The Nature of Science and Common Core Mathematics Practices as Depicted in Media

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Introduction

The *New York Times* article "Scientists Move Closer to Understanding Schizophrenia's Cause," written by Benedict Carey, highlights the nature of science and mathematical practices by featuring a study that was open to some initial criticism, but made way for new research into the cause of schizophrenia. The article shows that scientific knowledge is based on empirical evidence, is open to revision, and assumes an order and consistency in natural systems. The article also shows that this study meets Common Core Mathematical Practices by making sense of problems and persevere in solving them, reasoning abstractly and quantitatively, and modeling with mathematics.

Tenants of the Nature of Science

Scientific Knowledge is Based on Empirical Evidence

Empirical evidence is information that researchers generate using observation and experimentation to help uncover answers to questions (McShane & Lueken, 2019). The use of empirical evidence is highlighted throughout the entirety of the article, "Scientists Move Closer to Understanding Schizophrenia's Cause" (2016). The study conducted by scientists from Harvard Medical School, Boston Children's Hospital, and the Broad Institute included analyzing the genomes of over 60,000 people. They observed that people who had been diagnosed with schizophrenia were "more likely to have overactive forms of C4-A than control subjects" (Carey, 2016). This observation led the scientists to conduct an experiment using mice that were bred without the C4 producing gene. They then observed that the "evidence strongly suggested that too much C4-A leads to increased synaptic pruning" which may explain why individuals with

schizophrenia have thinner prefrontal layers and the reason the disorder does not emerge until a person's teenage years or early twenties (Carey, 2016).

It is important to note that the article is careful to not use dead words such as "proof" or "reason" but instead used alternative words like "evidence," "support," and "suggests" (Schwartz, 2007). These alternative words lend themselves to the nature of science by not making science a study where ideas are either right or wrong, but instead, that scientists investigate and experiment to find links or correlations, but never proof.

Scientific Knowledge is Open to Revision in Light of New Evidence

The nature of science is one in which scientific knowledge remains open to revision in light of new evidence. This goes back to the notion that science is about finding links or correlations, not proof.

Prior to this study, the scientific community had been baffled by what, if any, biological factors might contribute to a person becoming at risk for schizophrenia and why the disorder begins in a person's teens or early twenties. Other large-scale genetic studies of psychiatric disorders had been criticized, but this study was seen as a something the scientific community could use to help drive their research. The idea that the scientific community was so critical of genetic studies when it came to psychiatric disorders goes against the nature of science. However, this study provided new evidence, and many of those that were previously critics were now open to the idea that perhaps there might be a correlation between genes and psychiatric disorders.

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

The tenant that scientific knowledge assumes an order and consistency in natural systems is important because otherwise science would have no basis for which to guide its theories and laws. Including insight into this tenant, the author then allows the general public to understand why the scientists started where they did and how they used that starting point to help drive their research.

The natural process of synaptic pruning was given a spotlight in this study. Synaptic pruning is a "delicate, exquisitely timed process" in which the brain discards weak connections between neurons (Carey, 2016). Scientists had previously known of this process, but in the study, scientists observed that there appears to be a gene variant in those with schizophrenia that "facilitates aggressive pruning" (Carey, 2016).

Common Core Mathematical Practices

Makes Sense of Problems and Persevere in Solving Them

Much like science, math makes sense of problems and persevere in solving them. In this study, the scientists used the knowledge gained from previous genetic studies to focus their attention on a genome that had a strong association with schizophrenia. This genome is called the major histocompatibility complex or MHC for short. After collecting the data, the question remained "what's in there?" (as cited in Carey, 2016). The team of scientists then went on to use statistical methods to establish that there are "four common variants of a gene called C4, and that those variants produced two kinds of proteins, C4-A and C4-B" (Carey, 2016).

The team of scientists persevered through their investigations that led them not only to new insights, but to new questions. Each time their math solved the question they were working on, new ones arose. While math may solve problems, science asks more questions. Dr. Samuel Barondes noted that this study is "just one small step in a journey of a thousand miles" (as cited in Carey, 2016) into learning more about the biological components involved in psychiatric disorders like schizophrenia.

Model With Mathematics

Using the data collected from their analysis of the MHC, the team created a bar graph and dubbed it the Manhattan plot because it "looks like a cluster of skyscrapers [in which] the MHC looms highest" (Carey, 2016). Eric S. Lander, the director of the Broad Institute noted that the MHC was the Freedom Tower of the Manhattan plot (as cited in Carey, 2016).

Graphing is one way that scientists can model with mathematics. Modeling allows the data to become more visual so that variants in data, such as the C4-A and B in this study, can be easily distinguished.

Reason Abstractly and Quantitatively

The team was depicted as having reasoned both abstractly and quantitatively. They noticed correlations between their data and previous theories. One such correlation was that because their data pointed to the MHC genome, which is "known to contain genes that facilitate the body's immune response" (as cited in Carey, 2016), schizophrenia might be an autoimmune condition rather than a psychiatric disorder.

This abstract idea was then studied in a more quantitative fashion using statistics and analyzing the MHC genome of several thousand people both with and without schizophrenia.

Conclusion

The article "*S*cientists Move Closer to Understanding Schizophrenia's Cause" illustrates the nature of science and mathematical practices in several ways. It shows that scientific knowledge is based on empirical evidence, is open to revision, and assumes an order and consistency in natural systems. The article also shows that this study meets Common Core Mathematical Practices by making sense of problems and persevere in solving them, reasoning abstractly and quantitatively, and modeling with mathematics.

When these tenants and practices are illustrated in media, the general public gets a better idea of how math and science work together to help solve problems and generate new questions to help us delve deeper into our human experience, which is also a tenant of science- science is a human endeavor.

References

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