The Nature Of STEM **Ashley Condra Moore**

Of all the “nature of” STEM components, the one that I am most comfortable exploring is the “nature of Math”. Maybe this is because it was always my favorite subject in school, or maybe it is because I see so many students (and adults) who either love it or hate it that I feel the need to help those who hate Math change their feelings toward it. Whatever the reason, the “nature of Math” speaks to me the most.

Math is my favorite subject to teach in the classroom, and I am always looking for ways to bring all the components of STEM together for my students. Last winter our school was looking for a PBL opportunity for our students to participate in. A teacher in our school mentioned that there was an organization called Sleep in Heavenly Peace that might be perfect for this. Sleep in Heavenly Peace is a national organization whose mission is to be sure that all children have a bed to sleep in. When we discovered that there was a local chapter of this organization, we couldn’t think of a better project to involve our students in.

The students were asked to raise money for the local chapter of Sleep in Heavenly Peace by bringing in change. We talked to our students about what Sleep in Heavenly Peace does, and really tried to make them feel connected to it – because after all, we were raising money to buy beds for kids in our area, who were the same age as them. We wanted them to have a real interest in the project, because who knew… one day they could be the children who needed a bed. To get students further motivated, it became a competition to see whose class could raise the most money. Students were asked to make notes and cards to give to the children who received these new beds, also. The students also got to choose what kind of bedding they wanted to provide these children with the extra money that we raised. This is where I saw an opportunity to make this project even more real-life for my class.

Since we begin learning to count money in second grade, I decided that we would turn collecting change into a real-life learning opportunity, instead of just counting change on paper. This led me to thinking that students need to know that the things they want and ask their parents for don’t always come cheaply. So I gave each child a pretend amount of money, and told them that they had to choose bedding for our child their age, using only the budget that was given to them. I asked where we might find this bedding. They names lots of stores, but we decided on Walmart

because it was a place they were all familiar with, and that had the biggest assortment to choose from. We went online to Walmart.com and I showed them how to find bedding for children. After some time showing them around the site I let them get onto their Chromebooks to explore the site for themselves. They were really surprised at how much some things cost once we started looking. We talked about how if we went to the store to buy these things, or if we really purchased them online, that we could have to pay tax. But because they are second graders, we didn't count the tax into their total.

I can truly say that I have never had a group of kids that was more engaged or excited about doing Math than this group was during our project. Money was something that they knew about, because they want things and because they see their families trying to make and manage money of their own. They knew about online shopping because they had either shopped online themselves, or because they had shopped with a parent or grandparent online. Learning how to count money (a standard that they had to be taught anyway) was never more fun or exciting for them. Even though they were learning, they were also engaged in real-life, and were enjoying it while they did!

I wish these opportunities presented themselves more often. Or, maybe they do, I just miss out on them because I am so focused on what must be taught according to the curriculum and pacing of second grade standards. Enhancing my teaching of Math, and the other components of STEM, is a very doable thing. It just requires paying extra attention and intentionally changing the way that I am used to "teaching" my students.

The number one way that I feel I could enhance my Math teaching is by making it a goal to do much less front-loading, and to allow students to learn through productive struggle and inquiry. I was taught Math through front-loading. I have always observed other teachers teaching Math through front-loading. So, obviously that is how I have always taught Math. Until I worked with a friend of mine, and was introduced to the true world of STEM, like this Endeavor program exhibits, that is just the way I thought it was supposed to be.

It never ceases to amaze me how every time I allow my students to learn Math, or any other subject, through inquiry or problem-based learning, that every child, regardless of background or ability level, seems to experience the joy of learning like they never have before with traditional teaching. There are times where front-loading is necessary, but there are so

many times I could let my students learn by exploring and investigating skills without telling them exactly that they're looking for.

In the article by Peters-Burton (2014), the author states something that really spoke to me, that "the nature of Mathematics can be considered the cycle of inquiry… accounting for all possibilities through the manipulation of rules…validating the quality of solutions and models by understanding the differences between mistakes and reasonable choices that did not turn out to be successful." Students need to learn to problem solve by asking questions and manipulating the information they are given. They need to try out different strategies and ways of thinking, so they can learn that they won't always come up with the right solution the first time. They need to learn to persevere and to not give up just because their first thinking was wrong. They need to know that that "mistakes" aren't always bad, and that they are a great way to learn and improve themselves, often helping them find a more reasonable solution.

I can't think of a better way to enhance my instruction than to give my students more opportunities to experience all these things more often that I currently do.

The Nature of Math and The Nature of Science

In Appendix D of the NGSS Science Standards there is a Venn diagram that shows the overlap of Common Core State Standards in Math, Science, and English. Even though I have read these standards multiple times, seeing them presented this way was eye-opening, because there truly is so much overlap between them.

The two natures that share the most similarities to me are Math and Science. First, observations and inquiry are required in both subjects. In order to understand how the world around us works, and to create scientific solutions to solve the problems we see, we must observe the natural world around us (NGSS Appendix H). In order to find solutions to mathematical problems and unreasonable solutions, we must observe all of the data that we are given.

Second, there are many ways to investigate problems in both Math and Science. There are multiple ways to get to the same solution. How one person views a problem may be different from how another person sees a problem. But this doesn't mean that both people won't find a solution to this

problem. Even though they may come to their conclusions through different processes, they still can find solutions to the problem they are seeking to solve.

Third, what is happening in our world often changes the priorities within each discipline. When there are outbreaks of disease and viruses, scientists focus on finding medicines and vaccinations. But when a hurricane contaminates the water sources of a town, scientists focus their efforts and resources there. Just like mathematicians change their priorities when depression strikes their country, or when natural disasters destroy areas and force residents out of their homes and jobs, and money must come from somewhere to help them get their lives back together.

These are just three of the many ways that I see that the nature of Math and the nature of Science overlap.

Resources

NGSS Appendix D – All Standards, All Students
https://www.nextgenscience.org/sites/default/files/Appendix%20D%20Diversity%20and%20Equity%20-%204.9.13.pdf

NGSS Appendix H – Nature of Science in the NGSS

https://www.sciencelearn.org.nz/resources/413-tenets-of-the-nature-of-science

Peters-Burton, E. E. (2014). Is There a “Nature of STEM”? *School Science & Mathematics, 114* (3), 99–101. https://doi-org.ezproxy.montclair.edu/10.1111/ssm.12063