SCALE - BIG HISTORY ON A FOOTBALL FIELD

Preparation

- Assign students to groups.
- Ensure access to your school's football field (if you don't have a football field, you might try converting the activity for a basketball court or other large area).
- Find flags or some other type of marker that students can use to mark their thresholds on the football field. Cones from a PE teacher would work, or students themselves could be the assigned threshold markers.
- Have a camera on-hand to take pictures of your students and the thresholds laid out on the field.

Purpose

This hands-on activity helps students gain another perspective on scale—in particular, the scale of different things in relationship to each other. One thing that is especially important to keep in mind with any of the scale lessons is the importance of having students get out of their chairs. This will deepen their conceptual thinking of scale. The Big History on a Football Field activity has students translate the scale of the Universe to a familiar, everyday object.

Process

Have you ever met a person over 100 years old? Imagine the changes such people have observed in their lifetimes! There are Galapagos tortoises that have lived for 175 or more years and some whales often live for 200 or more years. The lifespans of most animals are a lot different from those of humans, but differences on this scale are not that hard to appreciate. When you compare human lifetimes with the history of our Solar System, the Milky Way, or the Universe, it gets tricky. The scale of time needed for considering the Universe and its parts, which are recorded in billions of years, is enormous compared with that of a human lifetime. To help put the timescale of Big History into perspective, you and your class will create a timeline showing the eight major thresholds of increasing complexity on the sideline of your school's football field.

The first step in this process is to organize your class into small groups. The student groups will need to calculate how many years each yard will represent. Your students should check in with you after making this calculation to ensure that it's correct before they proceed further.

Now, your students should go through the following steps and answer the following questions:

1. A football field is 100 yards from one goal line to the other, and the Big Bang happened 13.8 billion years ago. How many years would each yard equal if 13.8 billion years were to be mapped onto the football field? (Hint: divide 13,800,000,000 by 100.)

2. Working in their groups, calculate the yard line on which each of the major thresholds of increasing complexity should be placed. They can use one of the goal lines for Threshold 1, the Big Bang. The worksheet lists the thresholds and dates for each. To calculate how many yards from the goal each threshold should be placed, your students will need to take the number of years after the Big Bang for that threshold and divide it by the number of years that each yard represents. This will tell your students how many yards from your Big Bang goal line to place each threshold. Remind students to check their answers.

3. Mark each of the thresholds on the football field diagram attached to their worksheet. Some of the numbers will not be whole numbers. For those, approximate their exact positions on the football field.

4. Present findings. Once everyone has finished, the class should move out to the football field (or other area chosen for this activity). Make sure your students take their worksheets with them; also make sure you have something with which they can mark the thresholds on the field.

5. Once you're out on the field, mark each threshold, checking work carefully to make sure the thresholds match up correctly to the calculations.

6. Take pictures of the final results on the field. They would be great to refer back to later in the course.

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Threshold Conversion Table

A football field is 100 yards from one goal line to the other, and the Big Bang happened 13.8 billion years ago. How many years would each yard equal if 13.8 billion years were to be mapped onto the football field? (Hint: divide 13,800,000,000 by 100.)

Threshold	Years ago	Number of years after the Big Bang (ABB)	Years ABB divided by years per yard	Yard line placement
Threshold 1: The Big Bang	13,800,000,000	0	0	Goal line
Threshold 2: Stars Light Up	13,600,000,000	200,000,000	1.5	Between the 1- and 2-yard lines
Threshold 3: New Chemical Elements	13,550,000,000	250,000,000	1.8	A little before the 2-yard line
Threshold 4: Earth & the Solar System	4,560,000,000	9,240,000,000	67	On the 33-yard line
Threshold 5: Life	3,800,000,000	10,000,000,000	72.5	Between the 28- and the 27-yard lines
Threshold 6: Collective Learning	200,000	13,799,800,000	99.99855	Between the one-yard line and the goal line
Threshold 7: Agriculture	11,000	13,799,989,000	99.9992	Between the one-yard line and the goal line
Threshold 8: The Modern Revolution	250	13,799,999,750	99.999998	Between the one-yard line and the goal line

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A Scale Diagram of a Football Field

Once you and your group have made your calculations using the Conversion Table, carefully mark and label each threshold on this diagram.

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Process

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Your first step in the process is to calculate how many years each yard will represent. You'll do this in groups and then check in with your teacher to ensure you've calculated everything correctly.

Follow these steps, answering any questions:

1. A football field is 100 yards from one goal line to the other, and the Big Bang happened 13.8 billion years ago. How many years would each yard equal if 13.8 billion years were to be mapped onto the football field?

2. Work in your groups to calculate the yard line on which each of the major thresholds of increasing complexity should be placed. You can use one of the goal lines for Threshold 1, the Big Bang. The worksheet lists the thresholds and dates for each. To calculate how many yards from the goal each threshold should be placed, you'll need to take the number of years after the Big Bang for that threshold and divide it by the number of years that each yard represents. This will tell you how many yards from your Big Bang goal line to place each threshold.

3. After you've calculated everything, mark each of the thresholds on the football field diagram attached to your worksheet. Some of your numbers will not be whole numbers, so approximate those positions on the football field.

4. Share your findings with the class. Once everyone has finished, you'll move out to the football field (or another area chosen for this activity). Be sure you take your worksheet with you.

5. Once you're out on the field, mark each threshold, checking your work carefully to make sure you're matching up correctly to your calculations. When you're done, you'll have Big History laid out on the football field!

6. If you can, snap some pictures.

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Name: _____ Date: _____

Threshold Conversion Table

A football field is 100 yards from one goal line to the other, and the Big Bang happened 13.8 billion years ago. How many years would each yard equal if 13.8 billion years were to be mapped onto the football field? (Hint: divide 13,800,000,000 by 100.)

Threshold	Years ago	Number of years after the Big Bang (ABB)	Years ABB divided by years per yard	Yard line placement
Threshold 1: The Big Bang	13,800,000,000	0	0	Goal line
Threshold 2: Stars Light Up	13,600,000,000			
Threshold 3: New Chemical Elements	13,550,000,000			
Threshold 4: Earth & the Solar System	4,560,000,000			
Threshold 5: Life	3,800,000,000			
Threshold 6: Collective Learning	200,000			
Threshold 7: Agriculture	11,000			
Threshold 8: The Modern Revolution	250			

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Name:

Date:

A Scale Diagram of a Football Field

Once you and your group have made your calculations using the Conversion Table, carefully mark and label each threshold on this diagram.