherent curriculum, mathematical ideas are linked to and build on one another so that students’ understanding and knowledge deepen and their ability to apply mathematics expands. An effective mathematics curriculum focuses on important mathematics that will prepare students for continued study and for solving problems in a variety of school, home, and work settings. A well-articulated curriculum challenges students to learn increasingly more sophisticated mathematical ideas as they continue their studies.”

The curriculum for the math classes I teach are aligned with the Common Core State Standards. According to the Common Core website, "The Common Core concentrates on a clear set of math skills and concepts. Students will learn concepts in a more organized way both during the school year and across grades. The standards encourage students to solve real-world problems."

*Teaching:*

"Students' understanding of mathematics, their ability to use it to solve problems, and their confidence in doing mathematics are all shaped by the teaching they encounter in school. To be effective, teachers must understand and be committed to students as learners of mathematics. They must know and understand deeply the mathematics they are teaching and be able to draw on that knowledge with flexibility in their teaching tasks. Teachers must be supported with ample opportunities and resources to enhance and refresh their knowledge."

I have committed 15 years to teaching and hopefully I get to do so for several more. I love seeing students gain understanding through the lessons and activities I provide for them. I have shown deep understanding of the content I teach by earning an almost perfect score on the Praxis II, Mathematics: Content Knowledge. And I have had the opportunity to refresh my knowledge through professional development and participation in courses provided through our local educational co-op.

*Learning:*

"Research has solidly established the important role of conceptual understanding in the learning of mathematics. By aligning factual knowledge and procedural proficiency with conceptual knowledge, students can become effective learners. They will be able to recognize the importance of reflecting on their thinking and learning from their mistakes. Students become competent and confident in their ability to tackle difficult problems and willing to persevere when tasks are challenging."

I give students chances to reflect on their work for almost every activity they are assigned - sometimes individually, other times, in small groups. I let them know throughout the year that mistakes are expected and that they are valuable because they can learn from those mistakes. I do find difficulty in getting all students to participate to their fullest in challenging activities.

*Assessment:*

“When assessment is an integral part of mathematics instruction, it contributes significantly to students’ mathematics learning. Assessment should inform and guide teachers as they make instructional decisions. The tasks teachers select for assessment convey a message to students about what kinds of mathematical knowledge and performance are valued. Feedback from assessment tasks helps students in setting goals, assuming responsibility for their own learning, and becoming more independent learners.”

My students are assessed regularly. It comes in forms of questioning techniques, homework, quizzes, projects, and exams. They get quick feedback in order to determine if their thinking was correct and they get to perform activities to learn from their errors. By having students to always reflect on their performance, it helps to build habits that push them to become more independent learners.

*Technology:*

“Students can develop deeper understanding of mathematics with the appropriate use of technology. Technology can help support investigation by students in every area of mathematics and allow them to focus on decision making, reflection, reasoning, and problem solving. The existence, versatility, and power of technology make it possible and necessary to reexamine what mathematics students should learn as well as how they can best learn it.”

Each of my students have a laptop assigned to them by the school. I use them to deliver the curriculum, assign practice problems, give quizzes and tests, and communicate with students and parents. Within some of the lessons are links to helpful videos or interactive websites. I use technology quite a bit more than most of the teachers in my school; however, I feel that I could do a better job with it.

How to Enhance the Nature of Technology in my Math Classroom

There are a few things I could try in order to enhance other disciplines within my classroom. Because math is used everywhere, I would need to find how the math I teach applies to those others disciplines. For example, instead of just using technology as a teaching aid, I could teach how math has helped in the field of technology. I could show them how math is written in basic coding. Math is found abundantly in science. Exponential functions could be taught with cell reproduction from biology. Some geometry can be taught by looking at crystalline structures of various solids in chemistry. Unit conversions are found in all fields of

science. Engineering has been in my geometry classes in the past when I had students build bridges from balsa wood and determine their efficiencies. I could bring that back and expand on the engineering aspect of the project.

### 3 Ways The Nature of Math and the Nature of Technology Overlap

I am finding that in STEM courses, there are a lot of overlaps. I chose to further examine the overlaps between mathematics and technology.

1. According to Standards for Technological Literacy, “the study of technology includes the study of natural scientific laws, systems, design, modeling, trade-offs, and side effects. These topics are also explored and studied in science and mathematics.” (page 48)
2. It also states that “mathematical concepts, such as the use of measurement, symbols, estimation, accuracy, and the idea of scaling and proportion are key to developing a product or system and being able to communicate design dimensions and proper function.” (page 50)
3. “Likewise, progress in science and mathematics leads to advances in technology. The development of binary language, a digital language made up solely of ones and zeros; the invention of the transistor, a device designed to replace the vacuum tube; and the use of integrated circuits, a collection of millions of miniature transistors, helped spawn a new generation of machines, from laptop computers and compact disc players to digital television. The mathematical and scientific ideas applied in the development of these digital devices promoted further developments that resulted in new tools, such as computer modeling. These tools, in turn, are used to explore new scientific and mathematical ideas, thereby spawning additional discoveries.” (page 52)