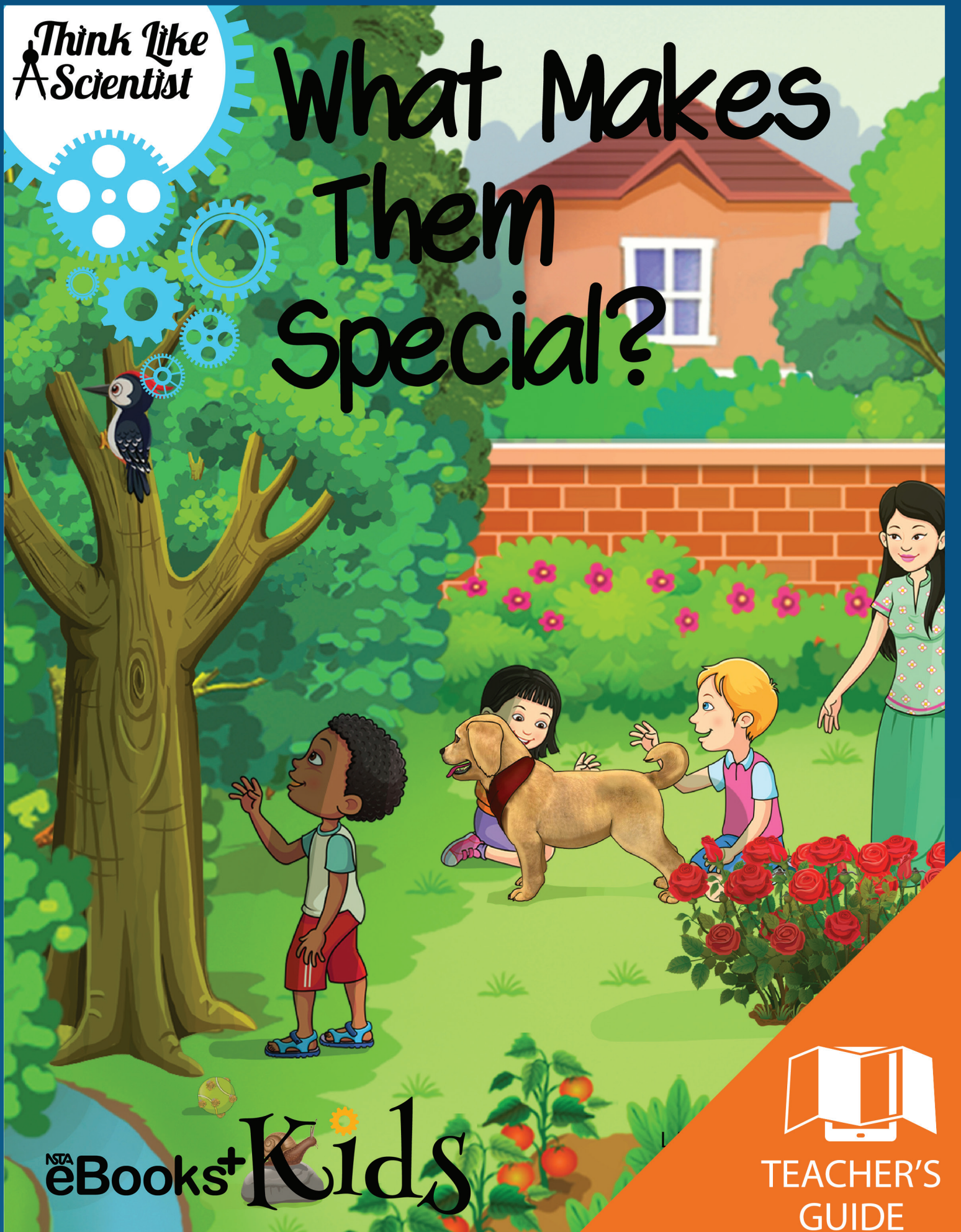
Think Like A Scientist

What Makes Them Special?



NSTA eBooks+ Kids

TEACHER'S GUIDE

with them: **What special features of plants and animals can inspire solutions to human problems?**

The Driving Question

TA driving question focuses on a key understanding that drives the teaching and learning for a given unit. It is an open-ended question that provides context for the purpose of student exploration, research, investigation, reflection, and understanding of a phenomenon. The question should relate to students' lives and integrate standards from other disciplines. The driving question for this book is:

What special features of plants and animals can inspire solutions to human problems?

Lesson Questions
Each lesson question is also focused on a key understanding that will help answer the driving question. Students must work through all the lesson questions to have a full understanding of the driving question. Each lesson focuses on how the structures and functions of plants and animals can help solve human problems by mimicking how plants and animals use external parts to help them survive, grow, and meet their needs.

Driving Question	**What special features of plants/animals can inspire solutions to human problems?**
Lesson Question	What's special about dogs paws?
Lesson Question	What is special about woodpeckers beak?
Lesson Question	What is the best way to protect the garden?
Lesson Question	Why do burs stick to the tennis ball?
Lesson Question	How do snails protect themselves?

Three-Dimensional Learning and the *What Makes Them Special* E-book

You will notice throughout the document that certain words and phrases are highlighted in different colors: blue, green, and orange. These colors correspond to the science and engineering practices (blue), crosscutting concepts (green), and disciplinary core ideas (orange). The book also incorporates engineering design (purple). This will help you quickly notice how each of the three dimensions and engineering design are used on a page. Refer back to this section for the full descriptions.

This e-book does not use all of the grade-level elements for the practices and crosscutting concepts, but that does not mean that you should not be aware of the other practices and concepts your students need to know. For a full list of all grade-level elements for the science and engineering practices and crosscutting concepts, refer to Appendix A.

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Disciplinary Core Ideas (DCIs)

This e-book examines an anchor phenomenon related to the following disciplinary core ideas:

LS1.A: Structure and Function **All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.**

LS1.D: Information Processing **Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1-LS1-1)**

Science and Engineering Practices

> Engaging in the practices of science helps students understand how scientific knowledge develops; such direct involvement gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world. The actual doing of science or engineering can also pique students' curiosity, capture their interest, and motivate their continued study.

(NRC Framework for K-12 Science Education, 2012)

Throughout the e-book are "**Be a Scientist**" and "**Be an Engineer**" buttons, which are connected to the science and engineering practices . These buttons provide students with the opportunity to explore these practices, learning how structures and functions help plants and animals survive and grow. Out of the eight practices below, the five that are bolded are the ones that students will work with in the e-book.

This teacher's guide provides possible answers to the questions posed to students via the "**Be a Scientist**" and "**Be an Engineer**" buttons. These questions are open-ended and used to promote student discussions. Scientists learn about how nature works and engineers use what scientists know to help humans solve problems.

Science and Engineering Practices

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying Out investigations
- Analyzing and Interpreting Data
- Using Mathematics and Computational Thinking
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

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Chapter 1

What's Special About Dogs Paws?

Chapter 1 focuses on the introduction of the structures and functions of animals and how humans solve problems by mimicking those structures and functions.

By the end of the chapter, students will be able to:

- ask a question(s) based on observations of the dog running across gravel;
- listen actively to arguments to indicate agreement or disagreement based on evidence of different structures of a dog's paw;
- develop an argument using multiple points of evidence that an external structure of an animal helps it survive;
- make observations to collect data that can be used to make comparisons;
- identify multiple structures of a dog's body and their functions that help the dog survive and grow;
- test solutions for the human problem (which shoe is better) by mimicking an animal structure and the structure's function;
- give evidence that all structures of animals are related to their function;
- use the metacognitive strategy of determining what is important in text (see Appendix C) to help build and connect learning about the structures and functions of the dog; and
- identify key content vocabulary to increase knowledge and understanding so it becomes part of their usable language.

Science Storyline (make and use in your classroom)

Create a storyline chart and record student thinking for each chapter of the e-book. Sample answers for Chapter 1 are shown in the example chart on the next page...

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What special features of plants/animals can inspire solutions to human problems?					
Lesson Question	**Phenomena** What we see.	**Claim** What do we.	**Evidence** What we observed or measured.	**Human Solutions** How engineers copy nature.	**Wonderings** What new questions do we have?
What's special about dogs paws?	Dog running across a gravel driveway.	Dogs have padded paws to protect their feet.	The dog ran on gravel on its paw pads and it wagged it's tail.		

Vocabulary

As you read the word, write it on the board and make sure the students use it when they are talking.

- **Survive**: when an animal or plant has its basic needs met for food, water, and protection and goes on living.
- **Grow**: to get bigger over a period of time.
- **Structure**: part of a living organism that helps it survive and grow.
- **Function**: how a structure works to help an animal or plant survive and grow.
- **Evidence**: something you can see, hear, smell, touch, or taste, or use a tool to measure.
- **Animals**: living things that move on their own, eat, breathe, and have babies.

Extended Investigation/Mathematics Connections

Sort and Make A Graph
Problem Solving: Additive Comparison and Put Together/Takeaway Problem Type (Appendix D)

Structures Used for Protection

Animal Suggestions:

- **Feet**: dog, frog, deer, crocodile, spider
- **Fins**: fish, shark, whale, stingray
- **Wings**: bird, bees, bats

Find 12 pictures of different kinds of animals. Have students make a graph to sort the animals into groups based on how different structures would be used for protection. After making the graph, have students discuss why these structures would help protect the animal. Next ask math questions such as the ones below and have students show equations that would answer the questions.

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Chapter 2 Before Reading

Driving Question (Learning Target): What special features of plants and animals can inspire solutions to human problems?

Setting the Stage

Read the title of the chapter and ask students what it makes them think of. Do a Think-Pair-Share. See Appendix B for instructions.

Introduce the text by saying: DJ, Lisa, and José continue to play with the tennis ball, and this time it rolls up to a tree where they see a woodpecker.

Teacher Notes

In this chapter the kids witness the phenomenon of the woodpecker tapping on a tree. They will explore how structures and their functions work together to help the woodpecker survive and grow.

Students are also introduced to the idea that animals have body parts that capture and convey information needed for growth and survival. The animals respond to these inputs with behaviors. This is the concept of information processing. Students will observe that the woodpecker uses its senses like the kids use their senses. Information processing is when we gather information through our senses and then we respond based on the information we receive. For example, the woodpecker taps the tree and hears a solid sound. It knows there is no food under the bark so it taps somewhere else.

Information processing is a great opportunity to teach or reinforce cause and effect. See below for examples.

> Cause: A woodpecker pecks on a tree trunk and hears a hollow sound.
> Effect: The woodpecker knows there is food under the bark and keeps pecking until it finds a grub.
>
> Cause: A woodpecker sees an ant on a tree trunk.
> Effect: The woodpecker eats the ant.
>
> Cause: The kids hear a tapping sound.
> Effect: The kids look up to find out what the tapping sound is.

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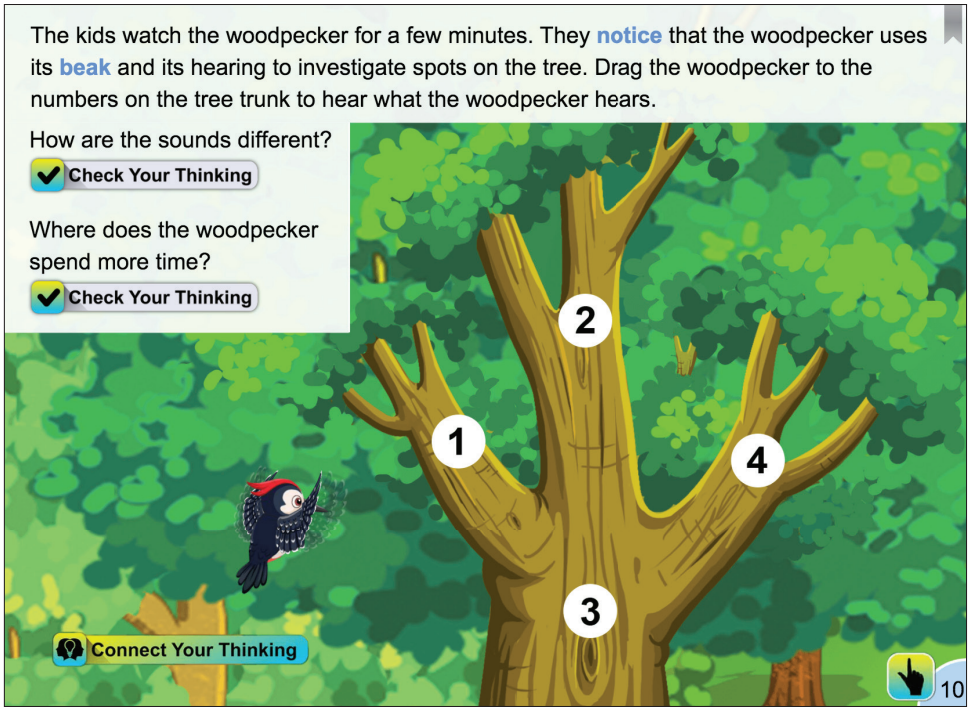

Students will interact with this page by selecting the spots on the tree and looking for patterns. Have them test each spot a couple of times to compare the sounds. Have students discuss what they noticed at each spot. Spots 2 and 3 sound different from spots 1 and 4. Spots 2 and 3 sound hollow.

> **Check Your Thinking answer**: Spots 1 and 4 have a solid sound. Spots 2 and 3 have a hollow sound.
>
> **Check Your Thinking answer**: The woodpecker spends more time in spots 2 and 3.

Ask students: Why do you think a woodpecker would tap on the tree? (Answers will vary but might include responses such as it is looking for food or it is building a nest.)

Ask students:

- What pattern did you notice? (Answer: The hollow sound is where the woodpecker found food, and there was no food where the woodpecker heard the solid sound.)
- What two structures did the woodpecker use to find food? (Answer: The two structures the woodpecker used to find food were its ears and beak. [This is the claim on the science storyline.])

Have students record their observations in the digital notebook.

> **Connect Your Thinking**: What **pattern** did you notice? What two structures did the woodpecker use to find food?

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Example chart:

Animal	Plant	Harms Plant	Helps Plant	Evidence
deer	cedar tree	X		eats the plant
rabbit	green bean	X		eats the plant
bee	dandelion		X	pollinates the plant

Note: In the next chapter students will learn that animals like deer and rabbits also help plants by carrying and spreading burdock fruit, or other seeds, to different areas.

> **Connect Your Thinking**: What animals do you think would harm the rosebush, and what animals do you think would help the rosebush?
> **Answer**: Animals that could harm the plant (might eat it) are deer, rabbits, and squirrels.

Animals that could help the plant (might pollinate it) are bees and spiders. (Pollen is transferred from the anther, the male part of a flower, to the stigma, the female part of a flower, and can be transferred among one plant or even to a nearby plant to fertilize it so it can make more flowers.)

Investigation

Materials:

- Scraps of canvas or leather.
- Washcloth or towel.
- Bubble wrap.
- Cardboard.
- Other materials that students could use to make a protective object for their hands.
- Dried bean, small rock, or rose stem.

Safety Notes

1. *Follow your school's safety procedures. You can also find recommendations at the beginning of this teacher's guide.*
2. *Students should wear eye protection (safety glasses or goggles) when participating in this activity.*
3. *If you choose to use the rose stem, students should NOT test their protective covering. The teacher should do the testing and describe what is felt.*

Students will be an engineer by generating and/or comparing multiple solutions to the problem of how they can prevent rosebush thorns from scratching their hands. Make a chart to fill in as students brainstorm all the possible solutions. Then compare their solutions and come to consensus about what would provide the best protection against rosebush thorns scratching hands. Record their choice in the digital notebook.

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Students will engage with this page by watching the video and looking for how the hooks and loops work. This video can be used as a Check Your Thinking activity, as it is cumulative of the learning that took place in this chapter.

Students will answer the "**Be An Engineer**" question by exploring alternative uses for Velcro. Discuss and record student thinking or brainstormed ideas. After students generate alternative uses for Velcro, use the extension activity below to investigate their recommendations .

Extension Investigation

Other Uses for Velcro

Materials:

- Adhesive-backed Velcro
- Classroom objects

Provide each student with a piece of adhesive-backed Velcro and challenge them to use it to solve a classroom problem. Students might create a pencil holder (because they keep losing their pencil), put a book on display (to share a great book everyone should read), create a display of class projects (so all students can share their work), make a holder for their glasses (so they don't keep dropping them), or develop a way for their papers to stop falling out of a folder (so they don't lose their papers).

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