Nature of Science in My Classroom

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The philosophies and principles of the Alberta Program of Studies for Elementary science guides my teaching, which are similar in many ways to the Nature of Science tenets of the NGSS, Appendix H

Science (Elementary) A.1-2 (1996) The science program of studies is built on the following principles (3 of 5):

- Children's curiosity provides a natural starting point for learning.
- Children's learning builds on what they currently know and can do.
- Confidence and self-reliance are important outcomes of learning.

The first tenant of the nature of science that I focus on is *science is a human endeavour*. Science requires curiosity and wonderment and the desire to find answers. Why is the sky blue, how plants make food or why do stars twinkle are just a few examples. "Creating positive relationships and a classroom that feels safe can help *all* students succeed. It helps level the playing field for students who have experienced trauma.... It does the same for children from disadvantaged backgrounds, students burdened with stressful home lives, and so on."[1] Children must feel safe to ask these questions without fear of ridicule. They must feel free to make a guess in an attempt to answer the questions with the confidence that their ideas are valid. "In order to really find out what your students are thinking, you have to first create a classroom environment in which they feel safe to share their ideas with you…"[2]
I share true stories about how people needed to make several attempts and failures before succeeding in their quest. For example when I teach a topic on electricity I might share this tidbit of information. "Edison and his team of researchers in Edison's laboratory in Menlo Park, N.J., tested more than 3,000 designs for bulbs between 1878 and 1880. In November 1879, Edison filed a patent for an electric lamp with a carbon filament."[3]

1. Do Students Learn More When They Feel Safe and Connected?
2. Formative Assessment for Secondary Science Teachers
3. Live Science is part of Future US Inc

In the end the children feel their ideas are valued and are excited to share their solution with the class. They begin to worry less about being “wrong” if they are allowed to share their reasoning.

The tenets that I will address in my classroom will be *science addresses questions about the natural and material world* and *science is based on empirical evidence*. These are two tenets that work well together. The first tenet states that “science findings are limited to what can be answered with empirical evidence” and the latter that evidence is “based on recognizing patterns...with the use of tools and technology to make accurate measurements and observations” (NGSS, Appendix H). It is essential to the scientific method (STEM) to be able to focus on data and observations that are recordable, reproducible and reliable. Whether it is thinking about ways to show that the Earth is not in the center of our solar system or why the sky is blue, you need more than stating, ‘that is the way it is…”,or “just because.” You need to find ways in which you can test these ideas. Being able to develop good questions is essential in coming up with ideas on how to find or create data and observations that you can analyze for patterns and possible answers to your question. Students need to develop the understanding that they already have observations, information and creativity that they can reference in creating possible solutions to their questions. Many students do not realize that they have been using these scientific methods all their lives. It is important that they understand this so that they can build upon their knowledge. They eat food and then get sick, they decide they should not eat that food again or they step on a bee in their bare feet, they might decide to wear shoes or not run through the flowers. This will allow them to go from this early stages of causation to being able to create more data to solidify or falsify their conclusions. How do I know if the food made me sick? Will wearing shoe prevent me from being stung?

It is easy to see the overlaps between the Nature of Science (NGSS) and the Nature of Mathematics. Mathematics plays an integral part of any scientific investigation. Whether it is the ability to recognize patterns and anomalies, to create tables and graphs, or being able to explain relationships in a logical sequence, math is a key tool in evidence-based scientific explanations.

Nature of Mathematics CCSS	Nature of Science NGSS
CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them. Students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends.	**Scientific Knowledge is Based on Empirical Evidence** Science findings are based on recognizing patterns. Scientists use tools and technologies to make accurate measurements and observations.
CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique the reasoning of others. They make conjectures and build a logical progression of statements to explore the truth of their conjectures.They reason inductively about data, making plausible arguments that take into account the context from which the data arose.	**Science is a Human Endeavor** Science affects everyday life. Creativity and imagination are important to science.
CCSS.MATH.PRACTICE.MP4 Model with mathematics. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions.	**Scientific Investigations Use a Variety of Methods** Science investigations use a variety of methods, tools, and techniques.

REFERENCES

1. Do Students Learn More When They Feel Safe and Connected?

https://www.kirstenskaboodle.com/do-students-learn-more-when-they-feel-safe-and-connected/

2. Formative Assessment for Secondary Science Teachers Book by Erin Marie Furtak page 29 https://books.google.ca/books?id=Kxvype50vAIC&pg=PA29&lpg=PA29&dq=why+students+need+to+feel+safe+to+be+
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2. Live Science is part of Future US Inc, an international media group and leading digital publisher.
https://www.livescience.com/43424-who-invented-the-light-bulb.html#:~:text=The%20first%20practical%20incandescent%20light%20bulb&text=Edison%20and%20his%20team%20of,lamp%20with%20a%20carbon%20filament.

APPENDIX H – Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards (April 2013)
https://www.nextgenscience.org/sites/default/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf

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http://www.corestandards.org/Math/Practice/

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