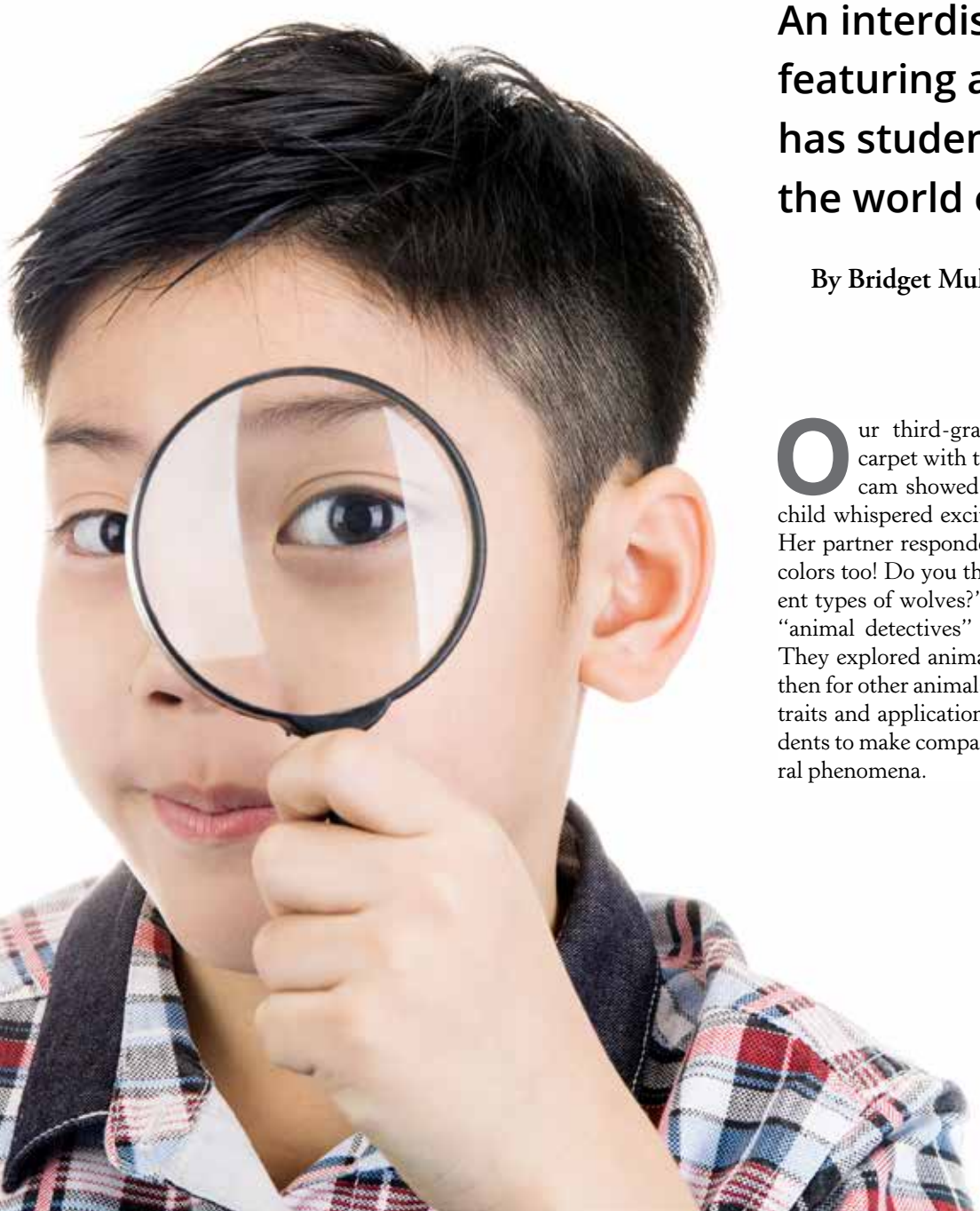
Animal DETECTIVES



An interdisciplinary unit featuring a wolf webcam has students investigate the world of animals.

By Bridget Mulvey and Carly Warnock

Our third-grade students gathered on the carpet with their partners. A live-feed webcam showed wolves at rest in their den. A child whispered excitedly, "They have lots of fur!" Her partner responded, "Yeah, and it's all different colors too! Do you think that means they are different types of wolves?" The children quickly became "animal detectives" and wore badges to prove it! They explored animal adaptations, first for wolves, then for other animals. These observations of animal traits and applications to other animals helped students to make comparisons and see patterns in natural phenomena.

During our two-week inquiry-based 5E learning cycle unit, children made observations and inferences to guide their explorations of animal traits and habitats (Bybee 2014). The children became "animal detectives" by studying a live-feed webcam and digital images of wolves in their natural habitat, reading books and online sources about other animals, and presenting original projects to the class. In third grade, students typically are ready to move beyond local organisms to those of other regions and habitats. A wolf webcam and nonfiction texts helped to broaden the variety of habitats observed and critically examined. Throughout, written and verbal communication deepened children's understanding of key science concepts, practicing Common Core English Language Arts (ELA) standards. Flexible grouping and differentiated activities supported each child's growth. Children entered the world of animals and emerged as thoughtful, thorough, and confident scientists. See NSTA Connection for an overview of the unit and the 5E model components.

Engage

From the beginning, the children were curious. "Animal Detectives?" one child asked, "What kind of work are we doing? Can I put my badge on?" The goal of the Engage phase was for children to learn how to make good observations and inferences as well as to connect the concept of habitats to students' own lives. The activity was a walk around our indoor school habitat.

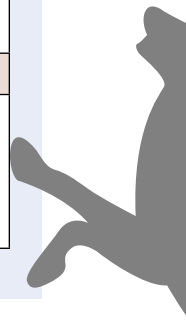
Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013):

3-LS3 Heredity: Inheritance and Variation of Traits

www.nextgenscience.org/3ls3-heredity-inheritance-variation-traits

The materials/lessons/activities outlined in this article are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

Performance Expectation	**Connections to Classroom Activity** *Students:*
3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.	• observe and infer to investigate animal traits and habitats.
Science and Engineering Practice	
Constructing Explanations and Designing Solutions	• observe and draw conclusions about wolves and their habitat through a live-feed webcam. • present animal examples with evidence to support their findings from nonfiction texts.
Disciplinary Core Idea	
LS3.B: Variation of Traits: • Different organisms vary in how they look and function because they have different inherited information.	• small groups investigate different animals and discuss inherited traits.
Crosscutting Concept	
Patterns	• discover connections and patterns among animals. • look for patterns across animals and their habitats.



Before we left the classroom, we asked children to offer suggestions of what not to do (e.g., run). Then we talked about what we *should* do: stay with our group, stop to write observations, and talk quietly with a partner. Children were divided up into groups of eight students, each accompanied by a teacher. For safety, groups walked close to the wall, not blocking doorways when we stopped to talk. With clipboards and paper/pencil or digital cameras in hand, students talked about and recorded observations of the school layout, object locations and size, accessibility, and safety. One child pointed above an outside door and commented, "The exit signs tell us where to go if there is a fire." Another added, "That keeps us safe because we can quickly get out of the building."

Back in the classroom, we gathered on the carpet to discuss our findings and list them on the board. The children were not sure if their statements were observations or inferences, leading us to clarify the difference between the two. We realized that the class needed more inference practice. Next, we modeled our thought processes as we determined whether example statements were observations or inferences. One boy stated he observed that the rugs in front of the door help students to not fall while walking in. Thinking out loud, teachers modeled that the rug in front of the door was an observation, one that we see with our eyes. We then discussed that this becomes an inference when you go beyond what you see to what you *cannot see*. In that moment, we *did not* see students remaining safe or not falling due to the rugs, but we *did* see the rugs strategically placed in front of the doors. We then concluded that this boy's idea was an inference. The class clarified that an observation is something that we can see, feel, hear, touch, or smell and an inference is something concluded based on those observations, using them as evidence. Throughout the unit, we encouraged students to provide evidence to support inferences. An observational assessment checklist (see NSTA Connection) guided instructional decisions. Children's initial ideas informed our development of an exploration to "zero-in" on observations of animal traits and habitats.

One Engage activity could be an outdoor habitat walk, with children finding various organisms and describing them and their surroundings. The unit also could start with long-term, live observational investigations of butterflies, mealworms, aquatic frogs, or other organisms.

Explore

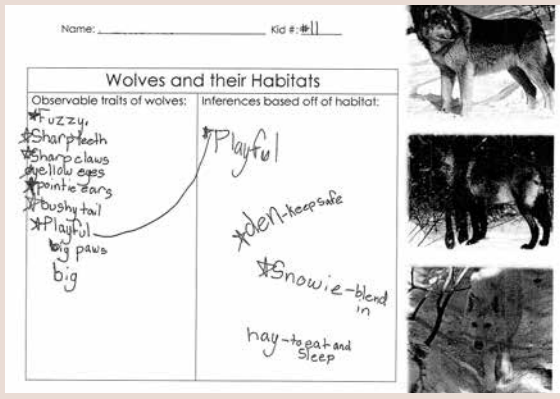
On day 2, we reviewed our own habitat in preparation for examining wolves' habitat. For three days, students observed a live-feed webcam and photos of wolves (Figure 1) projected on the whiteboard. Each student had a partner, clipboard, and observation sheet with separate observation and inference sections (Figure 2; see NSTA Connection) and a pencil to record observations. The webcam offered excitement as students were able to observe wolves interacting with their environment. We used photos when wolves were not visible and to study something closely. Our initial inquiry question was: "What characteristics do you observe of the wolves and their surroundings, or habitat?" The children were ecstatic when the live-feed began playing! The children made observations such as: the wolves have sharp teeth, small ears, are furry; some have brown fur and the trees are brown; their home is covered by rocks; and there is

FIGURE 1.

Live stream of wolves in their habitat.

FIGURE 2.

Observation sheet.



PHOTOS COURTESY OF THE AUTHORS

hay in the home. Then student pairs posed questions and discussed the role of the wolves' traits:

A: "I wonder if they can blend in with the outside."

S: "You mean because they are brown and the trees and stuff are brown?"

T: "Do you think their teeth are sharp to tear into food?"

R: "Or maybe even to fight their enemies!"

Throughout, a teacher walked around to listen to student discussions and ask questions to provoke higher-level thinking. Teacher questions included: Why do you think that might help the wolves survive? What is your evidence to support that conclusion? Why do you think that?

After discussing their ideas, we focused on the following questions: "What characteristics do the wolves have to help them survive in this environment? What would they need to keep warm, safe, hunt? How might these characteristics help the wolves survive?" With a little teacher prompting, students made inferences about wolves and their habitat as teachers recorded ideas on the board (Figure 3). One child commented that the snow helped white wolves to blend in with their surroundings. Another added, "Blending in helps the wolves hide from enemies and hunt better!" The class also identified parents and babies based on the website-provided information, then considered similarities and differences between them.

Then children wrote a journal response on photos of wolves in their habitat (see NSTA Connection for journal prompts). Responses were very detailed and specific. In response to a question about the environment, one child wrote, "They live in snowy places and they are white. This gives them the ability to blend in and it helps them hunt and not get hunted." All of the students made connections between the wolves and their habitat and what might help wolves survive.

In the Explore stage, everyone made stronger observations and inferences compared to the habitat walk. Students analyzed observations to construct explanations based on available evidence. Students already had started to identify patterns—an *NGSS* Crosscutting Concept—about the relationship between animal traits, their habitat, and survival needs. Now they were ready for key science concepts and vocabulary to be formalized.

FIGURE 3.

Students' observations and inferences.

FIGURE 4.

The word wall featured students' representations of the key concepts.

Explain

Next, we integrated nonfiction text reading strategies into a shared reading on fennec fox traits and how they help the fox in its desert habitat (Belleranti 2013), extending our study of traits to additional animals. Before reading, the class developed a reading strategies list: use sticky notes, look up unknown words, look at pictures, share ideas with a partner, and stop to think about what was read. We discussed how good readers form connections to prior knowledge and experiences. During the reading, children stopped, selected, and used a reading strategy. With no prompting, the class discussed observations and possible inferences, asking and answering their own questions. One child commented that the fennec fox has big ears to help it shed heat to keep it cool in the hot desert. A group debated about the fox's small feet: "They are small so maybe they could run away from predators faster." Another child argued that there might not be many predators in the desert and small feet could help them to not get too hot on the desert floor. Their comments indicated that they understood that animals have differing traits that support animals' survival in their environment, and children were comfortable debating the uses of those traits. Other good nonfiction texts to use are listed online (see NSTA Connection).

Afterward, children used the text to make sense of and define key terms: *organism*, *trait*, *offspring*, *inherit*, and *environment*. In groups of two, children identified use of a term in the reading then defined that term in their own words and illustrated it for our science word wall. The word wall (Figure 4) served as a great unit resource and as a formative assessment of students' understanding of terms. As children created the definition and representation of key concepts, the teachers added notes to our observational checklist (Figure 5, p. 60). Students who needed more prompting completed additional explorations of the wolf cam and photos in a small group to practice key concept and vocabulary application. The day's observational checklist data informed the composition of the next day's groups and materials to be provided. The teachers thought about reading levels, understanding of the key concepts, and observation and inference-making skills.

Extend

Next, groups of 4–5 students received a "top secret" mission folder with photos of different animal parents and offspring in their habitat and text at the group's reading level (Figure 6, p. 61). For example, the polar bear group received a folder aimed at fairly strong readers. The folder contained two photos of polar bears and their offspring

FIGURE 5.

Assessment checklist.

Objectives **Students will be able to...**	**Explain that traits can be passed down to an organism's offspring.**			**Use evidence they have observed about organisms to explain their differing traits.**	**Make connections between the traits and environment organisms in which organisms live.**
NGSS	**Disciplinary Core Ideas**			**Science & Engineering Practice**	**Crosscutting Concept**
Student	Variation of traits (LS3.B)	How traits help animals survive (LS3.B)	Inheritance of traits (LS3.A)	Uses evidence to support observations (3-LS3-2)	Identifies patterns (3-LS3-1)
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2					
3					
4					
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21					
22					
23					
24					
Key:	**Green** = full understanding, no teacher support needed **Yellow** = Emerging, still need some teacher support **Red** = no understanding, need full teacher support				

and a short reading made up of longer sentences, bigger vocabulary words, and more complex ideas. This reading required students to use their newly acquired inference skill to determine the potential importance of the polar bears' traits. The giraffe group received a folder aimed at struggling readers, with text comprised of a list of four facts expressed in shorter sentences and easier vocabulary words. This folder included two photos of giraffes and their offspring and an easy-to-read passage that very clearly discussed the giraffe's traits and their importance for survival. The differentiated materials helped all children to investigate the unit concepts in more depth but within their reach. Children put on "Animal Detective" badges and learned about their mission: to use powers of observation to investigate a focus animal, with each group having a different animal. The class discussed how to act as detectives, including keeping their own "clues" kept secret until each group is ready to share its conclusions. The groups huddled in close so they could not be heard by other detectives and examined their clues.

Teachers asked the following questions and wrote them on the board: What traits does this animal have to help it survive in this habitat? What traits do the offspring share with their parents? What traits did the offspring inherit from the parents? What traits do offspring of the same parent share? How do the traits vary across offspring? These questions helped to direct attention to specific aspects of the photos and promote comparisons of the traits of parents and offspring and their habitat. Children identified the small ears as something the polar bear offspring and parents had in common, as well as the white fur and claws on their feet. They also noticed how some of the offspring had different-shaped eyes. One group discussed how polar bears stay warm: "Well, it's their fur that keeps them warm, because it's so thick" said one. "Yeah and they have blubber," said another. "True," said the third, "But look at their ears too! It's just like the article we read about the fennec fox having big ears to let off heat. The polar bear would need small ears to save heat since it's cold in the Arctic." The children made amazing connections to the earlier reading.

Groups shared what they learned with the class, exposing each other to different animals and their traits. We noticed that many students could easily find similarities in the traits of parent and offspring but did not fully understand that the offspring traits were inherited from the parents. Almost all were making connections between animal traits and their habitat. For example, some children identified the pattern of ear size and habitat relative to temperature (small ears were more likely in colder weather habitats to

FIGURE 6.

Students' "mission folders."

help prevent heat loss, and large ears were more likely in warmer weather habitats to help cool the animal). Others commented that animals often were colored in ways that let them blend in with their habitat. Teachers clarified that many animal traits were inherited from parents (rather than developed during the animal's lifetime in response to the habitat); a fit between animal traits and their habitat help the animal to survive.

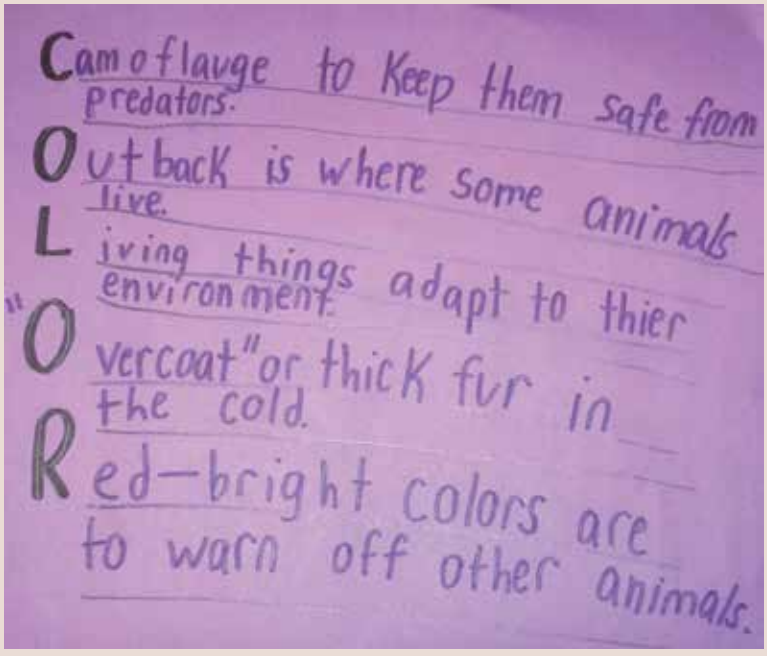
Despite the many strong aspects of children's understanding, some children still focused on simple similarities across animals such as each having ears, eyes, and fur. These children did not recognize offspring's specific traits as being inherited from parents. Also, the tension between inherited traits and those in response to the environment is difficult even for middle school students. For grade 3, children can understand that, with much food available in the environment, an animal might eat too much and get fatter. Due to concept complexity, teachers agreed to revisit the concept throughout the year. For this unit, we decided that students needed to compare the traits of very different animals next. To do this, students completed a secondhand inquiry project.

The next day, each small group explored a different set of *National Geographic* texts on animal traits and habitats, determined by interest and reading level, for a secondhand inquiry. Before the groups started on their work, the class examined the book covers, headings, and images within the books. The teacher modeled how to brainstorm questions from this information, then each group developed a list of possible questions they thought the books would answer. Each pair of students selected one question to answer through reading. They took notes in two columns. The left column included facts that helped the children answer their question, and the right column included children's reactions. These notes informed the writing of an informative text about what the children had learned about animals and habitats (ELA standard W.3.2). We held writers' workshops across multiple days to edit and improve the texts.

As the second part of the unit assessment, each group developed a presentation to share its understandings the following day. Children selected how they would present the facts they learned: an original poem, song, skit, or reader's theater. They used the internet to find pictures, videos, and additional facts on websites such as National Geographic Kids to

FIGURE 7.

An acrostic poem created by students.



add to their work (see Internet Resources). Group discussions supported new information discovery and meaning making to promote high-level understandings. On the last two days, students shared their presentations with the class. The groups verbally described and clarified key ideas. They provided evidence for their explanations and described patterns in relation to animal traits and habitats.

In a skit, one group acted out and described how poisonous frogs in the rain forest are brightly colored to keep predators away. Another group connected an elephant's big ears and the heat in the desert in a rap song. After the rap a child explained, "The elephant needs to let off heat, just like the fennec fox did!" One group created an acrostic poem using the word "color" (Figure 7). This used the key concepts just learned to begin the sentence for each letter. The children reported on a topic with specific details and appropriate facts, as recommended by ELA standard SL.3.4.

To help children further reflect on patterns across animals and habitats as a whole class, we discussed patterns and a teacher wrote them on the board. Students identified that both parent animal and offspring commonly have similar color and/or pattern of fur, bodies, and ears with similar shape, and more. To challenge students' thinking and lead into the next unit, we played a game that required them to extend their new knowledge. In this game, an animal habitat and two animals we had studied were projected on the board. We asked students to debate which animal would be more likely to survive or thrive in the given habitat and provide evidence for their answers. When students simply stated an animal, teachers promoted them by asking questions such as, "What traits do you think might help that animal to survive? What is your reasoning? Why might these traits help?" The game served as a lesson closure in which the relevant science concepts were revisited and clarified.

Based on presentations and observational checklist notes, students improved in their use of key vocabulary terms and their use of evidence to support conclusions. They also connected traits to inheritance from parents and gained understanding about of variation in traits and how survival improves with better matches between traits and habitat. Overall, 20 out of 24 children showed full understanding in all of the objectives. We reinforced these concepts in a later unit on relationships of plants and animals within habitats.

Evaluate

We evaluated children throughout the unit using varied techniques such as discussion, observation/inference sheets, journal entries, and creation and presentation of an original work. To track children's growth, we implemented a teacher observational checklist for the full unit. Formative assessments informed teacher decisions throughout, letting us know that children were ready to translate the concepts to make them their own. The summative assessment involved children developing an artistic work to express their new research findings. This act of creation highlighted the children's high level of understanding and challenged children to continue to make meaning of the science concepts.

Conclusion

Overall, children made connections across activities and found patterns across different animals and habitats. The children proved they were animal detectives, drawing conclusions based on evidence. They cracked the "case," using their own thinking to lead the way. ■

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NGSS Lead States. 2013. *Next Generation Science Standards: For states by states.* Washington, DC: National Academies Press. *www.nextgenscience.org/next-generation-science-standards.*

Internet Resources

International Wolf Center WebCams
www.wolf.org/visit/meet-our-wolves/wolfcams

National Geographic Kids
http://kids.nationalgeographic.com

NSTA Connection

Download checklists, rubric, and additional resources at *www.nsta.org/SC1510*.