

Variation in Traits

Lesson 3b: Variation at Work in the Wild

Grade 3	Length of lesson: 45 minutes	Placement of lesson in unit: 3b 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: Why do trait variations among desert beetles matter?
Main learning goal: Within a species, trait variations affect which individuals survive longer than others in their environment.		
Science content storyline: In the wild, living things of the same kind show variation in traits. Models can help us predict how trait variation will affect the predator-prey relationship in a specific environment. These models show how differences, or variations, in certain traits help some living things survive better than others in their environment.		
Ideal student response to the focus question: Variation in a trait means that some individuals are more likely to survive than others. For example, some prey organisms blend into their environment better because of their color. The individuals that blend in are more likely to survive than those that don't blend in very well.		

Preparation

Materials Needed

- Science notebooks
- Chart paper and markers
- *For desert-model simulation (1 set per class):*
 - Piece of fabric approximately 22" × 28"
 - 45 colored pom-poms, 7 mm or 10 mm in size (9 pom-poms of each color: red, yellow, brown, green, and black)
 - 5 cups, approximately 8 ounces each

Student Handouts and Teacher Masters

- 3.1 Using the Desert Model (Teacher Master) (from lesson 3a)
- 3.3 Beetles in the Desert—Analogy Map (1 per student)
- 3.4 Beetles in the Desert—Analogy-Map Answer Key (Teacher Master)

Ahead of Time

- Review the content background document, especially sections 3 and 4 on variation.
- Review the simulation instructions on handout 3.1 (Using the Desert Model). Create a class data table on chart paper and post it where students can easily refer to it during the simulation. (See the sample data table in the handout.) Also list the rules from the handout on chart paper and display them in a prominent location.
- Create a space for the class simulation and lay out the fabric.
- **ELL support:** This lesson is heavily language based, so ELL students will need strong support to succeed in understanding the content and participating in the activities. Introduce students to the lesson materials, structure, and content in advance so they know what's expected of them and can participate. In particular, review the desert model and what the materials represent. Also walk students through the simulation instructions and give them an opportunity to practice the simulation. Show students how to complete the analogy map (handout 3.3) as well. Introduce the following vocabulary words and make sure ELL students understand what they mean: *limitations* (of the model), *represent*, *predator/prey*, *organisms*, *camouflage*, and *more/less likely*. Review the following words as needed: *model*, *population*, *simulation/simulated*, *pom-poms*, *fabric*, *lizards*, *beetles*, *desert*, and *environment*.

Lesson 3b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
6 min	Link to previous lesson: Students share their predictions from the previous lesson about whether some beetles will survive longer than others in their environment.	<ul style="list-style-type: none"> Living things of the same kind show variation in their traits. This might affect which individuals are more likely to survive in their environment.
1 min	Lesson focus question: The teacher reviews the focus question from the previous lesson: <i>Why do trait variations among desert beetles matter?</i>	
6 min	Setup for activity: The teacher reviews the desert model and prepares students for the simulation.	<ul style="list-style-type: none"> Variation in color could affect which desert beetles survive longer than others in their environment.
10 min	Activity: Students perform a simulation of the story about desert beetles from the previous lesson.	<ul style="list-style-type: none"> Variation in color enables some desert beetles to survive longer than others in their environment.
15 min	Follow-up to activity: Students use an analogy map to make sense of the simulation and how it relates to the story about desert beetles.	<ul style="list-style-type: none"> Models can help us determine how trait variation affects the relationship between predators and prey in their environment.
6 min	Synthesize/summarize today's lesson: The teacher revisits the focus question. Then students answer the question by completing statements that summarize their current ideas and understandings.	<ul style="list-style-type: none"> Variation in a trait among living things of the same kind can affect which individuals survive in their environment and which don't.
1 min	Link to next lesson: The teacher informs students that in the next lesson, they'll continue working with their simulation data and learn how to represent it in different ways.	

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6 min	<p>Link to Previous Lesson</p> <p>Synopsis: Students share their predictions from the previous lesson about whether some beetles will survive longer than others in their environment.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Living things of the same kind show variation in their traits. This might affect which individuals are more likely to survive in their environment. 	Ask questions to elicit student ideas and predictions.	<p>Show slides 1 and 2.</p> <p>In our last lesson, you made some predictions about what might happen to beetles in the desert, and then you revised them based on the ideas we shared in a class discussion.</p> <p>Let’s hear some of your revised predictions. How did you answer the question, <i>Do you think some beetles will survive longer than other beetles in our desert environment? List one or two reasons why you think some beetles might or might not live longer than other beetles.</i></p> <p>Which beetles might the lizard eat first? Which beetles might the lizard eat last?</p> <p>Use the sentence starter on the slide when you share your ideas.</p> <p><i>I predict that some beetles [will/won’t] survive longer than others in our desert environment because _____.</i></p> <p>ELL support: Prepare ELL students in advance for sharing their revised predictions and ideas with the class. This will help make their thinking visible during the lesson.</p> <p>NOTE TO TEACHER: <i>At this point, listen to students’ ideas without trying to correct them.</i></p>	I predict that some beetles will survive longer than others because they can run faster than other beetles. The beetles that run faster will survive longer because they can get	

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			<p><i>Record predictions on chart paper so you can refer to them following the simulation.</i></p>	<p>away from the lizard.</p> <p>No, the color doesn't matter. What matters is whether a beetle can run fast.</p> <p>I predict that the brown beetles will survive longer because the lizard might not see them.</p> <p>They can hide because look like the sand in the desert.</p> <p>I predict that the beetles that are farther away from the lizard will survive longer because the lizard can't reach them.</p>	<p>Does the variation in the beetles' color matter?</p> <p>Tell me more about the lizard not seeing the brown beetles.</p> <p>What do you mean by "farther away"? Are you thinking about our model or the actual desert?</p>
1 min	Lesson Focus Question		Show slide 3.		

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	<p>Synopsis: The teacher reviews the focus question from the previous lesson: <i>Why do trait variations among desert beetles matter?</i></p>	<p>Set the purpose with a <u>focus question</u> or goal statement.</p>	<p>Our focus question for this lesson is the same as last time: <i>Why do trait variations among desert beetles matter?</i></p> <p>We know from our story about beetles and our investigations of ladybugs and plants that living things show variation in their traits. But do those variations matter, and if so, why?</p> <p>To figure this out, we'll use the desert model we talked about last time to simulate what might happen to beetles in their environment.</p> <p>The data we collect will not only tell us <i>whether</i> trait variation matters but <i>why</i> it matters.</p>		
6 min	<p>Setup for Activity</p> <p>Synopsis: The teacher reviews the desert model and prepares students for the simulation.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Variation in color could affect which desert beetles survive longer than others in their environment. 	<p>Make explicit links between science ideas and activities before the activity.</p> <p>Select content representations and models matched to the learning goal and engage students in</p>	<p>Show slide 4.</p> <p>Are you ready to test your predictions about what might happen to the desert beetles?</p> <p>Let's gather around the fabric and review the roles and rules for the simulation so we're clear about how to use our model.</p> <p>NOTE TO TEACHER: <i>Since you discussed the model in the previous lesson, this should be a quick review. First, revisit the roles and answer any questions. Next, ask students what each part of the model represents. Then point to the list of rules you posted on chart paper and run through the simulation guidelines. As needed, refer to</i></p>		

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		their use.	<p><i>handout 3.1 (Using the Desert Model). Also draw students' attention to the class data table you created for recording the simulation results.</i></p> <p>Show slide 5.</p> <p>First, let's quickly walk through each of the roles.</p> <p>Show slide 6.</p> <p>Now let's review what each part of the model represents.</p> <p>What does our desert model represent?</p> <p>NOTE TO TEACHER: <i>You may want to record student responses to the review questions on chart paper and post them in a central place so that students can refer to them during the simulation.</i></p> <p>What does the fabric represent?</p> <p>What does each colored pom-pom represent?</p> <p>How will our student lizards hunt for beetles and eat them?</p>	<p>The model shows what might happen to the beetles in real life.</p> <p>The fabric represents the desert where the beetles and lizards live.</p> <p>Each pom-pom represents a beetle of a different color.</p> <p>They'll use their</p>	

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			<p>What does the cup represent?</p> <p>NOTE TO TEACHER: <i>After this review, assign roles (lizards, counters, recorder, observers) and tell students where to position themselves around the fabric. Lizards should sit in a circle around the fabric. Counters and observers should sit in a larger circle around the lizards, and the recorder should stand by the data table.</i></p> <p>Next, I'll assign each of you a role. Five of you will be lizards, five of you will be counters, one student will be our recorder, and the rest of you will observe. Counters, I'll also assign you a specific pom-pom color to keep track of during the simulation.</p> <p>OK, now that everyone knows their role, let's get in our positions around our fabric desert.</p> <p>Lizards, please close your eyes and don't open them until I give the command to hunt. Remember, after you grab a pom-pom beetle, put it in your cup and close your eyes again until you hear me give the command to hunt.</p> <p>NOTE TO TEACHER: <i>Make sure all lizards have their eyes closed; then spread the pom-poms across the fabric and instruct the counters to</i></p>	<p>thumbs and index fingers like mouths to grab the beetles and eat them.</p> <p>The lizard's stomach.</p>	

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			<p><i>count the number of pom-poms in their assigned colors and report the result to the recorder.</i></p> <p>Counters, please count the number of pom-pom beetles in your assigned color and report that number to the recorder one at a time. Recorder, as the counters report their numbers, please fill in the first row on our class data table.</p> <p>Are there any questions about how to use our desert model before we begin?</p> <p>Counters, at the end of the round, you'll report the total number of beetles in your color that are still on the fabric, and the recorder will write this information on the data table.</p>		
10 min	<p>Activity</p> <p>Synopsis: Students perform a simulation of the story about desert beetles from the previous lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Variation in color causes some desert beetles to survive longer than others in their environment. 	<p>Select content representations and models matched to the learning goal and engage students in their use.</p>	<p>OK, let's begin our simulation!</p> <p>Lizards, ready, set, HUNT!</p> <p>NOTE TO TEACHER: <i>Engage lizards in six hunts to complete the round. Then direct the counters to count how many pom-pom beetles in their assigned colors are still on the fabric. Then have each counter report this information to the recorder. Make sure the recorder writes the numbers accurately on the class data table. If time allows, you might have students change roles and conduct a second round of hunts. Be sure to create another table for this data and have students compare and contrasts the two different rounds. Alternatively, you can create the</i></p>		

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		<p>Make explicit links between science ideas and activities during the activity.</p> <p>Engage students in analyzing and interpreting data and observations.</p>	<p><i>original table with split rows to accommodate more than one round.</i></p> <p>Show slide 7.</p> <p>Let’s revisit our predictions about whether some beetles would live longer than other beetles in our desert environment.</p> <p>Look at the revised predictions you wrote in your notebooks. Then compare your predictions with the results on our class data table. Think about the questions on the slide.</p> <p>Does your prediction match what happened in our simulation? What is your evidence?</p> <p>NOTE TO TEACHER: <i>Give students time to compare their predictions from the previous lesson with the results on the class data table.</i></p> <p>ELL support: You may want to have ELL students pair up and discuss this comparison with shared-language partners before the class discussion.</p> <p>So how many of you made predictions that matched what actually happened in our simulation?</p> <p>Let’s hear some of your predictions. Make sure to include the evidence from our data table that</p>		

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			<p>supports your prediction.</p> <p>NOTE TO TEACHER: <i>Don't spend too much time on this discussion, since students will have an opportunity to engage in more sensemaking in lesson 4.</i></p>		
15 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students use an analogy map to make sense of the simulation and how it relates to the story about desert beetles.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Models can help us determine how trait variation affects the relationship between predators and prey in their environment. 	<p>Select content representations and models matched to the learning goal and engage students in their use.</p> <p>Engage students in analyzing and interpreting data and observations.</p>	<p>Show slide 8.</p> <p>To connect what happens in the real world to our model, we're going to use a special kind of chart called an <i>analogy map</i>.</p> <p>NOTE TO TEACHER: <i>Distribute handout 3.3 (Beetles in the Desert—Analogy Map). Walk students through the sample row so they know how to complete the remaining rows. Point out that a few of the cells in these rows are filled in to draw their attention to some key features of the model. You may need to work through one or two rows with students as part of a class discussion to help them understand how to complete the rest of the analogy map.</i></p> <p>ELL support: Orient ELL students to the analogy-map activity in advance and complete one or two sample rows with them to make sure they understand how to complete the worksheet during the actual lesson.</p> <p>You'll notice that the first row on the handout has already been completed for you. Let's go through that example so you understand what to do for the</p>		

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			<p>rest of the rows.</p> <p>Now work on your own to complete the rest of the worksheet. Notice that some cells are already filled in for you to highlight important parts of our model.</p> <p>After you finish the remaining three rows, you can add another part of the model to the blank row at the bottom of the table and analyze it too.</p> <p>NOTE TO TEACHER: <i>Circulate around the room as students complete the analogy map and answer any questions they may have. Make sure to allow adequate time for this activity. Then lead a class discussion to review students' answers for the remaining rows.</i></p> <p>Whole-class discussion: Let's have a few of you share your maps with the class. Make sure to explain why you think part of the model is like part of the real world.</p> <p>NOTE TO TEACHER: <i>It's important that students understand why each part of the model is like the real world, so spend plenty of time discussing their reasons in the final column. Students may share other ideas related to why parts of the model and the real world are alike. These ideas are acceptable as long as students can justify them.</i></p> <p><i>Following the discussion, review the solution</i></p>		

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			<p><i>from handout 3.4 (Beetles in the Desert—Analogy-Map Answer Key). You may want to display it on a document reader.</i></p> <p>ELL support: Be explicit about how the different parts of the model relate to the real world. To make sure that ELL students have understood the simulation and the analogy-map activity, you want to meet with them after the lesson and engage them in a follow-up discussion.</p> <p>Show slide 9.</p> <p>Now that you’ve had an opportunity to think about the parts of our desert model and what they represent in the real world, let’s discuss the strengths and the limitations of the model.</p> <p>For example, one of the strengths of this model might be that the pom-poms are the same colors as the beetles in the story and in real life. A limitation might be that lizards in real life wouldn’t eat only six beetles.</p> <p>What ideas do you have about the strengths and limitations of the model?</p> <p>NOTE TO TEACHER: <i>If students, including ELL students, have previous experience critiquing models, you might want to have them pair up for this activity.</i></p>		

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			<p><i>Make sure to discuss why each student’s example is a strength or limitation of the model. If students bring up aspects of real life that the model can’t assess, such as how fast the beetles run or how far away they are from the lizards, address these limitations as well.</i></p> <p>ELL support: If you made a list on chart paper of the traits students mentioned earlier, referring to it here might help them make stronger connections.</p>		
6 min	<p>Synthesize/Summarize Today’s Lesson</p> <p>Synopsis: The teacher revisits the focus question. Then students answer the question by completing statements that summarize their current ideas and understandings.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Variation in a trait among living things of the same kind can affect which individuals survive in their environment and which don’t. 	<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 10.</p> <p>Let’s revisit our focus question for today, <i>Why do trait variations among desert beetles matter?</i></p> <p>Answer this question in your science notebooks using the sentence starters on the slide.</p> <ul style="list-style-type: none"> • <i>Variations among desert beetles matter because _____.</i> • <i>The model showed that variations in the beetles’ color matter because _____.</i> <p>Support your reasons using evidence from today’s simulation and the story we read in our last lesson. Try to include scientific words in your answers.</p> <p>ELL support: Preview the sentence starters with ELL students ahead of time and give them an opportunity to practice completing the statements</p>		

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			<p>so they're prepared to participate during the lesson.</p> <p> Embedded Assessment Task</p> <p>NOTE TO TEACHER: <i>A class discussion may be used as an embedded assessment task to gauge student understandings of traits and variations from using the model. Have students share one of their completed sentences from the analogy map and note any misconceptions or inaccuracies in student thinking that will need to be addressed in the next lesson.</i></p> <p>ELL support: If you have a class discussion following the activity to assess student thinking, let ELL students know in advance that you'll be asking them to share one of their completed sentences with the class.</p>		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher informs students that in the next lesson, they'll continue working with their simulation data and learn how to represent it in different ways.</p>	Summarize key science ideas.	<p>Show slide 11.</p> <p>Today we used a model to test your predictions about whether some beetles would survive longer than others in our desert environment.</p> <p>We discovered that variation in the color trait of beetles really does matter because the lizards ate more of the beetles that didn't blend into their environment very well.</p> <p>Next time, we'll use the data from our desert</p>		

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			model in some different ways to help us explain what can happen in the real world when living things of the same kind show trait variations.		