You Paid for It; Learn to Use It!

Education and Outreach on Selected Federal Agency Websites

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Each year brings an ever-increasing number of online resources for students and teachers about Earth Systems Science concepts. Many of these come from federal government agencies, reflecting both advances in understanding our planet and cooperation between scientists and educators. There are now probably tens of thousands of activities and other resources. This review will focus on selected sites to provide places for starting a search to find what you might be interested in using.

In addition to the online versions, many of these can be downloaded in pdf and other formats for classroom use. Remember that all of these resources were created using your tax dollars, so you already paid for and own these materials. Now find out what you have available for your curriculum and students!

U.S. Geological Survey (USGS) (http://www.usgs.gov/): The USGS describes itself as "an unbiased, multidisciplinary science organization that focuses on biology, geography, geology, geospatial information, and water . . . dedicated to the timely, relevant, and impartial study of the landscape, our natural resources, and the natural hazards that threaten us." Their Education section (http://education.usgs.gov/) provides links to resources dealing with topics ("What's New, What's Happening") that are suitable for current event activities or lesson plans. The "Educational Resources" section provides links to the many USGS programs, as well as to GPS and GIS teaching applications. Career information, partnerships, and highlighted themed classroom activities can be accessed through their "Of Special Interest" links.

The USGS home page now features links to current research topics, such as mercury contamination. Of particular value for STS programs is the "Science in Your Backyard" links. Clicking on your state leads to items about newsworthy events, such as flooding, invasive species, and acid rain threats. "Real-time" data are available about surface and groundwater conditions, floods and droughts, earthquakes, and other topics, such as mineral and recreation information.

National Aeronautics and Space Administration (NASA) (http://www.nasa.gov): NASA has, of course, been the premier government scientific agency for decades, and their web sites are chock full of great educational resources. There is so much, in fact, that clicking on the "For Educators" link opens another menu for links to materials designed for "Grades K – 4," "5 – 8," "9 – 12," "Post Secondary," and "Informal Educators." There are sections for websites about "Life on Earth," "Humans in Space," and "Exploring the Universe." The "News and Events", "Missions," and "Multimedia" sections all provide resources suitable for classroom applications. Despite impending changes in NASA's funding to reflect current political priorities, a vast amount of web-based materials exist for all levels and every course. For elementary students,

the NASA Space Place (http://spaceplace.nasa.gov/en/kids/) provides an excellent starting point for learning about our planet in the Universe.

Certain programs within NASA have their own websites with excellent educational resources, and selected examples will be provided here. The Jet Propulsion Laboratory based at the California Institute of Technology (http://www.jpl.nasa.gov) handles responsibility for many NASA missions. They have created thousands of Earth- and spaced-based images. JPL's Education pages (http://education.jpl.nasa.gov/index.html) link to hundreds of programs developed to support K–12, higher education, informal education, minority education, and other programs.

But within each mission site are what I consider the real "gems": educational activities that draw upon the goals and science of the mission. As with any treasure, you sometimes have to dig deeply to find them. For instance, one of my favorites deals with the "Genesis" mission (http://genesismission.jpl.nasa.gov/mission/index.html). You may recall that this project collected samples of solar wind particles in order to learn more about origins of our solar system, and then crash-landed during re-entry. Yet the extraterrestrial materials survive and are now undergoing analysis, which may produce reports of tremendous scientific value.

The set of classroom activities developed in connection with this mission provide exciting possibilities for students and teachers. One module for high school students, "Cosmic Chemistry: An Elemental Question" (http://genesismission.jpl.nasa.gov/educate/scimodule/indexCC-EQ.html), focuses on characteristics of chemical elements, and the processes of posing and answering questions that led to the development of the Periodic Table. For middle schoolers, the companion "Cosmic Chemistry: Understanding Elements" (http://genesismission.jpl.nasa.gov/educate/scimodule/UnderElem/index.html) encourages students to group elements by their characteristics, much as Dmitri Mendeleev did in the 19th century. Students then interact to find out about elements in particular groups. Using several resources, students also learn how elements are used in everyday products.

Similar "gems" are available in almost all of the JPL missions. These activities generally underwent extensive evaluation by outside panels of classroom educators and scientists before release. Many of these assessments were conducted by the Institute for Global Environmental Strategies (http://www.strategies.org/). With support from NASA's Goddard Space Flight Center, IGES has created sets of classroom activities about key issues, such as "Investigating the Climate System" (http://www.strategies.org/education/index.aspx?sub=education&sub2=productdevelopment).

National Oceanic and Atmospheric Administration (NOAA) (http://www.noaa.gov): NOAA is the umbrella organization for the government agency that probably interacts with all Americans everyday: the National Weather Service (http://www.nws.noaa.gov). But NOAA also includes many other agencies, all involved in monitoring and explaining our Earth System. The NOAA home page features links to "hot" environmental issues, such as global warming, stronger hurricanes, impending El Niño episodes, and other research topics.

For educational applications, NOAA now provides Podcasts (http://www.podcast.noaa.gov/), as well as web-based resources. The NOAA photo library provides access to more than 40,000 images. Every topic on their web pages -- from air quality and aviation to weather and whales -- include classroom-applicable resources along with their scientific and technology content.

The NWS web site (http://www.weather.gov/, not to be confused with The Weather Channel's web site, www.weather.com), provides both immediate access to current conditions and hazards, and also to many links to educational resources within NOAA and created elsewhere. Extensive efforts have been made by the NWS and other components of NOAA to coordinate and improve their educational outreach.

The National Ocean Service (http://www.nos.noaa.gov/) is less well known, but it provides a wide variety of online resources that can be used by teachers and students. One that I particularly enjoy using are the tide and current predictions. These come in various formats, include tables of predicted times and water levels for high and low tides (http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Tide+Predictions); graphic predictions for selected stations (http://tidesonline.noaa.gov/); current flow predictions (http://tidesandcurrents.noaa.gov/currents06/); and instructional activity kits (http://www.nos.noaa.gov/education/kits/tides/welcome.html).

U.S. Naval Observatory (http://www.usno.navy.mil/) (USNO): Founded in 1830 as the Depot of Charts and Instruments, the U.S. Naval Observatory is the federal government's official authority in the areas of precise time and astrometry, earth orientation parameters and other astronomical data required for accurate navigation and fundamental astronomy. Their products (http://aa.usno.navy.mil/data/) include online resources to determine Sun and Moon rise and set data or almost any location; phases of the Moon; solar and lunar eclipses; and much, much more.

Official time in this nation is based on the USNO Master Clock (http://tycho.usno.navy.mil/master.html). The educational importance of this has increased greatly with the expansion of GPS-based activities, so students and teachers can learn much from the Time Services Department website (http://tycho.usno.navy.mil/time.html).

Other Federal Agencies: There are many other federal agencies that provide web-based educational resources, far too many to include all in an article like this. One other organization that deserves special mention, however, is the Environmental Protection Agency (http://www.epa.gov/). During the past few years, the US EPA has, perhaps, lost some of its reputation for unbiased monitoring and defense of our country's air, water, and land resources. Recent budget cutbacks threaten continued existence of many EPA libraries and other data collections. Nonetheless, their educational website (http://www.epa.gov/epahome/educational.htm) still provides links to useful resources for elementary, middle, and high school students, as well as teachers and researchers.