Having students research an animal and write a report is a common middle level science assignment. This research report typically requires gathering facts about a species, its diet, and its habitat and draws on students’ natural curiosity of organisms. I decided this project needed an update in my classroom when I realized my students’ greatest struggle the prior year was in mastering a basic unit focused on organisms’ structures and functions, natural selection, and adaptation, concepts that are crucial to long-term success in understanding other biology-related content (Next Generation Science Standards MS-LS1-4, MS-LS1-5, and MS-LS4-4 [NGSS Lead States 2013]).

Unlike the traditional report, the project described in this article requires students to identify an organism’s structural and behavioral adaptations and explain how these allow the animal to survive in its environment, how the animal’s adaptations have evolved over generations, and issues of its current endangered status. Through this project, students...
are expected to master difficult new vocabulary, overcome misconceptions, and find obscure connections between animal structures and environmental pressures in the species’ history.

This project aligns with the goals and standards of not only the NGSS but also the Common Core State Standards (RST.6-8.1, WHST.6-8.2, WHST.6-8.9, SL.8.1, and SL.8.4) (see sidebar on p. 44 for more standards information).

**Common misconceptions about adaptation and evolution**

Mastering the foundational ideas of structure and function, natural selection, and adaptation is important because these concepts allow students to better understand more advanced concepts such as ecosystems, food chains, and systems thinking (Kampourakis 2013). Two major student misconceptions about animal adaptations include the belief that an individual organism can immediately change structurally or behaviorally in response to situations, rather than that a species changes over many generations, and that the design and purpose of adaptations are intentional in na-
ture rather than genetically accidental (Endreny 2006; Engel-Clough and Wood-Robinson 1985; Kampourakis 2013). Often, these misconceptions stem from students’ being given different definitions of adaptation, the misuse of the word in modern-day culture, and ignorance of the evolutionary processes that form species (Kampourakis 2013).

Having your students complete a preassessment probe will probably reveal similar misconceptions about evolution and adaptations (Figure 1). Most middle school students cannot define or give an example of an adaptation; many will wrongly explain adaptations as changes an animal makes to survive when in danger (students often define danger as predators, climate change, hunters, or illnesses), whereas only a few students will be able to correctly define adaptation and provide an example.

Even if they answer the preassessment questions incorrectly, at least a quarter of typical middle school students will probably claim to have received lessons on adaptation and natural selection in previous years. As Marzano (2007) suggests, this difficult topic needs more intentional scaffolding and authentic student-centered learning experiences, which naturally would offer more opportunities to improve their thinking and comprehension, leading to better retention of core vocabulary and skills. Providing an engaging learning experience is essential if students are going to retain these concepts for future application.

The project

This multiweek, primarily self-directed project involves students in creating an infographic to introduce them to structure and function, natural selection, and adaptations.

An infographic is a visual representation, chart, or poster of information about a particular topic. This student-centered, project-based format was intentionally chosen to help develop students’ higher-order thinking skills, such as analysis and synthesis, and personalize the content to engage each student (Coffey 2010). According to Krauss (2012), infographics are more engaging than many of the current methods used to teach new information and critical thinking because they “represent data and ideas visually, in pictures, engaging more parts of the brain to look at a problem” (p. 10). Also, asking students to create infographics provides a vehicle for teaching them how to filter information, communicate through visual aids, and develop creative presentations using technology.

Teams of two to three students create infographics that feature their chosen animal, its adaptations, and explanations of how the identified structures or behaviors aid in that species’ survival (Figure 2; for more sample student infographics, view the online version of this article at www.nsta.org/middleschool/connections.aspx). Student groups begin by brainstorming animals they are interested in learning more about and narrow their selection to one that has interesting physical features and behaviors that each member is happy to research for a few weeks. Once a species is chosen by a group, the group members write it on the board so other students know that that animal has been claimed.

Classroom time is primarily divided into work sessions lasting 20–30 minutes, with the exception of the last two days, when longer sessions become essential so students can analyze and compile their research, create a product, and present their findings. During work sessions, students follow a project calendar to organize themselves and use their time efficiently; what isn’t finished becomes homework (see the schedule in the student packet with the online version of this article).

When students aren’t working on their research, they participate in short activities either as an entire class or in small lab groups of four students, different from their project groups, to supplement the infographic project and provide more opportunities to engage with the themes of structure and function, natural selection, and adaptation. Some supplemental activities could include:

- exploring functions of cell organelles and how they work together;
- watching video clips about the content being explored;
- designing ears out of recycled materials to explore patterns of shape and function;
- testing and analyzing bird-beak structures under various environmental restrictions;
- playing online, explorative games about

**FIGURE 1** Animal adaptations preassessment probe

- Do your best to define adaptation. Provide several examples of adaptations in animals and explain why these adaptations are important.
- Explain how adaptations help a species survive. Does this process happen quickly or slowly? Explain your thinking.
Creations through minilessons

At my school, students have their own school-provided laptop, which simplifies organizing and managing learning. This technology allows learning to become naturally differentiated by providing choice, pacing, and ample modification options. If you don’t have classroom computers or your students don’t have access to computers at home, this project could be modified and completed in a computer lab (your students will need access to computers for at least six days).

Before students create their own infographics, give each student a project packet that includes due dates, a rubric, computer tips, and all the worksheets needed (view the student packet with the online version of this article). Have students begin by completing the Infographic Worksheet, which asks them to explore digital examples of infographics, noting similarities and trends, as well as their effect on modern learning. Then hold a class conversation about infographics and what makes an infographic successful or not.

After this, students can work at their own pace, following the directions outlined in the project packet and pausing to get teacher approval after each step. Some of the steps include selecting partners and getting parent approval (which ensures that parents are supportive of group members and due dates), learning about adaptations through a PowerPoint file, learning to identify valid online references, conducting research on their animal, understanding and then correctly citing their references, sketching their infographic, formatting the project, evaluating peers’ products, and self-assessing their final creation. Your task is to facilitate group work, ask questions that prompt students to come to their own conclusion based on their research, and help problem-solve. Also, holding short, 5- to 10-minute minilessons throughout the unit to explicitly teach re-

adaptions, survival, and classification;
• comparing population charts with abiotic changes to an environment; and
• exploring the evolution of the human brain.
search, critical thinking, technology, and presentation skills is helpful. Many of these lessons are applicable and relevant to other subjects and could easily be divided or shared among language arts, computer, or media-specialist teachers. Minilesson topics include:

- how to evaluate and find dependable sources;
- how to create a works-cited list by using an online generator (see Resource);
- features of a good infographic (Krauss 2012);
- why being a critical consumer of published information is important;
- tips and tricks for using software to create the infographic, such as
  - how to change page size,
  - how to add a background color,
  - how to draw shapes and add photos or art, and then format these, and
  - how to make a picture background transparent;
- how a professional presentation looks and sounds; and
- the role of an active scientific audience.

Included in the project packet are graphic organizers and other worksheets that help students review or practice the concepts taught in these minilessons. For some of the minilessons, I create and post PowerPoints on the class website so students can access and review skills or information as needed (for examples of student resources, see the online version of this article). Giving students access to each lesson, assignment, rubric, and the project calendar allows English language learners and special education and gifted students to work at their own pace. Some easy and effective accommodations include giving students blank infographic templates to fill in and personalize if they are struggling with the technology aspect, assisting small
groups in completing adaptation worksheets together, and conducting more frequent assignment check-ins. Also, the project rubric is divided into proficiency levels (2: provides basic information, 3: meets the learning target, and 4: provides a challenge for students exceeding the standard). It is helpful to encourage each student to use the rubric to meet the project requirements at a realistic proficiency level (view the rubric with the online version of this article).

**Science conference**

After students complete their infographics, you can hold an adaptations science conference so groups can present their work and answer questions for an audience of peers, staff, and visiting parents.

Before the conference, divide teams into two groups for presentations. The first teams simultaneously present their infographics to teams in the second group, which rotate through the presentations. Teams in the second group take notes on the presentations, ask follow-up questions, and give their peers feedback. This “interactive gallery walk” provides presenters with multiple opportunities to engage with their research and hone their communication skills. This presentation format also serves as a platform for shy students to present to their peers in a formal, but not overwhelming, setting. Formally presenting their findings to small audience groups gives students the sense that this information is significant, without the pressure of a large audience, and I have observed that students’ work quality and effort increases dramatically after I announce that they will be presenting it. For tips on organizing a successful conference, see the online version of this article.

**Evaluation of the project**

Nearly all my students demonstrated proficiency or higher on the same district summative assessment that students the prior year, who had not completed the project, struggled through. A high percentage of students exceeded proficiency by correctly answering the advanced critical-thinking questions on the exam. Also, during the first year that I implemented this project, all my students were present on conference day, all had a final infographic to share, and all chose to present. As Seiler (2013) notes, students who have a voice and active role in determining what knowledge is shared will be more engaged and retain new knowledge more frequently. Students involved in this project have a voice and a purpose, and the outcomes of this project are powerful because of their active role in learning.

Science teachers must continue to brainstorm other meaningful and authentic ways to give students greater choice in their learning experiences and more frequently incorporate technology into lessons. We also need to prioritize essential research skills for students to master at the middle school level and ask ourselves whether these skills have changed, considering students’ access to endless information on the internet. All teachers should develop more challenging opportunities for students to obtain, evaluate, and communicate their research.

**References**


**Resource**

KnightCite reference generator—www.calvin.edu/library/knightcite

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

<table>
<thead>
<tr>
<th>Standard</th>
<th>Performance Expectations</th>
<th>Dimension Name or NGSS code/citation</th>
<th>Matching student task or question taken directly from the activity*</th>
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<tbody>
<tr>
<td>MS-LS1: From Molecules to Organisms: Structures and Processes</td>
<td>The materials/lessons/activities outlined in this article are just one step toward reaching the performance expectations listed below.</td>
<td>Science and Engineering Practices</td>
<td>Research and analyze information from a variety of online sources to learn about the animal. How can you creatively communicate the structures and behaviors that help your species survive in its environment?</td>
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<td></td>
<td>• MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.</td>
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<td>• MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals’ probability of surviving and reproducing in a specific environment.</td>
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<td>• MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</td>
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<td>Disciplinary Core Ideas</td>
<td>How have environmental changes over generations affected the growth and development of your animal? Does your species have different adaptations at different stages of its life to help it survive?</td>
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<td></td>
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<td>• Natural selection leads to the predominance of certain traits in a population and the suppression of others.</td>
<td>How have environmental or genetic events affected the development of adaptations in your chosen species?</td>
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<td>Crosscutting Concepts</td>
<td>Identify physical structures of your species and how they function to help your animal survive in its environment.</td>
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<td>Structure and Function</td>
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<td>Cause and Effect</td>
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* Please see the online version of this article for these activities.

Connections to the Common Core State Standards, ELA (NGAC and CCSSO 2010)

RST.6-8.1, WHST.6-8.2, WHST.6-8.9, SL.8.1, and SL.8.4