# A Dazzling Journey to an AQUARIUM ECOSYSTEM

Using instructional technology engages students with close-up views of organisms.

By Karen Bucci

"This year in science was a fun and exciting journey with a dazzling twist!"
(Fourth grader, 2015)

For the past several years, I have taught my fourth-grade class the science module *Ecosystems* by National Science Resources Center's Science and Technology for Children (STC) (1996, 2005). A main idea in the unit is the importance of animals, plants, and nonliving elements in a habitat. Students build a model aquatic ecosystem to study and observe the relationships that exist between organisms and nonliving parts in larger ecosystems. A few years ago, I began incorporating my iPad with the wireless SmartScope iGO microscope and Wi-Viewer app (see Resources) to give students a closer look at our aquarium animals. These technological tools heightened students' understanding of the parts of a pond snail and their functions in its environment. Using technology in this capacity demonstrates how it has become an important part of education—its use in the classroom has developed from novelty to an invaluable method to present content information (Kenney 2011). When viewing pond snails through the Wi-Viewer app, students saw, close-up, structures necessary for their survival and function of the ecosystem.

## Essential Questions and Vocabulary

Students were asked to break apart the word *ecosystem* and define *eco* and *system* separately to help understand that parts of an ecosystem work together like a machine to function properly. I introduced the new vocabulary of *abiotic*—nonliving—and *biotic*—living. Throughout the unit, I incorporated questions provided from my training for the module. Essential questions included: *How do living things depend on each other? What role does each item play in the ecosystem? How are animals important to the aquarium? How will each animal get what it needs in your aquarium?* Students answered questions about the importance and roles of plants, animals, and nonliving things during classroom discussions, in written entries in their scientist notebooks, and on formal assessments. Typically, in both written responses and during class discussion, students were able to identify the role of the snail as the organism who kept the ecosystem clean.

We discussed roles of consumers, producers, and scavengers, how animals need plants for food, shelter, and oxygen, and how plants need animals for carbon dioxide to undergo photosynthesis. Students were asked to think about what happens if one item is destroyed, and how that affects the survival of the other components (NSRC 1996, 2005).

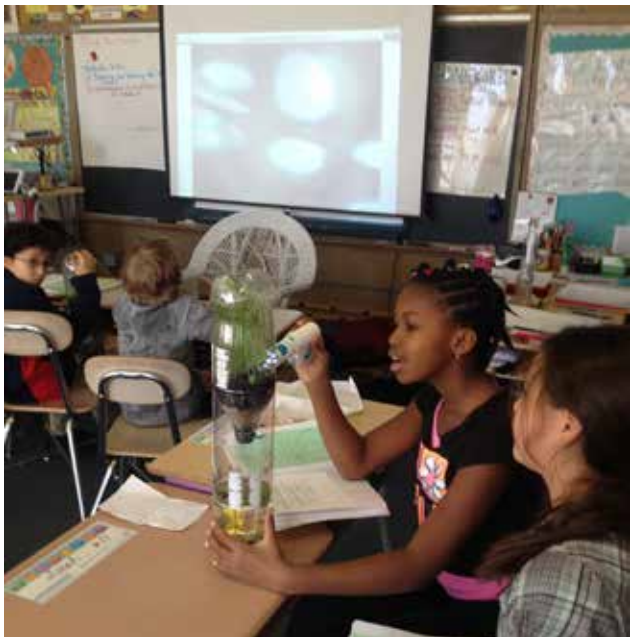
## Student-Built Aquariums

Students constructed aquariums in the classroom from pre-cut, two-liter soda bottles collected from families. Other materials, such as the living materials delivered separately by a supply company, were included in the STC kit that was distributed by a local educational support agency. Students worked with partners to build the aquariums following directions in the student activity manual. Materials were pre-portioned for each student pair and set out at our science table ahead of time for easy management and distribution. Student pairs added the components to the bottom of the two-liter soda bottle (with the top part cut off by the teacher): (1) one cup gravel (2) water up to 3–4 cm from the top (3) three full droppers of algae (4) two pieces of Elodea (5) one spoonful of duckweed (6) two guppies and two pond snails. Students should wear eye protection and wash hands after handling the materials.


Once the pond snails were added to the aquarium, students observed them using hand lenses or their eyes and recorded their observations in their scientists' notebooks. I reviewed the process of observation with students by asking, *what happens when you are making an observation? What is the difference between something you observe and something you infer, or conclude?* During classroom discus-

### The Wi-Viewer app and SmartScope iGO

The Wi-Viewer app is available (free) from iTunes with the purchase of the SmartScope iGO (a wireless connection is required). I purchased my SmartScope using money ($329) from my classroom budget. The Wi-Viewer app takes observation with a plastic hand lens to another level because specimens vividly appear on the screen of the iPad for closer examination, and videos and snapshots may be taken, making it an authentic and practical use of instructional technology.



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sion, students' typical response was that when you make an observation, you are noticing with your eyes and recording something you see. I emphasized observing and recording properties, such as size, color, texture, as well as movement, and other physical features and body parts. Many students recorded in their notebooks that the snails don't move and described them as "lazy."

## Reading Nonfiction Text

The STC student manual contains nonfiction text about the plants and animals used in the bottle aquariums and their roles and importance in the ecosystem. The selection gives interesting facts about the pond snail including the function of its different structures, its diet, and its role in the ecosystem. During another class time, after the building of the aquariums, student partners read the selection from the student booklet to learn about the parts of the pond snail. They read it has eyes located at the ends of its tentacles, a mouth that continuously opens and closes searching for food, and a tongue, called a *radula*, that has teeth. They learn it has a stomach foot and a shell, which is part of its body. They also learn the pond snail is a scavenger that keeps the ecosystem clean by eating dead plants and animals (NSRC 1996, 2005). At first glance, it is hard to believe they are complex organisms!

## Observing With the SmartScope

*"My favorite activity/experiment this year was when we looked at the pond snails and guppies under the digital microscope."* (Fourth grader, 2015).

On the next class session, after students (1) observed pond snails with hand lenses, and (2) read nonfiction text about the pond snail, the microscope with the Wi-Viewer app was introduced to observe the parts of the snail. Only one iPad and microscope was used. First, students were told expectations for the proper care and handling of the equipment and that if not handled properly, the privilege of viewing through it would be lost. Students were excited about using the technology and have always shown excellent responsibility when handling the devices. I demonstrated how to hold the microscope, zoom, increase brightness, and snap pictures.

The iPad connects to a document projector, allowing images to be displayed on the overhead screen. The wireless feature of the SmartScope iGO allows for whole-class implementation because the microscope can be passed easily from student to student while they are seated. Students were each given a few minutes to view the snail under the microscope and then were expected to pass it along. Passing the technology from student to student while the image is displayed on the overhead screen helps with management since students are still able to see an enhanced view even when it is not their turn. A "freeze" button may be snapped, allowing discussion of a particular view and a time to draw the organism and label its structures.

Through the Wi-Viewer app, the pond snails appeared quite different. The technology allowed students to observe the teeth the snail uses to grind food and the tentacles it curls and uncurls to sense its surroundings (NSRC 1996, 2005), which reinforces the disciplinary core idea of Structure and Function. We were dazzled by the motion of the mouth opening and closing, revealing sharp-looking teeth. Students commented that the pond snail looked ferocious—like a predator. They were excited seeing the tentacles swaying and noticing a pattern on the shell. We loved re-watching video of the snails' movement taken with the Wi-Viewer app.

One fourth grader wrote this for my classroom newsletter to parents:

> "The digital microscope is a tool to help you take a better look at animals. ... We took a closer look at the pond snails in our aquariums … under the digital microscope, the pond snails take up the whole screen of the iPad. On the snail, we saw the antennae move with the digital microscope, and we never got to see that with our own eyes. We also saw the snail's teeth. The teeth are really sharp and the pond snails are fast. … If he was eating, the pond snail opened its mouth and closed it. The digital microscope is really interesting because I like how it zooms in so you can see closer than you would with your eyes." (Fourth grader, 2016).

**The snail as it appears onscreen via the WI-Viewer app.**


**Student diagram of the snail, with the parts labeled.**

In the aquarium model, observing the pond snail's mouth and tentacles with the Wi-Viewer app reinforced how its parts operate and the role it plays as scavenger. For example, students learned the function of the snail's mouth is to eat debris and decaying matter to keep the ecosystem clean, which is the scavenger's job (NSRC 1996, 2005). They witnessed the pond snail doing its job and how much it moved, and with speed, since they had to move the microscope to keep it in view! They saw that they are the opposite of lazy, which was a previous student misconception.

There are other ways to use the technology to observe the pond snails, such as teacher demonstration, an independent learning station, or pulling students aside to view through the iPad while others work on scientific writing or diagrams. I have also passed my iPad and the microscope from student to student to view directly on the iPad screen. Once in use, whether whole-class or individually, these are the interjections typically heard: "Whoa! That's amazing! I can see the snail's teeth!"

"I loved all the units that we studied this year, and if I had to choose one, I think it would be ecosystems. … This year, I learned that a pond snail has teeth and also that they have antennae." (Fourth grader, 2015). This use of the iPad demonstrates how these devices spark interest and curiosity, leading to students' conceptual understanding (Kenney 2011).

## Formative and Summative Assessment

Incorporating digital microscopes into science lessons helps improve the accuracy of students' diagrams (Kniseley and Capraro 2013). By using the Smartscope and Wi-Viewer app, students created more detailed diagrams of the pond snail. Students drew the view of the pond snail through the Wi-Viewer app and labeled its parts. These diagrams were much more accurate than earlier "cartoon-like" drawings of the pond snail. I used these diagrams as a summative assessment piece. As formative assessment, students filled in a Venn diagram to compare and contrast the pond snail to a scavenger from a land ecosystem (an isopod) learned about earlier in the unit prior to learning about an aquatic ecosystem. As summative assessment, students wrote paragraphs in their scientist notebooks explaining what they learned. Students described the roles of each component in their aquariums and how they are important in the overall function of larger ecosystems. An important part of scientific writing is (1) being exact, (2) being specific about what was observed, and (3) citing and recording evidence (Fulwiler 2011). Prior to using the digital microscope with the Wi-Viewer app, students had the tendency to make generalized, implied observations like the snail being lazy. The microscope with the Wi-Viewer app helped students see details, giving them more evidence to use in their writing on what they learned about the pond snails, the purpose of their parts, and their function in the ecosystem. Checklists for their writing and sentence starters were provided as differentiation for students who needed extra support. Students' writing was scored using a rubric (see NSTA Connection).

## Conclusion

Using a SmartScope iGO with an iPad through the Wi-Viewer app allows me to implement technology in an effective, practical way to observe pond snails, supporting and enriching my regular science curriculum. This technology brought students closer to pond snails and enabled them to see structures necessary for their survival that they read about in the student manual but couldn't see before. The

## Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013):

**4-LS1-1 From Molecules to Organisms: Structures and Processes**
*www.nextgenscience.org/pe/4-ls1-1-molecules-organisms-structures-and-processes*
The chart below makes one set of connections between the instruction outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectation listed below.

| **Performance Expectation** | **Connections to Classroom Activity**<br>*Students:* |
|---|---|
| 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. | • build model ecosystems to observe living and nonliving elements and view the parts of a pond snail in action under the microscope to understand how they function.<br>• explain the importance and role pond snails play in an ecosystem. |
| **Science and Engineering Practice** | |
| Developing and Using Models | • build model aquatic ecosystems with living and nonliving elements to study relationships of organisms. |
| **Disciplinary Core Idea** | |
| LS1.A: Structure and Function<br>• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1) | • identify the mouth and tentacles of a pond snail and read nonfiction selection about the parts and role of a pond snail. |
| **Crosscutting Concept** | |
| Systems and System Models | • learn the relationships of living and nonliving elements in an ecosystem through their model of an aquatic ecosystem. |

digital microscope engaged my students in the scientific process of observation, fascinating them along the way and developing their understanding of the role of the pond snail in an ecosystem, making science, as my student phrased it, "a fun and exciting journey with a dazzling twist!" ■

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### Internet Resource

SmartScope iGO
*www.smartschoolsystems.com*

### NSTA Connection

Download the rubric at *www.nsta.org/SC1802*.