

Variation in Traits

Lesson 4b: Explaining Variation in Traits in the Wild

Grade 3	Length of lesson: 45 minutes	Placement of lesson in unit: 4b of 7 two-part lessons on variation in traits
Unit central question: Do all of the mice living in the same environment, such as a field or forest, have an equal chance of surviving?		Lesson focus question: How can data help us explain why trait variations among desert beetles matter?
Main learning goal: Data from a model can be used as evidence to support ideas that explain why trait variations affect which individuals are more likely to survive longer than others in their environment.		
Science content storyline: Variations among individuals of the same kind of living thing mean that some individuals are more likely to survive longer than others in their environment. Data from a model can be used as evidence to support an explanation of how trait variations affect which individuals are more likely to survive. Critiquing and asking questions about one another’s ideas can help us develop the best explanation possible. Based on the data and evidence from a model, we can conclude that better-camouflaged individuals are most likely to survive longer in their environment.		
Ideal student response to the focus question: Data from the desert simulation can help us figure out which beetles will survive longer than other beetles in their environment. We can use this data to calculate how many of each color of beetle were eaten and how many survived. Then we can represent on a bar graph the number of beetles of each color that survived.		

Preparation

Materials Needed

- Science notebooks
- Chart paper and markers
- Colored pencils
- Class data table of desert-simulation results (from lesson 3b)

Student Handouts

- 4.1 Calculating the Fraction of Beetles (from lesson 4a)
- 4.2 Bar Graph of Beetles That Survived (from lesson 4a)

Ahead of Time

- Review the content background document, especially sections 3 and 4 on variation.
- **ELL support:** This lesson is heavily language based, so ELL students will need strong support to understand the content and participate in the activities. Introduce students to the lesson materials, structure, and content in advance so they know what’s expected of them and can follow along and participate. In particular, review both completed handouts from lesson 4a and what the results mean. Introduce the following vocabulary words: *affect*, *whether*, and *claim*, . As needed, review words from previous lessons, including *more/less likely*, *difference/variation*, *analyze*, *data*, *evidence*, *fractions*, and *bar graphs*. Note that in this lesson, the term *difference* has a meaning that is similar to *variation*.

Lesson 4b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	Link to previous lesson: Students share why they think fractions or bar graphs made it easier to understand data from the desert model.	
1 min	Lesson focus question: The teacher reviews the focus question from the previous lesson: <i>How can data help us explain why trait variations among desert beetles matter?</i>	
5 min	Setup for activity: The teacher reviews the focus question from lesson 3, <i>Why do trait variations among desert beetles matter?</i> Then students consider a revised focus question: <i>Do differences in the color of desert beetles affect whether they get eaten?</i> The teacher prepares students to write a claim that answers this question and support their ideas with evidence from their simulation data.	<ul style="list-style-type: none"> Data provide evidence that can help us explain which individuals are more likely to survive in their environment.
20 min	Activity: Students write claims that answer the revised focus question and support them with evidence from their simulation data. Then they critique one another's claims and evidence.	<ul style="list-style-type: none"> Critiquing and asking questions about one another's ideas can help us develop the best explanation possible about why some individuals are more likely to survive in their environment.
8 min	Follow-up to activity: Students revise their claims and evidence based on peer reviews. Then they share their revised claims and evidence and develop a summary statement for the revised focus question.	<ul style="list-style-type: none"> Better-camouflaged individuals that blend into their environment are more likely to survive longer in their environment. Our desert model showed which beetles were more or less likely to be eaten based on color variations. We used the simulation data as evidence to help us explain which colored beetles were more likely to survive.
5 min	Synthesize/summarize today's lesson: Students answer the focus question and consider how data can provide evidence that helps them explain why trait variations among desert beetles matter.	<ul style="list-style-type: none"> Data from a model can be used as evidence to support explanations of how trait variations affect which individuals in a population are more likely to survive in their environment.
1 min	Link to next lesson: The teacher announces that in the next lesson, students will investigate what happens if the beetles' environment changes.	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
5 min	<p>Link to Previous Lesson</p> <p>Synopsis: Students share why they think fractions or bar graphs made it easier to understand data from the desert model.</p>	Link science ideas with other science ideas.	<p>Show slides 1 and 2.</p> <p>At the end of our last lesson, you completed this statement:</p> <p><i>[Fractions/bar graphs] make it easier for me to understand the data from our desert model because _____.</i></p> <p>Raise your hand if you thought <i>fractions</i> made it easier to understand the data.</p> <p>What reasons did you give for your answer?</p> <p>NOTE TO TEACHER: <i>Invite one or two students to share their reasons.</i></p> <p>Now raise your hand if you thought <i>bar graphs</i> made it easier to understand the data.</p> <p>What reasons did you give for your answer?</p> <p>NOTE TO TEACHER: <i>Invite one or two students to share their reasons.</i></p> <p>ELL support: Reviewing the statement and students' responses before the lesson will help ELL students participate more fully in this discussion.</p> <p>Today you'll write a claim about how variation in the color trait of desert beetles affects their</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		Summarize key science ideas.	<p>survival.</p> <p>Last time we talked about how scientists include as much evidence as they can in their explanations so that other scientists can understand and trust the results of their investigations.</p> <p>Just like scientists, we want our claims and explanations to be as clear and complete as possible so that others can understand and trust our results.</p>		
1 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher reviews the focus question from the previous lesson: <i>How can data help us explain why trait variations among desert beetles matter?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 3.</p> <p>In this lesson, we'll continue thinking about our focus question from last time: <i>How can data help us explain why trait variations among desert beetles?</i></p> <p>The claims we work on today will help us answer this question in a more scientific way.</p>		
5 min	<p>Setup for Activity</p> <p>Synopsis: The teacher reviews the focus question from lesson 3, <i>Why do trait variations among desert beetles matter?</i> Then students consider a revised focus question: <i>Do differences in the color of desert beetles affect</i></p>	Make explicit links between science ideas and activities before the activity.	<p>In our last lesson, you analyzed the data we collected from our desert model in lesson 3. Then you calculated fractions for the number of beetles that were eaten and survived and used that data to create a bar graph showing number of desert beetles that survived in our simulation.</p> <p>Today you'll use this data to develop a claim about how color variations in desert beetles affect their survival. To support your claim, you can use evidence from the class data table, the fraction</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p><i>whether they get eaten?</i> The teacher prepares students to write a claim that answers this question and support their ideas with evidence from their simulation data.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Data provide evidence that can help us explain which individuals are more likely to survive in their environment. 		<p>calculations, or the bar graph, or any combination of these data sources.</p> <p>Locate the fraction and bar-graph handouts you completed last time and keep them handy as you work on your claims and evidence.</p> <p>NOTE TO TEACHER: <i>Have students locate their completed work from handouts 4.1 (Calculating the Fraction of Beetles) and 4.2 (Bar Graph of Beetles That Survived). Make sure the class data table of desert-simulation results from lesson 3b is displayed where everyone can see it.</i></p> <p>Show slide 4.</p> <p>Our focus question in lesson 3 was <i>Why do trait variations among desert beetles matter?</i></p> <p>For our investigation in this lesson, I'd like you to think about this revised question: <i>Do differences in the color of desert beetles affect whether they get eaten?</i></p> <p>I'd also like you to consider a follow-up question: <i>What data can we use as evidence to support our claim (answer)?</i></p> <p>Please write these two questions in your science notebooks.</p> <p>In a moment, you'll begin working on the answers</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>to these questions. First, you'll make a <i>claim</i> that answers the revised focus question. Then you'll use your data from the desert model as <i>evidence</i> to support your claim.</p> <p>NOTE TO TEACHER: <i>If students don't have prior experience with observations, claims, and evidence, spend some additional time helping them understand these terms and what they relate to. Observations are the things students can see, record, or measure when they are conducting an investigation or using a model. A claim is a statement that answers a question or explains data and observations. Evidence is data that helps to support a claim and is the reason for making the claim. The language used in this context should be the same as the language used with students when they engage in this process in English language arts and math.</i></p> <p>ELL support: Before the lesson, ask ELL students to share examples of observations, claims, and evidence from their lives. Discuss these examples and record them on chart paper for students to refer to during the lesson. This will help them understand what the terms mean and enable them to participate more fully in the lesson activity.</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
20 min	<p>Activity</p> <p>Synopsis: Students write claims that answer the revised focus question and support them with evidence from their simulation data. Then they critique one another's claims and evidence.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Critiquing and asking questions about one another's ideas can help us develop the best explanation possible about why some individuals are more likely to survive in their environment. 	Engage students in constructing explanations and arguments.	<p>Show slide 5.</p> <p>Let's begin writing our claims!</p> <p>The question your claim should answer is <i>Do differences in the color of desert beetles affect whether they get eaten?</i></p> <p>Show slide 6.</p> <p>First, write the word <i>Claim</i> at the top of a clean page in your science notebooks. Then look at the results of our desert simulation, including our class data table from lesson 3 and the fractions and bar graph from our last lesson. Think about how this data helps answer this question.</p> <p>Then write a sentence in your notebooks that you think answers the question. This statement will be your claim. Claims are based on data and evidence, so use the data from our desert simulation as evidence to support your claim.</p> <p>ELL support: Consider allowing ELL students to discuss the data and possible answers to the question with a shared-language partner before writing a claim in their science notebooks.</p> <p>You may use one of the sentence starters on the slide to help you write your claim.</p> <p><i>Differences in the color of desert beetles</i></p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p><i>do affect whether they get eaten because ____.</i></p> <p><i>Differences in the color of desert beetles do not affect whether they get eaten because ____.</i></p> <p>ELL support: Use this starter-sentence approach with ELL students during the lesson preview. Discuss students' ideas for completing the sentence starters and record possible responses on chart paper. Then ask students to choose one of the sentence starters and responses from the list to write in their notebooks. This kind of linguistic scaffolding can be used for constructing a claim as well as including evidence to support the claim.</p> <p>Show slide 7.</p> <p>Next, you'll use evidence from our desert model to support your claim.</p> <p>In your notebooks, underneath your claim, write the word <i>Evidence</i>. Then list the information, data, and observations from our desert simulation that prove your claim is right. Try to include as much evidence as you can to support your claim.</p> <p>Student work time.</p> <p>NOTE TO TEACHER: <i>If your students haven't had prior experience with evidence, discuss what evidence is and give them an example. Make sure students list evidence from the desert model (e.g.,</i></p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		Engage students in communicating in scientific ways.	<p><i>the data table from lesson 3 and the fraction calculations and bar graph from lesson 4a) rather than evidence from other sources.</i></p> <p>Show slide 8.</p> <p>When scientists want to explain something they’re investigating, they talk about their ideas with other scientists. Sharing ideas helps them develop the best possible explanations. When scientists share their ideas, they communicate in scientific ways.</p> <p>In a moment, you’ll pair up with a partner to share your claims and evidence. I want you to talk about your ideas like scientists, so let’s review what it means to communicate in scientific ways.</p> <p>NOTE TO TEACHER: <i>Highlight the key actions on the CSW poster that you want students to implement as they share their claims and evidence with a partner.</i></p> <p>ELL support: ELL students would benefit greatly from a review of this poster before the lesson.</p> <p>First, let’s talk about the fifth action on the chart: “Give evidence for your idea or claim.”</p> <p>What is the symbol for this action?</p>	A magnifying glass.	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>Now look at the sentence starters on the chart. How might a scientist start a sentence when he or she gives evidence?</p> <p>As you present your claim and evidence to your partner, try to use these sentence starters to state your ideas clearly. I'll add an arrow pointing to this row to remind you of the sentence starters you can use to share your ideas.</p> <p>Next, look at the row that says, "Listen to others' ideas and ask clarifying questions."</p> <p>What is the symbol for this action?</p> <p>Why do you think this symbol is used?</p> <p>Now look at the questions a scientist might ask to better understand other scientists' ideas. What sentence starters are listed on this row?</p>	<p>My evidence is ... The reason I think that is ...</p> <p>I think it's true because ...</p> <p>An ear.</p> <p>Because it reminds us to listen.</p> <p>Are you saying that ...?</p> <p>What do you mean when you say ...?</p> <p>What is your evidence?</p>	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>I'll add an arrow pointing to this row to remind you of the questions you can ask to help you understand your partner's ideas.</p> <p>Finally, look at the row that says, "Agree or disagree with other's ideas."</p> <p>What are the symbols for this action and what do they mean?</p> <p>What are the sentences a scientist might use to agree or disagree with an idea? Who can give us an example of how you might complete these statements.</p> <p>I'll add another arrow pointing to this row as a reminder of what to say if you agree or disagree with your partner's ideas.</p> <p>Show slide 9.</p> <p>Turn and Talk: Now pair up with an elbow partner and share your claims and evidence with each other. As you discuss your ideas, make sure to use the sentence starters on our Communicating</p>	<p>Can you say more about ...?</p> <p>The thumb pointing up means you agree with an idea, and the thumb pointing down means you disagree.</p>	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>in Scientific Ways poster.</p> <p>NOTE TO TEACHER: <i>If you feel it might be helpful, start off the activity by modeling for students how to present a claim and evidence, ask questions, and critique ideas and evidence.</i></p> <p><i>Allow adequate time for pairs to discuss their claims and evidence. As you circulate around the room during this activity, remind students to communicate in scientific ways using the sentence starters on the poster.</i></p> <p>ELL support: To make sure ELL students understand what’s expected of them, explicitly model how to present a claim and evidence that answers the revised focus question. Also demonstrate the kinds of questions to ask and how to critique ideas and evidence. Explicitly model critiquing dos and don’ts for students. Have students practice presenting their claims and evidence before the lesson, if possible. Have one partner read her or his claim and evidence; then have both partners discuss the first partner’s ideas. Then switch roles so the second partner has a turn. Be sure to discuss both partners’ work.</p>		
8 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students revise their claims and evidence based on peer reviews. Then they share their</p>	Engage students in constructing explanations	<p>Show slide 10.</p> <p>Now that you’ve discussed your ideas for answering our revised focus question, think about any changes you would like to make to your claims based on your partners’ feedback.</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>revised claims and evidence and develop a summary statement for the revised focus question.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Better-camouflaged individuals that blend into their environment are more likely to survive longer in their environment. Our desert model showed which beetles were more or less likely to be eaten based on color variations. We used the simulation data as evidence to help us explain which colored beetles were more likely to survive. 	<p>and arguments.</p>	<p>Take a few minutes now to make any changes you want to make. You can add something to your claims and evidence, remove something, or make other changes you think will improve your explanation or strengthen your evidence.</p> <p>Be sure to make any changes using a different-colored pencil. This will help you keep track of how your thinking has changed.</p> <p>Individual work time.</p> <p>Show slide 11.</p> <p>Whole-class discussion: Let’s hear a few of your revised claims for answering the question, <i>Do differences in the color of desert beetles affect whether they get eaten?</i> For now, just share your claim, not your evidence.</p> <p>NOTE TO TEACHER: <i>Invite two or three students to share their revised claims. At this point, have them share only their claims, not their evidence. They’ll share their evidence when they answer the follow-up question about the data they can use as evidence to support their claims.</i></p> <p>ELL support: Give ELL students an opportunity to practice sharing their claims during the lesson preview.</p> <p>Can we all agree on the ideas that answer our</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>revised focus question? How could we express these ideas in a single claim?</p> <p>NOTE TO TEACHER: <i>If time allows, combine student claims into a single claim, using their wording. For example: “Based on the data and evidence from our model, beetles that are better camouflaged are less likely to get eaten and more likely to survive longer in their desert environment.”</i></p> <p>Show slide 12.</p> <p>Now let’s hear your ideas for answering our second question, <i>What data can we use as evidence to support our claim (answer)?</i></p> <p>ELL support: Give ELL students an opportunity to practice answering this question during the lesson preview so they know what’s expected of them and how to participate.</p> <p> <i>Embedded Assessment Task</i></p> <p>NOTE TO TEACHER: <i>Consider using the claim and evidence discussion as an embedded assessment task to assess students’ understandings of the lesson content and provide feedback.</i></p> <p><i>If you would like students to write a complete</i></p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<i>explanation of their claims and evidence in paragraph format, consider doing this during the English language arts segment.</i>		
5 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students answer the focus question and consider how data can provide evidence that helps them explain why trait variations among desert beetles matter.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Data from a model can be used as evidence to support explanations of how trait variations affect which individuals in a population are more likely to survive in their environment. 	<p>Highlight key science ideas and focus question throughout.</p> <p>Engage students in making connections by synthesizing and summarizing key science ideas.</p>	<p>Show slide 13.</p> <p>The focus question we've been exploring over the past two lessons is <i>How can data help us explain why trait variations among desert beetles matter?</i></p> <p>ELL support: Review the summary questions with ELL students in advance. Engage them in thinking through the meaning of the questions and how they might answer them.</p> <p>What data did we use today to help us explain why trait variations among desert beetles matter?</p>	<p>We used the data about how many beetles of different colors were eaten or not eaten.</p> <p>In our class data table, in our fraction handout, and on our bar graph.</p> <p>We used our fractions to see if more beetles of one color were eaten or if more survived.</p>	<p>Where did you find that data?</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>How did the data from our desert model help us explain why <i>color variations</i> among desert beetles matter?</p> <p>So based on our data, do trait variations among desert beetles matter? Why or why not?</p>	<p>The data made it easier to see which colored beetles survived and which were eaten.</p> <p>The data showed us how many beetles of different colors were eaten and not eaten.</p> <p>Yes, they matter a lot because the beetles with colors that blend into their environment better are more likely to survive, and the ones that don't blend in as well are more likely to get</p>	<p>How did the data help you see that?</p> <p>How did knowing the number of beetles help you explain what happened?</p> <p>Can anyone add to these ideas?</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
				eaten.	
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher announces that in the next lesson, students will investigate if the beetles' environment changes.</p>	Link science ideas to other science ideas.	<p>Show slide 14.</p> <p>In our next lesson, we'll investigate what happens if the beetles' environment changes.</p>		