

Didactic scenario

1. Title				
The Experiment of Eratosthenes				
2. Keywords				
Circumference of the Earth , experiment , Eratosthenes, STEAM				
3. Basic information				
STEAM Subject: Maths				
Typical interaction time with the educational scenario in the teaching hours for in-school work: 2 teaching hours.				
General description of the scenario:				
<p>Students will gain the experience of carrying out the historical experiment, with very simple means, following the steps of the great scientist Eratosthenes, as it was done in 240 BC. The " Geometers " students will set in the ground bars or other objects, they will measure their height and the length of their shadow and then, with simple mathematical calculations and with the help of appropriate applications of New Technologies (Google Earth, SunCalc etc.), will calculate Earth's circumference and radius. The students will be divided into groups and will do the experiment.</p>				
Phases	Stage			Time
Students awareness	Preparatory stage			15'
Angle measurements	Preparatory stage			20'
Conducting an experiment	Implementation stage			40'
Evaluation, feedback	Evaluation stage			15'
Age group: 12 years old (6 th grade in the Greek educational system).				
Estimated difficulty level :				
Very Easy	Easy	Moderate	Challenging	Very Challenging
			X	
Teaching resources				
Material: ruler or a tape measure, protractor, cardboard, right triangles, pencil, chalk, worksheets, rod				

(or another object).

School infrastructure: computer, video projector, interactive whiteboard, internet access, tablet.

Additional material from external sources/online tools: Google Earth , YouTube , photodentro ,
<https://www.nhc.noaa.gov/gcalc.shtml>

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4. Educational Problem

In Greek primary education there is no mention of Eratosthenes' method. Primary school students are taught at school that the shape of the Earth is "an oblate spheroid" by a series of impressive photographs of the Earth from space. This knowledge remains useless, if students do not engage themselves in "measuring the Earth" with simple mathematical calculations.

5. Learning objectives

After the implementation of the scenario, the students, depending on the class they attend, will be able to:

1. Understand the concept of verticality and draw right triangles.
2. To measure angles with the protractor
3. To give them a motivation to use applied concepts of Geometry and to actively participate in learning.
4. To use technological tools such as applications, but also "traditional" tools such as ruler, protractor, pencil.
5. To make learning amusing by using collaborative activities.

6. Phases of the Scenario

Phase 1

Title: Arousing the interest of male and female students

Indoor	Outdoor	Mixed
X		

Phase duration in minutes: 15'

Detailed description of the scenario phase:

A questionnaire is given to detect the students' previous knowledge about the subject. We use the platform "Google Earth" to show how small we are, compared to the size of the Earth. A video from YouTube is being played <https://www.youtube.com/watch?v=F34Ft-7VpIM> with reference to the Eratosthenes experiment. Editing questionnaires and plenary discussion.

Activity sheets: Questionnaire.

Phase 2

Title: Introduction to the method, measurements

Indoor	Outdoor	Mixed
X		

Phase duration in minutes: 20'

Detailed description of the scenario phase:

We use examples of measurements from the formulas proposed for the Eratosthenes experiment with the aim to better understand the concepts so that we can then proceed to the practical application of the experiment outdoor. Students practice making measurements and calculations of simple shapes. Time is provided for feedback in case of possible misunderstandings. Create a list and gather the appropriate materials to conduct the experiment outdoor.

Activity Sheets:

Worksheets with figures and formulas for mathematical calculations.

Phase 3

Title: Working in groups, conducting an experiment

Indoor	Outdoor	Mixed
		X

Phase duration in minutes: 40'

Detailed description of the scenario phase:

Division of the students into groups that operate in a specific time frame and a method of communication is defined for any clarifications and gradual handling of the experiment. The worksheet is distributed to the groups and we start by finding coordinates using the google earth software. Afterwards, the students go to the school yard where they will take measurements according to the worksheet.

Measuring lengths with a ruler or tape measure, placing a shadow measuring object perpendicular to the ground, designing a right triangle, measuring an angle with a protractor, concept of tangent. Calculation, data analysis and final measurement.

Activity Sheets:

Worksheets and useful links for conducting the experiment as well as for measuring experiment data.

Phase 4

Title: Evaluation/Feedback

Indoor	Outdoor	Mixed
X		

Phase duration in minutes: 15'

Detailed description of the scenario phase:

The work submitted by each group is evaluated in plenary. What is the measured circumference of the Earth? Compared to the actual Perimeter of the Earth? . Do you think the experiment was successful? What could have gone wrong?

At the individual level, each student's participation in the discussions, their answers to the questions are evaluated. Is Eratosthenes' idea accurate? If you were to repeat the experiment what would you change? The next meeting is set for March 20. On this day the Sun is directly above the Earth's equator and the length of the day is approximately equal to the night.

Activity Sheets:

Worksheets and useful links for conducting the experiment.

7. Evaluation Methodology

Students are motivated to actively participate in the various phases of teaching. The components for the evaluation of each student are: The students' work by using digital tools, the nature of the activities, the team work, the active participation in class activities and the exchange of results through investigation and experimentation.

8. Additional resources for the teacher

Folder: The Experiment of Eratosthenes_ Additional resources for the teacher