

Overview

The dynamics of earth science include the studies of forces of nature that build up and wear down the earth's surface. Dynamics include energy flow across the earth's surface and its role in weather and climate. Space science is concerned with the origin and evolution of the universe. The understanding of these concepts uses principles from physical sciences, geography and mathematics.

- Topics addressed in the Middle School Earth and Space Science Course include:
- Origin and Evolution of the Universe
- Earth's Structure, Processes and Cycles
- Earth and Human Activity
- The Roles of Water in Earth's Surface Processes

MS Earth & Space Science

Module Title	Message	Assignment / Call to Action (200 Character Max)	Resource / URL	Info about the URL (published on the "i" button of a resource/ url)	Internal Notes (not published to the course)	Copyright Notes
Module I: Origin and Evolution of the Universe	This module will focus on one of the big ideas of astronomy, that the universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.					
	Students will focus on the following essential questions: What is the Universe and what is Earth's place in it? How does gravity determine the motion of the solar system and the objects in it?					
The Universe and Its Stars	In this lesson, you will explore, describe, and explain patterns of the apparent motion of the Sun and stars in the sky. Including how the Universe began with a period of extreme and rapid expansion known as The Big Bang Theory. The Sun and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. 3.3.6.B1, 3.3.7.B1 3.3.7.B2	DISCOVER the functions of NASA by viewing images, missions, videos, and news.	https://itunes.apple.com/us/app/nasa-app/id334325516?mt=8			
		IDENTIFY two or three reasons for why we need to explore space as you WATCH the TED talk from Brian Cox.	http://www.ted.com/talks/brian_cox_why_we_need_the_explorers			
		FORMULATE your own estimate of the number of communicative civilizations in the Milky Way as you INTERACT with the Drake's Equation calculator.	http://www.pbs.org/lifebeyondearth/listening/drake.html			
		LEARN about the Big Bang as you WATCH The Beginning of Everything -- The Big Bang.	https://www.youtube.com/watch?v=wNDGgL73ihY			
		CONSTRUCT an explanation of the Big Bang theory based on astronomical evidence as you READ through this site.	science.nasa.gov/astrophysics/focus-areas/what-powered-the-big-bang			

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		INVESTIGATE the history of space exploration as you ENGAGE in this app.	https://itunes.apple.com/us/app/solar-walk-free-planets-solar/id559702509?mt=8			
		EXPLORE the Hubble Space Telescope as you INTERACT in this site.	www.hubblesite.org www.webbtelescope.org			
		APPLY concepts about astronomy as you INVESTIGATE two simulations that correctly explain each model.	http://astro.unl.edu/animationsLinks.html			
		DEMONSTRATE a timeline of events, and the significance of each event, in manned space travel as you CREATE an interactive image	https://itunes.apple.com/us/app/thinglink/id647304300?mt=8	Or use the web version.		
Sun, Earth, Moon, and the Solar System	In this lesson, you will explore the solar system and its parts: the Sun and a collection of objects including planets, moons, and asteroids. All objects are held in orbit around the Sun by its gravitational pull. A model of the solar system can explain the motion of the planets in the sky relative to the stars. You will learn the relationship of the Earth, Moon, and Sun resulting in phases, tides, and eclipses. 3.3.6.B1, 3.3.7.B1 3.3.6.B2, 3.3.7.B2, 3.3.8.B2 3.3.7.A4	MODEL characteristics about our solar system by CREATING a virtual pop-up book about each planet.	http://solarsystem.nasa.gov/planets/index.cfm , Our Solar System app, Pocket Universe app, http://www.zooburst.com/			
		COMPARE & CONTRAST characteristics of inner and outer planets as you CREATE a Venn Diagram App.	Pocket Universe app, Our Solar System App			

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		CRITIQUE the reasons given in TED Ed on "Why we need to go back to Mars" as you PARTICIPATE in the discussion section of the site.	www.ted.com/talks/joel_levine			
		Hypothesize the cause of the four seasons on Earth. ILLUSTRATE the earth/sun relationship for each season using the Make Beliefs Comix app or website. (www.makebeliefscomix.com).	http://astro.unl.edu/naap/motion1/animations/seasons_ecliptic.html (Flash) OR Earth and Space App (\$2.99) https://itunes.apple.com/us/app/earth-and-space/id693244832?mt=8			
		DISTINGUISH the different features of the Sun by viewing live images. INVESTIGATE the interactive activities to gather information about the Sun.	https://itunes.apple.com/us/app/diy-sun-science/id836712493?mt=8			
		EXPLORE the solar system as you INTERACT with this app.	https://itunes.apple.com/us/app/exploring-the-solar-system/id530448035?mt=8 (\$1.99)			
		DEMONSTRATE understanding of the solar system with planet descriptions and distances from Earth as you CREATE an interactive image.	https://itunes.apple.com/us/app/thinglink/id647304300?mt=8			

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		<p>LEARN about the phases of the moon as yo WATCH The Moon video. ASSESS your knowledge as you COMPLETE the moon match quiz.</p>	<p>http://teachers.henrico.k12.va.us/staffdev/clough_d/Moon/Phases.html</p>			
		<p>LEARN about gravity as you WATCH a video.</p>	<p>https://youtu.be/p_o4aY7xkXg</p>			
		<p>IDENTIFY how stars are classified on the Hertzsprung & Russell Diagram as you ANALYZE this site.</p>	<p>http://www.spacetelescope.org/videos/heic1017b/</p>			

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Module II: Earth's Structure, Processes and Cycles	This module will focus on the Earth being composed of a variety of different materials, which are a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that are constantly changing the Earth surface.					
	Students will focus on the following essential questions: How and why is Earth constantly changing? What type of materials make-up the Earth surface and how are they formed? What evidence supports the theories that the Earth has evolved over geologic time?					
Earth Features and the Processes that Change It	In this lesson, you will explore that plate movements are responsible for most continental and ocean floor features and for the distribution of most rocks and minerals within Earth's crust. Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. 3.3.7.A1, 3.3.6.A3, 3.3.7.A3 3.3.7.A6	INVESTIGATE how plates move on the surface of the Earth as you ENGAGE in this app.	https://itunes.apple.com/us/app/earthviewer/id590208430?mt=8			
		RECOGNIZE important factors regarding the theory of plate tectonics as you WATCH this video.	www.bozemanscience.com/plate-tectonics			
		IDENTIFY parts of the Earth's interior as you WATCH the video, "Earth's Not-So-Juicy Center."	www.youtube.com/watch?v=YHqzCBpu_Q			
		INVESTIGATE how plate tectonics shape the earth's surface as you ENGAGE in this app.	https://itunes.apple.com/us/app/earthviewer/id590208430?mt=8			
		MONITOR earthquake activity around the world and IDENTIFY the plates located nearby as you INTERACT with this app.	https://itunes.apple.com/us/app/iquake/id364895287?mt=8			
		DESCRIBE the different types of plate boundaries and ARTICULATE their movements as you EXPLORE this app.	https://itunes.apple.com/us/app/showme-interactive-whiteboard/id445066279?mt=8			
		DEFINE what pseudoscience is as you READ "When Continental Drift was considered Pseudoscience."	www.smithsonianmag.com/science-nature/when-continental-drift-was-considered-pseudoscience-90353214/?page=1			
		DEMONSTRATE understanding of plate boundaries as you SCREENSHOT an image from google earth app and DRAW the plate boundaries and their movements on a blank map of the Earth.	https://itunes.apple.com/us/app/showme-interactive-whiteboard/id445066279?mt=8			
		INVESTIGATE how plates move on the surface of the Earth as you ENGAGE in this app.	https://itunes.apple.com/us/app/inkflow-visual-notebook/id519524685?mt=8			
		LEARN about the theory of plate tectonics as you READ CK-12 Earth Science for Middle School, Chapter 6.	https://itunes.apple.com/us/book/ck-12-earth-science-for-middle/id503172457?mt=11	https://itunes.apple.com/us/app/ck-12-studynow/id611509018?mt=8		
		Summarize the current theories about plate tectonics as you CREATE a presentation using.	https://itunes.apple.com/us/app/keynote/id361285480?mt=8			
Earth Materials and Systems	In this lesson, you will explore that all Earth processes are the result of energy flowing and matter cycling within and among the Earth's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. These interactions have shaped Earth's history and will determine its future. 3.3.8.A1	CATEGORIZE the four Earth systems as you WATCH a video about the each system.	www.youtube.com/watch?v=CmbXcNh4FcM			
		SHOW Earth's systems and how they interact with one another as you ILLUSTRATE the four systems in a comic strip.	MakeBeliefsComix app OR www.makebeliefscomix.com			

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		REVIEW the Earth's systems as you EXPLORE this site.	http://esw.climate.nasa.gov/2014/09/earth-system/			
		DEPICT your understanding of Earth's systems as you CREATE an infographic.	http://piktochart.com/			
		MODEL your understanding radiation, conduction, or convection as you DESIGN an animation that model them.	ShowMe App; Educreations App; Explain Everything App			
		MODEL your understanding of radiation, conduction, or convection as you CREATE a tutorial from your animation demonstrating radiation, conduction, and convection.	https://itunes.apple.com/us/app/storehouse-visual-storytelling/id791297521?mt=8			
		DEMONSTRATE the interactions between each of the Earth's systems by CONSTRUCTING a flowchart modeling the systems.	https://itunes.apple.com/us/app/pureflow/id600955222?mt=8			
		LEARN about erosion as you WATCH this video from Bill Nye.	https://youtu.be/H0Wqrhe9n4A			
		DEMONSTRATE your knowledge of how weathering and erosion shapes the land as you COMPLETE this activity.	http://www.kineticcity.com/mindgames/warper/			
		EXPLORE the rock cycle through as you INTERACT with the story about rocks.	https://itunes.apple.com/us/app/the-rock-cycle/id471106554?mt=8			
The History of Planet Earth	In this lesson, you will explore historical geological events include the formation of mountain chains and ocean basins, volcanic eruptions, periods of massive glaciation, and development of watersheds and rivers. Analyses of rock strata and the fossil record provide evidence of Earth's evolution.	OBSERVE the movement of Earth's plates through different eras of geological time as you ENGAGE in this app.	https://itunes.apple.com/us/app/earthviewer/id590208430?mt=8 and https://www.dropbox.com/s/6pb2x7kk8v78hxz/Earth%20Plate%20Sketch%20Sheet.pdf?dl=0			
		SKETCH the location of the continents for four different times.				
		REVIEW a video on Earth's origins ASSESSING your preconceptions.	https://www.youtube.com/watch?v=8qnnoePeHlk			
		APPLY scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to CONSTRUCT a spreadsheet of organized data of Earth's formation and early history.	www.bighistoryproject.com/pages/syllabus			
		WATCH the timemapper tutorial and CREATE a timeline of geologic history highlighting change over time of one specific region of Earth.	Prezi app; http://timemapper.okfnlabs.org/			
Biogeology	IN this lesson, you will explore how evolution is shaped by Earth's varying geological conditions. Sudden changes in conditions (e.g., meteor impacts, major volcanic eruptions) have caused mass extinctions, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish. The evolution and proliferation of living things over geological time have in turn changed the rates of weathering and erosion of land surfaces, altered the composition of Earth's soils and atmosphere, and affected the distribution of water in the hydrosphere.	ESTABLISH four types of events/extinctions that shaped Earth's varying geological conditions. ORGANIZE a specific event for each type, along with the era, period and time it occurred.	https://itunes.apple.com/us/app/earthviewer/id590208430?mt=8			
		DOCUMENT the effects of a specific event altering the Earth's geological conditions as you GENERATE an iMovie trailer	https://itunes.apple.com/us/app/imovie/id377298193?mt=8			
		LEARN about Louisiana land loss as you WATCH "What if your home was slipping into the Ocean?"	https://www.youtube.com/watch?v=ZlpyxJY2Cd8			
		DISCUSS and SUMMARIZE how erosion is affecting beaches across the globe as you WATCH this video.	https://www.youtube.com/watch?v=zQhrqqaQiwQ			
		DEMONSTRATE UNDERSTANDING of the geological eras of the Earth reflecting key events of evolution and surface changes from each era by CREATING a Prezi that zooms out through each era.	Prezi app; http://prezi.com/			

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Module III: Earth and Human Activity	<p>This module will focus on the big ideas of earth and space science: The universe is composed of a variety of different objects, which are organized inot systems, each of which develops according to accepted physical processes and laws. Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.</p> <p>Students will focus on the following essential questions: What is the Universe and what is Earth's place in it? How and why is Earth constantly changing? How do Earth's processes and human activities affect each other?</p>					
Natural Resources	In this lesson, you will explore how humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geological processes (link to ESS2.B). Renewable energy resources, and the technologies to exploit them, are being rapidly developed. 3.3.8.A2	INVESTIGATE possible complications of sharing resources by playing the "Resources for the World" game.	https://www.dropbox.com/s/44f48cgl3by72z/Resources%20for%20the%20World%20Lesson.pdf?dl=0	This is a simple game that requires some materials.		
		CATEGORIZE the energy types found in your immediate environment by completing "Activity 1 Energy Detective. " (pages 13-18)	www.nrel.gov/docs/gen/fy01/30927.pdf			
		ASSESS the need for nuclear energy by watching the TED video, "Does the world need nuclear energy?"	www.ted.com/talks/debate_does_the_world_need_nuclear_energy			
		ANALYZE the pros and cons of various energy sources by organizing energy sources in a flowchart.	https://itunes.apple.com/us/app/idea-sketch/id367246522?mt=8			
		DEBATE the pros and cons of using alternative energy resources by recording a podcast.	https://itunes.apple.com/us/app/garageband/id408709785?mt=8			
	Extension Activity:	DEVELOP a campaign to inform your community about the benefits of various energy resources.				
Natural Hazards	In this lesson, you will explore that some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions. Others, such as earthquakes, occur suddenly and with no notice; thus they are not yet predictable. However, mapping the history of natural hazards in a region, combined with an understanding of related geological forces can help forecast the locations and likelihoods of future events.	SUMMARIZE at least five different global events/hazards in a slide presentation. (e.g., PowerPoint, Keynote, Prezi)	http://www.gdacs.org/			

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		SCRUTINIZE the patterns of natural global cooling and heating cycles.	http://www.teachingboxes.org/seaLevel/lessons/studentPage.jsp			
		EXPLORE the impact of climate on agriculture.	www.epa.gov/climatechange/impacts-adaptation/agriculture.html			
		CONSIDER the tornado survival tips from the American Red Cross. PREDICT how well you would do in a disaster situation.	http://www.redcross.org/prepare/disaster/tornado			
		EXPLORE the effects of natural disasters on a virtual city in SimCity Build It.	SimCity Build It app			
		INVESTIGATE the effects of volcanoes exploring a volcanic eruption on Volcano 360 App.	https://itunes.apple.com/us/app/volcano-360/id651461233?mt=8			
		CONNECT the effects of impactful events/hazards by CREATING a virtual tour on Google Earth.	https://itunes.apple.com/us/app/google-earth/id293622097?mt=8			
Human Impacts on Earth Systems	In this lesson, you will explore how human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically, as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. 3.3.6.A2, 3.3.7.A2 4.5.6.A 4.5.7.A	FORMULATE an opinion on population growth after ANALYZING the population video.	http://youtu.be/9_9SutNmfFk			
		IDENTIFY reasons food production may not be reasonable by 2050 by LISTENING to a podcast (5:38 - 10:15).	https://itunes.apple.com/us/podcast/lester-brown-sobering-facts/id462415188?i=168981766&mt=2			
		DETERMINE your impact on the environment by CALCULATING your individual carbon footprint.	https://itunes.apple.com/us/app/zero-carbon/id336848607?mt=8			
		DEMONSTRATE positive and negative impacts of human activity on the Earth by DESIGNING a series of informational posters.	iPiccy.com, bighugelabs.com , glogster, board builder			
	Extension Activity:	DESIGN an atmosphere to see if it would support life.	forces.si.edu/atmosphere/interactive/atmosphere.html (Flash)		flash	

Table 1

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Module IV: The Roles of Water in Earth's Surface Processes	This module will focus on three big ideas of the hydrosphere. Beginning with water's unique combination of physical and chemical properties is central to Earth's dynamics. These properties include water's exceptional capacity to absorb and store energy. Water has the ability to transmit sunlight; to expand upon freezing; to dissolve and transport many materials; and to change phases easily. Each of these properties plays a role in how water affects other Earth systems (e.g., ice wedging in weathering rock).					
	Students will focus on the following essential questions: What is the relationship between the energy of the Sun and temperature differences among land, water, and atmosphere? What is the role of the water cycle in weather?					
The Roles of Water in Earth's Surface Processes	In this lesson, you will explore how water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation. The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. Global movements of water and its changes in form are propelled by sunlight and gravity. Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. 3.3.6.A4, 3.3.7.A4 3.3.6.A5 3.3.7.A5 3.3.7.A6	DISCOVER more about the water cycle as you ENGAGE in this app.				
		SELECT at least four key points of the water cycle to USE on a flowchart of the water cycle.	http://earthguide.ucsd.edu/earthguide/diagrams/watercycle/ (FLASH) or The Water Cycle app, PureFlow app, Idea Sketch app			
		THINK about the scarcity of fresh water in the world as you WATCH this video and RESPOND to the guided discussion questions.	ed.ted.com/on/S0OVTWHS			
		DISCOVER what causes hurricanes to form. CREATE a tutorial to explain the formation.	https://itunes.apple.com/us/app/educreations-interactive-whiteboard/id478617061?mt=8			

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		DEMONSTRATE your understanding of groundwater and surface water as you CREATE a Venn Diagram comparing them.	https://itunes.apple.com/us/app/venn-diagram/id666981188?mt=8			
		SHOW your understanding of groundwater and surface water as you DESIGN a labeled diagram.	https://itunes.apple.com/us/app/thinglink/id647304300?mt=8			
		INVESTIGATE these images of sinkholes. DETERMINE why these types of events occur.	news.nationalgeographic.com/news/2014/07/140724-sinkhole-pictures-photos-geology-science			
		LEARN about Lifestraw as you RESEARCH What makes this product necessary in Africa but not the US.	www.buylifestraw.com/the-cause			
		CREATE a Public Service Announcement to share the goals of Life Straw with your community. PLAN a fundraiser to purchase a Life Straw with which to experiment.	https://itunes.apple.com/us/app/imovie/id377298193?mt=8			
		THINK about how a rain barrel could be beneficial in your neighborhood as you WATCH this EPA video.	www.youtube.com/watch?v=rSBKqFrzoZA			
		DESIGN a plan to share with your school community about the importance of rain barrels. PRESENT to the principal/PTA to encourage the use of rain barrels for your school.	https://itunes.apple.com/us/app/keynote/id361285480?mt=8			
		DEMONSTRATE your understanding about the water cycle and water's role on Earth as you PRODUCE a short documentary.	https://itunes.apple.com/us/app/imovie/id377298193?mt=8			
		LEARN about the dynamics of the currents that make up ocean gyres as you EXPLORE this site.	www.windows2universe.org/teacher_resources/leaky_gyre.html			

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Weather and Climate	In this lesson, you will explore that weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. Because these patterns are so complex, weather can be predicted only probabilistically. 3.3.8.A4, 3.3.6.A5 3.3.7.A5	EXPLAIN how weather works by CREATING a virtual lecture using Tellagami app.	http://www.weatherwizkids.com/weather-climate.htm and Tellagami app			
		RECOGNIZE the connection to convection as you WATCH how the warm air gives hurricanes their energy video.	www.youtube.com/watch?v=1p-3YYivlQ			
		LEARN how to read weather map as you REVIEW this weather map.	https://itunes.apple.com/us/course/how-to-read-weather-maps-create/id909195101			
		DEMONSTRATE your understanding of weather as you SIMULATE a weather report using imovie.	https://itunes.apple.com/us/app/imovie/id377298193?mt=8			
		LEARN about the current and past catastrophic events as you EXPLORE this app.	https://itunes.apple.com/us/app/xweather/id520729396?mt=8			
		LEARN about how scientists measure in a hurricane as you WATCH this video.	http://www.nhc.noaa.gov/audio/archive/ www.youtube.com/watch?v=D8byi87--DU			
		ANALYZE data from yearly precipitation and temperature graphs from locations around the world as you INTERACT with this site.	https://itunes.apple.com/us/app/weather-hopper-weather-history/id781800379?mt=8			
		ANALYZE the data from the generated tornado as you RUN a tornado simulation.	https://itunes.apple.com/us/app/tornado-by-american-red-cross/id602724318?mt=8			
		DEMONSTRATE the most common paths of hurricanes as you CREATE an animated image.	https://itunes.apple.com/us/app/thinglink/id647304300?mt=8			
		EXPLORE the types of clouds and learn about the characteristics of each type.	http://www.harcourtschool.com/activity/science_up_close/610/deploy/interface.html			

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		TEST your knowledge on the atmosphere.	http://studyjams.scholastic.com/studyjams/jams/science/weather-and-climate/earths-atmosphere.htm	FLASH		
		TEST your knowledge on the air pressure and wind.	http://studyjams.scholastic.com/studyjams/jams/science/weather-and-climate/air-pressure-and-wind.htm	FLASH		
		DISCOVER properties of the atmosphere as you WATCH this video.	https://youtu.be/fyfN9t_E0w8			
Global Climate Change	In this lesson, you will explore how human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. 4.3.7.A, 4.4.7.A,	COMPARE and CONTRAST climate and atmospheric conditions during the Ice Age and today (Greenhouse Effect). CREATE a poster/presentation which highlights at least three major differences between the two climates/atmospheres. (e.g., Prezi, bighugelabs.com)	https://sites.google.com/site/thepleoceneocenerthermalmaxim/2-paleocene-climate/why-earth-s-climate-is-different-today-1 and EarthViewer app	https://itunes.apple.com/us/app/earthviewer/id590208430?mt=8		
		DISCOVER how steroid use in baseball is an analogy for climate change by WATCHING the video, "Steroids, Baseball and Climate Change."	www.youtube.com/watch?v=MW3b8jSX7ec			
		OBSERVE the changing of Greenland's icecap as you WATCH this video.	http://youtu.be/kteMXaUNvIc			
		IDENTIFY patterns associated with Global CO ₂ and the seasons as you WATCH a "Year of in the Life of CO ₂ ."	https://www.youtube.com/watch?v=x1SgmFa0r04			
		DEVELOP a logical argument about human impact on the Earth's mean surface temperature, HIGHLIGHTING your findings using the ShowMe app (or something similar).	https://itunes.apple.com/us/app/edureations-interactive-whiteboard/id478617061?mt=8			