

## The Nature of Science

Children are natural observers of the world around them. I do not teach kids. I facilitate discovery through afterschool workshops and STEM summer camps. Most of my kids fall in the first grade through fifth grade range but I also see quite a few middle school kids. Understanding science concepts is best done with direct and indirect observations, hands on activities, creativity, flexibility and connecting them to the everyday world. Our organization has been focused on robotics since 2012 which incorporates technology and engineering. My goal is to have us offer more science related workshops and concepts in our afterschool program. I can offer this during the summer camp weeklong STEM workshops as we have the time and flexibility to explore our world and the universe.

Astronomy and the Earth's Place in the Universe is an area I am comfortable with. I already work with scouts earning their Astronomy and Space Exploration Merit Badges. Astronomy has so much to offer our kids starting with observations regarding our place in the solar system and making inferences from those observations with models and scale. Starting with the sun, the moon and the position (orbit) of the planet kids can learn about the changes of the amount of daylight everyday and how the Earth's orbit and tilt dictate our seasons. The night sky offers even more observations with the position of the Big Dipper, which planets may be observed and knowing the constellations associated with specific seasons. Asking the kids why the Earth, Moon and Sun go through these changes makes them think and will hopefully open their mind. Collecting the data from observations and relationships leads to recognizing and understanding patterns while gathering evidence.

Technology is readily available to assist in these observations. In today's world we do not need a telescope but having one creates the hook when a kid can safely observe the sun or the moon. Seeing the craters on the moon magnified is a great 'wow' factor with kids. The telescope lends itself to understanding engineering and math concepts and the very nature of light. The magnification of a telescope is its focal length of the objective lens divided by the focal length of the eye piece. An explanation of the number of lenses inside a telescope tube and how it focuses light touches on the engineering aspect of it. NASA has a Solar System Exploration website allowing us to see the relative position of the planets at any given moment.

Making the relationship of apparent brightness of stars can be done understanding the distance of the Earth to our Sun. This may be done by showing how bright a star normally appears from our latitude in the night sky, and then showing the relative size comparison image. This ties into math concepts of size, distance, and scale with models. The color of a star may be of interest to kids once they understand that its temperature indicates its color.

Demonstrating the phases of the Moon can be a fun observational activity for kids. It uses modeling of the Earth, Sun and Moon positions using spheres and a flashlight. Kids can see how three objects of different sizes can cast a shadow as they move while recording observations. Through these observations, kids can use math to keep track of the next full moon.

The Nature of Science and Astronomy fit into the NGSS standards 4-ESS3-1 Earth and Human Activity and (1-5) ESS1 Earth's Place in the Universe. It contains core ideas, practices, and

cross cutting concepts. Making this accessible to all students is important. Kids in urban settings may not see any stars in the night sky. There are numerous websites and apps for the cellphones and iPads to show them objects. Providing virtual-hybrid workshops may be a way to reach urban kids, ethnic groups, economically disadvantaged students and those with limited English proficiency.

## References

Council, N. R. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press.

NGSS. (2013). *Appendix D - "All Standards, All Students"*. Retrieved from nextgenscience.org: <https://www.nextgenscience.org/resources/ngss-appendices>

NGSS. (2021). *The Standards*. Retrieved from nextgenscience.org: <https://www.nextgenscience.org/>

NSTA. (2021). *Nature of Science*. Retrieved from NSTA.org: [https://www.nsta.org/nstas-official-positions/nature-science#:~:text=Nature%20of%20science%20\(NOS\)%20is,based%20personal%20and%20societal%20issues.](https://www.nsta.org/nstas-official-positions/nature-science#:~:text=Nature%20of%20science%20(NOS)%20is,based%20personal%20and%20societal%20issues.)

Peters-Burton, E. (2014). Is There a "Nature of STEM"? *SSM Journal*, 99-101.