Developing Understanding of Science Process Skills Through Research and Practices

Faith Ebling, Savannah Cessna, Adria Lindemann, Noelia Lopez, Charleen Sawin, Kyndal Smith and Dr. Suparna Chatterjee

ARKANSAS TECH UNIVERSITY

Abstract

The research examines out first-hand experience of conducting experiments in science and conceptualizing the experimental design process for teaching science concepts in elementary grades. We used *Drosophila*, the fruit fly as a model organism for studying the phenomenon that animals have traits inherited from parents. The phenomenon is a performance expectation in the Next Generation Science Standards (3-LS3-1). We observed the phenomenon, developed hypothesis, conducted experiments , collected data, analyzed and communicated our findings through discussions and presentations. We utilized our knowledge acquired from the process in developing lesson plans for teaching in elementary grades. In this presentation we will discuss how developing understanding of science process skills through research benefited our teaching practices . We recommend explicitly discussing the nature of scientific inquiry and implementing hands-on opportunity to practice skills can help teachers develop and refine science teaching methods.

Introduction and Research Question

The purpose of this study is to gain science process skills through understanding of genetics and the inheritance of traits. We will use this knowledge to develop lesson plans following the dynamic and open-ended process of the scientific method; "a set of broadly transferable abilities, appropriate to many science disciplines and reflective of the behavior of scientists" (Vitti & Torres, 2006, para 1). We will use our experiences from this project to help make us better science teachers in the future.

Research Question:

- *How can hands on research and practice benefit students in learning science process skills?*

Materials and Methods

Materials:

- Microscope
- Compound Light Microscope Leica EZ4 and LAS EZ software application
- *Drosophilia* Wild Type eggs, larvae, and flies
- *Drosophilia* Mutant eggs, larvae, and flies

Methods:

Science process skills include:
Observing
Measuring
Classifying
Inferring and Predicting
Communicating
(Vitti & Torres, 2006)

Discussion Questions During Research:

- *Can white eyes develop naturally in wild species of flies?*
- *Why were the mutants white eyed?*
- *Was this an inheritance trait or a mutated trait in the drosophila populations?*
- *If it was a mutated trait, did those flies breed and have that gene was passed on?*

Analysis and Findings

This research project allowed us as pre-service teachers to practice hands-on research and experiment in a lab using the science process skills. When observing the wild type *drosophila* and the mutant *drosophila* we had a couple of different observations:

- The wild type *Drosophila* had red eyes
- The mutant strains had white eyes
- Once the parent *Drosophila bred* offspring and were separated, we were able to observe the offspring and their inherited traits.
- Upon observation of the offspring, we observed that the offspring of both the wild type *Drosophila* (red eye) and the mutant (white eye) had the same eye color as their parents.
- The eye color trait was passed on from parent to offspring. The photos from our observations are provided below in our findings/results.

Examples of our discussion questions we answered as we conducted the research:

- Was the trait (white eye color) inherited in offspring from their white eyed parents?
  - Yes, the white eye color resulted in offspring were inherited from white eyed parents.
- Is white eye color a mutated trait, did those flies breed and have that gene be passed on?
  - Yes, it is due to a mutation in parents. When we observed the offspring of the mutant drosophila we saw that they had the same exact eye color as the parents. The same was true for the wild type, red eye color *Drosophila* offspring inherited the red eyes from their red eyed parents.

Wild type parents

Mutant parents

Wild type offspring
(Leica EZ4 Microscope)

Mutant offspring
(Leica EZ4 Microscope)

Discussion

Our science process skills were developed as we observed the *Drosophila* under each microscope, made predictions, experimented to see inherited traits, and collected and interpreted our results. This hands-on research project allowed us to use these skills and consider how we would guide students in science exploration. Using the microscopes and computer software, we were able to closely observe the appearance of the *Drosophila* and make predictions about their offspring. It was exciting to use the tools and technology in the lab to further our learning.

Hands-on research and practice benefits students in learning the science process skills because it allows students to explore science concepts through engaging processes. Students gain conceptual knowledge as they "use the materials to perform investigations, make observations, and construct explanations" (Robertson, Price, & Craven, 2021, p.15).

Future Direction

In the future, we would like to observe what the offspring of a wild type and a mutant type looked like. Due to time limitations, we were unable to conduct this experiment. If future learners have the opportunity, we would be eager to see the analysis of this combination.

Implications

As elementary intern students, by going through this activity we got to experience first hand the importance of having hands-on, authentic instruction. We utilized the different science processes in order to observe, inquire, evaluate, predicte and forming conclusions. Future interns for elementary classrooms should take the opportunity to learn how to make science education engaging.

In conclusion, we discovered that hands-on research and practice can greatly benefit our learning of the science process skills as well as our students' learning. This research experiment on the inheritance of traits in *Drosophila* is a great example of creating engagement in learning and using the science process skills.

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