IT'S STILL DEBATABLE!

USING SOCIOSCIENTIFIC ISSUES TO DEVELOP SCIENTIFIC LITERACY

K–5

Sami Kahn

NSTA press
National Science Teaching Association

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Dedication

This book is dedicated to teachers—current and future—who wake up each morning and choose to change the world … one student at a time.

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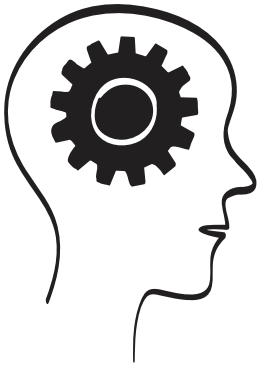
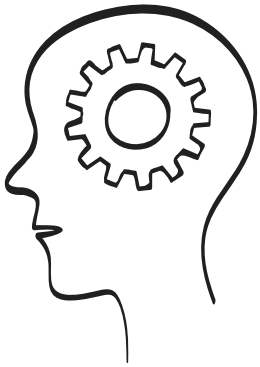
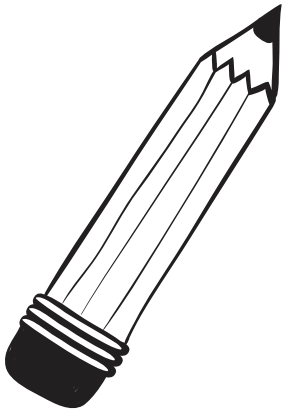




About the Author

Dr. Sami Kahn is a 30-plus-year veteran science educator with extensive experience in classroom teaching, professional development, and curriculum development. She is proud to share that she has taught science to students in almost every grade, from kindergarten through college. Dr. Kahn currently serves as Executive Director of the Council on Science and Technology at Princeton University where she works to promote scientific literacy for all through STEM education research, course development, and outreach. An award-winning teacher and scholar, she uses her background in science education and law to inform her research and teaching on inclusive science practices, socioscientific issues (SSI), argumentation, and social justice. Dr. Kahn has authored numerous journal articles, including several in *Science and Children*, and has coauthored three books on enhancing scientific inquiry experiences for children and adults, including the NSTA Press book *It's Debatable! Using Socioscientific Issues to Develop Scientific Literacy, K–12* (2014). Her service to the field includes leadership positions with the National Science Teaching Association and the Association for Science Teacher Education. Dr. Kahn holds an MS in ecology and evolutionary biology from Rutgers University, a JD in law from Rutgers School of Law, and a PhD in curriculum and instruction with a specialization in science education from the University of South Florida, where she served as a presidential doctoral fellow. Before coming to Princeton, Dr. Kahn held positions at Ohio University, Collegiate School in New York City, and Rutgers University.



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Prelude

"A Cup of Inspiration"

I had just settled in at my desk, cup of coffee in hand, when one of my fourth graders who had arrived early at school approached and asked what seemed like a very simple question: "Ms. Kahn, is coffee good for you?"

Now, I have to confess that the first thing that came into my mind was "Of course! It's what keeps me sane!" But the science teacher inside me quickly kicked in, and I replied, "Well, coffee contains substances called antioxidants that help cells do their jobs well. It definitely has some health benefits."

"So, should kids drink coffee?" he queried.

And there it was—a "should" question. On its surface, it seemed innocent enough, but "should" questions aren't always easy, and they often aren't answerable by science alone. In this case, I knew that science could *inform* my answer but not necessarily determine it. Should I simply respond with a *safe* answer like "It's up to children's parents whether they should or shouldn't drink coffee"? I decided to keep the conversation going.

"Well, the other thing about coffee is that it contains caffeine, which is a type of stimulant. It can make people nervous and make it harder for them to fall asleep at night. So a lot of people are against giving coffee to children."

My student nodded rather somberly, but then, showing a bit of glint in his eye, he asked, "But what about *decaf*? Why don't my parents let me drink decaf?"

I wondered … could my eager young student be trying to get me to contradict his parents? But might he also be genuinely interested in the science behind the bean? Although I felt the pull of quicksand drawing me in ever deeper, I was also intrigued.

"Even decaf has caffeine," I answered. "Maybe that's why your parents don't want you to have it. Have you ever asked them why?"

He paused for a moment, looking rather circumspect before replying: "Nope, I didn't ask because I know when it's a *maybe* no versus a *definite* no. This was a *definite* no!"

Sensing his disappointment and wanting to take advantage of a teachable moment, I said, "Why don't we both learn a bit more about this coffee subject? I'm curious!"

We proceeded to scour some online articles about the pros and cons of coffee, how coffee actually gets decaffeinated (something I never really thought about), and how caffeine affects children and adults. As we searched, I found myself naturally talking to him about the difference between sources like medical journals or university websites (we noticed the .edu and .org extensions) and Wikipedia. We even found information on coffee companies' websites, sources that, my student astutely noted, "might be trying to sell us on it." Our takeaway from our brief perusal was that there is fairly solid evidence that coffee can lower risks for several different diseases, including type 2 diabetes, Parkinson's disease, and some cancers. But it can also harm tooth enamel, leach calcium from bones, and cause anxiety and insomnia. And adding sugar, cream, and flavors (and whipped cream!) contributes empty calories and fat.

My student and I had a great time learning together by weighing the copious and somewhat confusing information about this everyday product. I was quite surprised by how much science content we discussed in a short time, and we touched on issues such as determining the trustworthiness of sources, how and why different studies might yield different results, and the tentativeness of scientific knowledge. This brief interlude added to my deep belief in the use of debatable socioscientific issues (SSI) in science teaching, especially for elementary-age students, as they are developing the habits of mind that will last a lifetime. They are at an age when their thoughts, feelings, and beliefs about science are being solidified.

Soon, I heard the voices of his classmates arriving, so I turned to my student and said, "We've seen some arguments for and against coffee. What do you think about it?"

He confidently replied, "I'm going to wait until I'm older to try it, just in case it's not good for me. I have a feeling there'll be LOTS more research by then!"

That night, my student shared our findings with his parents, who had, in fact, nixed coffee for the reasons we had identified but hadn't articulated those reasons to their son. He now felt empowered because he could engage in an informed discussion on this subject and could even understand and appreciate his parents' decision, whether he ultimately agreed with it or not. It was on that day that I decided an elementary-level sequel to *It's Debatable!* was needed. And in case you were wondering, it was also on that day that I decided to continue drinking my morning cup of coffee!

—Sami Kahn

Unit I

Introduction: *It's Debatable!* for the Next Generation

Do we need zoos?

Which alternative energies are best?

Is football too dangerous for kids?

I have heard it said that today's students are tomorrow's decision makers. While that is certainly a true statement, it is also true that today's students are *today's* decision makers! Every day, children are deluged with information that has an impact on their lives and choices, from which foods are healthiest to whether a particular product or technology is best. Children receive input from a variety of sources and must learn to distinguish fact from fiction. There is so much information available today that it is sometimes easy to forget that information isn't knowledge, and knowledge isn't wisdom. As elementary teachers, we try to instill in children the ability to weigh information and make thoughtful choices, but it certainly isn't easy. Quality science education demands that our students apply scientific understanding to their everyday lives, yet this is a tall task, particularly since science teaching is often done in isolated contexts, making it difficult to recognize and apply science in everyday situations. Think about it. Do you know any adults

who took years of science classes but have difficulty applying any of the content to decisions about health, technology, and the environment?

The authors of *A Framework for K–12 Science Education* clearly had this challenge in mind when they noted the importance of preparing students to "engage in public discussions on science-related issues, to be critical consumers of scientific information related to their everyday lives, and to continue to learn about science throughout their lives" (NRC 2012, pp. 1–2). The *Next Generation Science Standards* (*NGSS*) echo the importance of ensuring informed decision making through science in the following opening statement:

> *There is no doubt that science and, therefore, science education is central to the lives of all Americans. Never before has our world been so complex and science knowledge so critical to making sense of it all. When comprehending current events, choosing and using technology, or making informed decisions about one's healthcare, science understanding is key.* (NGSS Lead States 2013, p. 1)

This vision of scientific literacy expects students to make sense of science and apply it to real-world decision making. It also requires teachers to address an extensive array of standards and position them in meaningful contexts for our learners. As daunting a task as that is, there's even more to the story. Elementary teachers know that the real-world scientific questions that students confront can't always be answered easily by science. The messiness of these questions may stem from the fact that scientific understanding is often incomplete and ever changing, a situation that can lead students (and the public) to be confused about the information they receive or, worse, to doubt the integrity of science itself. Children also wonder about moral or "should" questions that can be informed by science but also require consideration of the consequences of their decisions on others. While science teachers could easily be put off by these difficult questions, a growing body of research suggests that these are precisely the types of questions that fascinate and engage students, including those who otherwise might not be interested in science. The use of debatable, science-related societal questions, or socioscientific issues (SSI) (Zeidler 2014), can serve as a powerful teaching framework that addresses science content, the application of that content, and the type of informed citizenship that is envisioned within the *NGSS*.

How does this work? Let's consider the question "Is football too dangerous for kids?" Can you spot the science? Clearly, examining this question would require understanding concepts of forces and motion (What happens when objects collide? How do helmets work?). It would also require an understanding of anatomy

(Why would we protect our heads? How does the brain work?). Engineering also enters the picture, as we could ask students to examine and test different helmets, and even design their own (Which helmet protects best? What materials work best for this purpose and why?). And yet, even after all this scientific investigation, this issue still leaves open questions like *Who* should decide whether football is too dangerous? Should the rules be different for children of different ages? What are the costs and benefits of youth sports? Approaching the topic of forces and motion in this way creates a rich context for learning by engaging students in an issue that feels real to them, motivates them to investigate the underlying content through science and engineering practices, and allows them to emulate the type of real-world, evidence-based decision-making practices that they will use throughout their lives.

One of the most compelling reasons for SSI implementation in contemporary classrooms is that it clearly supports the conceptual shifts that drove the development of the *NGSS*. The authors of the *NGSS* sought to eliminate superficial, decontextualized science learning and instead support high-quality, real-world, evidence-based investigation and deliberation. These priorities are quite different from those of earlier science education standards and are articulated in Table 1.1 (p. 4), along with how SSI curriculum supports them.

Of course, elementary teachers don't just teach science—they teach children! This means that social and communication skills, literacy and numeracy, and character development though personal and civic responsibility are also key goals. The approach outlined in this book emphasizes each of these critical facets of elementary pedagogy in a seamless manner. Through thoughtful, collaborative problem solving, students begin to think about ways they can support their classroom, school, town, and global community through scientific understanding, civic engagement, conscience, and caring. Typical SSI lessons engage students through hands-on investigations and research in conjunction with discourse through debates, role-playing, in-person or online discussion platforms, and written communications. By interacting with others in this way, students challenge their existing beliefs, collect and examine evidence through multiple research experiences, and develop arguments from evidence.

It should be noted that although moral and ethical issues are broached, teachers do not instruct students in *what* to believe, but rather *how* to integrate information from a variety of sources, evaluate the quality of those sources, and develop perspective-taking skills. Unlike other science-and-society approaches, SSI focuses on empowering students to become agents of change in their schools and communities by integrating diverse viewpoints, appreciating the impact of their actions (or inactions) on others, and finding common ground toward the development

TABLE 1.1.

How SSI Addresses Conceptual Shifts Identified in the *NGSS*

Conceptual Shift in *NGSS*	How SSI Addresses Conceptual Shift
"K–12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real world."	SSI provides students with real-world evidence about problems relevant to their lives and helps students gain appreciation and understanding of the nature of scientific inquiry, including its complexity and interdisciplinary nature.
"The *NGSS* focus on deeper understanding of content as well as application of content."	SSI teaches content in context through extended inquiries that reinforce learning and encourage application of learning through numerous methods, including lab and field investigations, internet research, debates, and writing activities.
"Science and engineering are integrated in the *NGSS*."	SSI often relates to engineering concepts and allows students to deliberate on the impacts of technology on society and of society on technology.
"The *NGSS* are designed to prepare students for college, career, and citizenship."	SSI prepares students to be critical consumers of scientific information and lets them rehearse skills necessary for college and beyond, including argumentation and discourse, evaluation and analysis of primary sources, understanding of diverse perspectives, and informed decision making.
"The *NGSS* and *Common Core State Standards* (in English language arts and mathematics) are aligned."	SSI is interdisciplinary in nature, reinforcing language, literacy, and math skills through evidence-based argumentation, research and writing, debate, and data analysis, all in a manner that emulates real-world scientific applications.

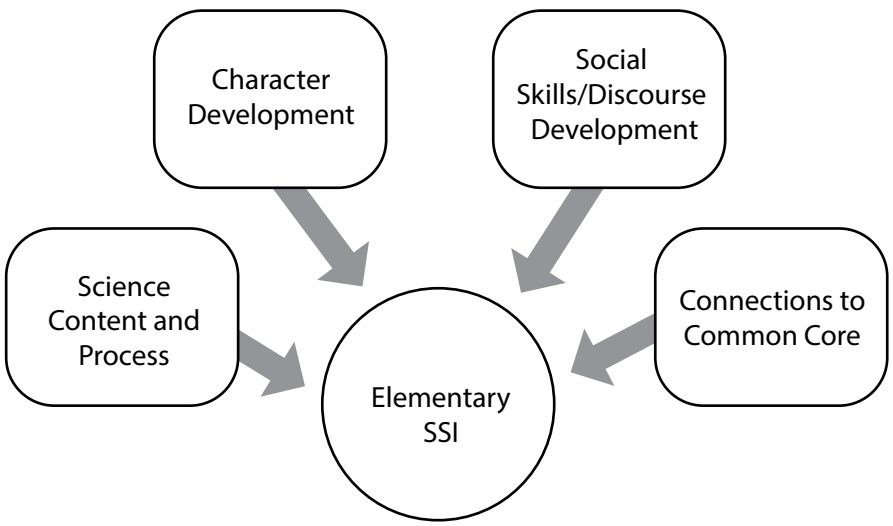
Source: **Adapted from Zeidler and Kahn (2014).**

of thoughtful solutions. Extensive research has suggested that the SSI approach supports increases in students' science content knowledge, understanding of the nature of science, quality of argumentation abilities, and characteristics for global citizenship, including empathy and perspective taking (Zeidler 2014). And SSI's emphasis on evidence-based argumentation and civic engagement makes integration with the *Common Core State Standards* in English language arts and mathematics (NGAC and CCSSO 2010), as well as the National Council for Social Studies (NCSS 2010) curriculum standards, seamless. This type of integrated curriculum supports what we know about how young children learn best. It is also an efficient way of teaching, a critical consideration given how little time elementary teachers are typically allocated for science and how much is expected to be covered across disciplines in a given day.

Most important, SSI makes science real for students; they are invested in their learning because they feel real connections to the questions and want to make a difference in the world, and in their own lives. This book uses a model for elementary SSI (see Figure 1.1) that recognizes the importance of social skills and discourse, interdisciplinary connections, character development, and of course, science learning. In the following chapter, SSI is connected to two other pedagogical models to form a framework that will help ensure that inquiry and equity are emphasized in your classroom.

FIGURE 1.1.

Key Elements of Elementary SSI Model



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Lesson 4

Monkey Business

Do We Need Zoos?

Suggested Grade Levels

K–2

Driving Questions

- How do animal parents care for their young?
- How do young animals take care of themselves?
- How are young animals similar to and different from their parents?

Lesson Overview

Students take virtual tours of zoos and wild spaces through texts and internet research to learn how animal parents care for their young, how young animals take care of themselves, and how young animals are like and different from their parents. After creating a project that communicates how animal parents care for their young from the perspective of the young animal, students learn about the arguments for and against zoos through readings and classroom discourse, then develop a position poster on the issue.

Connecting to the *NGSS*

(See full alignment in Table A.4 on p. 505.)

- LS1.B: Growth and Development of Organisms
    - Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1-LS1-2)

- LS3.A: Inheritance of Traits
    - Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents. (1-LS3-1)

Societal Issues

Animal Rights, Concepts of Freedom and Altruism

Nature of Science

- Scientific Knowledge Is Based on Empirical Evidence
    - Scientists look for patterns and order when making observations about the world.
- Science Addresses Questions About the Natural and Material World
    - Scientists study the natural and material world.

CCSS Connections

- English Language Arts
    - RI.K.7. With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).
    - RI.1.7. Use the illustrations and details in a text to describe its key ideas.
    - W.K.1. Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book (e.g., My favorite book is ...).

NCSS Connections

- Theme 8: Science, Technology, and Society
    - Use diverse types of media technology to research and share information.
- Theme 10: Civic Ideals and Practices

- Evaluate positions about an issue based on the evidence and arguments provided, and describe the pros, cons, and consequences of holding a specific position.

C3 Framework

- Dimension 4: Communicating Conclusions
  - D4.1.K-2. Construct an argument with reasons.
  - D4.3.K-2. Present a summary of an argument using print, oral, and digital technologies.
- Dimension 4: Taking Informed Action
  - D4.8.K-2. Use listening, consensus-building, and voting procedures to decide on and take action in their classrooms.

UDL Toolkit

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action and Expression
Engaging in topics (animals and zoos) that are personally and socially relevant to students adds meaning and motivation.	Using text readings, read-alouds, websites, and pictorial guides provides alternative means of presenting information.	Providing sentence starters, four square organizer, and opinion letter templates supports composition and information management.
Allowing students to choose the animals they "visit" during internet research and the way they present their research project support autonomy and motivation.	Using T-charts, concept maps, and checklists maximizes transfer and generalization of information.	Allowing students to share their ideas through a yes/no argument line, writing, pictures, and options including drama, music, and art gives multiple opportunities for communication.
Providing an extension activity (researching baby animal names) provides varied demands and optimizes challenge.	Having alternative readings (bullet-pointed zoo article) removes unnecessary barriers to reaching instructional goal.	Providing checklists and multilevel templates for projects aids in scaffolding students' planning and strategy development.

Suggested Schedule and Sequence

- Day 1: **Engage** with *My Visit to the Zoo* read-aloud and Animal Parents Concept Map
- Day 2: **Explore** with Animal Parents and Their Young four square internet research and What's My (Baby) Name? extension activity
- Days 3–4: **Explain** with *How Animal Babies Stay Safe* read-aloud and *Born in the Wild: Baby Mammals and Their Parents* mini read-aloud, and **Elaborate** and **Evaluate** with How My Parents Care for Me animal baby perspectives project and presentations
- Day 5: **Elaborate** with Do We Need Zoos? article or list and T-chart, and **Evaluate** with Yes/No Line Debate and Are You for Zoos? position poster or My Opinion on Zoos opinion letter

Materials

(per class)

- Internet access (1 device per 2–3 students recommended)
- Sticky notes
- Pencils
- 1 copy of "Yes" and "No" signs (pp. 152–153)
- Tape

For How My Parents Care for Me project

- Craft materials, paper, crayons or markers as needed, depending on how students choose to complete this activity

Student Handouts

- Animal Parents and Their Young
- What's My (Baby) Name?
- How My Parents Care for Me
- Do We Need Zoos? (choice of narrative article or bulleted list)
- Are You for Zoos? (younger) or My Opinion on Zoos (older)

Media

Books

- *My Visit to the Zoo,* by Aliki
- *How Animal Babies Stay Safe,* by Mary Ann Fraser
- *Born in the Wild: Baby Mammals and Their Parents,* by Lita Judge

Websites

- Zooborns, about animal babies born in zoos
  www.zooborns.com
- San Diego Zoo Kids, with age-appropriate information on zoo animals, including live animal cams
  http://kids.sandiegozoo.org/animals

Background for Teachers

Animals are a favorite topic of study for young children. The study of animals through observation can support students' reasoning, particularly with regard to comparing and contrasting physical attributes and recognizing patterns of development and behavior. It's no surprise that the *NGSS* focus on the importance of comparing and contrasting animal parents and their offspring to provide a basis for understanding heredity (that animals can have offspring, and those offspring are like, but not exactly the same as, their parents). The *NGSS* also expect students to recognize patterns of behavior that parents exhibit to ensure the survival of their young (and the behaviors of the young to ensure their own survival). These two standards taken together reinforce a critical aspect of the nature of science—that scientists learn about the natural world by observing patterns.

In this lesson, students take two virtual visits to a zoo: one by reading a book and the other by conducting online research. Students are asked to use their observational skills to spot the ways that parents and offspring are alike and different and to look for those protective behaviors that support the survival of young animals. This study provides a context for reminding students that humans, too, are animals who display many of the same behaviors they observe in other animals.

This lesson also raises the controversial question of whether we need zoos. For some, zoos are remarkable places that bring people close to wild animals, allow for educative experiences, and save wildlife through protection and breeding programs. Others view zoos as cruel or sad places that infringe on animals'

rights to freedom and, in some cases, treat animals inhumanely. While some might ask whether such an emotionally charged issue is appropriate for young children, research suggests that it is precisely these types of issues that are successful in engaging students in critical discourse and understanding different perspectives. As someone who taught K–4 students for more than a decade, I found this issue to be one that even the youngest students hold strong intuitions about, yet they have rarely considered both sides of the issue. The activity in this lesson asks students to consider various arguments for and against zoos to help them recognize the complexity of such issues and develop their own informed, evidence-based decisions.

Additional Resources

Articles discussing the debate surrounding zoos

- *www.theatlantic.com/news/archive/2016/06/harambe-zoo/485084*
- *www.wgbh.org/news/2016/06/02/local-news/do-we-really-need-zoos*

5E Lesson Plan

Engage: *My Visit to the Zoo* Read-Aloud and Animal Parents Concept Map

1. Ask students, "Have you ever been to a zoo? If you have, what was it like? If you haven't, what do you think it would be like?" Allow students to turn and talk to a partner briefly. Say, "Today we're going to take a trip to the zoo in a book." Show students the cover of *My Visit to the Zoo,* by Aliki, which portrays a tiger parent and cub in the foreground and an elephant parent with a calf in the background, with children observing. Ask, "I wonder … why do you think the author chose to put these particular scenes of animal parents and their young on the cover?" (accept all answers; students will likely suggest that zoos are places that want animals to have families, perhaps because they are endangered)
2. Read the first two sentences on page 4 of the book: "I didn't really want to visit the zoo. I had been to one that made me feel sad." Ask students, "Why do you think a zoo might have made the author feel sad?" (accept all answers; students will likely indicate that it might have made the author feel sad that animals were in cages and not free) Continue reading the book, which describes a much more pleasant experience for the author because the zoo had habitats where the animals could live similarly to when they are in the wild. As you

read, pay careful attention to the scenes and descriptions of animal parents and their young as follows:

- Page 7 shows a gibbon carrying its baby. Ask, "How is the baby similar to the adult?" (same face, body parts) "How is it different?" (much smaller)
- Page 8 shows macaques and baboons holding and giving a ride to their young. Ask, "How is the macaque baby like its parents?" (same color and body parts) "How is it different?" (no mane or fur around its head, much smaller) "Why do you think the baby baboon rides on its parent?" (it's tired, for safety)
- On page 12, note that the docent told the author that the zoo had recently celebrated over 1,000 births!
- Page 13 shows and reads, "Families of chimps playing and grooming each other affectionately." Ask, "What does the author mean by 'grooming'?" (the chimps pick parasites off each other) "What does 'affectionately' mean?" (with care, not harshly)
- Pages 14–15 show orangutans and gorillas with babies. Ask, "How are these parents caring for their young?" (holding, caressing, playing)
- Pages 16–17 show a cheetah with cub and a lioness with cub. Ask, "How are these parents and their young similar?" (same coloring: cheetah cub has spots like its parent, lion cub has same coloring as well) "How are they different?" (both young are much smaller than their parents but otherwise look very much like them)
- Page 18 shows a dorcas gazelle and an Arabian oryx. Ask, "What is this gazelle fawn doing?" (nursing, getting milk from its mother) "How does this Arabian oryx baby look like its parent?" (same coloring) "How is it different?" (no horns, much smaller)
- Page 19 shows a giraffe, with a marabou stork in the distance. Ask, "What do you think this stork is bringing to the nest?" (food for its young) "How does this giraffe resemble its parent?" (it looks exactly the same except much smaller)
- Page 21 shows African elephants and reads, "Everyone loved the playful, affectionate elephants—especially the baby guarded by its mother." Ask, "How is the mother 'guarding' its baby calf?" (keeping its trunk on it, holding it close, keeping an eye on the people) "The

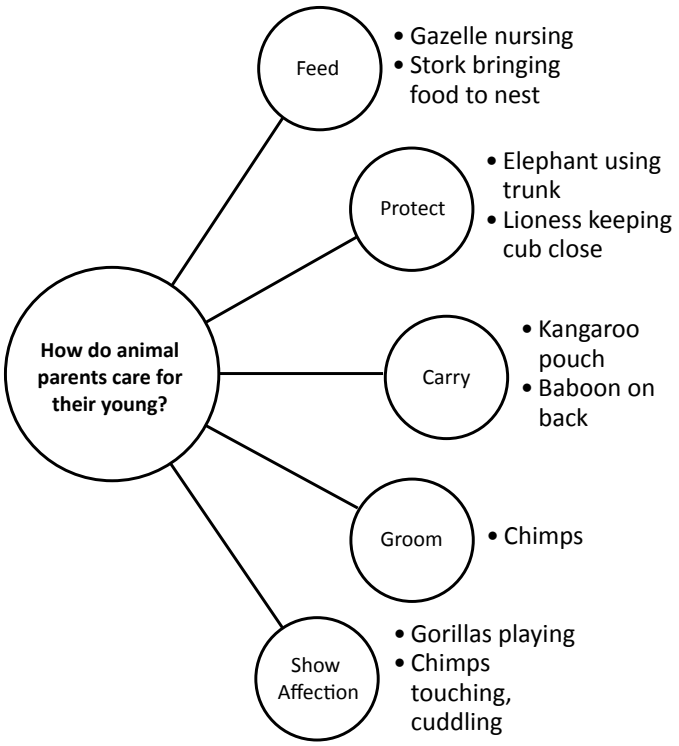
author uses the word 'affectionate' again. Why do you think she does this?" (to show that animal parents are loving and caring toward their offspring)

- Page 24 shows a red kangaroo. Ask, "How is the mother kangaroo caring for its joey?" (she carries her joey in her pouch where she can protect it)
- Page 25 shows a polar bear. Ask, "How is the polar bear parent caring for her cub?" (cuddling and protecting it) (*Note:* On page 25, the author states that "unlike other animals, pandas have not bred successfully in captivity so far." This is no longer true. In addition to successful captive breeding programs in China, several zoos have had panda births. They are more difficult to breed than other animals, though, and there has been limited success in releasing captive-bred pandas into the wild. This is a great opportunity to share with students the fact that scientific information changes over time!)
- Page 28 shows a mute swan. Ask, "How are the cygnets, or baby swans, similar to their parent?" (they swim, have beaks and feathers) "How are they different?" (they are brown, not white, and much smaller) "Why do you think the cygnets may be brown?" (it provides camouflage from predators, especially in the nest)
- Page 31 shows the nursery with a zoo employee feeding a leopard cub with a bottle. Ask, "Why do you think some zoo babies are in the nursery?" (they may need extra care)
- After reading page 32, ask, "What do you think the author thinks about zoos now?" (that they are good places because they breed and protect animals) Ask students to give a thumbs-up, thumbs-down, or thumbs-in-between to show how they feel about zoos now. Allow for brief discussion and assure students that they will have more time to discuss this important topic soon. For now, you'd like to focus on the ways animal parents cared for their young in the book.

3. Write the question "How do animal parents care for their young?" on the board. Ask students to share ideas and write them on the board, trying to organize ideas into big categories such as "Feed," "Protect," "Groom," and "Show Affection." Your class Animal Parents Concept Map might look similar to the one in Figure 5.11 (p. 134).

FIGURE 5.11.

Sample Animal Parents Concept Map



Keep the concept map available during the remainder of the lesson, as your class will build on it as students engage in more research and reading.

Explore: Animal Parents and Their Young Four Square Internet Research and What's My (Baby) Name? Extension Activity

1. Explain to students that they will now have a chance to virtually visit several zoos and learn about how different animals care for their young. Distribute the Animal Parents and Their Young student handout (p. 144), which is a four square graphic organizer. Set up internet access so that there are two or three students per device (e.g., laptop, PC, or iPad).

2. Use a projector to show students the website *www.zooborns.com*. Inform students that they are now zoologists, scientists who study animals, and they are doing research on how animal parents care for their young. When scientists try to understand information about the world, they look for patterns. Your students' job as scientists will be to find examples of animal parents caring

for their young in different ways. Show students the home page, scrolling down to look at some of the most recent births. Demonstrate for students how to choose specific animals by selecting a name on the right-hand side of the screen. (*Note:* Although this website has a lot of verbiage, students can scroll through photos of animals to observe behaviors of parents, such as a tiger parent licking its cub or an aardvark nursing its baby. Several of the animals also have videos associated with them.)

3. Instruct students that when they identify a photo of a parent caring for its young, they should draw a picture of it in the square that has that type of behavior and write the animal's name. The squares have the topics "Protect," "Feed," and "Carry," as well as a wild card. The wild card is for a behavior of the student's choice. Challenge students to try to find a different type of behavior, such as grooming, showing affection, or even communicating with their offspring.

4. As students are working, clarify any questions and evaluate informally by checking to make sure students are using the graphic organizer correctly.

5. When students have completed their research, have them switch partners and present their research to each other. After a few minutes, ask students, "Were you able to find any new examples for 'Protect,' 'Feed,' or 'Carry' that we hadn't included on our Animal Parents Concept Map?" (Add any examples to the concept map.) Ask, "Was anyone able to find any examples of 'Grooming' or 'Showing Affection'?" (Add these to the concept map.) Finally, ask, "What did you have in your wild card square? Was anyone able to find any new behaviors that we haven't seen yet?" (students may mention parents building homes or communicating with their offspring; if no new behaviors are mentioned, it is fine, as new ones will be introduced in the next activity)

6. Extension activity: If students have extra time, distribute copies of the What's My (Baby) Name? handout (p. 145). Have them scroll down to the "Baby Animal Names" link (or visit *www.zooborns.com/zooborns/baby-animal-names.html*) and learn the names for the various babies they have found. An answer key for the handout is in Figure 5.12 (p. 136).

FIGURE 5.12.

What's My (Baby) Name? Answer Key

Animal	Baby Animal Name
Camel	Calf
Coyote	Pup or whelp
Eagle	Eaglet or fledgling
Fox	Kit
Giraffe	Calf
Kangaroo	Joey
Llama	Cria
Turtle	Hatchling
Zebra	Colt or foal

Explain: *How Animal Babies Stay Safe* Read-Aloud and *Born in the Wild: Baby Mammals and Their Parents* Mini Read-Aloud

1. Have the Animal Parents Concept Map in view. Distribute three or four sticky notes to each student, along with pencils. Show students the cover of the book *How Animal Babies Stay Safe,* by Mary Ann Fraser, which has an illustration of a tiger parent and her cubs. Ask students, "Does this cover show a way that the tigress is caring for her cubs?" (protecting them by keeping them close, watching for danger) "We're going to learn about some new animal parents today and how they care for their young. Your job is to jot down any new ways that parents do this. When you hear something new and interesting that you'd like shared on our concept map, jot it on a sticky note and we'll add them to our map after reading."
2. Read the book aloud, periodically stopping to allow students to jot down their notes. Then, allow students to share their notes by posting them on the concept map.
3. Below are some guidelines for the new ideas that the book introduces in case students don't mention them in their sticky note postings:
    - Page 10 shows a dog with puppies. The author states that the puppies "cannot keep themselves warm or get their own food." Ask, "What

is something that the dog mom does to care for her young that we haven't mentioned before?" (*keeps them warm*)

- Pages 12–13 show various animal parents *building homes* for their families.
- Pages 20–21 show various animal parents alerting their young to danger. Ask, "How do some animals *alert* their young to danger? (howling, barking, scent, or quick fin movements)
- Pages 22–23 show animal parents risking their lives for their young. Ask, "Why do some animal parents *risk their lives* to protect their young?" (because their young are very important to them, they will fight off enemies even if it is risky for them)
- Pages 24–25 show mother raccoons and ask, "How do mother raccoons *trick enemies?*" (they act as decoys and distract the enemy away from the babies)
- Show students pages 26–27 and ask, "How do elephants protect their young?" (they *stay in a herd* and keep the babies in the middle)

4. Ask students, "The book also mentions some ways that baby animals are able to stay safe by themselves. What are some of those ways?" (camouflage with surroundings; huddle together to stay warm and safe, like penguin babies do when they form a crèche)
5. Tell students that there is one more thing that parents do that wasn't mentioned in either of the books, but it is very common in mammals. Ask, "What is a mammal?" (an animal that feeds its babies milk; some examples are dogs, cats, horses, people, lions, and elephants) Open up the book *Born in the Wild: Baby Mammals and Their Parents,* by Lita Judge, to pages 36–37, which show a sea otter mom and pup. The text reads, "The baby learns." Ask students, "What do you think this baby learns?" (accept all answers) Read the next two pages, which explain that some animal parents *teach* their young how to survive.
    - Ask, "How do these animal parents teach their young to survive?" (pika parents *teach* their young that a loud chirping scream means danger, and the baby pikas *learn* that they should go back to the den; the sea otter parent *teaches* her pups how to swim and dive, to find clams and urchins, and to open clams with rocks; young orangutans

take at least 10 years to *learn* from their mothers where to find food, how to use sticks for tools, and how to build a sleeping nest)

Misconception Alert

With so much discussion of how animal parents care for their young, it is easy for children to develop the misconception that animal babies are helpless. This is not the case and in fact, the *NGSS* standard 1-LS1-2 emphasizes the fact that many baby animals do their part to protect themselves once they are able. Actions such as responding to parents' danger calls, crying when they're hungry, and imitating the parent as they learn different survival tasks are all ways that animal babies contribute to their own growth and survival. Be sure to take time to discuss these behaviors.

6. Add "Teach" to the Animal Parents Concept Map, along with examples. Let students know that they can look through the rest of the book when they are working on the next project.

Elaborate: Animal Baby Perspectives Project: How My Parents Care for Me

1. Tell students that they will now have a chance to become experts on one kind of animal and the way its parents keep it safe. Distribute copies of the two How My Parents Care for Me student handouts (pp. 146–147). Read aloud the instructions on the first handout (p. 146), which includes a planning checklist and rubric.
2. Tell students that the second handout can help them plan and outline their project. It has blanks for students to fill in and a small four square graphic organizer. Animals can be either chosen by students (preferred) or randomly assigned. If students are choosing, encourage them to select different animals from other students so that there is a good mix for their presentations.
3. Provide students with the books that were read in class, as well as others, and be sure that the Animal Parents Concept Map is accessible. Also, provide students with internet access for research using Zooborns (*www.zooborns.com*) and the San Diego Zoo Kids website (*http://kids.sandiegozoo.org/animals*). The latter has very clear information on zoo animals, along with videos on many of the animals. Provide paper and craft materials as needed for the project.

Evaluate: How My Parents Care for Me Presentations

1. Have students present their projects to the class. Assess using the handout list of required elements, giving extra points for clarity and creativity.

Elaborate: Do We Need Zoos? Article or List and T-Chart

1. Show students the cover of *My Visit to the Zoo* to remind them of the book. Ask, "Do you recall how the author felt at the beginning of the book?" (she didn't like zoos) Ask, "And what was her opinion after her visit to the zoo?" (she thought they were good places that cared for and protected animals) Explain that people have different opinions on zoos; zoos are *controversial* because some people think they are needed and some people don't. We're going to read about some of the reasons for this controversy, and then you'll have a chance to share your opinions.

2. Distribute copies of the Do We Need Zoos? handout, using either the narrative article (p. 148) or the bulleted list (p. 149). (*Note:* Two versions have been included to give the teacher the choice of how to present the material. One is in narrative form; this can be read aloud by the teacher, by older students in pairs, or by student volunteers. The other version is presented as bulleted points and is less detailed than the narrative version. This can be presented by the teacher using a document reader displaying an enlarged image of each of the points, with students following along or reading chorally with the teacher, or with students taking turns reading bulleted points aloud.)

3. After reading, draw a yes/no T-chart on the board, with the heading "Do We Need Zoos?" at the top. Ask students to share, *in their own words,* some of the reasons people give on each side of the issue. This will allow you to assess student understanding and reinforce some of the key reasons. Remind students that you are not asking for their opinions yet; you would simply like to summarize some of the reasons they learned from the reading. Summarize students' responses on the T-chart, which might look something like Figure 5.13 (p. 140).

FIGURE 5.13.

Sample Yes/No T-Chart

Question: Do We Need Zoos?

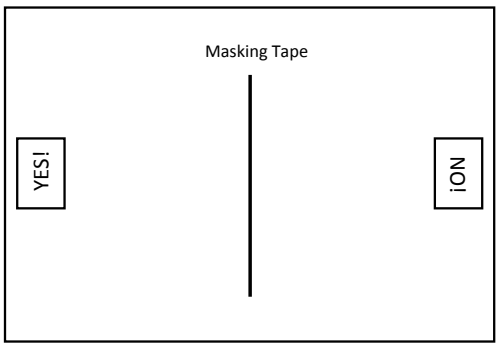
Yes	No
Animals are safe in the zoo.	Wild animals should be free.
Zoos breed endangered species (example: California condor).	Animals don't have a choice whether to be in a zoo or not.
People care more about animals when they visit them up close.	The habitats are too small (example: elephants walk long distances in large groups in the wild).
Scientists can study animals in the zoo to learn more about them.	A lot of the animals that are bred in zoos aren't released into the wild.

Evaluate: Yes/No Line Debate and Are You for Zoos? Position Poster or My Opinion on Zoos Opinion Letter

1. Post the "Yes" sign (with the thumbs-up picture) on one side of the room and the "No" sign (with the thumbs-down picture) on the other. Put a 3-foot line of masking tape on the floor in the center of the room so that it divides the room into two sides, with one side as "Yes" and the other side as "No." (For young students, you can put the signs on the floor on either side of the line to provide a closer visual cue.) The room should look similar to Figure 5.14.
2. Write the following sentence frames on the board:

FIGURE 5.14.

Room Setup for Yes/No Line Debate



"I think that _____ because _____."

"I disagree with you because _____."

"According to the article/book/website/my personal experience, _____."

"I think you should also consider _____."

3. Tell students that you'd like to hear their opinions on zoos, and we're going to share our opinions in a fun way. Remind students that there is *no wrong answer.* There are good reasons on both sides of the issue. The important thing is that they share their ideas in a thoughtful and respectful manner. Explain that you would like to know whether they think we need zoos. If they think the answer is yes, they should go to the "Yes" side of the line. If they think the answer is no, they should go to the "No" side of the line. They may not straddle the line by putting one leg on either side. For now, you are asking them to choose a side. *Tip:* If you have never done this type of activity before, you may wish to have students write down "yes" or "no" before they get up to go to either side of the line. They can write it on a sticky note and post it on their shirts or simply write it down on paper. This will encourage students to stick to their opinions rather than joining friends or changing their minds because they don't see as many students going to their side of the line. Once your students have done this type of discussion a few times, they will become more confident and will trust that it is a safe environment to have a dissenting opinion.

   As students go to their side of the line, you may notice some of them going far to the edge of the room (to show that they feel strongly about the issue) or coming close to the line (to show that they feel mixed about the issue). This is a wonderful aspect of the activity; another activity in Lesson 8 (p. 249) of this book uses a yes/no spectrum line, which allows for a continuum of opinions. The present activity uses the yes/no line to force students to choose a side, which emphasizes the difficulties in this type of decision making. It is also simpler for children to remember which side is which.

4. When students are on their chosen sides, point to the sentence frames on the board, and ask them to share their opinions in that format. Remind them that they need to take turns and listen hard to other people's opinions. Have students share their opinions, making sure they justify their opinions (claims) using evidence from the books, the article, the websites, or their personal experiences at zoos. Also pay careful attention to whether you see anyone switching sides or scooting toward or away from the line. If you notice that, you can say, "I see that some people may be rethinking their positions on

the issue, and that's fine. Would any of you like to share your thoughts on that?" Ask, "What arguments *persuaded* you to change your mind?" When all students who wish to share their opinions have shared (and all students will have the opportunity to share their opinions in written or pictorial format as well), ask students to move to their final spots so that they can see where their classmates stand on the issue. Ask, "How did it feel to share your opinions this way?" (accept all answers) "What other information might be helpful for you to know about zoos to help you make your decisions?" (accept all answers; students may note that some zoos may be better than others in terms of how they care for their animals, and they may indicate that they would want information on individual zoos rather than making a sweeping decision about all zoos) Encourage students to look at different zoos' websites, as many will indicate whether they have received accreditation from organizations that have more stringent standards than are required by law, such as the Association of Zoos & Aquariums (AZA).

5. A choice of two handouts is available for the next evaluation activity. The first, Are You for Zoos? (p. 150) is the simpler of the two and asks students to fill in the blank as to whether they think we need or don't need zoos, complete the sentence "My top reason is _____," and draw a captioned picture of their top reason. The second, My Opinion on Zoos (p. 151) requires more writing, as it asks students to give three reasons and is in the general form of an opinion letter. For earlier grades or classes with many English language learners, you may wish to use only Are You for Zoos? For older grades, you may wish to use both, with My Opinion on Zoos being used first to elicit more detailed writing, followed by Are You for Zoos? which can be completed afterward and displayed. My Opinion on Zoos can also be used as a homework assignment. Tell students that they have a chance to educate the school community about the issues of zoos by creating opinion posters that will be displayed around the school. Distribute the handouts of your choice, and allow students to display completed Are You for Zoos? posters for the school community.

Going Deeper

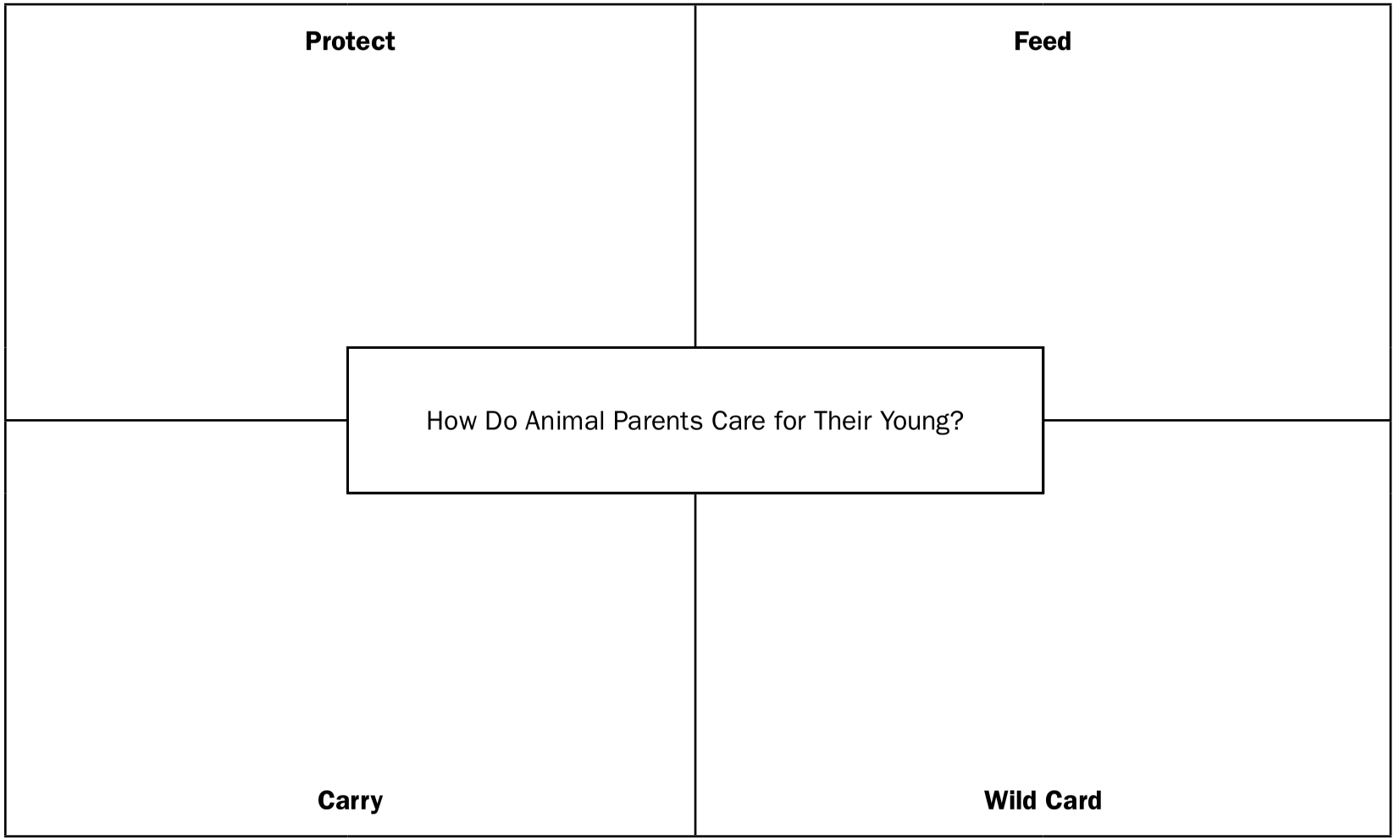
- Students can develop booklets or e-books on animal parents and their young.

- Students can observe webcams on zoo websites (such as the San Diego Zoo website included in the list of resources) to watch parenting behavior in real time.
- Students can research information on their local zoo to see how the zoo's work is aligned with the yes/no arguments they read about.
- Students can research zoo breeding programs to add evidence to the yes/no T-chart about breeding and releasing successes and failures.
- Students can interview parents, siblings, and others about their thoughts on zoos.
- Students can research the history of zoos and create a timeline.

Zoologist Name: _____ Date: _____

Animal Parents and Their Young

Draw and describe an example of each of the behaviors in the boxes below. Be sure to include the animal names!



Name: _____ Date: _____

What's My (Baby) Name?

Using the Zooborns website (*www.zooborns.com*) or other resources, try to find out the names of these amazing animal babies!

Animal	Baby Animal Name
Camel	
Coyote	
Eagle	
Fox	
Giraffe	
Kangaroo	
Llama	
Turtle	
Zebra	

Name: _____ Date: _____

How My Parents Care for Me

Animal Baby Perspectives Project

For this project, research how parents of one type of animal care for their young. Then, teach what you learned to your class *from the perspective of the young animal!* You can write a story, make a poster, create a 3-D diorama or sculpture, perform a play, write and sing a song, or draw a comic strip. Your project must include the following:

- ☐ The type of animal you are
- ☐ Your baby animal name (for example, chick, cub, calf)
- ☐ Where you were born
- ☐ What you eat
- ☐ One way that you are <u>similar to</u> your parents
- ☐ One way that you are <u>different from</u> your parents
- ☐ One way that you take care of yourself or protect yourself
- ☐ One way that your parents take care of you

Check the boxes ☑ as you complete each step. 8 checks = 8 pts. Extra points for clarity and creativity!

Name: _____ Date: _____

How My Parents Care for Me

(Use this form to help you plan your project.)

I am a baby _____. Baby _____s are called
type of animal type of animal

_____. I was born in _____. I like to
name of baby animal place where this type of animal lives

eat/drink _____.
food or drink

One way that I am <u>similar to</u> my parents is …	**One way that I am <u>different from</u> my parents is …**
One way that I can take care of myself (or protect myself) is …	**One way that my parents take care of me is …**

Do We Need Zoos?

Some Zoo History

Humans have kept wild animals for thousands of years. Records from ancient Egypt show that animals were kept in large **collections** as a sign of wealth and power. Animal collections called **menageries** were common in Europe through the 1800s. The Philadelphia Zoo was the first zoo in the United States. It opened in 1874. At that time, zoos focused on making the animals easy for humans to see, so the animals were kept in small, simple cages.

New and Improved?

As years went by, people became more concerned about the **welfare** of the animals. Today, most zoos focus on **conservation,** which means protecting animals, especially those that are **endangered.** They also try to educate the public so that people will care about animals. But there is a lot of **controversy,** or disagreement, about whether we need zoos.

Woo-hoo for Zoos!

People who support zoos say that they protect animals by keeping them safe. They also argue that many animals that were nearly **extinct** have been bred in zoos. For example, only 22 California condors were alive in the 1980s. Thanks to zoos, over 400 condors exist in zoos and in the wild today. Supporters also argue that people care more about animals when they see them in zoos. Most people would never have the chance to see animals like elephants and tigers in the wild. Many of today's zoos also have large, **realistic** habitats that are healthier for the animals. Zoos argue that their zookeepers care about the animals and that they follow laws that protect animals. Many zoos also have animal **enrichment** activities, such as hiding the animals' food or making toys to keep the animals busy and happy. Scientists also study animals in zoos to learn more about them. Finally, many zoos use money they earn to protect animals in the wild.

Boo for Zoos!

People who are against zoos say that it is cruel to keep animals in **captivity** where they are not free. They also argue that humans don't have the right to keep wild animals, especially because animals don't have the choice of whether they want to live in zoos or not. They also say that people only have zoos for their own **entertainment.** People who are against zoos also feel that the animal habitats are never as real or as large as habitats in the wild. They point to elephant habitats as an example. Elephants in the wild often walk for miles each day and travel in very large packs. This is not possible in most zoos. Some people also argue that many animals that are bred in zoos never get **released,** so it doesn't make sense to keep breeding them. There also are stories about zoos that are unclean and where the animals are not well cared for. Some people say that the laws protecting animals in zoos aren't **enforced** well. Finally, they argue that the money that is spent on keeping zoos could be better spent on protecting the animals' wild habitats.

Do We Need Zoos?

Read what people say for and against zoos to help make your decision.

Woo-hoo for Zoos!

- Zoos protect animals by keeping them safe and by **breeding** them.
- Many animals that were nearly **extinct** have been saved by zoos.
- People care more about animals when they see them and learn about them in zoos.
- Most people would never have the chance to see animals like elephants and tigers in the wild.
- Zookeepers care about the animals.
- Animals are kept in **realistic** habitats.
- Zoos have **enrichment** activities to keep the animals busy and happy.
- Scientists study zoo animals, which helps us understand them better.
- Many zoos use money they earn to protect animals in the wild.

Boo for Zoos!

- It is cruel to keep animals in **captivity** where they are not free.
- Humans don't have the right to keep wild animals.
- Animals don't have a choice about whether they are kept in zoos.
- People keep animals in zoos for their own **entertainment.**
- Zoo habitats are never as real or as large as habitats in the wild.
- Animals that are bred in zoos rarely get **released** into the wild.
- Some zoos are unclean and the animals are not well cared for.
- Laws that protect animals in zoos aren't **enforced** very well.
- Money that is spent on zoos could be better spent on saving wild habitats.

Name: _____ Date: _____

Are You for Zoos?

I think that we _____ zoos.
need **or** don't need

My top reason is _____

_____.

Here is my picture:

Name: _____ Date: _____

My Opinion on Zoos

I think that we _____ zoos.
need **or** don't need

Here are my reasons.

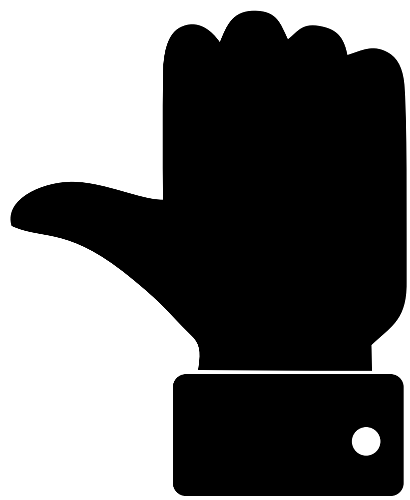
Reason #1

Reason #2

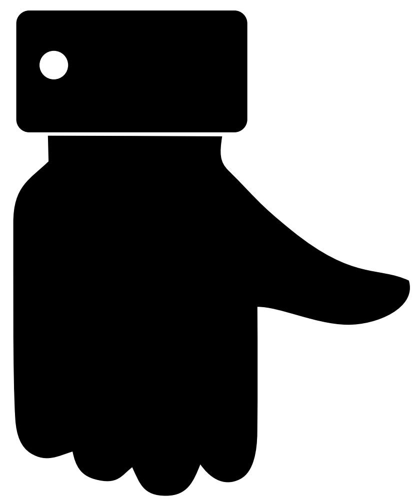
Reason #3

That is why I think we _____ zoos.
need **or** don't need

YES!



NO!



Index

Page references in **boldface** *indicate information contained in figures and tables.*

IT'S STILL DEBATABLE!

USING SOCIOSCIENTIFIC ISSUES TO DEVELOP SCIENTIFIC LITERACY

K–5

It's Still Debatable! encourages scientific literacy by showing you how to teach the content and thinking skills K–5 students need to explore real-world questions like these:

- Is football too dangerous for kids?
- Do we need zoos?
- Should distracted walking be illegal?

At the core of the exploration is the Socioscientific Issues Framework. It uses debatable, science-related societal questions, or socioscientific issues, to address science content, help children learn to apply the content, and encourage them to become informed citizens. The book supports the *Next Generation Science Standards*; links to the *Common Core State Standards*, *National Curriculum Standards for Social Studies*, and *C3 Framework*; and is developmentally appropriate for diverse elementary classrooms. It also includes a chapter especially for use in methods courses and professional development programs.

The framework gives students practice in the research, analysis, and argumentation necessary to grapple with difficult questions with roots in life, physical, Earth, and environmental science. After introducing the framework and explaining how it supports the standards, the book shows you how to implement the concept through 14 lessons.

"All educators have an obligation to develop a new generation of informed, ethical, engaged decision makers who are able to apply science in their everyday lives and in society."

—Author of *It's Still Debatable!*

Because the book is specifically for elementary grades, the author made it a teach-ready resource that integrates science into your packed school days. You get clear and accessible background information, practical guidance on how to use the lessons, and developmentally appropriate assessments and handouts. You even find out how to develop your own socioscientific issues curriculum.

Both practical and content-rich, *It's Still Debatable!* doesn't shy away from controversy. Instead, it encourages you and your students to confront just how messy the questions raised by science (and pseudoscience) can be. After all, as the author notes, when science feels real to students, "They are invested in their learning because they feel real connections to questions and want to make a difference in the world, and in their own lives."

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Grades K–5

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