



Exploitation of Research results In School practice



Guide



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Package description - Guide

Title	Digital Maps and Geographical Coordinates
Pupils' age	13-15 y old
Level of education or type of school	Lower Secondary School
School subject	Geography (physics, mathematics)
Short description of content	
The educational package investigate the geometry of geographical coordinates and how to use the related digital maps to get various type of geographical and socio-cultural information. We review concepts related to "Coordinate Reference System" (2D and 3D) and geographic coordinates (latitude, longitude and height). A theoretical algorithm for measuring distances around the globe is provided, and a practical and fun method for measuring latitude and longitude. Also the relations between positions (and distances) on the surface of the globe and a 2D map is discussed related to "conversion systems", in the context of modern technologies that use GPS tracking systems. The math of GPS and some Octave/MatLab programs for simple numerical analysis of related problems are also discussed. Will be examined practical applications of these theoretical knowledge as: use the map location of various places of interest (home and school position, the distances between them, etc.); using information from databases accessible via the Internet to calculate distances and surfaces; finding important administrative or cultural information, for example (cadastre and real estate or archeology; art-architecture; written heritage; mobile heritage; ethnography; history; music; numismatics and theater.); etc.	
Concept and learning outcomes	
Pupils know: • basic arithmetic and trigonometric relations • geographical terms and objects • reading a map and correct use of map symbols Pupils understand: • how geographic coordinates can be calculated around the globe • use of geographical coordinates for various places of interest • GPS and digital maps concepts and principles • the importance of interdisciplinary	



- understand the utility and use real data and various type of geographical and socio-cultural information provided by digital maps
- how different knowledge from geography, physics, mathematics or social life can be correlated in everyday life

Pupils are able to:

- use the GPS tracking systems
- use information in databases accessible via the Internet, to calculate geographical distances and surfaces
- use of geographic coordinates to locate elements and phenomena around the globe
- recognition of geographical terms in different texts or in new contexts
- Identify geographical names and terms in foreign languages (correct reading in different European languages)

Elements of educational package (created in ERIS)

- a multimedia presentation of concepts that must be earned
- various simple materials for interactive experiments

Additional materials for teachers (websites links, science articles, etc.)

- http://andrew.hedges.name/experiments/convert_lat_long/
- <http://www.open.edu/openlearn/society/politics-policy-people/geography/diy-measuring-latitude-and-longitude>
- https://en.wikipedia.org/wiki/Haversine_formula;
- <http://astro.unl.edu/classaction/animations/coordsmotion/longlat.html>;
- <https://www.google.com/maps>
- <http://demonstrations.wolfram.com/LatitudeAndLongitudeOfAPointOnASphere/>
- https://en.wikipedia.org/wiki/Universal_Transverse_Mercator_coordinate_system
- <http://www.gfz-potsdam.de/en/section/earth-system-modelling/topics/density-structure-of-the-earth/integrative-gravity-and-isostatic-models/>
- <https://www.freemaptools.com/measure-distance.htm> ;
<https://www.freemaptools.com/area-calculator.htm> ;
<https://www.freemaptools.com/elevation-finder.htm>
- https://eu.mio.com/ro_ro/expicatii-sistem-gps_cum-functioneaza-sistemul-gps.htm
- <http://www.ancpi.ro/> ;
- <http://geoportal.ancpi.ro/>
- <http://www.eurogeographics.org/>
- <http://eulis.eu/about-us/>
- <http://www.cimec.ro/> ;
- <http://patrimoniul.gov.ro/ro/>
- <https://zabytek.pl>
- <http://www.jpi-culturalheritage.eu/>
- <https://www.google.com/culturalinstitute/beta/project/streetviews>



Online lesson

Subject	Digital Maps and Geographical Coordinates
Duration	1-2 hour
Materials/Preparation	
• a multimedia room with internet access and appropriate PC programs for webinar access • the multimedia presentation of the subject • various simple materials for interactive experiments (two inflatable balls; marker; scissors; small wooden sticks; a bright light lamp; phones with GPS, etc.)	
Lesson flow	
The educational package investigate the geometry of geographical coordinates; the math of position, distances and areas estimation and how to use the related digital maps to get various type of geographical and socio-cultural information. • First we discuss the importance of the interdisciplinarity of science and knowledge • We review concepts related to history of maps and "Coordinate Reference System" (2D and 3D) and Geographic Coordinates (latitude, longitude and height) (History ↔ Geography), (Physics ↔ Geography). • Then we discuss the angular coordinates transformations in different formats and a way for calculating distances around the globe (Math ↔ Geography) is provided, also a practical method for measuring latitude and longitude (Practical skills). • A mathematical method of position estimation using GPS satellite information (Math ↔ Geography) will be analyzed, in the context of modern technologies that use GPS tracking systems (Physics ↔ Geography). • The overview of transforming geographic coordinates into Cartesian coordinates and orthogonal projection. Also the relations between positions (and distances) on the surface of the globe and a 2D map is discussed related to "conversion systems". • The digital maps concept and model of the shape of the Earth - geoid, is discussed • Will be discussed practical applications of these theoretical knowledge as: use the map location to indentify various places of interest (home and school position, the distances between them, etc.); using information from databases accessible via the Internet to calculate distances and surfaces; finding important administrative - real estate and cadastre (Geography ↔ Administration), or cultural informations (archeology; art-architecture; written heritage; mobile heritage; ethnography; history; music; numismatics and theater.); etc. (Geography ↔ Culture)	
Homework	



Depending on the specific knowledge and skills to the particular classroom:

- a step-by-step how to we measure experimentally latitude and longitude in a certain position in the world
- To see how well we can draw the map from home to school, open on a PC the map at a scale encompassing both location - home and school (using for example "Google Maps"). Capture the image from the screen by pressing "Print Screen" and then copy the image (" Ctrl + V ") in a graphic editing program – something like" Paint "in Windows. Use now some lines and text (using the tools of the program) to mark the road and save the map as an image ("map.jpg").
- use free applications on the Internet for measuring distances, elevations and determining local areas (calculate distances that the pupil has to go home from school - straight or on the streets - courtyard school area, etc)
- individual search of applications ("apps") for mobile and tablet to be based on the use of databases defined by geographical coordinates