

Curriculum Topic Study (CTS) Summary

Select a key lesson that allows you to see your students' thinking or stands at an important intersection for further learning. Use the Curriculum Topic Study Topic list to identify the topic most relevant to this lesson. This topic will be the basis of your CTS summary.

CTS Topic Guide: Earthquakes and Volcanoes Page: 177

Curriculum: STC/MS "Catastrophic Events" Grade: 7

Accessing Prior Knowledge	<ol style="list-style-type: none">1. What important ideas or skills make up this topic?<ul style="list-style-type: none">• <i>The Earth's surface is moving.</i>• <i>The Earth's surface is composed of large moving areas called plates.</i>• <i>When plates interact there can be different results (volcanoes, earthquakes, mountains) depending on how the plates are moving relative to each other. Earthquakes and volcanoes are more common at plate boundaries.</i>• <i>Earthquakes occur when two plates slip past each other rather rapidly.</i>• <i>Volcanoes occur when one plate is subducted under another.</i>• <i>It is important to be aware of dangers caused by plate tectonics and to prepare appropriately for them.</i>• <i>Students should be able to read maps.</i>• <i>Students should be able to collect and interpret data.</i>2. What is important for students to know and be able to do about this topic?<ul style="list-style-type: none">• <i>Students should recognize that there are a number of catastrophic events on the Earth which have a common cause, namely, plate tectonics. Students should be able to recognize the locations of past and possible future catastrophic events.</i>3. What learning opportunities or teaching strategies are most effective with this topic?<ul style="list-style-type: none">• <i>Using computer simulations.</i>• <i>Using geographical maps that show plate boundaries.</i>• <i>Using geographical maps that show events at plate boundaries.</i>• <i>Building models.</i>4. What difficulties or misconceptions are associated with his topic?<ul style="list-style-type: none">• <i>Many students don't understand that the Earth under their feet is moving.</i>
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Using CTS: Choose a CTS study guide that best describes the topic covered in this set of lessons. You will use this study guide to complete your CTS summary.

<p>I. Identify Adult Content Knowledge</p>	<p>IA: Science for All Americans</p> <ul style="list-style-type: none"> Readings: <ul style="list-style-type: none"> Chapter 4, <i>Processes that Change the Earth</i>, pp. 44-46 <p>IB: Science Matters- Achieving Scientific Literacy</p> <ul style="list-style-type: none"> Readings: <ul style="list-style-type: none"> Chapter 13, <i>The Restless Earth</i>, pp. 174-189 Ch. 14, <i>Igneous Rocks</i>, pp. 193-194.
<p>Examine the resources indicated in Section I of the CTS study guide.</p>	<ol style="list-style-type: none"> What big ideas and major concepts make up this topic? <ul style="list-style-type: none"> <i>The continents and the ocean floor (the Earth's crust) are made up of separate sections that lie over a hot, almost molten layer.</i> <i>These separate sections of the crust are called plates.</i> <i>The plates move an inch or more a year over the hot, soft layer.</i> <i>As they move they may collide with other sections of the crust. This is called a convergent boundary.</i> <i>Or, as they move they may pull apart from other sections of the crust. This is called a divergent plate boundary.</i> <i>Convergent plates may cause: the plates to move sideways; compression of land into folds that eventually become mountains; or, one plate to slide under the other (subduct) and go deeper into the Earth.</i> <i>On the boundaries of convergent plates several events may take place: earthquakes may shake the Earth's surface and volcanoes may erupt and release molten rock, building up the mountain.</i> <i>Divergent plates cause: land to sink and form valleys; and, in thin parts of the ocean floor, molten rock rises, widening the ocean floor and forming undersea mountains that may rise above the surface of the ocean forming islands.</i> <i>Because the plates are constantly moving, nothing on the Earth's surface is permanent.</i> <i>We can predict where earthquakes will happen much more accurately than we can predict when they will happen.</i> <i>Volcanoes produce magma which cools to form igneous rocks.</i> What examples or contexts were used to explain the ideas? <ul style="list-style-type: none"> <i>Illustrations In Science Matters, three of the plate movements are illustrated: 1. Divergent plates along a volcanic ridge, 2. Convergent plates with one subducting under the other, 3. Convergent plates scraping against each other sideways.</i> <i>The Hawaiian Islands are an example of ocean floor divergent plate boundaries where the plates have moved apart and new material is brought to the surface in the form of lava.</i> <i>The San Andreas Fault is an example of converging plates that are scraping together sideways.</i> What insights about the topic did you gain from this reading and how might these insights inform your classroom practice? <ul style="list-style-type: none"> <i>From this reading I gained more information about the movements of the plates on the Earth's crust. There are two types of movement, converging and diverging. Converging movement includes the three forms noted above. The different types of movement are responsible for volcanoes and earthquakes.</i>

Check with your facilitator before going on to the next section.

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<p>II. Consider Instructional Implications</p>	<p>IIA: <i>Benchmarks for Science Literacy</i></p> <ul style="list-style-type: none"> • Readings for selected grade levels: <ul style="list-style-type: none"> • 4C, <i>Processes that Shape the Earth</i> general essay pg. 71; grade span essays pp. 72-74 <p>IIB: <i>National Science Education Standards</i></p> <ul style="list-style-type: none"> • Readings for selected grade levels: <ul style="list-style-type: none"> • Grades 5-8, Standard D essay, pp. 158-159
<p>Examine the resources indicated in section two of the CTS study guide.</p>	<ol style="list-style-type: none"> 1. What suggestions are provided for effective instruction at your grade level? <ul style="list-style-type: none"> • <i>Students may be more interested in the phenomena of earthquakes and volcanoes than in the underlying causes so teachers should start with the students' interests and work towards the science.</i> • <i>Student's understanding of this content will depend on improving their sense of very long time periods and familiarity with the effect of multiplying tiny fractions by big numbers (i.e. very small rates of change by very large periods of time).</i> • <i>According to the NSES, plate tectonics is best left to later middle school since students do not have direct experience with the phenomenon of moving plates. The Benchmarks state that the theory of plate tectonics should not be covered until high school. The topic is covered in the STC Catastrophic Events curriculum.</i> 2. What insights about the topic did you gain from this reading and how might these insights inform your classroom practice. <ul style="list-style-type: none"> • <i>It will be difficult for students to appreciate the very long time frame needed for most Earth processes to occur and they need to understand that millions of years are needed for substantial change since the rate of change is so small. Volcanoes and earthquakes are examples of Earth processes that occur over relatively short periods of time but require long periods of time to "build up."</i>

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<p>III. Identify Concepts and Specific Ideas</p>	<p>IIIA: <i>Benchmarks for Science Literacy</i></p> <ul style="list-style-type: none"> Readings for selected grade levels: <ul style="list-style-type: none"> 4C, <i>Processes that Shape the Earth</i> general essay pp. 72-74 <p>IIIB: <i>National Science Education Standards</i></p> <ul style="list-style-type: none"> Readings for selected grade levels: <ul style="list-style-type: none"> Grades 5-8, Standard D <i>Structure of the Earth System</i>, pp. 159-160; <i>Natural Hazards</i> pg. 168
<p>Examine the resources indicated in section three of the CTS study guide.</p>	<ol style="list-style-type: none"> What learning goals align well with this topic? <ul style="list-style-type: none"> Plates on the scales of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions. Land forms are the result of a combination of constructive (crustal deformation, volcanic eruption, and deposition of sediment) and destructive forces (weathering and erosion). The interior of the Earth is hot. Heat flow and movement of material cause earthquakes and volcanic eruptions. Some changes in the Earth's surface are abrupt (earthquakes and volcanic eruptions) while other changes happen very slowly. Internal and external processes of the Earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans. Natural hazards include earthquakes and volcanic eruptions (among others). How do these goals help you clarify what is important to teach in this topic? <ul style="list-style-type: none"> <i>They identify the cause and rate of plate movement and the Earth processes that result from plate movement. They also identify the social context of understanding natural hazards.</i> How does the learning goal change from one grade span to the next? <p><i>Earlier grades focus on:</i></p> <ul style="list-style-type: none"> <i>Properties of Earth materials (rocks, soils, water, atmospheric gases).</i> <i>Changes in Earth's surface due to slow and rapid processes.</i> <p><i>Later grades focus on:</i></p> <ul style="list-style-type: none"> <i>Specific mechanisms and consequences of plate tectonics.</i> <i>Energy sources within the Earth that drive mantle convection which propels the plates.</i> <i>History of science involving the theory of plate tectonics and its relatively recent acceptance within the scientific community.</i> What insights about the topic did you gain from this reading and how might these insights inform your classroom practice? <ul style="list-style-type: none"> <i>Students need to understand that cataclysmic events that happen very quickly are the result to plate movements that happen very slowly. If students have a natural curiosity about the events themselves, this can be used to foster interest in the cause behind the events.</i> <i>The theory of plate tectonics was only recently accepted (last 40 years) illustrating that scientist's do not change theories often and they only do when confronted with a lot of evidence to support a new theory. Although this is not formally considered until high school, it can be used to illustrate nature of science in middle school.</i>

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<p>IV. Examine Research on Student Learning</p>	<p>IVA: <i>Benchmarks for Science Literacy</i> Readings: 4C, <i>Processes that Shape the Earth</i> pg. 336 IVB: <i>Making Sense of Secondary Science- Research Into Children's Ideas</i> • Readings: Ch. 14 <i>Igneous Rock</i> pg. 113, <i>Mountains and Volcanoes</i>, pp. 113-114.</p>
<p>Examine the resources indicated in section four of the CTS study guide.</p>	<ol style="list-style-type: none"> 1. What specific misconceptions or alternative ideas might a student have about this topic? <ul style="list-style-type: none"> • <i>Many students believe the world was always as it is now.</i> • <i>Many students believe that any changes to the Earth have been sudden and comprehensive.</i> • <i>Some students have difficulty constructing coherent explanations about causes of volcanoes and earthquakes.</i> • CHECK DIVER FOR ANY MORE 2. Which ideas might be more resistant to change? <ul style="list-style-type: none"> • <i>The first may be very resistant to change, especially if students come from a belief system where scientifically held notions about the age of the Earth are discounted.</i> 3. Are there examples of questions or tasks that could be used to find out what students know about this topic? <ul style="list-style-type: none"> • <i>Neither source suggests specific questions or tasks for eliciting prior knowledge about this topic.</i> 4. What insights about the topic did you gain from this reading and how might these insights inform your classroom practice. <ul style="list-style-type: none"> • <i>Students might not understand that the world is not as it looked in the past and that processes that have changed the Earth are still at work. Thus, the Earth is constantly changing even if we don't always perceive it. Helping students develop a critical eye for evidence that is consistent with scientifically held notions will be important in my classroom.</i>

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<p>V. Examine Coherency and Articulation</p>	<p>V: Atlas of Science Literacy</p> <ul style="list-style-type: none"> Selected maps to read: <i>Changes in the Earth's Surface</i>, pp. 50-51; <i>Plate Tectonics</i>, pp. 52-53
<p>Examine the resources indicated in section five of the CTS study guide.</p>	<ol style="list-style-type: none"> What connections can you identify among concepts or skills in the topic? <ul style="list-style-type: none"> <i>Heat flow in the hot interior of the Earth causes movement of the Earth's crust resulting in earthquakes and volcanic eruptions and creates mountains, valleys, and ocean basins.</i> <i>Some of this movement is sudden, causing earthquakes and volcanic eruptions.</i> <i>The interior of the Earth is hot. Heat flow and movement of material within the Earth cause earthquakes and volcanic eruptions.</i> <i>The Earth formed as a hot, molten ball. Then, as the surface cooled, it formed solid rock as an outer crust</i> What prerequisite ideas can you identify for learning the topic at your grade level? <ul style="list-style-type: none"> <i>The Earth has many landforms and understand that the Earth's surface changes.</i> <i>Some changes are so slow or so fast that they are hard to see. How fast things move differs greatly.</i> What insights about the topic did you gain from this reading and how might these insights inform your classroom practice. <ul style="list-style-type: none"> <i>Students in grades 6-8 are not ready to learn about the mechanism of plate tectonics unless they have previous experience with, and understanding of, change in the Earth's landforms. However, they are ready to learn about the results of plate tectonics and these can be taught with lessons about plate movement.</i>

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<p>VI. Clarify State Standards and District Curriculum</p>	<p>VIA: State Standards- Link Sections I-V to learning goals and information from your state standards or frameworks that are informed by the results of the topic study.</p> <p>VIB: District Curriculum Guide- Link Sections I-V to learning goals and information from your district curriculum guide that are informed by the results of the topic study.</p>
<p>Examine the state standards document and your district curriculum guide.</p>	<ol style="list-style-type: none"> 1. What learning goals and information from the state standards are informed by the results of your topic study? <ul style="list-style-type: none"> • <i>EALRs 1.2 Benchmark 2: Describe the components and interconnections of the Earth system, including the solid Earth (crust, hot convecting mantle, and dense metallic core), the hydrosphere, and the atmosphere. Describe the interactions among the components of Earth's systems. The theory of plate tectonics is addressed in Benchmark 3.</i> • <i>EALRs 1.3 Benchmark 2: Describe how heat (thermal) energy flow and movement (convection currents) beneath Earth's crust cause earthquakes and volcanoes. Describe the processes of constructive and destructive forces and how they continually change landforms on Earth. The causes and effects of volcanoes and earthquakes in Washington State are covered in Benchmark 3.</i> 2. What learning goals and information from your district curriculum are informed by your curriculum topic study? <ul style="list-style-type: none"> • <i>Although Plate Tectonics is part of the STC Catastrophic Events kit used within my district at the middle school level, and is the ultimate cause of earthquakes and volcanoes, both the Benchmarks and the EALRs suggest that the topic is more appropriate at the high school level. Both documents focus on the more immediate causes of earthquakes (plate slippage) and volcanoes (plate subduction) than on the causal mechanism of plate movement.</i>
<p>Visit www.curriculumtopicstudy.org for updates or supplementary readings, web sites, and videos.</p>	