

Amanda Bathalon

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Methods of STEM Education - Elementary

Nature of Science and Common Core Mathematical Practice Analysis

This quarter my second grade class will be studying plants. The science program that we use briefly mentions how important growing food in space would be in order for viable space colonies to be developed. So I thought I'd see if there were any recent developments along those lines. I think that my students will be excited to read and discuss an article by Marina Koren entitled *How do Plants Grow in Space*.

Science is a Human Endeavor

This article does an excellent job showing that science is a human endeavor. The NGSS Nature of Science Matrix describes the learning outcomes for high schools in this category: "Individuals and teams from many nations and cultures have contributed to science and engineering advances" (NGSS, 2013). The article notes that the first plant to flourish in space was on a Russian space station. "The most advanced chamber on the [International Space] station, about the size of a mini fridge, has precise sensors monitoring the conditions inside, and all astronauts need to do is add water and change filters (Koren, 2019)." The technology that has been engineered and maintained by so many people is certainly a highlight of this article.

Scientific Knowledge is Open to Revision in Light of New Evidence

The article presents current evidence that is leading to revision of scientific knowledge. "Scientists had long assumed the movements were influenced, in part, by the force of gravity. On the International Space Station, roots exhibited the same pattern, without gravity as a guide" (Koren, 2019). The complete explanation in the article gives basic information about how scientific knowledge is evolving.

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

This article is filled with examples of order and consistency in natural systems. In the work done to grow plants in space, it seems that as long as devices are engineered to provide for the needs of the plants, the plants will grow. The variables are not always known as in the case of the failed attempt to grow sprouts on the surface of the moon. Other known variables don't pose the problem scientists once presumed, as in the case

of microgravity on the International Space Station. Nevertheless, plants will grow if you give them nutrients, water, light, and the right temperature.

MP2 Reason Abstractly and Quantitatively

Temperature is not usually something that young students engage in when studying plants. This article points out in an engaging way that temperature is important to plant growth. While the article doesn't explicitly explain just how cold –62 degrees Fahrenheit is, it does set the stage for students to begin to explore what they do know through their experience of different temperatures on the Fahrenheit scale. Students would benefit from thinking of examples on Earth that show the importance of temperature on plant development. When young learners are given the opportunity to understand quantitatively units of measurement, as they develop they will begin to use that understanding to reason more deeply.

MP1 Make Sense of Problems and Persevere in Solving Them

The example of the failed sprouts on the surface of the moon is not presented as a failure. Although not stated, the article implies that this failed attempt is an opportunity to learn and try again (due to the many successful devices that have been engineered to support plant growth on board the International Space Station). There is great value for students to see across disciplines examples of professionals working with grit to understand and work towards a solution to a problem.

MP7 Look For and Make Use of Structure

One of the most interesting parts of this article is the evidence given for helping scientists to understand that plant growth is not effected by gravity. When comparing the root systems of plants grown on Earth to those grown in space, scientists noticed the same “filigree-like pattern” (Koren, 2019). Noticing details and comparing details to find patterns is an important practice.

Sources:

Koren, Marina (2019, January 30) How Do Plants Grow in Space. Retrieved from <https://www.theatlantic.com/science/archive/2019/01/plants-flowers-international-space-station-moon-mars/581491/>.

Next Generation Science Standards. (2013, January) Appendix H Nature of Science for Public Release. Retrieved from <https://www.nextgenscience.org/>