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Assignment: Nature of Science & Math: Analyzing the Presence in Everyday Communication

The article I will be analyzing for this assignment is a New York Times article entitled "In Coral Skeletons, Microscopic Portraits of Resilience?" written by Steph Yin in June 2017.

The function of the article was to share new findings on amorphous calcium carbonate and how this could potentially play a role in coral resilience in regards to ocean acidification. Although I do not think the article was structured in the best way to present new empirical data on coral skeletons and the possible implications this may have in light of climate change, it does meet some of the nature of science tenets outlined in the NGSS, as well as some of the practices in the CCMS.

Part A. Nature of Science discussed in NGSS

Tenet: Science is a Human Endeavor

The nature of science is a process that is both empirical and subjective. Science is the pursuit of knowledge through the upholding of various organized practices and processes in order to create an understanding of the natural world. This knowledge is constructed through the lens of human inferences and implication of raw data that is used as evidence to support such ideas (Schwartz, 2007). Thus science is a human endeavor that is followed with very human characteristics- there are no absolutes and there is evolution, which often opens room for debate in interpretations. The history of science gives it a human face, and much like humans, as time goes on, it is an ever-changing enterprise (NGSS Matrix, 2013). In the NYT article, the change is presented such that "findings suggest coral may be more robust in the face of human-driven ocean acidification than commonly thought" (Yin, 2017 p. 1). This shows that based on new ultrahigh-resolution microscopic imaging evidence of how coral skeletons are formed, there is a shift in viewing coral as more equipped to fight climate change with natural biological processes than originally believed. Though this new data can serve as evidence to support a positive claim, there is still much debate about the implications of this new understanding. One side of the debate is that this first report of amorphous calcium carbonate in coral suggests the organisms are able to control how solid material is deposited. Though the argument is not clearly presented about how this would play a role in defense towards ocean acidification, it does lend itself to producing some hope in the media and part of the scientific community. "It is true that corals lose calcium carbonate in a more acidic environment- but they maintain the ability to grow back that skeleton" (Yin, 2017 p. 5). The other side of the debate is that not all scientists agree with this sentiment and still believe the harmful effects of climate change will prevail, as there is much data to suggest that coral species are very sensitive to changes in their environment.

Tenet: Scientific Knowledge is based on Empirical Evidence

Science knowledge is based on empirical evidence that holds common rules in evaluating this evidence, to derive explanations about natural systems. Science is both a set of practices and an accumulation of knowledge and it is through the practices that knowledge is generated (NGSS Matrix, 2013). In the NYT article, scientific knowledge is presented as a result of ultrahigh-resolution

microscope imaging and other techniques for observing the structure of molecules. It is this empirical evidence that allows the scientist to create a model of coral calcification involving amorphous calcium carbonate. Although this data has been uncovered it appears that scientists are still in the task of establishing scientific knowledge, as the process of calcification using amorphous calcium carbonate is still not fully understood. This is true to the nature of science as is shows the act of accumulating and building ideas together to eventually form scientific knowledge and understanding.

Tenet: Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

A scientific theory is a well-established explanation of how or why a phenomenon happens. A scientific law describes what is happening in terms of the variables at play and is often associated with a quantified formula relating the relevant concepts. Simply put, the law describes what and the theory explains why (Schwartz, 2007). In the NYT article, one of the biggest criticisms of the implications of the new evidence on coral skeletons is that the scientists who claim the positive implications are ignoring the well known fundamentals of chemistry and the laws that govern it. " It was an oversimplification to take seawater chemistry out of the equation. Acid dissolves calcium carbonate, so the more acidic the ocean is, the more difficult it is for coral to organize that first bit of skeleton". (Yin, 2017 p. 5) This shows somewhat of a danger in the way the article presents the information about the amorphous calcium carbonate as this can lead to misconceptions in the public regarding the dangers of climate change to the oceans. It becomes easier to dismiss ocean acidification and warming if the public believes the coral have a natural defense mechanism toward changing environments.

Part B. Common Core Mathematics Practices

Practice: Construct viable arguments and critique the reasoning of others

There are many overlaps in the practices of the NGSS and CCMS. One of the most prominent is the practice of constructing viable arguments and the critique of reasoning by others. The NYT article is a prime example of this as it shows arguments constructed by various scientists that in some respect disagree with each other. It is not as though the scientist in the article disagree with the reality of ocean acidification and warming due to human driven climate change, but rather the disagreement in the implications of new data on the process of calcification regarding amorphous calcium carbonate. The best description of the practice that lends itself to the article is students can " think inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is" (Standards for Mathematical Practice).

Practice: Use appropriate tools strategically

The NYT article describes scientists applying the mathematical practice of using appropriate tools strategically. In order to better understand corals and their biological processes, they are using ultrahigh-resolution imaging technology and other techniques to observe the structure of molecules. This application of tools and technology comes at an appropriate time and is worth researching as coral are suffering due to increased and uncontrolled carbon dioxide human emissions. I particularly like this description of the practice as it is fitting for the article students "are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations" (Standards for Mathematical Practice).

Practice: Look for and make use of structure

This NYT article lends itself to the practice of looking for and making use of structure. Although it does not provide structure in a mathematical sense, it provides molecular structure for coral skeletons. One practice description that stands out in regards to the article is that students "can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects" (Standards for Mathematical Practice). The scientists whose research has uncovered the amorphous calcium carbonate are trying to make use of their findings by generating implications of hope in the face of ocean acidification. In a way, this is a valuable thought process and can inspire. In other ways, as brought forth by opposing arguments, is that this can shift perspective on the true issue of climate change and ocean acidification and bring false hope.

References:

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