

Nature of Science and Common Core Math Practice Analysis

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One often misrepresented areas in the media is the true nature of both mathematics and science. The *Scientific American* article “Momentum Isn’t Magic- Vindicating the Hot Hand with the Mathematics of Streaks” is a particularly interesting exception to this, as it emphasizes the fluid nature of scientific knowledge and the way in which mathematicians persevere to build new knowledge. It would be a powerful article to use in the classroom to help students see mathematics and science as a body of knowledge that is dynamic and ever-growing.

Nature of Science Analysis

Scientific Knowledge is Open to Revision in Light of New Evidence

This article most supports the idea that science is open to revision over time. The article discusses the belief that a “hot hand” in sports is a “delusion” and the revisions that have been made to that theory (Miller, 2018, p.2). This especially tied to the rubric that the NGSS uses to describe the nature of science, where it is noted that science is subject to change based on either new evidence or reinterpretation of existing evidence. It’s important to understand that “theories do not with time become laws of facts” (NGSS, 2013). With the participation of the scientific community, the analysis of new evidence, or the reinterpretation of old evidence, science is always subject to change and growth. I was particularly impressed by their article’s exposure of a situation in which there was contested debate, leading to a change of opinion based on new or reexamined empirical evidence.

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

This article speaks to science’s assumptions of order in an unique way. It opens by discussing the idea that “humans have a predisposition to see patterns in randomness” and that this had been an argument against the “hot hand” for decades (Miller, 2018, p.2). The article also addresses the idea that probabilities of successfully shooting a basketball have been equated to flipping a coin, a very orderly and predictable mathematical situation. However, it also discusses the differences between expected and observed values in

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these scenarios. Science is meant to model our world, but science does assume “consistent patterns in natural systems” and observed phenomena may not always exactly model what science assumes (NGSS Lead States, 2013)

Science is a Human Endeavor

This article represented the human side to the nature of science in an extremely interesting way, addressing head on the debate that exists in the scientific community on certain topics. This particularly connected to the Schwartz reading to me, in which there was a discussion of moving students away from the view that there is one “correct” answer (Schwartz, 2007, p.44). Schwartz also suggests having students consider how “scientists know if they have come up with good explanations from their observations” (Schwartz, 2007, p.45). The Scientific American article specifically shares a collection of email threads, internet forum discussions, and other modes of debate in which scientists argued over something for which both sides claim to have “empirical evidence.” This sheds light on how scientists decide whether their empirical evidence is an acceptable foundation on which to shape a revision to a theory. Peer review and agreement in the scientific community, and lively debate are all important parts of refining scientific theories.

Common Core Mathematics Practices Analysis

Make Sense of Problems and Persevere in Solving Them

The article profoundly addressed this standard for mathematical practice, as it discussed repeatedly how the approach to a problem varied over time. In this case, analogous problems were considered in order to gain insight, progress was monitored and evaluated, and correspondences were identified between different approaches (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010).

Construct viable arguments and critique the reasoning of others

This closely related to Science as a Human Endeavor, as it was directly discussed what a great debate was held in the mathematical and scientific community over the findings that the “hot hand” might be real. Debate ranged from online discussions via email or message boards to journal articles, with each side looking to “justify their conclusions, communicate them to others, and respond to the arguments of others” (National

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Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). Ultimately, the researchers were able to identify bias in the original data and defend their reasoning using the “formal mathematical procedure for updating beliefs based on new information, Bayesian inference” (Miller, 2018, p.6).

Model with Mathematics

One of the methods researchers used to defend their work in this article was to model with mathematics. They drew on the relationship between shooting a basket and flipping coin and were able to model accuracy in shooting with the number of consecutive head flips in a row (Miller, 2018, p. 5). By modelling a more complex situation with this simpler one, the researchers were able to see that the previous mathematical model had not taken into account the “principle of restricted choice” (Miller, 2018, p.6). They were also able to tie the scenario to another closely related model, The Monty Hall Problem. All these results are interpreted in context to make sense of the scenario as it related to basketball.

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