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Nature of STEM

For the purpose of the work in this class, I will be collaborating with an 8th grade ELA teacher, and will refer to those standards, tenants, and lessons. The National Council of Teachers of English (NCTE) would be seen as the organization that are the experts in ELA education. I will refer to the 12 standards of the NCTE as the basis of curriculum in ELA because they have a guiding vision and standards according to their website, but no “nature of” statement.¹ Also, I will refer to Kentucky’s KAS standards for Reading and Writing² at the 8th grade level specifically when needed.

I chose to first focus on the Nature of Technology tenets. I have been an instructional technology coach and computer science teacher for the last 3 years, and I will admit I had never read the ITEA document because I did not even know it existed. I use the International Society for Technology in Education (ISTE) standards in my work, and was totally unaware that the technology standards were a whole different ballgame. I say this just to point out how needed this exercise is. When I think of the T in STEM I thought of the ISTE standards which refers to technology use in life, but mainly the word technology to them is digital technology like the internet. When looking at the ITEA’s nature of technology section, I see the much broader view of technology and more clearly how it fits into STEM as a whole, and the connections to ELA.

The Nature of Technology has 3 standards, the first being that students will understand the characteristics and scope of technology. In the breakdown of this standard it says, “A technological literate person understands the significance of technology in everyday life and the way in which it shapes the world.”³ The first NCTE standard refers to students reading with the purpose of understanding themselves, cultures, and the world. What better way for a student to understand any of these things than to read about technology?

¹ (n.d.). NCTE / IRA Standards for the English Language Arts. Retrieved September 23, 2021, from <https://ncte.org/resources/standards/ncte-ira-standards-for-the-english-language-arts/>

² (n.d.). Kentucky Academic Standards Reading and Writing. Retrieved September 23, 2021, from https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Reading_and_Writing.pdf

³ <https://www.iteea.org/File.aspx?id=67767&v=b26b7852>

The second Nature of Technology standard is to understand core concepts of technology, which are systems, resources, requirements, optimization, processes, and controls. While the NCTE standards do not have any clear connections to this idea, I do believe that there is a similarity in the way NCTE asks that students apply knowledge of things like language structure and conventions to create, critique, and discuss texts. Both standards are essentially about the rules which people must follow within a given area. I must use capital letters when writing so that people understand what I am communicating, just as I must adhere to the physical laws that limit my ability to push a box across the floor. There are some parallels to be drawn in both of these standards.

The third Nature of Technology standard talks about relationships among technologies and also connections to technology and other fields. The connection between this standard and the NCTE standards is way more clear because it is right there in the writing - connections to all other fields. The NCTE standards contain one specific standard that states students will use a “variety of technology” to “gather and synthesize information”. In the case of these two standards they reference each other as the vehicle for getting the job done!

I see the “nature of” statements and broad standards from each of these individual content areas starting to blur more and more as I learn more. As I read the nature of statements more closely I am starting to think of them more broadly and see their value in a larger context. With the recent gaps due to the pandemic and its effects on education, it feels like we have narrowed in on loss of skills. However, if you look at the ELA standards I can see many areas where students have grown tremendously over the past 2 years, like writing for different purposes and to different audiences. They may not have had the opportunity to cover a certain minute piece of content, but a majority of the teachers I know had students as young as 3rd grade doing lessons on how to communicate via email with a teacher, and then the kids used that skill for an authentic audience. When looking at the broader scope of the standards or nature of statements, it seems the students did not experience a loss of education, just a shift to different skills. Also, the different areas (science, ELA, technology, etc) are not siloed off in my mind but are becoming a web where they overlap, reference each other, or can be used as a tool to learn the other.

For example, there is an NCTE standard that asks students conduct research on issues by generating questions, in which they gather information and communicate. It would be very easy to create a project around the scope of technology in an ELA classroom. Middle school students would be engaged by researching and discussing technology as an innovation, or debating if a certain technology which was the result of human activity is a good or bad innovation. I immediately think of this being a debatable topic because middle school students will

debate anything, so why not bring an awareness of technology (that is not just cell phones or the internet) into the picture? This would be covering a technology topic by using ELA standards.

The technology statements also reference innovation and invention. These principles lend themselves to project based learning lessons. Students might be asked to innovate on a current product, which would call for them to go through the design process. The first steps of the design process, as I have taught it, are to research what is currently on the market. The process of research, comprehension of texts, and relating to texts are ELA standards. Once students had done the research and created a new or innovated product they would present their findings to an appropriate audience, which is also an ELA standard. Once again, Students would be using ELA skills to accomplish the exploration and application of technology standards. This interdisciplinary approach to teaching is one my district is learning about through PBL. There are numerous benefits to an interdisciplinary approach which include, “deepen learning and teaching in order to acquire a more holistic picture of the complex phenomena of nature, society and real life” according to the article *Interdisciplinary craft designing and invention pedagogy in teacher education: student teachers creating smart textiles*.⁴

In addition to reading the nature of document from ITEA, I read the Standards for mathematical practice because I assumed that ELA and math would be the two subjects that were the farthest removed from one another and it would be interesting to see if I was right. I was wrong and with a quick rereading of both sets of standards I immediately found connections. Standard one in math is to, “Make sense of problems and persevere in solving them” and problem posing is addressed in the ELA standards when it references how to research to find data. Students would need to find data to solve a problem or make draw a conclusion in either case. Both sets of standards use the word “data”. However, when thinking about the *Whats in a Word*⁵ article I do think that the ELA standards could have used the word evidence instead of discoveries. They gist of the ELA standard is that students use data to support their discoveries, which was really a product of their research and could have been discoveries. The second parallel I found in the two was that the math standards ask students to construct arguments and critique reasoning of others, while the ELA standards mention communicating in a variety of ways and to variety of audiences several times. So math is asking them to make an argument and ELA is encouraging them to craft that argument effectively. One could not exist without the other. A third connection is one that I often made with my elementary students, and that is to draw the connection between math symbols and structure (standard 6 on precision and 7 on structure) and grammar structure and conventions. As a liner

⁴ Karppinen, S., Kallunki, V., & Komulainen, K. (2017). Interdisciplinary craft designing and invention pedagogy in teacher education: Student teachers creating smart textiles. *International Journal of Technology and Design Education*, 29(1), 57-74. doi:10.1007/s10798-017-9436-x

⁵ Schwartz, R. (2007). What's in a Word? How Word Choice Can Develop (Mis) conceptions about the Nature of Science. *Science Scope*, 31(2), 42-47.

minded person I thought about a compound sentence as: independent clause + , conjunction + independent clause = compound sentence. I made anchor charts with these grammar equations to teach my class.

I did not have a hard time making the connections between separate subjects once I started to examine each more closely. The lessons ideas came very quickly and could probably go much deeper with practice on my part. The connections between subjects was obvious because the spirit of each set of standards and at times even the wording was similar. We live in a world where the subjects are intertwined, so this should all be obvious to educators, but I am shocked at how much this made me think and what I learned.