

5E Arts Integrated STEM Lesson Plan – Template

This template serves as a guide for developing a lesson that integrates across subject areas and includes the components of a quality STEM lesson. Please use it to support your work and engage in discussions with your instructors and peers when you have questions.

Lesson Title: *A Walk Through Earth's Time*

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Topic: *Earth's History, Fossil Record*

Targeted Grade Level: *Middle School Grades 6-8 (Specifically 8)*

Time Needed: *Two weeks*

Subject Integration: *Science, Art, and Mathematics*

Justification: The students will be studying Earth's History and how we can infer what has happened to the Earth through the fossil record in Science. The students will use mathematics to look at scale and proportion when they have to calculate how long each time period is on the timeline for the small scale and the large scale. The Arts will be clearly visible when the students create animations and illustrations to show how the Earth looked during each time period.

Standards:

NGSS Performance Expectations

MS-ESS1-4 . Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

MS-ESS2-2 . Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
<p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MSESS1-4),(MS-ESS2-2)</p>	<p>ESS1.C: The History of Planet Earth</p> <p>The geologic time scale interpreted from rock strata provides a way to organize Earth’s history . Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1- 4)</p> <p>ESS2.A: Earth’s Materials and Systems</p> <p>The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth’s history and will determine its future. (MS-ESS2-2)</p>	<p>Scale Proportion and Quantity</p> <p>Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-4),(MS-ESS2-2)</p>

Common Core State Standards:		
<p>Math:</p> <p><i>MP.2 Reason abstractly and quantitatively.</i></p> <p><i>7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.</i></p> <p>ELA:</p> <p>SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p>		
ITEEA Standards		
National Art Standards		
<p><i>MA: Cr1.1.1.8- Generate ideas, goals, and solutions for original media artworks through application of focused creative processes, such as divergent thinking and experimenting. (Generate and conceptualize artistic ideas and work.)</i></p> <p><i>MA:Cr 2.1.1.8- Structure and critique ideas, plans, prototypes, and production processes for media arts prosecutions, considering intent, resources, and presentation context. (Organize and develop artistic ideas and work.)</i></p>		

MA:Cr 3.1.8- Implement production processes to integrate content and stylistic conventions for determined meaning in media arts productions, demonstrating understanding of associated principles, such as theme and unity. Refine and modify media artworks, improving technical quality and intentionally accentuating selected expressive and stylistic elements, to reflect an understanding of purpose, audience, and place. (Refine and complete artistic work.)

Measurable Student Learning Objectives:

1. Students will be able to place events in sequence and assign relative times to each event.
2. Students will be able to gain an understanding of relative and numerical time.
3. Students will be able to become familiar with the methods used by scientists to develop the Geologic Time Scale.
4. Students will be able to gain an understanding of deep time (4.6 billion years of Earth's history).
5. Students will be able to become familiar with events in the Earth's history and how they relate to one another.
6. Students will be able to investigate the Earth's history based on scientific theories (fossil record).
7. Students will be able to infer what life on Earth looked like during specific times.
8. Students will be able to design presentations based on their interpretation of the fossil record.
9. Students will be able to measure and create scaled representations of Earth's history.
10. Students will be able to integrate multimedia and visual representations into their presentations.

Nature of STEM:

This lesson incorporates the Science of Earth's history with mathematics in scale and proportion of creating a timeline. The technology comes into play when the students use different mediums (apps and programs) to create the illustrations and animations of those time periods. With each section a profession can be a focal point for STEM careers.

Engaging Context/Phenomena:

Asking the students what Earth looked like in the past will get them to thinking about current events (what we consider current when we look at the overall size of Earth's history. Using The Great Dying (https://science.nasa.gov/science-news/science-at-nasa/2002/28jan_extinction) will lead them past what they consider

current events and give them a deeper understanding of what time looks like. This article will also lead to next steps when we start on Human Impact and Earth's resources. This is where I will be using data from <https://science.nasa.gov/earth-science/programs/research-analysis/climate-variability-and-change>.

Differentiation of Instruction:

I will have a few students that will work in groups instead of individually. I will have students that will refuse to create a visual product and need to create written work instead. I have GT students who will need more advanced areas of time when it comes to creating their timelines and students who will need time periods with more simple life to illustrate.

Real-life Connection:

The real-life connection is with the timeline. The students will see how earth has changed over time and then in the next lessons they will compare how quickly or slowly those changes are reoccurring. This lesson leads us into Human Impact and Earth's Resources.

Possible Misconceptions:

Most students think that the majority of Earth's time was filled with dinosaurs. They do not actually understand that there was a time when nothing lived on earth and it was a great ball of ice or fire. That the Great Oxygenation Event (other life) had to happen first.

5E Model	5E Objectives
<u>Engage</u>	Procedure: Pre-assessment Ask students how we know what life on Earth was like 100 years ago, 200, 500, a thousand, a million years ago?

Have the students suggest major events that have happened throughout Earth's history and have them estimate how long ago they occurred.

Complete the Sequencing Time activity in which students gain an understanding of relative and numerical time by placing events of their own lives in sequence. Students become familiar with the methods used by scientists in developing the Geologic Time Scale.

Show them an overhead or picture of the Geologic Time Scale and ask them what they know about it. (Obvious answers would be about dinosaurs and human history.)

Have students listen to the audio file on The Great Dying from https://science.nasa.gov/science-news/science-at-nasa/2002/28jan_extinction

Have students suggest major events that have happened throughout Earth's history and have them again estimate how long ago they occurred.

Modifications

Prompting and Cueing for students who need help thinking of events that may be significant for their timeline.

Scribe for students who need a writer.

Standards Addressed

Scale Proportion and Quantity: Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Formative/Summative Assessments

Formative assessment will occur as each student creates a timeline specific to their own personal experiences.

	<p>Resources</p> <p>Sequencing Time</p> <p>https://www.geosociety.org/documents/gsa/timescale/timescl.pdf</p>
<p>Explore</p>	<p>Procedure:</p> <p>How Big is a Billion activity.</p> <p>Determining the Age of Rocks and Fossils activity.</p> <p>Modifications:</p> <p>Prompting and cueing</p> <p>Standards Addressed</p> <p>ESS1.C: The History of Planet Earth</p> <p>The geologic time scale interpreted from rock strata provides a way to organize Earth's history . Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1- 4)</p> <p>ESS2.A: Earth's Materials and Systems</p> <p>The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)</p> <p>Formative/Summative Assessments</p> <p>Completion of the above activities with 80%+ success rate.</p>

	<p>Resources:</p> <p>UCMP Web Time Machine https://ucmp.berkeley.edu/help/timeform.html</p> <p>How Big is a Billion https://ucmp.berkeley.edu/education/explorations/tours/geotime/guide/billion.html</p> <p>Determining the Age https://ucmp.berkeley.edu/fosrec/McKinney.html</p>
<p><u>Explain</u></p>	<p>Procedure:</p> <p>Earth's Time (scale on paper)</p> <p>Make a scaled timeline.</p> <p>The students will be making a timeline of Earth's history on a long strip of adding machine tape. The timeline should be done to scale. A scaled representation requires that 10 cm on the timeline represent the same amount of time anywhere along the timeline and each amount of time, say 5 million years, be represented by the same distance throughout the timeline.</p> <p>The students will:</p> <p>Measure out strips of adding machine tape 4.56 meters long. A meter stick will be provided in the lab.</p> <p>Select one end of the tape to represent the Present. Beginning at that end, they will mark off each billion years (1 billion, 2 billion, etc.)</p> <p>Starting with the oldest event (Event #1), mark off all of the important events in Earth's history shown in the worksheet given. In each case the student should write the date and event directly on</p>

the timeline. (I use a worksheet from the following Website-
https://d32ogogmya1dw8.cloudfront.net/files/quantskills/activities/timeline_list_of_events.doc)

Turn their timeline into the instructor.

Modifications

Precut and marked timelines

Prompting and cueing

Standards Addressed

ESS1.C: The History of Planet Earth

The geologic time scale interpreted from rock strata provides a way to organize Earth's history . Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1- 4)

ESS2.A: Earth's Materials and Systems

The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

MP.2 Reason abstractly and quantitatively.

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

	<p>Formative/Summative Assessments</p> <p>Students will complete the timeline for Earth’s History placing events in the appropriate time frames.</p> <p>Resources</p> <p>https://d32ogogmya1dw8.cloudfront.net/files/quantskills/activities/timeline_list_of_events.doc</p> <p>adding machine tape</p> <p>meter sticks</p>
<p><u>Elaborate</u></p>	<p>Procedure:</p> <p>The students will create another timeline working in groups.</p> <p>The students will make the scale larger by measuring the main hallway of the school.</p> <p>The students will calculate using the measurements from their timelines in the Explain section to create a larger scaled version to display in the hallway.</p> <p>The students will then be allowed to pick time periods listed on the previous time line to create an animation or illustration to represent what the Earth would have looked like during that time period based on the fossil record.</p> <p>The students will present their products to the class for evaluation.</p> <p>Modifications</p> <p>Working with partners</p> <p>If students are more comfortable creating flipbooks and then taking pictures and placing them in google slides that may be an option.</p>

If students are unable to create visual art they may partner with another to narrate the illustrations or animations using poetry or dialogue.

Standards Addressed

MA: Cr1.1.1.8- Generate ideas, goals, and solutions for original media artworks through application of focused creative processes, such as divergent thinking and experimenting. (Generate and conceptualize artistic ideas and work.)

MA:Cr 2.1.1.8- Structure and critique ideas, plans, prototypes, and production processes for media arts prosecutions, considering intent, resources, and presentation context. (Organize and develop artistic ideas and work.)

Formative/Summative Assessments

Students will be graded using the rubric attached. Specific content can be changed to fit the curriculum as needed.

Resources

Depending on the base system you are using the following could be an option for animation apps:

<https://www.pencil2d.org/>

<https://krita.org/en/>

<https://www.synfig.org/>

<https://animationpaper.com/>

<https://opentoonz.github.io/e/>

	<p>FlipaClip- app on google play https://www.kdanmobile.com/en/animation-desk</p>
<p>Evaluate</p>	<p>Procedure: Post Assessment School Gallery Walk (Presentations)</p> <p>Modifications There should only be modifications to the post assessment by this time for students who need limited choices or a scribe/reader on the post assessment. During the Gallery Walk students who do not wish to present to other classes will have their presentations already made.</p> <p>Standards Addressed <i>MA:Cr 3.1.8- Implement production processes to integrate content and stylistic conventions for determined meaning in mediarts productions, demonstrating understanding of associated principles, such as theme and unity. Refine and modify media artworks, improving technical quality and intentionally accentuating selected expressive and stylistic elements, to reflect an understanding of purpose, audience, and place. (Refine and complete artistic work.)</i></p> <p>Formative/Summative Assessments (I am still not sure how this will work on the presentation part to the rest of the school. I would like to use barcodes so the teachers can scan and watch the presentations in their classrooms, or have chromebooks available at stations to watch the presentations.)</p> <p>Resources Chromebooks</p>

	Access to students in other grade levels.
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Teacher Background:

Teacher needs to be aware of all theories of earth’s history

The teacher needs to be knowledgeable about several mediums for the students to create their presentations or have GT students work ahead and become familiar with whatever medium you are using. You may need to get permission from IT to get certain apps or programs to be unblocked for use.

The teacher also needs to be aware that there are some religious beliefs that contradict the scientific theories that the earth is 4.5 billion years old.

Science/Art Integration Rubric

	Below Expectation	Approaching Expectation	Meets Expectation	Exceeds Expectation
	5	10	15	20
Proposal/Originality	No planning of the project or turning in	Limited planning of the project or	Planning of the project and turning	Planning is obvious and

	a copy of someone else's design.	turning in a copy of someone else's design with a simple change.	in someone else's design with several moderate changes.	design is completely original.
Difficulty Level	xxxxxxxxxxxxxxxx	Little difficulty in the overall design. Will take limited effort to complete.	Moderate difficulty in the overall design. Will take some effort to complete.	Extreme thought and difficulty in the design. Will take quite a bit of effort to complete.
Knowledge of Content	Displays little understanding of concepts. Rarely give a complete explanation.	Displays a satisfactory understanding of most concepts. Sometimes gives appropriate but incomplete explanations.	Displays considerable understanding of most concepts. Usually gives complete or nearly complete explanations.	Displays a thorough understanding of all or almost all concepts. Consistently gives appropriate and complete explanations independently.
Application of Content	Relates concepts to the outside world with little accuracy.	Relates concepts to the outside world with some accuracy.	Relates concepts to the outside world with usual accuracy.	Relates concepts to the outside world with complete accuracy.
Communication	Expresses ideas with limited critical thinking using limited terminology. Few ideas are well organized and effective.	Expresses ideas with some critical thinking skills using some correct terminology. Some ideas are	Expresses ideas with considerable critical thinking skills using mostly correct terminology. Most ideas are well	Expresses ideas with in-depth critical thinking skills using consistently correct terminology.

		well organized and effective.	organized and effective.	Ideas are well organized and effective.
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