2nd Grade Project BioEYES Details

On the first day of Project BioEYES, the BioEYES Outreach Educator brings all of the necessary equipment to the classroom, including the sophisticated microscopes students use to observe and study live zebrafish adults and their offspring. Each student is invited to assume the role of "junior scientist" in an important experiment. When given this role, students become energized with curiosity and excited about the activity. Students split into small groups, set up fish tanks, and choose mating pairs of zebrafish. Over the course of the week, students observe zebrafish behavior and follow the development of resulting embryos. Each day, just like research scientists in the laboratory, students hypothesize and test ideas, ask questions, record findings, and think critically about the impact scientific research has on our community. During the 2nd and 5th grade experiments, students learn about the importance of habitat, the organ functions common to both humans and fish, the role of DNA, and different science careers. Students cross (mate) zebrafish to obtain embryos, whose development they will observe throughout the week. Students participating in the 7th grade experiment cross albino and wildtype zebrafish on day one and subsequently observe embryo development, looking for answers to research questions about genetic inheritance. By the last day students observe the results, determine whether their hypotheses are correct, and discuss their understanding of dominant and recessive genes. The 7th grade curriculum also educates students about the use of zebrafish in scientific research and introduces them to related career possibilities. In the high school experiment, students also cross albino and wildtype zebrafish, raise offspring, and observe development and skin pigmentation. However, sophisticated aspects of genetics are covered, including the use of the Punnett square and more complicated genetic crosses. The discussion of science and allied careers is more in-depth with this age group as well. In all grades, the idea of the stereotypical scientist is broken down and students are encouraged to see that science is open to each of them as a career path.

On the last day, students in all grade levels observe the beating heart of a zebrafish larva. For most, this is their first glimpse of an actual heart pumping in real time. The experience often inspires a visceral reaction unlikely to be duplicated by a video or picture. Many students express delight and amazement and truly see the fish as like themselves.

Standards

Standard 1.0 Skills and Processes

Students will demonstrate the thinking and acting inherent in the practice of science.

A. *Constructing Knowledge*

1. Raise questions about the world around them and be willing to seek answers to some of them by making careful observations and trying things out.
    - **a.** Describe what can be learned about things by just observing those things carefully and adding information by sometimes doing something to the things and noting what happens.
    - **b.** Seek information through reading, observation, exploration, and investigations.
    - **c.** Use tools such as thermometers, magnifiers, rulers, or balances to extend their sense and gather data.

    - **f.** Suggest things that you could do to find answers to questions raised by observing objects and/or phenomena (events such as, water disappearing from the classroom aquarium or a pet's water bowl).
    - **g.** Use whole numbers and simple, everyday fractions in ordering, counting, identifying, measuring, and describing things and experiences.

B. *Applying Evidence and Reasoning*

1. People are more likely to believe your ideas if you can give good reasons for them.

    - **b.** Develop reasonable explanations for observations made, investigations completed, and information gained by sharing ideas and listening to others' ideas.
    - **c.** Explain why it is important to make some fresh observations when people give different descriptions of the same thing.

C. *Communicating Scientific Information*

1. Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question.

b. Describe things as accurately as possible and compare observations with those of others.

c. Describe and compare things in terms of number, shape, texture, size, weight, color, and motion.

d. Draw pictures that correctly portray at least some features of the thing being described and sequence events (seasons, seed growth).

e. Have opportunities to work with a team, share findings with others, and recognize that all team members should reach their own conclusions about what the findings mean.

f. Recognize that everybody can do science and invent things and ideas.

D. *Technology*

1. Design and make things with simple tools and a variety of materials.

b. Recognize that tools are used to do things better or more easily and to do some things that could not otherwise be done at all.

3. Examine a variety of physical models and describe what they teach about the real things they are meant to resemble.

a. Explain that a model of something is different from the real thing but can be used to learn something about the real thing.

b. Realize that one way to describe something is to say how it is like something else.

Standard 3.0 Life Science

The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time.

C. *Genetics*

1. Explain that there are identifiable stages in the life cycles (growth, reproduction, and death) of plants and animals.

b. Compare and describe the changes that occur in humans during their life cycle (birth, newborn, child, adolescent, adult, elder).

c. Given pictures of stages in the life cycle of a plant or an animal, determine the sequence of the stages in the life cycle.

d. Provide examples, using observations and information from readings that life cycles differ from species to species.

F. *Ecology*

1. Explain that organisms can grow and survive in many very different habitats.

b. Explain that organisms live in habitats that provide their basic needs.

- Food
- Water
- Air
- Shelter