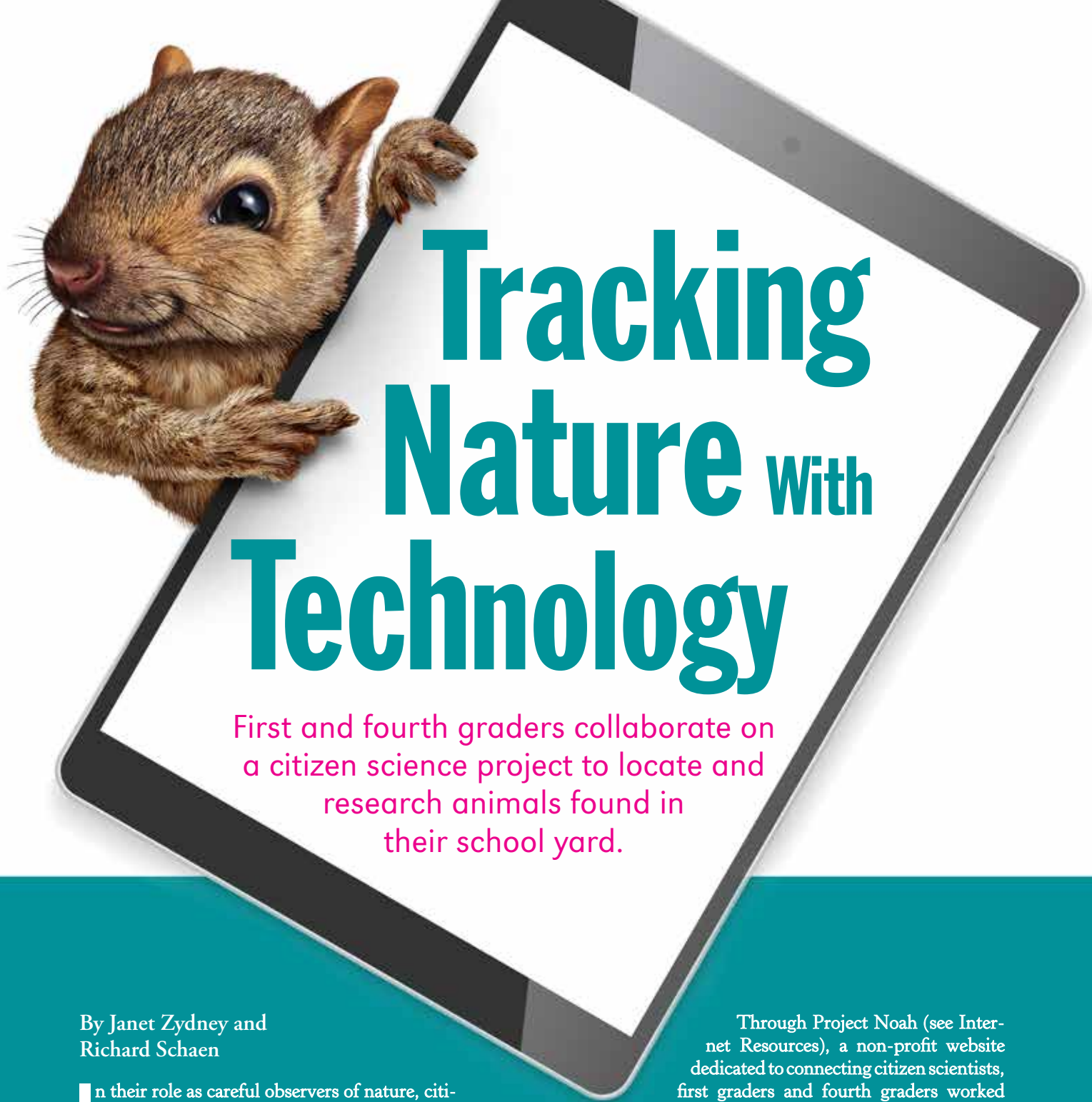


Tracking Nature With Technology

First and fourth graders collaborate on a citizen science project to locate and research animals found in their school yard.

By Janet Zydney and Richard Schaen

In their role as careful observers of nature, citizen scientists are helping to "answer the most challenging ecological and environmental questions, addressing issues that affect everyday lives" (McKinley et al. 2015, p. 4). They help answer these questions by providing scientists with a large pool of data that can be analyzed (National Wildlife Foundation 2016). The proliferation of citizen science mobile apps has greatly facilitated this process by enabling anyone with a smartphone or tablet to easily capture data (Malykhina 2013). This enables much greater amounts of data to be collected than otherwise possible.

Through Project Noah (see Internet Resources), a non-profit website dedicated to connecting citizen scientists, first graders and fourth graders worked together to locate, research, and share their observations on animals. In the process, the students focused on *Next Generation Science Standards* relating to animals' needs and habitats (NGSS Lead States 2013). The project also emphasized the key 21st-century concept of using technology to foster collaboration (International Society for Technology in Education 2015). Not only was there collaboration among different grade levels within the school, the Project Noah site, which is accessible to the global science community, enabled the students to work with others on a global scale.

Background

This five-day project was led by a fourth-grade teacher, a first-grade teacher, and an education professor. We decided on this collaboration because the project tied in nicely with both the first and fourth graders' standards on living things, and we felt that the fourth graders—the oldest students in the building—would be the best student mentors for the first graders. The first-grade class had 20 students, and the fourth-grade class had 21 students. The students worked in groups of four, with two first graders and two fourth graders in each group. Within the groups of four, students sometimes worked in partners, with one of the first graders paired with one of the fourth graders. In all, there were 10 groups, with the one extra fourth grader acting as a "floater," pitching in to help groups as needed.

Throughout this project, the students used Project Noah, which consists of a social media website to share photos and observations of wildlife, plus an associated app that enables users to easily photograph and capture observation data at a site. Note: Since the implementation of this project, Project Noah has discontinued the app. Now users can access the website on their mobile device and share information in real time or capture information offline using the camera and notepad on their mobile device and share it when they get back to the classroom. Project Noah is comprised of various missions that are focused on different environmental efforts. Anyone who is a member of the site can create a mission that they want to collect data on. For example, there are missions to track the migration of monarch butterflies or to understand why the ladybug species distribution is changing.

Our students contributed to a specific mission of Project Noah entitled "Global Schoolyard Bioblitz!"—a mission created as part of a collaboration between The National Environmental Education Foundation and National Geographic Education to record the biodiversity found in school yards throughout the world. While this particular mission has more of an educational focus to encourage students to explore nature, it has been used as part of a more formalized bioblitz in the national parks, which enables scientists "to take a snapshot of an area's biodiversity in about 24 hours" (National Geographic Society 2016, paragraph 1).

PHOTOS COURTESY OF THE AUTHORS

Students record observations on iPads.

FIGURE 1.

Safety rules while outside.

1. Stay within specified perimeter so we can see you.
2. Remain with your assigned partner at all times.
3. Come line up when you hear the whistle blown.
4. Do not put iPads on the ground where they could get dirty or wet.
5. Hold iPads with two hands.
6. No running.
7. Wear proper attire, such as long pants, closed-toe shoes, hats, and sunscreen.

Setting Up the Project and Outside Environment

Since the school did not have its own iPads for general classroom use, we partnered with a university to borrow 10 iPads—one iPad per group. For schools that don't have access to iPads, the project could also be done with any mobile device (e.g., smartphones, tablets, etc.). We created a teacher account on Project Noah and signed all iPads into the same account on the app. Using the teacher account on the iPads allowed our students to upload photographs and information about the animals in our school yard to the global mission. We numbered the groups and the iPads so that each group could use the same iPad each time and thus easily gain access to its own data on the iPad. By setting the iPads to airplane mode, we ensured that the groups would not accidentally upload their work to the Project Noah website until one of us checked their work.

In addition to the iPads, students had access to their school's laptops. We found laptops easier for the students for typing, but schools that don't have laptops could use any device that allows them to do research and writing. Between the two teachers, there were 20 laptops, so students could work in partners (one first grader and one fourth grader) within their groups. In order to enable the partners to log into the Project Noah website and make comments

on each other's work, we created 20 student accounts linked to the teacher account. Creating the student accounts allowed us to monitor the student comments to ensure that they were appropriate to appear on a global website.

One of the advantages of this type of outdoor learning experience is that there is not much preparation required outside in the school yard, as students are resourceful at finding animals. However, we did set up bird feeders prior to the project to attempt to attract birds for our students to observe. In addition, our school yard has compost bins and a vegetable garden that attracts lots of insects, and it borders on a wooded area where occasionally squirrels, rabbits, and even deer can be found. To ensure our students' safety, we scouted out the area ahead of time to check for dangers such as bees' nests or poison ivy. Fortunately, we did not find any such hazards.

Introducing the Project

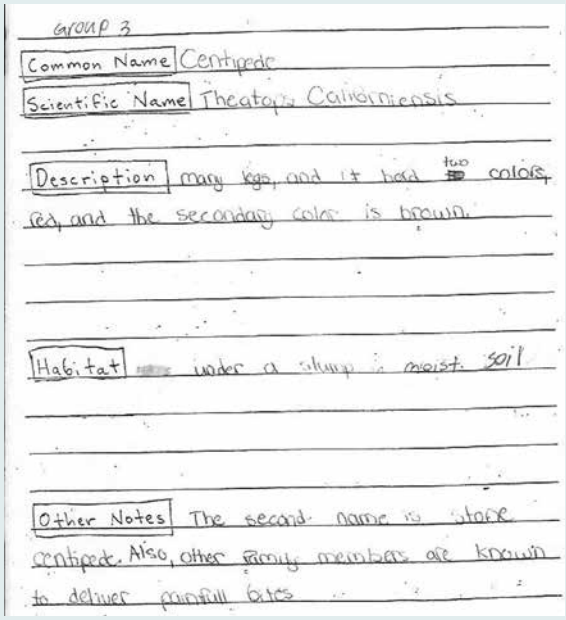
On the project's first day, we met only with the fourth graders for about 30 minutes. The meeting began with a discussion about the importance of citizen scientists. We explained that we would be using the Project Noah databank to record biodiversity in our area. When we asked the fourth graders why they thought scientists would be interested in cataloging this information, the fourth graders brainstormed several ideas. These students had studied living things through a variety of units in previous grades, so they came to the project with good schema. For example, one student suggested it might be useful for identifying invasive species.

We also used this meeting with the fourth graders to emphasize how they would be expected to act as leaders when they later worked with their much younger first-grade partners. A nice discussion then followed about ways that the fourth graders could best be leaders, such as by helping the first graders use the iPads and by working as facilitators should disagreements arise during the course of the project, such as who got to touch the iPads first.

This initial meeting proved to be very fruitful because on the second day of the project, when the first graders and fourth graders first got together, the fourth graders immediately took the lead in productive ways. First, the fourth graders introduced the project to the first graders by leading a discussion about citizen scientists. The first graders had focused throughout the year on how good citizens help the community, and they had previously studied the values of scientific contributions. So, they seemed to quickly understand the concept of citizen scientists. Then, after a brief presentation from us about how to navigate around the Project Noah site, the groups got together and used the school computers to explore the site on their own, with the fourth graders providing assistance to the first graders as needed.

FIGURE 2.

A completed template from one of the student groups.



This introduction, which lasted about 45 minutes, was successful in that group dynamics were established, and the students were all excited about the animals that other students from around the world had already uploaded to Project Noah. The second day ended with students sharing about the most interesting animals and information that they had discovered on the site. For example, one student shared that she found a beautiful blue striped butterfly on the Project Noah site that had been discovered at a school in Costa Rica.

Photographing Nature

On the project's third day, we placed an iPad on a document camera to demonstrate how to use the Project Noah app. After the short demonstration, students in each group practiced using the app to take close-up photographs in the classroom and to enter test information, which was later deleted. Considering that the students had different levels of previous experience with iPads, we assisted as needed with the basics of iPad usage. Then, before heading outside, we discussed several safety rules for the groups to follow in the school yard (Figure 1, p. 39).

After this introduction, the groups excitedly headed outside with their iPads to the school yard to search for animals. During the 45-minute session, each group was

able to photograph at least one animal. These photographs included many bugs, such as a beetle, a pillbug, and a centipede, as well as one action shot of a squirrel. All groups returned very proud of their work and were now ready to identify and research the animals they had discovered.

Research and Data Entry

To help keep the project focused and more manageable, we told each group on the fourth day that it needed to decide on just one animal from its photographs to identify and research. The groups then worked on the school computers for about an hour to gather information about their chosen animals, and they worked on the iPads to enter the information onto the Project Noah app.

To facilitate this process, we provided the groups with several resources, such as a link to an insect identification website that listed in alphabetical order photographs and information about bugs found in Ohio. We also helped focus the groups' research by providing them with note pages with headings—*Common Name, Scientific Name, Description, Habitat, Other Notes*—that matched the headings they would use on the Project Noah app to enter their information (Figure 2).

Each group developed its own system to complete its tasks. In one group, for instance, one of the fourth graders jotted down information on the note page, while the other fourth grader worked with the first graders to help them enter the information onto the Project Noah app. Once again the fourth graders showed strong leadership skills, and we teachers enjoyed sitting back and listening while the students worked things out among themselves. When needed, we did step in to address misconceptions students had. For example, some groups incorrectly believed that some of the insects in the school yard, such as beetles, were poisonous to humans. We then had conversations with them about how these insects might have defensive mechanisms to protect themselves from predators, but that they are not dangerous to humans.

By the end of the hour, each group had met its goal of entering information onto the Project Noah app on the iPads. The app itself recorded the location where the observation was made. After checking the groups' work, we uploaded the groups' observations from the app to its corresponding website, and it was then live for students around the world to see. Students' finished work can be found on the Project Noah website as well as on the first graders' classroom website (see Internet Resources). This work includes a variety of information about animals' body parts, survival mechanisms, and reproductive activities, such as that squirrels have teeth that constantly grow to help them eat nuts, that centipedes can protect themselves with pincers, and that mosquitos use blood to help lay eggs.

Students do research on school computers.

Celebration and Sharing

To celebrate the project's completion, the groups got together on the final day for about 45 minutes to share their work. On this day, they worked on the laptops in partners within their groups to view other groups' work on the Project Noah website. Through their student accounts, the groups posted comments for each other. There were many comments praising other groups' work, such as about their "awesome" photographs. The groups also had good dialogue through their comments, such as discussions about exactly where the animals had been found in the school yard or about whether one of the bugs was poisonous because of its bright color.

In some cases, people from outside the school had already commented on the work through the Project Noah website. One group, for instance, that had photographed what it thought was a mosquito learned from a comment on the website from an entomologist that it was not actually a mosquito. One of the Project Noah rangers, who helps monitor the site, later posted a comment that it was actually a wood gnat and shared a resource called BugGuide for the students to learn more. The group was very excited when this person added, "Very cool find! I have never seen one of these before."

It was these outsiders' comments that perhaps best represented why this project was such a success. Not only were the students exploring nature and discovering possibly hard-to-spot animals, they were learning from their mistakes and connecting their experiences with people around the world!

Reflections

A great strength of this project is that it could be easily replicated and adapted for different classrooms. For example, the level of complexity of the research could be adjusted depending on the students. Since Project Noah covers a wide variety of living organisms, the focal point of the project could be changed, too—plants or trees, for instance, instead of animals or insects.

When we do the project again, we will change a few things. First, we will have the students use the camera on the iPad to take photographs and then upload them to the Project Noah app, instead of using the camera feature on the app itself. Because of some technical issues with the app, some of the groups had good photographs that were accidentally lost. The camera feature on the app also did not allow students to zoom in on their photographs, which made identification of animals difficult at times.

Also, we will improve how we assess the students. This project took place during the last week of school, and considering all the other things going on at this busy time of year, assessment was admittedly a weakness for us. We did conference with the groups to give feedback about the quality of their work, such as the clarity of their photographs and the thoroughness of their information. Considering the importance of precision and accuracy in citizen science, we also discussed with the students how issues such as incorrect spellings of insects' names were problems.

In the future, we plan to expand our assessment, such as through a checklist that evaluates the quality of students' work (see NSTA Connection). In addition, to encourage higher-order thinking, we plan to expand the project to include extensions, such as having the groups compare and contrast the animals they found with animals found by students in other parts of the world.

Although there were things we would change, overall we felt this project was a huge success. Not only did it connect to *NGSS* standards related to living things for both the first and fourth graders, it allowed the students to apply their research and writing skills. It also fostered a great degree of collaboration and showed that even elementary students can be citizen scientists. ■

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Students share results of the project.

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Internet Resources

BugGuide
http://bugguide.net/node/view/12267

Insect Identification
www.insectidentification.org/insects-by-state.asp?thisState=Ohio

Project Noah
www.projectnoah.org, www.projectnoah.org/users/Elm%20Elementary

NSTA Connection

Download the sample checklist for assessing student performance: *www.nsta.org/SC1804*.

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

1-LS1-2 and 4-LS1-1 From Molecules to Organisms: Structures and Processes
www.nextgenscience.org/pe/1-ls1-2-molecules-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 expectations listed below.

Performance Expectations	**Connections to Classroom Activity** *Students:*
1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	• research and write information about animals found around the school yard to be uploaded to the Project Noah website, including descriptions of the animal, such as external structures, details about the animals' habitats, and survival mechanisms.
Science and Engineering Practice	
Obtaining, Evaluating, and Communicating Information	• locate and photograph animals found around the school yard, use the internet to research information about the animals, and share information with other groups.
Disciplinary Core Ideas	
1-LS1. A: Structure and Function • All organisms have external body parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. 4-LS1. A: Structure and Function • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	• research and include information about the animals' body parts, including how they are used and function, when adding information to the Project Noah app.
Crosscutting Concept	
Patterns	• use observable features of animals to properly identify them, including their scientific and common names.

Connecting to the *Common Core State Standards* (NGAC and CCSSO 2010):

CCSS. ELA-LITERACY. R1.1.10: With prompting and support, read informational texts appropriately complex for grade 1.

CCSS. ELA-LITERACY. W-1.6: With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.

CCSS. ELA-LITERACY. W. 4.6: With some guidance and support from adults, use technology, including the internet, to produce and publish writing as well as to interact and collaborate with others.