1. Central Focus

   a. Describe the central focus and purpose of the content you will teach in the learning segment.

   [The central focus of this learning segment is understanding Earth’s geologic processes, focusing on volcanoes. It was developed for seventh grade students in the Rocky Mountain west using Next Generation Science Standards. The central focus is based mostly on standards MS-ESS2 and MS-ESS3. Teaching this subject to students in this region is unique due to the fact that students are next-door to the Yellowstone super volcano. Most students are familiar with Yellowstone being a volcano, but they do not know why, or what makes it a volcano. Students will gain those understandings throughout this learning segment.

   When most students think “volcano” they relate only to cone-shaped mountains that violently explode with magma. The goals of this segment are to introduce students to where volcanic regions occur on Earth and why, in relation to plate tectonics. Students will be able to identify different landforms that come from volcanoes. They will also be able to explain how hot spots form, differentiate between types of volcanoes and eruptions, develop an understanding of what causes a volcano to erupt as well as the physical and chemical properties of magma.

   Students will use this information to simulate volcanic monitoring stations, and determine when a volcano might become a hazard to civilians and how to keep them safe.]

   b. Given the central focus, describe how the standards and learning objectives within your learning segment address

      ■ the use of science concepts,
      ■ the application of scientific practices through inquiry, and
      ■ the development and evaluation of evidence-based explanations of or reasonable predictions about a real-world phenomenon based on patterns of evidence and/or data.

   [The science standards to be met in this learning segment are based on the Next Generation Science Standards. These standards include explaining how geological processes have changed the Earth’s surface citing evidence, describing roles of geothermal energy on Earth, and applying knowledge of geoscience processes to suggest future possibilities for prediction and preparation of communities for natural disasters.

   To meet these standards, students will use models to engage in laboratory investigations to study large Earth systems, including using household products to investigate viscosity as related to magma, and to demonstrate the role of gases in volcanic eruptions and the creation of different types of volcanic rock. Students will use inquiry to relate these models to real world volcanic phenomena.

   Students will also apply scientific practices through inquiry by participating in a volcano]
monitoring simulation where they will analyze and interpret maps and data that is given to different teams of students. Students will be given "real-time" data that they have to process in a short timeframe, and then provide their expert advice to another team. Each team will have a job to do with the information they are given.

The laboratory investigations and the simulation provide the students with relatable data, patterns and evidence that will give the students the tools to develop explanations of volcanic and geothermal activity on Earth.

c. Explain how your plans build on each other to help students understand relationships between scientific concepts, scientific practices through inquiry, and the phenomenon in the learning segment.

[This learning segment begins after the students have already been introduced to the phenomenon of layers of the earth, plate tectonics driven by convection currents, and earthquakes. This volcano segment continues to build upon those geoscience ideas and Earth’s natural processes. The students begin with an independent research activity to lay the foundation of knowledge they need to continue to explore geoscience processes specific to volcanic activity on Earth (Lesson 1).

In order for students to understand the variety of volcanic activity, they will first explore the chemical and physical properties of magma, which is the driving force of geoscience processes. Since this is an integrated science class, students have previously touched on basic chemistry and elements and how they bond. This prior knowledge will be addressed, and I will build on that since one of the factors that influences viscosity is chemical structure.

Students will use a model to investigate the idea of viscosity and inquire the importance of viscosity in magma and volcanic activity. Students will investigate viscosity in a laboratory exercise by measuring and collecting data on the viscosity of common household items. They will use this data to draw conclusions about the viscosity of magma and how that relates to volcanic processes.

To continue to build on the understanding of how volcanoes work, and the chemical and physical properties that drive and form them, students will investigate the role that gases play in different types of volcanic eruptions, and explore different volcanic landforms (Lesson 3). Using Nearpod, students will be engaged in a presentation on volcanic landforms and how they come to be through different geologic activity. This information will lead students to gain an understanding of how different landforms are created from volcanic activity, and the different volcanic rocks that can be produced. This part of the learning segment emphasizes areas the students are familiar within the region including Yellowstone and Devils Tower.

Using the information gained from exploring how volcanoes work, why they erupt, and what can happen when they do erupt, students will participate in a volcano monitoring simulation (Lesson 4). For the simulation the class will be divided into four teams: the seismic team, deformation monitoring team, well water and weather team, and the eruption center. Students will interpret maps and analyze data to keep the civilians on the island safe from any volcanic threats. Students will be given "real-time" data and short time frame to process it, and deliver their advice to another team. That team will then interpret the data they received, and pass their advice on. After the simulation, students will discuss the issues they had and relate what they experienced in class to what might happen in the real world. Leading up to this point, students will gain knowledge about how tectonic processes driven
by magma, can be monitored, and also how unpredictable they are. They will get a real-world look at what scientists look for before a volcanic eruption, and how quickly it can happen.

All the knowledge gained from research, the lab investigations, and analyzing and interpreting data during the simulation will be assessed using a post-assessment that mirrors the pre-assessment given before the learning segment.

2. Knowledge of Students to Inform Teaching

For each of the prompts below (2a–b), describe what you know about your students with respect to the central focus of the learning segment.

a. Prior academic learning and prerequisite skills related to the central focus—Cite evidence of what students know, what they can do, and what they are still learning to do.

[ Students have spent a total of 6 weeks learning about plate tectonics and earthquakes leading up to this learning segment on volcanoes. They have been formatively and summatively assessed for understanding throughout each of these areas, as well as in previous areas of study including basic chemistry, physics, and biology. They have adequate understanding of the layers of the interior of the Earth, what drives plates to move, divergent and convergent plate boundaries, different types of faults, and seismic waves and how they are used by scientists to study the inner workings of the Earth.

Each area of science throughout the year has also aimed at building on grade-level science process and language skills using laboratory investigations, and a variety of writing and reading tasks. In this learning segment, the students complete an opener each day where they write in complete sentences using science language that they are already familiar with, and building on that language each day. Reading a variety of text, including scientific articles, news articles, and textbook passages throughout the year has introduced the students to different presentations of scientific information. This has given the students opportunities to build process and comprehension skills of scientific material presented in different formats.

Throughout this learning segment, I will pre-assess the students’ understanding of the material using openers at the beginning of each class period to gauge what they already know and where they might be struggling with the material. For example, prior to Lesson 1 students will be asked to write about their prior experience with volcanoes. Prior to Lesson 2, students are asked to define viscosity, and before Lesson 3 students are asked to write about the difference between effusive and explosive volcanic eruptions. ]

b. Personal, cultural, and community assets related to the central focus—What do you know about your students’ everyday experiences, cultural and language backgrounds and practices, and interests?

[ The student population of this middle school is 86% Caucasian and 9% Hispanic. It is a non-Title school with 38% of the population of free and reduced lunch rate. The community can be considered rural. Based on this information, about 2 out of 5 of the students most-likely come
from lower income households. This means that some of my students might be coming to school without their basic needs met, and they will not be prepared to learn, or engaged in class. No matter the demographics, every student will come to class with different experiences and different background knowledge, and it is my job to try to relate the material to them and make it as personal as possible. Many of these students hold value in the outdoors, and many have had personal experiences related to Earth’s processes including visiting hot springs, geysers, and landforms created by volcanic activity. Many students are also aware that Yellowstone National Park is a volcano, and they have either visited the park or have learned about the park in previous grades. Integrating a local aspect will make it more familiar for the students and easier for them to relate to.

3. Supporting Students’ Science Learning

Respond to prompts 3a–c below. To support your justifications, refer to the instructional materials and lesson plans you have included as part of Planning Task 1. In addition, use principles from research or theory to support your justifications.

a. Justify how your understanding of your students’ prior academic learning and personal, cultural, and community assets (from prompts 2a–b above) guided your choice or adaptation of learning tasks and materials. Be explicit about the connections between the learning tasks and students’ prior academic learning, their assets, and research/theory.

Knowing the standards that the students have been exposed to in previous academic years and earlier in this class allowed me to determine what needed to be covered in order for them to meet the standards for this learning segment adequately. This information also gave me the tools to determine what information the students are already familiar with, and what information needed to be introduced to them in order to scaffold the material throughout this learning segment. Using a Constructivist theory approach, I give students opportunities to develop an understanding of the material through experiencing it, and relating it to experiences they may have already had. I try to have the students actively engaged in their own learning as often as possible, allowing them to work cooperatively and engage in class discussion (http://teachinglearningresources.pbworks.com/w/page/19919544/Constructivism). They are given opportunities to make scientific inferences in relation to ideas they already have about the geological processes of the Earth, and areas they are familiar with, like Yellowstone. Students will also be given opportunities for peer support when developing ideas by using a think/pair/share strategy in Lesson 3. By using different strategies to present the information in this learning segment, I ensure that students are able to process the material in a way that works for them according to his or her learning style.

b. Describe and justify why your instructional strategies and planned supports are appropriate for the whole class, individuals, and groups of students with specific learning needs.

Consider the variety of learners in your class who may require different strategies/support (e.g., students with IEPs or 504 plans, English language learners, struggling readers, underperforming students or those with gaps in academic knowledge, and/or gifted students).

Throughout the learning segment, I take into account that all students learn differently, and at different paces. This is why I use a variety of instructional strategies, both teacher centered and student centered, to deliver instruction. During my teacher-centered instruction (Lesson 3), I make sure that I present information in engaging ways that include visuals, and student
interaction by asking both convergent and divergent questions that account for possible misconceptions, student logic, and scaffolding needed to guide students to the correct answers. This strategy provides challenges for students with higher intellectual capabilities and students that need accommodations. Many of the activities in this learning segment require cooperative learning groups that are selected in a heterogeneous way to ensure that students with IEPs and 504 plans are paired with peers who can provide support in the areas where students with accommodations might struggle (Lesson 1, 2, and 4). Students with modified curriculum will receive modifications on assessments, and all students with reading and writing accommodations will have opportunities to work with Para educators on reading and writing assignments.

c. Describe common preconceptions (based on prior academic learning and experiences) within your central focus and how you will identify and address them.

[Regarding Earth’s geologic processes, specifically volcanoes, students have a few misconceptions. Because of movies and television, students generally relate volcanoes only to cone shaped mountains that erupt violently. This was made clear to me during discussion after the first opener about students’ experiences about volcanoes. Unless they personally experienced otherwise, most are familiar with cone shaped, explosive volcanoes. Introducing them to different types of volcanoes and volcanic landforms, different types and consistencies of magma and lava, and geothermal features as related to places they are familiar with helps them to bridge the gap between what they think they know, and what is reality (Lesson 1 and 3). Bringing in the local aspect of volcanic activity in Yellowstone and surrounding areas, really helps them to relate the new information to personal experience and can ensure any misconceptions they may have are corrected. Students also have a misconception that when a volcano does erupt, what comes out of it is smoke and ash similar to what comes out of a campfire. Polling the class on this topic confirmed this misconception. Before the volcano monitoring simulation activity in Lesson 4, I make sure students understand volcanic hazards, and what is happening during an eruption by passing around actual volcanic ash from Mount St. Helens and discussing that the ash actually consists of fragments of pulverized rock, minerals and volcanic glass. Another important idea to introduce to the students is that volcanoes don’t only bring about hazards and destruction, but they can be vital in the formation of healthy soils that bare life. In Lesson 3, the Nearpod presentation brings this information forth to the students and assesses them on their understanding of this concept.]

4. Supporting Science Development through Language

As you respond to prompts 4a–d, consider the range of students’ language assets and needs—what do students already know, what are they struggling with, and/or what is new to them?

a. Language Function. Using information about your students’ language assets and needs, identify one language function essential for students to

- use science concepts,
- apply scientific practices through inquiry, or
- develop and evaluate explanations or reasonable predictions about a real-world phenomenon.

Listed below are some sample language functions. You may choose one of these or another language function more appropriate for your learning segment.
[Interpret. Students use process skills to interpret data and information in order to make reasonable predictions related to monitoring volcanic activity in the areas of deformation, seismic waves, and weather during a simulation activity.]

b. Identify a key learning task from your plans that provides students with opportunities to practice using the language function. Identify the lesson in which the learning task occurs. (Give the lesson/day and number.)

[In Lesson 4, the Thunder Island Simulation, students work in teams to receive, analyze, and interpret information related to monitoring volcanic activity on a fictional island. They must interpret the given information, and correctly communicate it to other teams in order to keep the people on the island safe from any threat of volcanic eruptions.]

c. Additional Language Demands. Given the language function and learning task identified above, describe the following associated language demands (written or oral) students need to understand and/or use:

- Vocabulary and/or symbols
- Plus at least one of the following:
  - Syntax
  - Discourse

Throughout Lesson 4, students will be introduced to the terms volcanic ash, seismic monitoring, seismic activity, deformation, andesitic lava flow, and basaltic lava and ash. These unfamiliar terms and ideas will be introduced during the instructions and introduction for the activity. The students will then be using these terms and addressing these ideas as discourse throughout the simulation activity.

d. Language Supports. Refer to your lesson plans and instructional materials as needed in your response to the prompt.

- Identify and describe the planned instructional supports (during and/or prior to the learning task) to help students understand, develop, and use the identified language demands (function, vocabulary and/or symbols, syntax, or discourse).

In the instructional materials for Lesson 4, there are introductory instructions that will be projected onto the classroom Smart Board. These instructions will be addressed to the entire class. The students can ask clarifying questions throughout the introduction, and new terms and ideas will be thoroughly explained. As each team receives their specific instructions, also found in the instructional materials for Lesson 4, they will be given time to read over the handout, and ask questions to clarify terms and ideas as needed for them to understand and use the discourse. During the discussion at the end of the simulation, I will re-visit the terms, using them in the discussion and relating them to real-life situations.

5. Monitoring Student Learning

In response to the prompts below, refer to the assessments you will submit as part of the materials for Planning Task 1.

a. Describe how your planned formal and informal assessments will provide direct evidence of students’ understanding of

- science concepts,
- the real-world phenomenon, AND
- the application of scientific practices through inquiry

throughout the learning segment.

[ Formal assessments are done as in-class work in the form of independent study using the internet (Lesson 1), laboratory investigations (Lesson 2), and a given pre and post-test. These assessments are directly related to the science concepts being covered in the corresponding lessons and provide examples and models of real-world phenomenon related to the central focus of Earth’s geologic processes. The questions answered in these assessments are in the students own words, and involve the students making inferences and using critical thinking skills and inquiry to develop an understanding of how volcanoes work through modeling the real-world phenomenon inside the classroom and making connections from those models to the actual processes. Informal assessments occur throughout each lesson in the learning segment. As the students participate in the learning tasks, they will continually be informally assessed on participation, communication, and in the form of openers prior to each task. Discussions and questions during informal assessments will act as a guide to a greater understanding of the real-world phenomenon and the science concepts being covered. Strategic questioning, as well as simulating scientific processes will also give the students opportunities to use inquiry skills to further gain an understanding of the content. ]

b. Explain how the design or adaptation of your planned assessments allows students with specific needs to demonstrate their learning.

Consider the variety of learners in your class who may require different strategies/support (e.g., students with IEPs or 504 plans, English language learners, struggling readers, underperforming students or those with gaps in academic knowledge, and/or gifted students).

[ Giving students opportunities to answer questions in their own words with subjective assessments allows the higher academic achievers to display a deeper understanding of the content, while a student with an IEP or 504 can also display their understanding, even if it is limited. Students with writing difficulties are given the option to use a word processor, or work with a Para educator. There are also opportunities for students to work in pairs where struggling students are paired with higher achievers that can assist in reading, clarifying, and writing. The pre and post test is objective, and a modified version will be given to students on a modified curriculum. The modified assessment gives fewer options for each multiple choice question, as well as fewer true or false questions, and a word bank for any short answer. Any additional supports needed will be given on an individual basis by myself or the Para educator within the classroom. ]