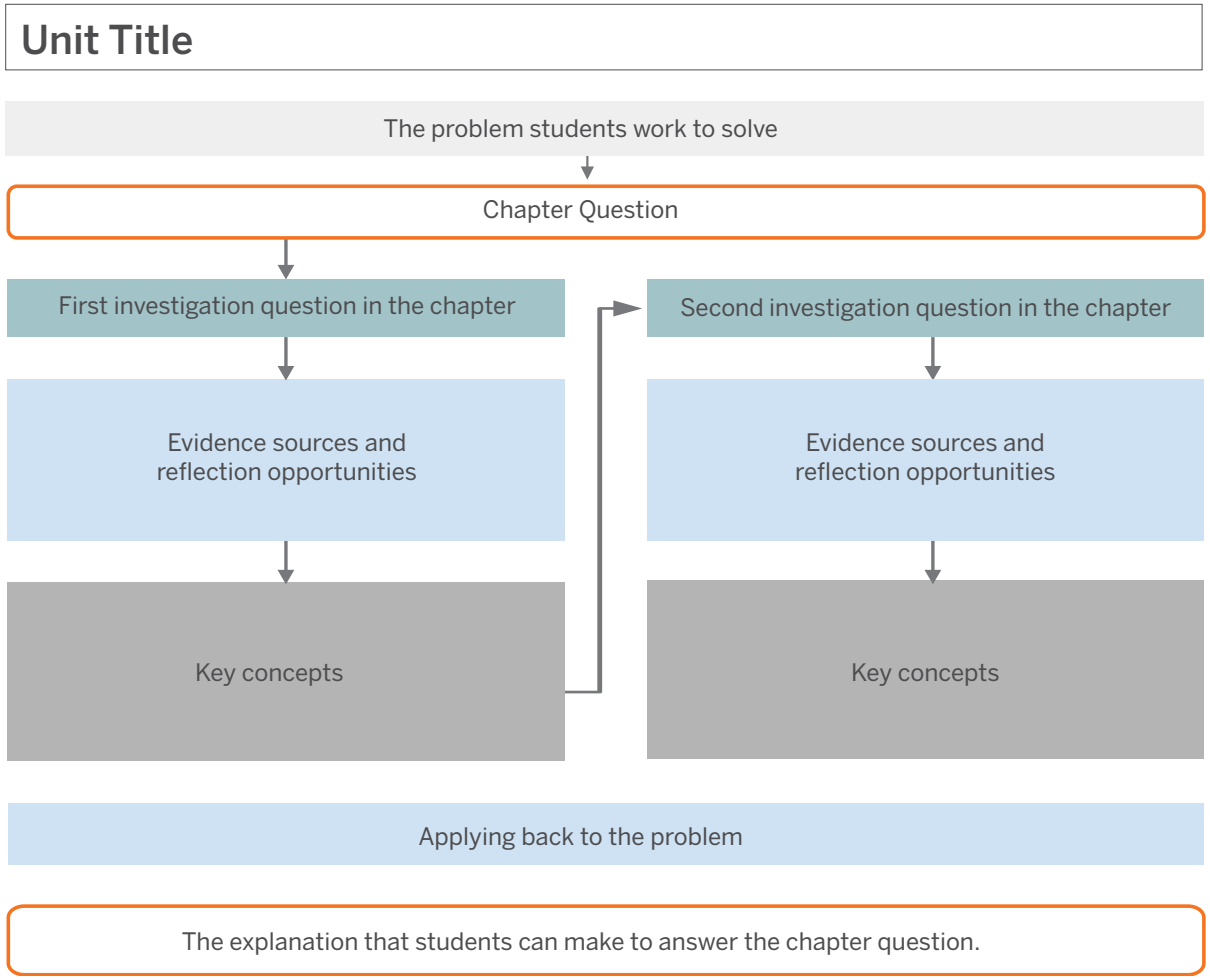
Vision and Light Coherence Flowchart

The storyline of the unit

In each Amplify Science unit, students figure out a phenomenon by asking questions, gathering evidence, and coming up with an explanation of how the phenomenon works. The Coherence Flowchart visually represents the storyline of the unit, showing the coherent flow of questions, evidence, and ideas that support students as they build complex explanations of the unit's anchor phenomenon. The Coherence Flowchart on the following pages (one chapter per page) can be used to see the connections between the questions that drive students' experiences, the evidence they gather, the ideas they figure out, and the new questions that those ideas generate. The diagram to the right explains the structure of a chapter in the Coherence Flowchart.

Note: The Coherence Flowchart is a tool for teachers and is not meant to be distributed to students.

Typical structure of one chapter in a Coherence Flowchart



Instruction is framed by questions about the unit's anchor phenomenon and the related problem students are solving. Chapter Questions then guide students in figuring out the phenomenon, piece by piece. Within each chapter, Investigation Questions focus students on a manageable piece of content that will help them figure out the Chapter Question. Each question motivates activities, and each activity provides specific evidence related to the Investigation Question. Students synthesize the understanding constructed over multiple activities, and this understanding is formalized through key concepts. Often a key concept leads students to an additional Investigation Question students need to pursue to answer the Chapter Question. At the end of the chapter, students' new understanding is applied back to the unit's anchor phenomenon and leads students to a new Chapter Question or a final explanation.

AmplifyScience

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Vision and Light: Investigating Animal Eyes

Problem students work to solve

Why is an increase in light affecting the health of Tokay geckos in a Philippine rain forest?

Chapter 1 Question

How does a Tokay gecko get information about its environment?

Investigation Question

How do animals use their senses to get information about their environment? (1.1-1.4)

Evidence sources and reflection opportunities

- Explore how senses help people get information about objects in their environment (1.2)
- Read *Investigating Animal Senses* (1.3)
- Investigate how information about objects can be blocked from the senses through a full-class demonstration (1.3)
- Observe videos of animals and plants using senses to help them survive (1.4)
- Investigate what is needed to see objects inside a Mystery Box (1.4)

Key concepts

- Animals have different structures that allow them to get information from their environment. (1.3)
- Sound and scent can carry information about the environment to an animal. (1.3)
- Animals have different structures that allow them to get information from their environment, which helps them survive. (1.4) (Revised from 1.3)
- Light, sound, and scent can carry information about the environment to an animal. (1.4) (Revised from 1.3)

Application of key concepts to problem

- Write about how animals get information from their environment (1.4)
- Discuss how a Tokay gecko gets information about its environment (1.4)

Explanation that students can make to answer the Chapter 1 Question

In order to survive, a gecko must avoid predators and find prey. To do this, geckos use structures to get information from their environment. For instance, a gecko uses its ears to hear if there is a predator nearby and its vision to watch for predators.

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Vision and Light: Investigating Animal Eyes

Problem students work to solve

Why is an increase in light affecting the health of Tokay geckos in a Philippine rain forest?

Chapter 2 Question

How does light allow a Tokay gecko to see its prey?

Investigation Question

How does light allow an animal to see something? (2.1-2.5)

Evidence sources and reflection opportunities

- Read about an animal's eye in *Handbook of Animal Eyes* (2.1)
- Use the Sim to investigate how light allows an animal to get information from its environment (2.1)
- Revisit the Chapter 1 Mystery Box investigation (2.2)
- Create digital models to show how light allows an observer to see something in the Mystery Box, and how the transfer of information can be blocked (2.2)
- Read *I See What You Mean* (2.3)
- Return to the Sim to further investigate how light allows an animal to get information from its environment (2.4)
- Critique inaccurate models about how light allows animals to see things (2.4)
- Model new ideas about the Mystery Box, using a digital tool (2.4)

Key concepts

- Light needs to get to an object for an animal to see the object. (2.3)
- Light needs to reflect off an object and get to the eye for an animal to see the object. (2.4)

Application of key concepts to problem

- Use Explanation Cards to discuss the Chapter 2 Question (2.5)
- Write explanations to answer the Chapter 2 Question (2.5)

Explanation that students can make to answer the Chapter 2 Question

First, light travels from a source to the gecko's prey. Then, it reflects off the prey and travels to the gecko's eyes. As it travels from the prey to the gecko's eyes, it carries information about the prey.

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Vision and Light: Investigating Animal Eyes

Problem students work to solve

Why is an increase in light affecting the health of Tokay geckos in a Philippine rain forest?

Chapter 3 Question

How does a Tokay gecko know that it is looking at its prey?

Investigation Questions

How do an animal's structures allow it to see its prey? (3.1-3.3)

How do animals know how to react when they get information about their environment? (3.3-3.5)

Evidence sources and reflection opportunities

- Observe sounds from African savannah (3.1)
- Use the Sim to investigate how eye and brain structures allow animals to see (3.1)
- Read about how various body structures function together to allow an animal to see in *Handbook of Animal Eyes* (3.1)
- Read and discuss *Crow Scientist* (3.2)
- Use the Sim to investigate how animals recognize different types of prey (3.3)

- Read about how animals know how to react when they get information about their environment in *Handbook of Animal Eyes* (3.3)
- Discuss reactions to images and sounds from an environment (3.4)
- Create digital models to represent how an animal gets information from its environment (3.4)
- Participate in Think-Write-Pair-Share about the Investigation Question (3.4)

Key concepts

- When scientists change only one variable in an investigation, they can figure out if it makes a difference. (3.2)
- Light receptors in the eye respond to light and send information to the brain. The brain processes this information to form an image. (3.3)

- After forming an image, the brain compares the image to memories. Then an animal can make a decision that could help it survive. (3.4)

Application of key concepts to problem

- Create models to show how animals process information from light (3.5)
- Use Explanation Cards to discuss how light, light receptors, and information processing allow a Tokay gecko to recognize its prey (3.5)
- Write explanations to answer the Chapter 3 Question (3.5)

Explanation that students can make to answer the Chapter 3 Question

Light from a source reflects off the prey and travels to the Tokay gecko's eyes. The light enters the eye through the pupil and then reaches light receptors. The light receptors respond to the light and send information from the light to the brain. The brain processes this information and forms an image. By comparing the image to memories, the gecko can recognize what it is looking at and make a decision that might help it survive.

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Vision and Light: Investigating Animal Eyes

Problem students work to solve

Why is an increase in light affecting the health of Tokay geckos in a Philippine rain forest?

Chapter 4 Question

How could more light at night make it hard for a Tokay gecko to see its prey?

Investigation Question

Why do different animals need different amounts of light to see well? (4.2-4.5)

Evidence sources and reflection opportunities

- Compare reaction of skink and Tokay gecko to light (4.1)
- Read *Seeing Like a Shrimp and Smelling Like a Snake* (4.1)
- Compare what diurnal and nocturnal animals see during day and night (4.2)
- Create digital models to show what different animals see under the same light conditions (4.2)
- Research how animals see in *Handbook of Eyes* (4.2)
- Use the Sim to investigate now different predators see their prey in different amounts of light (4.3)
- Use modeling tool to explore how light receptor sensitivity affects what an animal sees (4.4)
- Write about how light receptor sensitivity affects what an animal sees (4.4)

Key concepts

- Different animals can have light receptors with different sensitivities. The brain cannot form a clear image if there is too much or too little light for the type of receptors an animal has. (4.4)

Application of key concepts to problem

- Build and orally explain physical models of animal vision (4.5-4.6)
- Write explanations to answer the Chapter 4 Question (4.6)

Explanation that students can make to answer the Chapter 4 Question

When light gets to a Tokay gecko's eyes, the gecko's light receptors respond and send information to the brain. The brain processes this information to form an image. Since the highway lights were installed, there is much more light at night. Tokay geckos have light receptors that form clear images in very low-light conditions, so the extra light at night makes it difficult for them to form clear images of their prey.

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Vision and Light: Investigating Animal Eyes

Problem students work to solve in Chapter 5

How do human senses help humans survive in their environments?

Chapter 5 Question

How do our senses help us understand our environment?

Opportunities to engage in practices and apply key concepts

- Revisit *Investigating Animal Senses* to focus on the importance of controlling variables in an investigation (5.1)
- Plan how to investigate a human sense (5.1)
- Conduct an investigation of a human sense (5.2)
- Share investigation results (5.2)

Practice that students can do in response to the Chapter 5 Question

Students can more independently design an investigation that only changes one variable at a time to figure out how human structures and receptors inform our senses and help us survive.

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