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Abstract

The free web-based resources are tremendously helpful in our new digital decades to teachers and students for developing and reaching good quality education in almost all possible spheres of knowledge. One of the most important missions of any research organization is to spread a knowledge. The research organizations and new technologies offers great possibilities to improve the quality of teaching by open educational channels and implementing supportive interactive materials and activities in classroom.

Keywords: e-learning, ecology education, supportive interactive materials

1 Introduction

Effectiveness of learning depends on quality of content and delivery mechanisms (Jain, 2016). Modern media, internet, spatial data form drones and satellite systems are helpful teacher's approaches, making the information of processes occurring in the nature to be easier understood (Bryndza *et al*., 2001).

In ecology, many subjects are tidily connected with the scientific information received from the new technologies, which are widely applied in a research of Earth and wildlife. For instance, the origin and assessment of pollution, prediction and consequences from disasters, as well as evaluating and conservation of natural resources.

Remote sensing technology, especially aerial photography and satellite imagery, are used intensively nowadays in all over the world. Geographic information systems (GIS) estimates the natural resources, monitors the pollution and land use, exert biological control and health studies, helps for social and economic planning, disaster avoidance, and management of conservation areas and parks (Fava *et al*, 2010). GIS have been mentioned as a suitable approach in teaching biology, ecology, and geography, and has been adopted in many secondary schools in all over the world (Kerski, 2007; Bryndza *et al*., 2001; Johansson, 2006; Fava *et al*, 2010).

2 Educational resources from new technologies in education

Learning about Earth is part of NASA's mission; NASA offers many education resources for kids, students and researchers in different fields (NASA Science, 2014).

In 2004, NASA launched the Aura satellite as part of its Earth Observing System. Aura carries four science instruments, which study the atmosphere. One of the instruments is TES - Tropospheric Emission Spectrometer. As TES passes over Earth's surface, it gathers data that can give a profile of the atmosphere. The profile shows with different colours how much greenhouse gases are in the atmosphere at different altitudes. Using such of kind new digital scientific data in the lessons can help the teacher better to explain and support his point of view working in classroom. For example, distributions of ozone or other greenhouse emissions (fig.1).

On figure 1, the areas of highest ozone levels are shown in red. All zones, where the red is closest to Earth's surface are situated near to the large cities in the US. Aura's polar orbit takes it

over the North and South Poles, Earth rotates beneath, and after16 days of orbits, TES has measured ozone over the whole planet and starts over (NASA Science, 2019). On that web site can be found different kind if supportive learning materials, as classroom activities for kids, infographics, images and movies for kids, students and other learners.

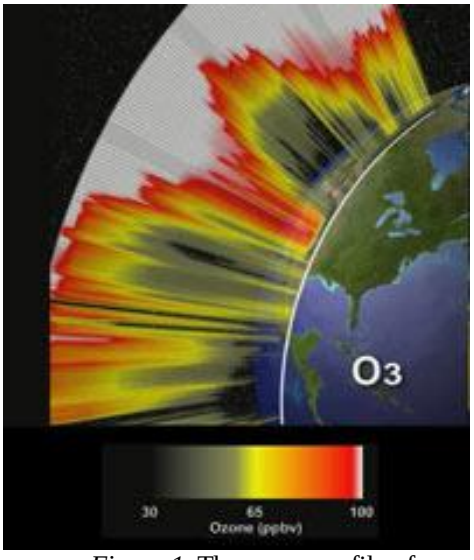

Figure 1. The ozone profile of atmosphere

EU Copernicus is another program that offers information services based on satellite Earth observations, and Copernicus Atmosphere Monitoring Service (CAMS) is one of six services (CAMS, 2019). The (CAMS), provides regular, high quality data about air emissions and atmospheric composition related to pollution and health, solar energy, greenhouse gases and climate forcing (CAMS, 2019). The service also tracked the wildfires and other natural disasters.

Remote sensing data and particularly satellites observations provide precise and broad information for caution and prevention of potentially disasters, rescue and rehabilitation. Satellite images combined with other GIS data helps to analyse a risk and mapping a hazardous zones, early warning, cyclone location, drought monitoring, and assessment of flooding, oil spill, forest fire and progress of desertification, modelling risks in specific regions. GIS takes an essential lot in climate change monitoring (Fava *et al*, 2010). All that questions are difficult topics not only for researchers, but also for ecology learners, and the clearance of those apprehensions is a crucial in all aspects concerning the sustainable development and high quality education (fig.2).

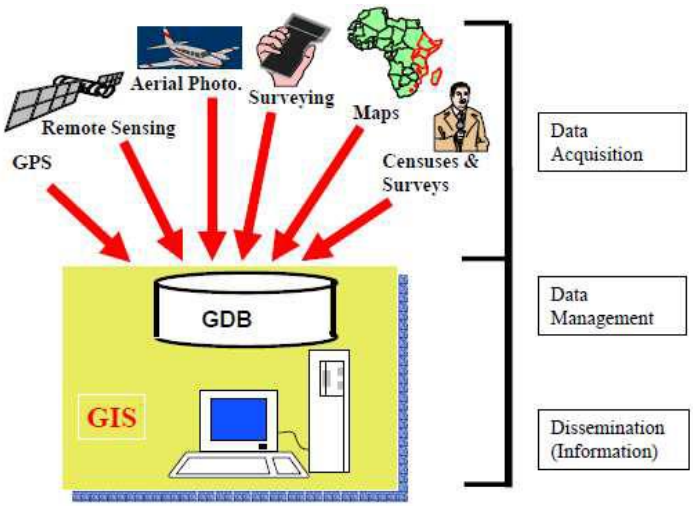

Figure 2. Geographic Information Process (United Nation Statistic Division, 2004)

3 Good practices in applying GIS in secondary schools

The successful EU project GISAS (Geographical Information Systems Applications for Schools), has been run between 2003-2006, with the purpose of water quality assessment of rivers in the neighbourhood of the partner school in different countries. The objectives of the project included: *introduce GIS into European secondary and upper secondary schools; create educational materials, exercises and a webbased-learning environment for teachers; use the GIS as a tool to enhance the study of water quality; support international cooperation among teachers and students in web-based learning environment* (Johansson, 2006). According to Johansson, (2006) applying the innovative learning tools allowed the students in active manner to learn important ecological problems. Moreover, students learn to create databases or how to access to existing digital databases, which providing a new way to study (Johansson, 2006).

There are many reports also from different projects, which are using a digital map created with a GIS, carried out in secondary schools, related to waste management, pollution of a river, and chemical measurements. Sanchez (2009) underline the benefits of applying those tools as enhancing of problem-solving skill and collaboration, so additionally, for the digital culture is important to integrate geotechnologies into the curriculum for the elaboration (Sanchez 2009).

Education is a critical component for the future, and applying GIS information in education is the guaranty of progress (Milson et al., 2012). According to Lenart, (2001), GIS technologies are convenient and attractive approach to satisfy the curiosity of learners, and one of the cheapest ways supporting objective and accurate perception, builds a student's attitudes, and stimulates solid connection of thoughts, plans and activities. The EC funded network, digital-earth.eu, which encourages the sharing of novel practices and promotion of invention and best practices in the execution of geomedia as a digital learning environment for school learning and teaching (González & Donert, 2001).

4 Free open resources for teaching with GIS

Free and open source software projects provided GIS software (Fava *et al*, 2010). Free available desktop GIS software and applications can be found as:

- GRASS (Geographic Resources Analysis Support System) GIS, - http://grass.osgeo.org/ - offers geospatial data management and analysis, image processing, graphics/maps production, spatial modeling and visualization;
- Map Window GIS - www.mapwindow.com - a desktop application capable of viewing shapefiles, and raster data in many formats. It can reproject data, clip, merge, and perform other geoprocessing through a "GIS Tools" plug-in;
- Quantum GIS – www.qgis-org - runs on Linux, Unix, Mac OSX, and Windows. QGIS supports vector, raster, and database formats. It also can display tracks from GPS. It is also available in a web server version;
- GvSIG - http://gvsig.gva.es/ - is an tool for handling geographic information. It has a friendly interface and it can access to several data format (raster or vector);
- SAGA - http://geosun1.unigeog.gwdg.de/saga/ht ml/index.php – a geographic information system, with a unique 'Application Programming Interface' (API) for geographic data processing. This API makes it easy to implement new algorithms- The SAGA API supports grid data like digital terrain models and satellite images, vector data, and tables;
- uDig - http://udig.refractions.net/ - an open source spatial data viewer/editor, with special emphasis on the Open GIS standards for internet GIS, the Web Map Server and Web Feature Server standards;
- Map Maker - http://www.mapmaker.com/ - ease of use, can learn how to draw, edit and print basic maps, and link them to databases. It has a simple and clean user interface (UI).

In addition to the Desktop GIS software, there are also Web GIS software and additional components, such as Database and Libraries (Fava *et al*, 2010):

- Map Server - http://www.mapserver.com/ - deliver dynamic GIS and image processing via Web, contains stand-alone application for building maps, scale bars and legends offline;
- GeoTool - http://cartoweb.org/ - open source GIS toolkit written in Java, using Open Geospatial Consortium specifications;
- OpenLayers – http://geoserver.org - open source AJAX library for accessing all kinds of geographic data layers, originally developed and sponsored by MetaCarta;
- PostGIS – www.postgis.refractions.net/ - adds support for geographic objects to the PostgreSQL object relational database;
- MapFish – http://mapfish.org/ - it is an easy-to-use and extensible web 2.0 mapping application framework;
- GeoServer – http://geoserver.org - open source software server written in Java that allows users to share and edit geospatial data;
- Cartoweb - http://cartoweb.org/ - ready-to-use Web GIS, as well as a convenient framework for building advanced and customized applications.

Implementing GIS in classroom helps students faster and deeply to understand the content of numerous disciplines: *geography*, *environmental studies*, *history*, *mathematics*, *language arts*, *chemistry*, *biology*, *civics*, and many other. It helps students think critically, use real data, make community. It does so in informal, primary, secondary, and university settings and appeals to today's digital and visual learners (Kerski, 2018). Geotechnologies, along with biotechnologies and nanotechnologies, are the three key skills on job markets for 21st Century (Gewin 2004).

4 Conclusions

Using a new research information and high technology tools in the training process make the education more valuable and attractive. For nowadays generation, that is classified as a digital native that is a crucial cause, preparing them for integrating in the technology progress that accelerates the speed of executing in all scopes of humankind development.

Acknowledgement

This publication is supported by a university project № 3 ФТТ/22.05.2018 г. Theme: „Assessing the ecological purity of food raw materials and food products"(Trakia University, Faculty of Technics and Technologies – Yambol).

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