5E Arts Integrated STEM Lesson Plan

Lesson Title: Rock Out With Geology

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Topic: Geologic/Earth History

Targeted Grade Level: 9/10th Grade Earth Science

Time Needed: ~5 days

Subject Integration: The Subjects incorporated within this lesson are Art, Science and Technology.

Justification: There are many misconceptions regarding the Earth's history (i.e. the Earth is significantly younger than 4.5 billion years). In this project students will be researching a specific period of geologic time to create an informational song and video that communicates major characteristics of that period. An analogy for the lesson would be a person going on a trip in a car. A cohesive song and music video would be the destination of the trip. The passenger in the car would be the Earth science content being learned and the technology used to record and produce the song and video would be the car. Each of the parts of the car going on the trip are necessary for the trip to occur and likewise, the lesson cannot be completed without the incorporation of arts, science and technology. Music provides a great avenue to more easily learn and enjoy material than for example, writing a research paper. It is not possible to record and produce a song and video without technological skills. A live performance happens once, where a video can be shared with others not in attendance (i.e. a friend or family member that lives far away). The purpose of this assignment is to create a workpiece that will inform others about a period of our Earth's vast history and music aided with the technological skills to record and produce make that possible.

Standards:

NGSS Performance Expectations:

***NGSS* - HS-ESS1-6.** Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

The New York State Science Learning Standards (NYSSLS) for this performance expectation is exactly the same including naming conventions as the NGSS performance expectation. NYS adopted the NGSS standards in 2016 (https://bit.ly/2Q321iQ)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Constructing Explanations and Designing Solutions Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6)	**PS1.C: Nuclear Processes** Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.	**Stability and Change** Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS1-6)

Common Core State Standards:

Math: There are no math standards explicitly addressed in this lesson

ELA: New York State Next Generation Learning Standards for Literacy - RST4: Determine the meaning of symbols, key terms, and other content-specific words and phrases as they are used in scientific or technical sources.

ITEEA Standards

Standard 17. Students will develop an understanding of and be able to select and use information and communication technologies.
N. Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate
Q. Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.

National Art Standards

Anchor Standard #1. Generate and conceptualize artistic ideas and work.
Anchor Standard #5. Develop and refine artistic techniques and work for presentation.
Anchor Standard #6. Convey meaning through the presentation of artistic work.

Measurable Student Learning Objectives:

- Students will be able to communicate how radioactive dating provides evidence for different geologic periods via song.
- Students will be able to construct and produce a song and music video that communicates the key features of a period of geologic history.

Nature of STEM:

This lesson addresses aspects of the nature of science including that scientific knowledge is based on empirical evidence and that science is a human endeavor. With regard to empirical evidence, one of the goals of the lesson is to have students identify evidence that we have collected to support the ideas of scientists as to what the Earth looked like in its distant past. Additionally, it is also to be understood that science is a human endeavor. All of our time periods are separated using human logic for what is significant enough to mark a transition from one geologic era or period to the next. So even at the largest scale of geologic time it is human decisions in terms of defining and quantifying and giving meaning of geologic time that allows us to understand from a historical perspective how the Earth has developed.

Engaging Context/Phenomena:

The engaging context will be a video on Earth's past geo-history, highlighting some keys points in time. After introducing the project, a completed project which shows the teacher rapping about a geologic topic will be played.

Data Integration:

Students will be working with segments of geologic time and therefore time related data. NASA offers some articles with relation to geologic time such as this one: https://science.nasa.gov/wavelength-topics/geologic-time

Differentiation of Instruction:

Broad differentiation strategies may include (specific adaptations will discussed later on)

- Preferential seating arrangements will have been made for select students as is required by their individual IEP or 504 plans.
- Students will make use of a graphic organizer to arrange their thoughts and ideas before writing
- Directions will be repeated with clarity, consistency, and frequency to help students who have trouble focusing stay on task. Directions will be rephrased for students who are having difficulty following directions or procedure guidelines.
- Select students whose IEP or 504 plan requires the student to explain directions to the teacher will do so.
- Academic language required for the lesson will be pre-taught and students will have access to those definitions while working.
- Students whose IEP or 504 plan requires refocusing and redirection will be prompted by the teacher to complete their required tasks as necessary.

Real-life Connection:

There are three important real-life connections that will be made in the lesson:

1. **Art Connection:** Music is a very powerful method of communication. For example, popular advertisements often include catchy and or melodic jingles to help you remember the product/service. Similarly creation of the original or parody song will supply students an opportunity to share the information they have learned about their chosen period of geologic history. Students will gain experience in the creative process of music making. Lastly because the variety of music is so wide and available it offers students the chance to engage specifically with music which is meaningful to them whether it be representative of a personal preference or a part of the culture.
2. **Science Connection:** The past history of the Earth can be a controversial topic among certain religious ideologies. Exploration of Earth history during this lesson could serve as an opportunity for students to become exposed to ideas about how our present day Earth and its inhabitants have come to be which are widely accepted by the modern scientific community.
3. **Technology Connection:** In an increasingly digital world, the ability to use hardware and software that can help us to record video and sound and produce presentation worthy material are very valuable skills for some members of tomorrow's workforce. For example a student pursuing a career in marketing could learn the beginnings of video editing skills/practices that will allow them to help reproduce advertisements in the future.

Possible Misconceptions:

There are a lot of misconceptions regarding the history of our Earth. Primary misconceptions include broadly, the formation of the Earth and the timeline for the evolution of living organisms. More specific misconceptions may include:

- Dinosaurs and people (or potential proto-humans) existed at the same time
- The Earth is significantly younger than 4.5 billion years
- Organisms can "evolve" at the species level during their lifespan
- Humans have created all radioactive material
- Evolution always results in organisms which are better adapted to survive

Lesson Procedure:

5E Model	5E Objectives
Engage *Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as appropriate. Learn about what students already know and want to know.*	**Procedure:** During this phase the students will video on Earth's past geo-history, highlighting some keys points in time. During the video, students will write big events that pop out to them, they will be asked to write down at least five things they saw. Students will break after the video to discuss with a partner the items they have written down. The teacher will then lead a whole class discussion after the peer to peer discussions. Once the discussion has concluded the teacher will then introduce the project. After introducing the project, a completed project which shows the teacher rapping about a geologic topic will be played. **Modifications:** See "Differentiation of Instruction" (Page 5); All appropriate accommodations will be made so that this part of the lesson will be accessible to all members of the classroom. **Standards Addressed:** • **NGSS - Disciplinary Core Ideas - PS1.C: Nuclear Processes** Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.

	Formative/Summative Assessments: Class discussion and peer to peer discussions will serve as formative assessment during the lesson. **Resources:** Chromebooks and project worksheet
Explore *Plan for students to engage in hands-on activities that are designed to facilitate conceptual change.*	**Procedure:** During this phase, students will research and write a song about a selected period of geologic time. They will be working in groups of three. Students will be given a set of guiding questions and criteria to focus on while researching. After performing their research, students will construct a song using their research. The teacher will supply a handout that shows how a parody song can be made with an example. While students are working the teacher will roam the room and perform check-ins with students. **Modifications:** See "Differentiation of Instruction" (Page 5); All appropriate accommodations will be made so that this part of the lesson will be accessible to all members of the classroom. **Standards Addressed:** ● **ELA:** New York State Next Generation Learning Standards for Literacy - RST4: Determine the meaning of symbols, key terms, and other content-specific words and phrases as they are used in scientific or technical sources. ● **National Art Standards: Anchor Standard #1.** Generate and conceptualize artistic ideas and work. ● ***NGSS* - HS-ESS1-6.** Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. ● **NGSS - Cross Cutting Concepts - Stability and Change** Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS1-6) **Formative/Summative Assessments:** The research questions and written song will serve as formative assessments. If students are making appropriate progress, they will receive full credit. **Resources:** Chromebooks and project worksheet

Explain *Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts.*	**Procedure:** During the Explain phase, students will perform, redcord and produce their songs and music videos. There will be regular check-ins with the teacher to make sure students are on pace to finish within the time allotted for in class. The teacher will roam and assist as needed. **Modifications:** See "Differentiation of Instruction" (Page 5); All appropriate accommodations will be made so that this part of the lesson will be accessible to all members of the classroom. **Standards Addressed:** • **National Arts Standards: Anchor Standard #5.** Develop and refine artistic techniques and work for presentation. • **Standard 17.** Students will develop an understanding of and be able to select and use information and communication technologies. ○ **Q.** Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. **Formative/Summative Assessments:** The research questions and written song will serve as formative assessments. If students are making appropriate progress, they will receive full credit. **Resources:** Chromebooks,project worksheet and music production software
Elaborate *Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and skills.*	**Procedure:** This lesson/assignment will build into our next topic of Earth's current biologic and geologic activities. Students will be able to make comparisons between what Earth was like during their researched period and Earth today. We will revisit students' songs and the components of them after we have talked about our current period of geologic history. **Modifications:** See "Differentiation of Instruction" (Page 5); All appropriate accommodations will be made so that this part of the lesson will be accessible to all members of the classroom. **Standards Addressed:**

	• **NGSS - Constructing Explanations and Designing Solutions** Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6) **Formative/Summative Assessments:** There will be a formative class discussion that will occur during this phase followed by summative assessment where students will make comparisons between their period of geologic time that they selected for this lesson and the current geologic period. **Resources:** Chromebooks, completed projects
Evaluate *Assess students' knowledge, skills and abilities.*	**Procedure:** After students are finished students will be given the opportunity to show their final product or perform their song live if they wish. During the performances, the other groups will fill out an evaluation sheet based on a rubric given to each student. The students will aid in assessing the projects or their peers and share feedback in a whole class discussion. Afterwards the teacher will evaluate the projects given the rubrics that the other groups have filled out and use a rubric that the teacher gave each of the groups at the start of the project. **Modifications:** See "Differentiation of Instruction" (Page 5); All appropriate accommodations will be made so that this part of the lesson will be accessible to all members of the classroom. **Standards Addressed:** • **National Art Standards: Anchor Standard #6.** Convey meaning through the presentation of artistic work. • **Standard 17.** Students will develop an understanding of and be able to select and use information and communication technologies. ○ **N.** Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate **Formative/Summative Assessments:** The group evaluations performed by different members of the class will serve as a formative assessment as will the class discussion. The final project will serve as a summative assessment. **Resources:** Chromebooks, completed projects

Teacher Background:

The teacher should have a good fundamental understanding of Earth History. It is not necessary for the teacher to be an expert in several different geologic time periods, but an understanding of basic Earth formation, dynamic changes to the planet's surface and atmosphere and evolution of life are needed. Additionally the teacher should be familiar with at least one video/music editing software for students to use. It does not matter what software is chosen (iMovie, Windows Movie Maker etc.) as long as the teacher is able to demonstrate and help students use the program. Students who already have knowledge in this area could be allowed to use a different video editing software that they enjoy. Lastly, the teacher should be familiar with basic song structure (i.e. verse, chorus, bridge etc.)

Collaborative Project – Rock-Out with Geology!

Now that you have become familiar with the structure of the Earth, the different types of plate boundaries, and the theory of Continental Drift, you will now create a geology themed original or parody song using this information.

In groups of 4-5, you will:

- Write your own original or parody song about the topics we've recently covered
    - Refer to the document in the Collaborative Project folder on Schoology entitled "Requirements and Tips When Writing Your Original or Parody Song"
- Perform and record your song, so that you may share it with your classmates!
    - Refer to the document in the Collaborative Project folder on Schoology entitled "Requirements and Tips When Performing and Recording Your Song"
- Create a music video that will accompany your song
    - Refer to the document in the Collaborative Project folder on Schoology entitled "Requirements and Tips When Creating Your Music Video"

Roles for Students:

- Singer(s)/Performer(s): Responsible for performing your new song
- Lyricist(s): Responsible for creating your original or parody lyrics
- Videographer(s): Responsible for the creation of your music video
- Producer(s): Responsible for the overall completion of your song and music video

*Note you may (and I expect you to) change roles or combine your efforts to complete the different aspects of the project and responsibilities lifted above

Grading and Assessment

- Refer to the document in the Collaborative Project folder on Schoology entitled "Collaborative Project – Rubric"
- The rubric describes how you and your group will be evaluated throughout the course of the project and on your final video

Requirements and tips when writing your original or parody song

It can be intimidating to begin writing your first original or parody song, but if we break the process down into parts it's actually very easy!

1. Learn about the topic or content you want to write about

2. Decide if you want to write an original or parody song. I have provided some benefits of each below if you are having trouble deciding.
    a. If you are writing a parody song, you must check with me before you move to the next step, so I can approve the original song is appropriate
3. Begin writing your lyrics
    a. Your song should summarize the previous topics that we've recently covered or describe in detail a specific portion of those topics
    b. A song is composed of two major parts:
        i. Verses:
        ii. Hook:

    *If you're having difficulty while writing your lyrics, I will be around to provide support. When stuck on a tricky line or idea you want to describe, bounce as many ideas off your group mates as possible, it will help you to create and narrow down your ideas (both good and bad).

4. Check-In Before Finalizing Your Lyrics
    a. Before you move on to the performing/recording stage, check in with me, so I may approve your lyrics or offer suggestions on improvements that could be made.

<u>Uploading Your Video to YouTube</u>

After completing your music video your next step will be to upload the file containing your music video to YouTube.

- Refer to the document in the Collaborative Project folder on Schoology entitled "Creating a YouTube Account and Uploading Videos"
- Only one member of your group needs to upload your music video
- Make sure to provide me with the name of your channel after you upload your music video, so that I can look it up!

Rubric for “Rock out With Geology” Project

	Above Satisfactory	Satisfactory	Emerging	Below Satisfactory
Creation of Parody Lyrics	Lyrics are of excellent quality, specifically pertain to the topics we've recently covered, and are representative of the original song's pattern of lyrics.	Lyrics are complete, and are of satisfactory quality. Topics that we've covered in class were addressed in the song's content.	Lyrics are complete, but are substantially lacking. There was some reference to the topics we've recently covered.	Lyrics are incomplete, are severely unchanged, or are inappropriate.
Performance and Recording of Parody	The song was well-recorded to the best of the group's ability. It is enjoyable to listen to the song, and the singer/performer is easily understood.	The song was of satisfactory recording, and performance. It may be difficult to determine what is being sung/performed.	The performance and recording of the song is poor, lacking enthusiasm, or of extremely low quality. It is difficult to determine what is being sung/performed.	The performance and recording of the song is incomplete, poorly executed or is inappropriate.
Production of Music Video	The music video is visually appealing. The song's lyrics have been displayed so that they coincide with the audio, and are legible. Additional graphics were added	The music video is visually appealing. The song's lyrics have been displayed so that they coincide with the audio, and are legible. No additional graphics were added.	The music video is not visually appealing. The song's lyrics do not coincide with the audio, and or are not legible.	The music video is incomplete, severely undeveloped, or is inappropriate.

Participation & On-going Check-ins	Check-ins were made frequently throughout the course of the project. Students successfully completed the project and showed genuine enthusiasm during the process	Required check-ins were made throughout the course of the project. Students successfully completed the project.	Some check-ins were made throughout the course of the project. Students attempted to complete the portions of the project that were assigned.	No check-ins were made throughout the course of the project. Students showed a disinterest in the project, and made no effort in completing the project.
Content of Parody Song/Video	There is excellent incorporation of information presented or researched on during the Dynamic Earth Unit. Students incorporated all of the major parts of the unit into their Song/Music Video (Structure, Tectonics, Continental Drift)	There is evident incorporation of information presented or researched on during the Dynamic Earth Unit. Students incorporated two of the three major parts of the unit into their Song/Music Video (Structure, Tectonics, Continental Drift	Some incorporation of information presented or researched on during the Dynamic Earth Unit were made. Students incorporated one of the three major parts of the unit into their Song/Music Video (Structure, Tectonics, Continental Drift)	Very little or no incorporation of information presented or researched on during the Dynamic Earth Unit has been made. Students did not incorporate any of the three major parts of the unit into their Song/Music Video (Structure, Tectonics, Continental Drift)