

NGSS Connections

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Natural Products

Grade Level: Middle School

Performance Expectations: Students' ability to complete the following performance expectation(s) will be supported by participation in this activity.

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Dimension	NGSS Code or citation	Corresponding student task in activity
Disciplinary Core Idea	LS2.A Interdependent Relationships in Ecosystems <ul style="list-style-type: none"> • Species involved in competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and non-living are shared. 	Students study natural products, which are produced by plants as a chemical defense against predators and to ward off infections.
	ETS1.B Developing Possible Solutions <ul style="list-style-type: none"> • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. 	Students work to find a solution to the disease problem of one village using a systematic approach and evidence to support their proposed solution.
Practice	Asking Questions and Defining Problems <ul style="list-style-type: none"> • Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. • Ask questions to identify and/or clarify evidence and/or the premise of an argument. 	Students ask questions to determine what could be causing the diarrhea in Village B. They ask additional questions to clarify information, such as understanding the significance of intermarriage and understanding how maintaining the same sanitation between two villages (one afflicted with diarrhea and the other healthy) in studying the problem.
	Planning and Carrying out Investigations	Students either plan their own investigation or order protocol steps in sequence in order to determine if some foods possess natural products that would kill

	<ul style="list-style-type: none"> Plan an investigation individually and collaboratively and in the design identify independent and dependent variables and controls, what tools are need to do the gathering, how measurements will be recorded, and how many data are need to support a claim. 	<p>bacteria. In both cases, students identify independent and dependent variables and controls, and determine what measurements and data are taken and how those measurements and data will be taken.</p>
	<p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze and interpret data to provide evidence for phenomena. Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). 	<p>Students analyze and interpret the data for evidence to infer if the foods contain natural products, and if so, if those foods could help cure Village B of diarrhea.</p> <p>Students determine the number of trials for their investigation and any variance in data collected across the class, then discuss data limitations. Also, some student groups consider that the investigation used one microorganism, and consider how other microorganisms might respond to the natural products present. The use of one microorganism in this investigation serves as a limitation.</p>
Crosscutting Concept	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Proportional relationships (e.g., speed as the ration of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. 	<p>Students consider the ratio of bacterial suspension to plant extract as they work through the lab protocols. Students also consider the concentration of the natural product (i.e., amount of plant used to make the extract) and may consider how dilution or ratio change might affect the bacteria's response.</p>
	<p>Systems and System Models</p> <ul style="list-style-type: none"> Students learn that models are limited in that they only represent certain aspects of a system under study. 	<p>Some student groups discuss that they used a single species of microorganism as a model for the effects of natural products. This is a limit to the investigation.</p>
<u>Nature of Science</u>		

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurements and observation.

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations.

Scientific Knowledge is Open to Revision in Light of New Evidence

- Scientific explanations are subject to revision and improvement in light of new evidence.

Connections to [Common Core State Standards](#)

English Language Arts/Literacy

RST.6-8.3

RST.6-8.4