The Nature of STEM in 3rd Grade Science Class

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Abstract

The nature of science is investigative, hands-on, and relates closely to the nature of mathematics. In the third-grade classroom, these two disciplines can interact with one other through a number of assignments, projects, and investigations. Problem-solving, identifying patterns, and using a variety of research methods and tools are examples of ways in which these two disciplines overlap. In order to address these principles throughout instruction, it is important for educators to develop unit plans that involve student-led questioning and investigation.

As a second-year, third-grade teacher, my current approach to teaching science is very traditional, meaning that the majority of each unit consists of concepts being explained through readings, videos, and experiments. I would like to make my instruction more hands-on, authentic, and investigative. While I try to include experiments and projects when I can, most of my science instruction comes from reading out of our science texts or viewing videos on the concept(s), followed by class discussion, worksheets, and other forms of assessments. A project that I developed last year and continued to develop further this year is my Zoo Project. I made the project more multi-disciplinary by adding a persuasive writing piece this past year, but there are still many things I can do to make this project more authentic and student-driven.

My Zoo Project looked a little different this year, since distance-learning required the students to research their animals and develop their exhibits remotely, but it still served its purpose as the culmination of our study of life cycles, adaptations, and ecosystems. The students chose animals they would like to add to our class zoo and mapped out the steps of the animals' life cycles on paper. Next, they researched where the animals live and what they need in their environments, as we studied biomes and the interactions within them together as a class. Finally, the students created exhibit models for their animals that included all the necessary parts of the animals' ecosystems and wrote letters to the zoo director (me) explaining why their animals should be included in our zoo.

As the project currently exists, I think it addresses the following three tenets of the nature of science: "Science is a Way of Knowing," "Science is a Human Endeavor," and "Science Addresses Questions about the Natural and Material World" (Next Generation Science Standards, 2013, p. 6). The project addresses the first tenet as students research animals, their needs, and their life cycles to decide what type of exhibit would be best for them. They must

learn about the animal and the way it interacts with its environment before they can begin to develop an exhibit. This requires them to see science as a means of acquiring knowledge and information. The second tenet is addressed as the students consider the zookeeper's role in creating a satisfactory exhibit in which the animals can live. We read books and watch videos about and with zookeepers to see how important their jobs are, and what exactly they entail. The project addresses the third tenet as the students ask how animals and humans can interact with different ecosystems and environments – the world around them.

While I think the project as it currently exists addresses a few tenants of scientific inquiry, I do believe that it could address more and be more multi-disciplinary. For example, by providing the students with population data for the animals they are studying, I could address more tenants of science as well as principles of mathematics. As seen in both the Next Generation Science Standards (2013, p. 5) and the Common Core State Standards Initiative's Standards for Mathematical Practice, the nature of both science and mathematics requires students to seek patterns in data and in the world around them, so giving students the opportunity to study population data would address both areas of learning in the classroom. By tracking populations of dolphins – for example – and finding patterns in the climate, plant life, and other environmental factors around them, students can determine what requirements are necessary to make an ecosystem a good home for dolphins. They can then use this information to guide the development of their habitats, and are incorporating both scientific and mathematical inquiry into their design process.

Another science principle that could be addressed with some adjustments made to this project is "Scientific Investigations Use a Variety of Methods" (Next Generation Science Standards, 2013, p.5). By setting up the unit of study with the question "What would happen if I

took a plant from the rainforest and planted it in the grass outside our school?," I am giving the students an opportunity to think about third-grade scientific concepts (life cycles, adaptations, living things and their environments), as well as best practices for finding answers to those questions. As the project exists right now, the students study each biome through texts and videos, and then conduct their own research on their animals through reading books, articles on the internet, and watching videos. But what if the students were able to develop an investigation by actually studying the effects of a foreign object being transplanted to a different type of ecosystem? Or, if they were able to travel to a zoo and record observations of their animal interacting with its habitat? There is absolutely merit in books and videos and other sources of information, but there is much to be said for hands-on investigation, as well. In his video on the use of phenomena in the science classroom, Paul Andersen emphasizes the importance of starting off a unit of study with some type of activity that allows for student-led questioning and exploration that flows into teacher-directed explanation (Bozeman Science, 2019). This has really challenged me to view the way that I teach, and has encouraged me to approach science in a much more hands-on and student-directed manner.

The tenets of mathematics overlap with those of science quite a bit. For example, both disciplines stress the importance of students being able to use a variety of tools and methods to solve problems (Next Generation Science Standards, 2013, p. 5 and Common Core State Standards Initiative). In the example of my zoo project, this could mean guiding the students to resources to read and watch to learn more about their animals, as well as providing them with opportunities to observe their animals and make note of how they interact with their environments (for example, a trip to the zoo). A way to integrate this principle of math into the project would be to have the students measure their exhibits with a ruler and calculate the

dimensions of their exhibits. As addressed previously, science and mathematics both acknowledge the importance of discovering patterns in the world (Next Generation Science Standards, 2013, p. 5 and Common Core State Standards Initiative). Through studying population data for an animal, students must make sense of patterns in the natural world and in the data they analyze. Another way in which the disciplines overlap is in their focus on problem-solving and perseverance; both the nature of science and the nature of math encourage students to seek multiple solutions to problems, through a variety of strategies (Next Generation Science Standards, 2013, p. 6 and Common Core State Standards Initiative).

The nature of both science and mathematics encourages students to use various tools and strategies to solve problems and make sense of the world around them. While my project currently exists as a science project, I think it could become a cross-curricular project that focuses on science and mathematics and allows students to see how interconnected the two disciplines truly are. I think this can only further enhance my students' growth and understanding of the concepts, as well as increase their interest in both mathematics and science. While there is still a lot of work to do, I believe my project is on its way to becoming a true cross-curricular learning experience for my students.

References

Bozeman Science. (2019, July 9). *Scientific phenomenon and sensemaking* [Video]. Youtube. https://www.youtube.com/watch?v=3ps3Js-psgo

Common Core State Standards Initiative. *Standards for mathematical practice.* http://www.corestandards.org/Math/Practice/

Next Generation Science Standards. (2013). *NGSS release: APPENDIX H – understanding the scientific enterprise: The nature of science in the Next Generation Science Standards*. https://www.nextgenscience.org/sites/default/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf