

There are a number of levels of development for introducing spatial learning into an outreach program. In traditional elementary school materials, spatial learning takes the form of specifically focused workbooks that contain maps and questions that require the student to ultimately read the map, follow directions, navigate through a series of steps, and identify objects at final locations.

However, spatial thinking has applications throughout society and can now be based upon real-world settings and examples that can be constructed interactively utilizing online databases of information that are tied to maps. While the steps of learning in traditional materials are still valid with the new technology, personal adaptability and immediacy create the opportunity for new excitement that emanates from developing maps of the viewer's actual surroundings.


Detailed below are three real-world examples that engage adults to expand their capacity for spatial learning. While spatial theory is an important backdrop to understand and guide the formation of materials, the focus for this paper is to actually put together the series of steps to guide the use of the technology.

Three examples of interactive creation of materials for learning involve:

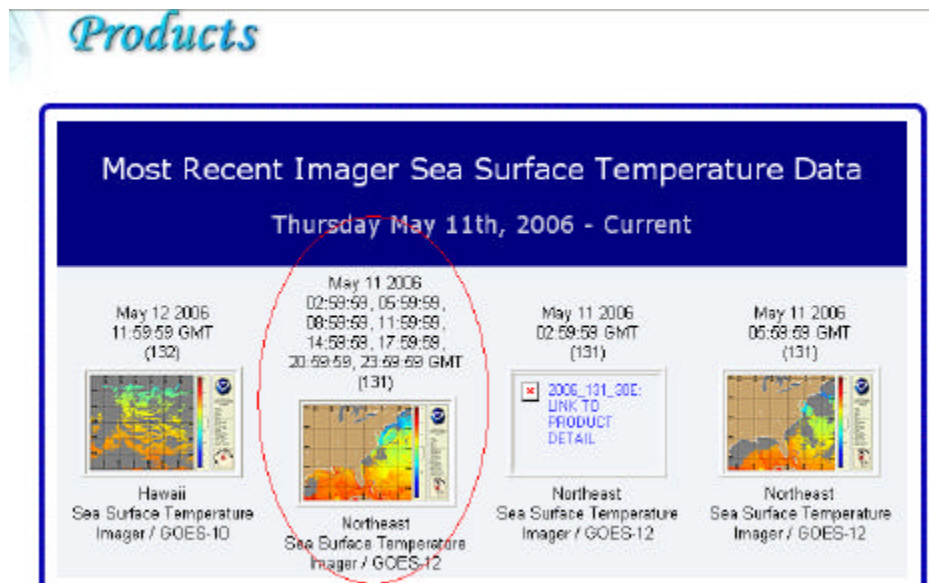
- obtaining data from National Oceanographic and Atmospheric Administration (NOAA) regarding ocean currents,
- arranging a time-series of pictures from an ocean-front camera to show spatial-temporal change, and
- using web browser rollovers to create interactive, multi-image learning system.

#### NOAA

“NOAA's CoastWatch Program processes near real-time oceanographic satellite data, and makes it available to Federal, State, & local marine scientists, coastal resource managers, and the general public” and is located at <http://coastwatch.noaa.gov/> on the internet. By clicking on “Product Search”, users are presented with a wide variety of real-time NOAA products. For this example, the focus will be on the gulfstream, a current of warm water that flows up from the south and has effects on weather, wildlife, and local beach water temperature. The idea is to provide area residents with an ongoing activity that people can flexibly utilize (daily, weekly, monthly, or for a special event) to provide a high technology tie to the real world.

This author has investigated these products and has found that the “GOES Imager Sea Surface Temperature Products” page shows clear images of the gulf stream. By clicking on that link, users are brought to a series of pages that alphabetically list the “GOES Imager Sea Surface Temperature Products”. The page that shows the gulf stream images is obtained by pressing the arrow  on the bottom of the page four times to get to the “Northeast Sea Surface Temperature Imager / GOES-12” information. For ease of retrieval, users should add this web page ([http://coastwatch.noaa.gov/interface/most\\_recent.php?&product=sst&sensor=Imager&of\\_fset=80](http://coastwatch.noaa.gov/interface/most_recent.php?&product=sst&sensor=Imager&of_fset=80)) to their list of Favorites.

A page full of images are shown and are available for users to investigate, however this author prefers the composite image, usually signified by a series of times under the date in the heading of the image, as shown:

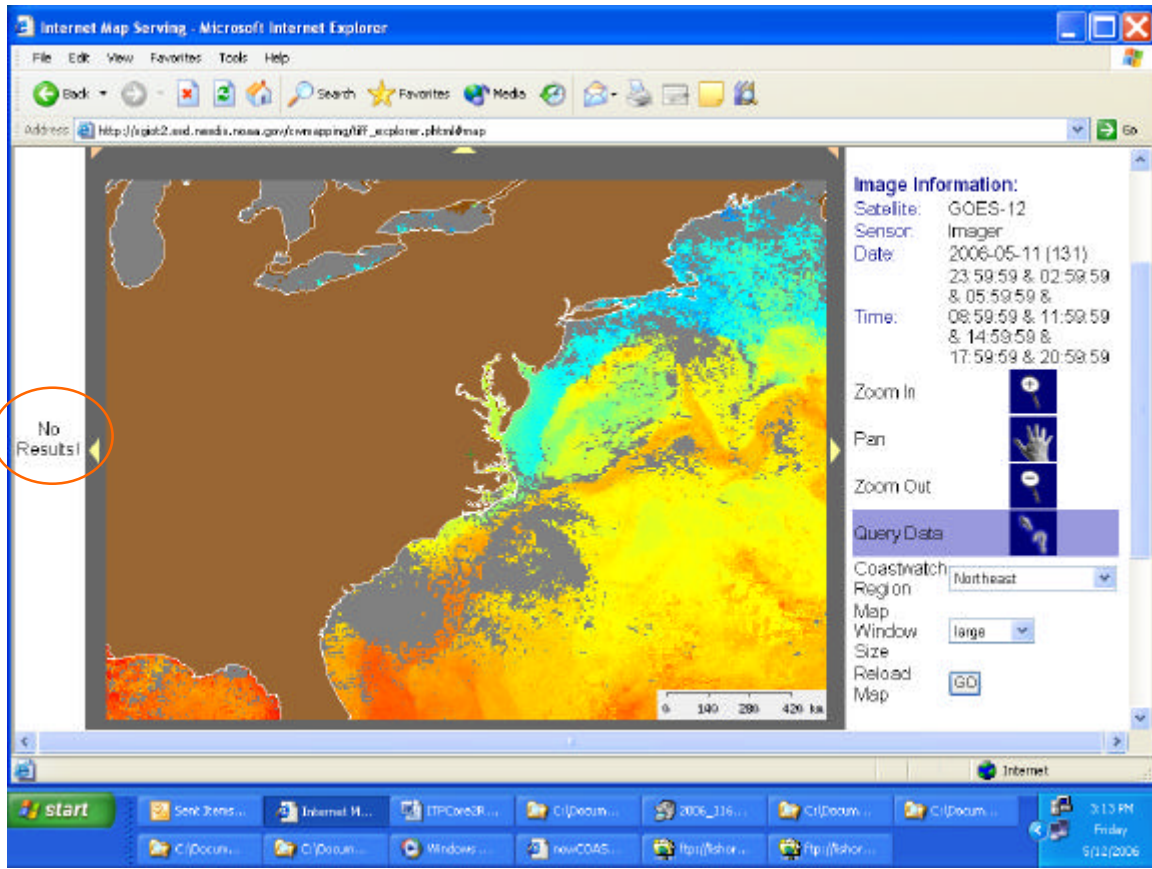


By clicking on the image, citizens are brought to a page with the image and a list of formats as follows:

2006\_131\_39E (hdf)  
2006\_131\_39E (png)  
2006\_131\_39E (tif)  
Explore this Tiff in MapServer  
DODS HDF Access  
MetaData

By right-clicking on the (png) link, one can download the image presented at the top of the web page in a format that emphasizes a smaller file size, while the (tif) image format is larger with colors and resolution that are truer to the original image. At the same time, format type may make a difference downstream to a technological process that utilizes a one's personal creativity to rearrange the images into a derivative product. One example that people can be led to create is a powerpoint movie showing change over time by downloading images and placing them in exactly the same place on a slide (see additional powerpoint file entitled, "[topex](#)").

Furthermore, by clicking on the link to, "Explore this Tiff in MapServer", a new interactive web page loads that permits users to interactively pan, zoom, and query for data. A critique of this particular web service is that the query did not return results, but they normally would be designed to return temperature.



An internet map service usually only functions to deliver information as determined by the designer. However, higher levels of interactive spatial learning tools are available that enable teachers to outline colors and assign values for colors from the legend to the areas on the image to return the Sea Surface Temperature. Part of the goal of CELLS is to provide those school districts who invest in the appropriate assets to provide their students with these “higher level” learning experiences.

The topex1.ppt file was created by placing images recorded at successive points in time by a NASA satellite at the same exact position on a slide using the Format Picture option found by right-clicking on the image. The intention of the CELLS web site is to provide the public with the forum to display the results of their school work and summer projects. These projects give general directions that lead users through the process of creating step-by-step recipes to provide others visiting the web site with the capacity to perform the same work with new data, such as is described above for the Gulf Stream. In the Google Map version, persons will be able to identify aspects in their surroundings that connect to seal life. It is a by people for people type of web site for science. There is the potential to also provide a forum for people to interact in blog fashion, although this author is skeptical of starting blogs earlier than participant demand can support (see <http://pub95.ezboard.com/briverheadfoundationmessageboard> for a forum on the Riverhead Foundation, who do seal rescue and rehabilitation). However, the postings show that questions from the general public are common, and the answers to one person’s

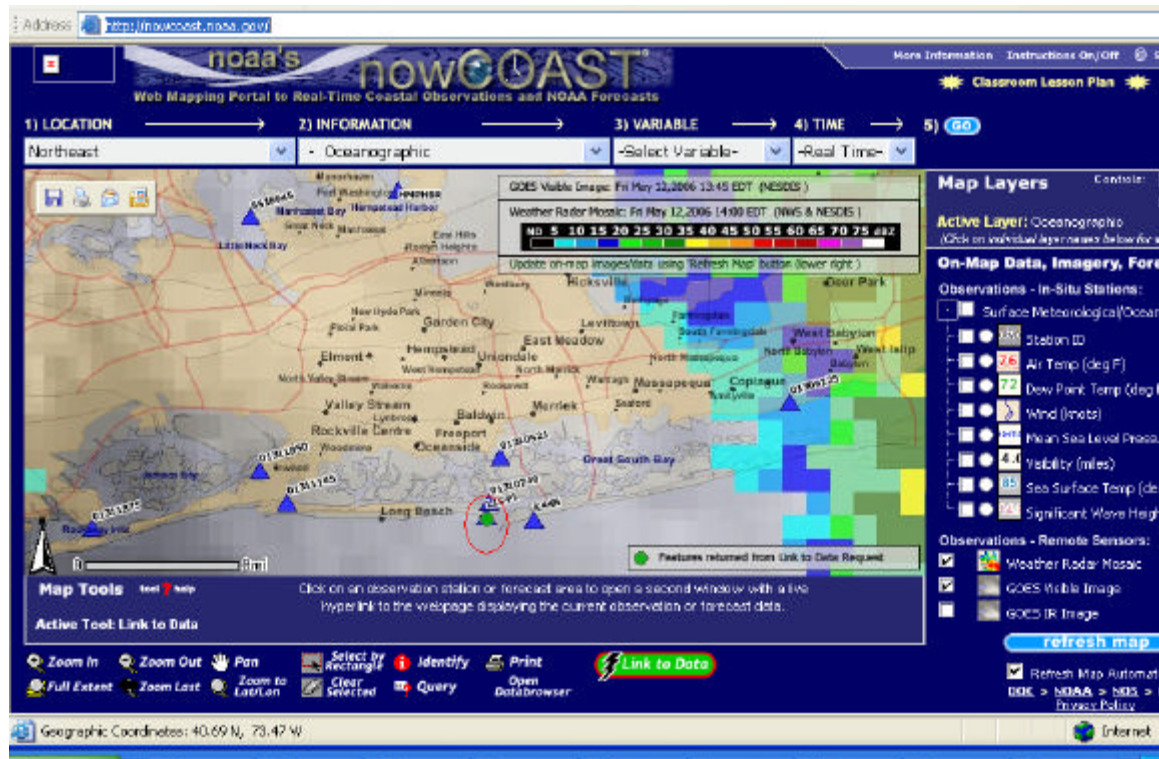
question will probably serve to answer another's. Therefore, a log of material provides a history for interested persons to peruse. One can foresee guided publication of information, and the opportunity that "staged" interactions can do a better job of leading visitors through an interesting, engaging forum. More than frequently asked questions, and less that spontaneous, haphazard interaction.

## NOWCOAST

One of the main issues that this author has with the technology of interactive, scientific web mapping is the variation of its functionality by technological set-up. For example, the NOWCOAST is a wonderful, interactive web service that provides NOAA information, but it has difficulty performing successfully and consistently. This author routinely experiences frustration using the site, and therefore does not recommend it as a learning experience for non-experts.

That said, this user did push through to get the browser to work, and chose  
1. Northeast Location 2. Oceanographic Information 3 No variable selected 4 Real Time and 5 pressed GO to get

A map of the Oceanographic weather stations appeared, the author then pressed on the blue triangle to get to real-time data.



The real-time data screen brought up a page of science information, along with a recent web cam picture:

Address <http://nowcoast.noaa.gov/dataBrowser.jsp> Go


**nowCOAST Databrowser** Browse nowCOAST Record History

[Previous Record](#)
[Next Record](#)
[Delete Record](#)
[Back to Map](#)
[Open Link](#)

Record: 5 / 5 Map Layer: Observations: Oceanographic ▲

Feature Name: Point Lookout, Long Island

Attention: The Hyperlink Below May Originate from a non-NOAA Site.



Live webcam image of Point Lookout Beach  
*Click on image for larger version.*

## Sea Conditions at POINT LOOKOUT

### Long Island, New York USA

Latitude 40 degrees 35.0 minutes North  
Longitude 72 degrees 35.2 minutes West

A service of [LIShore](#)

Page last updated 05/12/2006 14:31 EDT

**STATUS NOTICES 18 June 2005:** Network connectivity to the Point Lookout camera was lost on 6/15, so no images are getting through. We have notified the network provider but expect it will be at least Monday before a repair is made. We regret any inconvenience.  
Tom Wilson

Tide and Weather Observations at Town of Hempstead East Marina, Reynolds Channel, Point Lookout.			
Time	05/12 13:30	Maximum last 24 hr	Minimum last 24 hr

By clicking on the sea cam picture, a new page opens with a larger page and a link to archived images at <ftp://lishore.msrc.sunysb.edu/pub/liwebcam/15/>

“Archived image names take the form L5yyyyymmddhhmm.jpg, reflecting the year, month, day, hour, and minute they were taken.”

By downloading images and placing them in a powerpoint slide show, as described above, a time series of imagery can be created showing the daily tides, daily sunrises versus time, and sunrises by season, showing the movement of the sun throughout the year. These projects fit into a curriculum on earth science and provide materials consistent with New York State Standards. While powerpoint is this author’s current technological capability, it is the intention to learn more about video editing from the ITP program and expand the capability to deliver recipes for students to construct time-lapse videos.

In the meantime, this author did find an interesting example of interactive display of map imagery that performs in a manner more consistent with a positive learning experience. The idea came from the time-series web site at [http://fl.biology.usgs.gov/Nonindigenous\\_Species/ZM\\_Progression/zm\\_progression.html](http://fl.biology.usgs.gov/Nonindigenous_Species/ZM_Progression/zm_progression.html)

The site uses rollover technology to display time-series data quickly and easily. Underneath each image is an explanation that matches the image that is showing. By taking the information at <http://www.geobabble.org/flux-ecoregions/> and adapting it to a simpler version, it is possible to create an interactive experience that shows the different types of information that scientists use to create new models of our world, and a draft form is available at <http://globalscience.home.att.net/ZM/zmedrive4.html> which points users to a valuable national resource.

At their interactive site, “maps containing the data used to develop the draft NEON climate domains are now available, along with an interactive tool for exploring the maps. The web-based mapping application was created by William Hargrove and Forrest Hoffman of the Environmental Sciences Division of Oak Ridge National Laboratory. Hargrove is the developer of the mapping technique used to generate the NEON domain map. Users can zoom in, pan to areas of interest, and make comparisons between maps without losing their extent of interest when viewing the 30 original environmental variables, as well as the nine derived output maps”, this author feels that the interactivity detracts from the learning process due to the delay of looking at the maps.

By selecting specific maps and displaying them using the web rollover technique, the information rapidly pops up to the viewer. Simple seal web projects would replicate the process to create these maps, except that the viewers would be shown maps of seal movements, for example, along with specific text for the particular image.

In this example, we are seeing the benefit of geo-referencing data to real-world coordinates, and then performing mathematical operations on the data set to obtain unique and powerful scientific models of the real world.