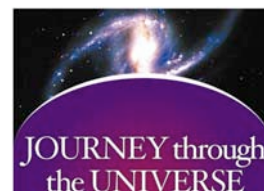


Introduction to the *Journey through the Universe* Program and the *Earth Systems Science* Module's Grade 5-8 Lessons



1. The Program

Journey through the Universe (<http://journeythroughtheuniverse.org>) is a national science education initiative that engages *entire* communities—students, teachers, families, and the public—using education programs in space exploration and the space sciences to inspire and captivate. The initiative embraces the notion that—*it takes a community to educate a child*.

Journey through the Universe programming is tailored to a community's strategic needs in science, technology, engineering, and mathematics (STEM) education, and is a framework for partnership between school districts, museums and science centers, colleges and universities, civic and business organizations, and the public. The cornerstone philosophy for all programming is—*inspire... then educate*.

2. The Grade K-12 *Earth Systems Science* Education Module

Earth Systems Science is one of several Education Modules developed for the *Journey through the Universe* program. The Module contains activities at three grade levels (K-4, 5-8, 9-12). Each grade level package is called an **Education Unit**. Each Unit contains lessons comprised of content overviews, inquiry-based hands-on activities, assessment rubrics, resource listings, student worksheet masters, and answer keys.

The *Earth Systems Science* Education Module focuses on the interactions of Earth's four systems: biosphere, atmosphere, hydrosphere, and geosphere. The biosphere encompasses all life, from complex human beings to single-celled organisms. The atmosphere is the shell of gases surrounding the Earth. We live at the bottom of this dynamic ocean of air, which exhibits meteorological phenomena—weather—on both local and global scales. The gaseous water in the atmosphere—together with all Earth's water in every form: solid, liquid, and gas—comprise the hydrosphere. Finally, the vast rocky and metallic bulk of the Earth is defined as the geosphere.

Each of these systems is remarkably dynamic over both long and short timescales. It is also the case that no one system stands alone. Complex processes that shape and define the Earth we know are the means by which these four systems interact with one another. One cannot, for instance, study weather in the atmosphere, or atmospheric evolution, without understanding the dramatic impact on weather from processes involving the geosphere, hydrosphere, and biosphere.

The lessons contained in this Education Module, at every grade level, explore the nature of Earth's systems, and demonstrate that observed phenomena on Earth are not unique to a particular system but arise from the interaction of these systems. And a true understanding of any phenomenon requires an understanding of all four systems. It is a systems approach to Earth science.

The lessons were developed from the ground up from national science education standards and benchmarks. Lessons target core standards and benchmarks through inquiry-based, hands-on activities whose objective is deep conceptual understanding of both content and process.

3. The *Earth Systems Science* Grade 5-8 Lessons

This document provides a description of each lesson and the embedded inquiry-based activities for the *Earth Systems Science* **middle school (grade 5-8)** Education Unit. Also provided are connections to grades 5–8 National Science Education Standards.

EARTH SYSTEMS SCIENCE: THE 5-8 EDUCATION UNIT PROGRESSION

Lesson Title	Lesson Description	Activities
Lesson 1: Plate Tectonics: Movin' and Shakin'	The motion of Earth's continental plates causes earthquakes and volcanoes at the plate boundaries. In this lesson students explore whether there is a correlation between locations of earthquake and volcanic activity and plate boundaries. Students then discuss this correlation as evidence of plate tectonics. Students also explore the impact on plant life due to volcanic outgassing.	<p><i>Activity 1: We're Crackin' Up;</i> In this activity, students plot the locations of actual earthquakes and volcanoes on a world map. Students then compare these locations to a map of Earth's plate boundaries, revealing evidence for the theory of plate tectonics.</p> <p><i>Activity 2: Volcanic Gases;</i> In this activity, students plan and conduct an experiment to determine the effect of volcanic gases on plants.</p>
Lesson 2: Water Resources	This lesson addresses the water resources that are important to millions of people in North America and Africa. Each activity focuses on the physical nature of a water resource, how humans depend upon the resource, and how human use affects the resource, creating both problems and opportunities. Students will use data and satellite images to examine how human actions can degrade, improve, or maintain the quality of each resource. They then analyze and interpret graphical data to make recommendations for improving future use of these resources.	<p><i>Activity 1: Chesapeake Bay, Resource Use or Abuse?;</i> In this activity, students will role play members of the community and discuss how they use the Bay and how they can work to protect it.</p> <p><i>Activity 2: The Nile: A Sustainable Resource?;</i> In this activity, students examine how humans influence the Nile River, and how this in turn affects all of the countries along the Nile River Basin.</p>
Lesson 3: Weather It Works or Not	Meteorologists study the atmosphere by recording and analyzing data in order to learn more about weather patterns and behavior. Students become amateur meteorologists by building their own weather station and keeping a record of measurements. They will notice that many factors influence local weather, including global atmospheric changes and the interactions among Earth's systems.	<p><i>Activity: Predicting the Weather;</i> In this activity, students will build their own weather tools—thermometer, barometer, and hygrometer—and use them to observe and predict the weather.</p>

CONNECTION TO STANDARDS

This Education Unit has been mapped to the National Science Education Standards (National Research Council, National Academy Press, Washington, DC, 1996). A complete explanation of the Standards can be found at: <http://www.nap.edu/html/nse/html/>. Core standards for each lesson are indicated by a “√.”

EDUCATION STANDARDS IN EARTH SYSTEMS SCIENCE					
5-8 EDUCATION UNIT					
National Science Education Standards, 5-8					
Standard A: Science as Inquiry		Standard D: Earth and Space Science		Standard F: Science in Personal and Social Perspectives	
A1: Abilities necessary to do scientific inquiry	A2: Understandings about scientific inquiry	D1: Structure of the Earth system	F2: Populations, resources, and environments	F3: Natural hazards	
Lesson 1: Plate Tectonics: Movin' and Shakin'	√	√	√		√
Lesson 2: Water Resources	√	√		√	
Lesson 3: Weather It Works Or Not	√	√	√		