Global Learning - Pedagogical Concepts involving Virtual Globes

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Abstract

Recently, virtual globes like NASA Worldwind, Google Earth, MS Local Live and of course ArcGIS Explorer have become significant building blocks for learning environments in Geography and beyond. Due to their free availability and attractive interfaces these virtual globes for many have become synonymous with GIS, even though they 'only' offer an additional interface paradigm by projecting distributed geospatial services onto a globe surface and allowing free navigation without constraints of map sheets, spatial scales of representation (to a degree) and themes.

Using these 'catchy' and widely accessible virtual globe interfaces for teaching Geography-related topics of course is becoming increasingly popular in schools and other eductional environments. This paper explores some of the specific characteristics of learning in virtual globe environments. Several types of interactions and workflows are peculiar for navigation and learning in these kinds of environments. Examples are the frequent changing of scales to switch between overview / context and local detail, free lateral panning in order to explore a location's wider surroundings, moving to perspective views for a better understanding of topographic frameworks, and the toggling of themes to learn from different thematic views. These types of interactions are basic building blocks and thus foundations for 'global learning'.

Without yet having a solid base of empirical evidence, the authors are assessing the potential of a virtual globe - based pedagogies. By interacting will all kinds of geospatial information from a freely navigable 'global' view it is expected that current shortcomings of localized, 'boxed-in' learning environments will be reduced. It remains to be seen if skills ranging from general topographic frameworks to topological and geometrical relationships and knowledge about interrelations between spatial factors will significantly improve.

Keywords: Geography education; virtual globes; orientation and navigation skills; contextual learning

Virtual Globes in Education

While virtual globes (Butler 2006) are helpful in numerous school subjects, the following discussion is primarily focused on learning in Geography or closely related subjects. Learning Geography has traditionally been supported by maps and other visuals, with worldwide perspectives supplied by atlases and globes. The latter were, and still are excellent tools for building a mental map of global phenomena, but have one distinct disadvantage: they do not scale well to local scales, causing a 'break' in educational media.

Local and regional issues and frameworks have to use large to medium scale maps not directly related to the global overview supplied by an atlas or a globe.

As we as teachers attempt to bridge the gap between local action and global thinking, we need learning media scaling seamlessly between local and global environments. Virtual globes come in handily for this task, providing a unified framework for geographic learning which has never been available before.

General educational principles should not depend on any particular media. Fundamental approaches like active, constructivist learning or any other principles we might subscribe to will not be facilitated or blocked by media. New media in Geographic learning like virtual globes, though, need to be linked into learning processes designed for these basic educational principles. The media pedagogy of virtual globes therefore is translating generic learning philosophies into the specific realm of this novel technology, hopefully creating new options, opening innovative pathways and in the end improving learning successes.

Navigating Virtual Globes

Several characteristics of 'navigating globes' are similar to online map services students might have experienced before. Concepts like layers, freely changeable scales and flexible pan operations will be familiar. Beyond that, there are several significant differences between online map services and virtual globes: maps require the explicit definition of projections (even if the service might do this on autopilot there always is an underlying projection with particular characteristics), with a map we ultimately encounter an edge, or a map sheet boundary, and maps usually have a defined scale.

Navigation skills required for competent handling of virtual globe displays can therefore build on map navigation experiece, but have to go beyond. While most individuals have acquired the requisite skills for navigating globes by personal experimentation, in an educational setting it will be important to pursue a structured approach towards building media competence for virtual globe manipulation.

Some of the specific skills required to successfully gather information and build knowledge from working with virtual globe interfaces are:

- Navigate the globe in its entirety: intuitively understand the mapping of a spherical object onto a 2D view, spin the globe in all directions, understand geographical coordinates (latitude, longitude) and particular points / lines (poles, equator, Greenwich meridian, tropics etc), handle directional orientation (e.g. re-establish a north-up view), seasonal / diurnal sunlight variation etc.
- Manage scale: zooming in and out, understand the concept of scale in the context of a globe view, acknowledge there is no uniform scale across the view, link scale to 'level of detail' (LOD), appreciate fractal dimensionalities and compare features across the globe at the same scale.
- Layers and themes: switch layers on and off, recognize bottom-up drawing sequence of layers as well as scale dependency of layer visibility, reorganize layers,

handle transparency and add new layers (where feasible – e.g. from OpenGIS conformant services or from a GPS track.

- Establish a PoI: finding a point (or feature) of interest based on 'informed search', appreciate the scale dependence of annotation visibility, locate a feature based on a coordinate value pair (e.g. http://tools.wikimedia.de/~magnus/geo/geohack.php?params=34_7_24_N_117_34_46_W_type:city), work with gazetteer services and other catalogues.
- Measure – 'Geometry': measure and identify locations, use distance and area tools, recognize the characteristics of great circle distances e.g. when using length tools showing a curved arc between origin and destination, understand levels of accuracy, recognize apparent centrifugal shortening when measuring distances away from the current view centre.

The above listed skills are limited to 'vertical view', map-like navigation. Most virtual globes today offer the option to render terrain elevations from oblique angles with other layers draped on top. In this case navigation across different perspectives can get quite complicated, and users frequently 'get lost' in their virtual world. A button to 'get me back to a vertical, north-up and overview-scale perspective' then is an indispensable asset for any user interface. Navigating perspectives here is considered an issue separate from virtual globe navigation.

Active Learning Pathways

By now most teachers will have recognized that the principles of constructivist learning hold substantial promise, building on the insight that just listening to or reading / viewing materials is inferior to actively solving problems, working through tasks or other 'doing' activities. Solving carefully crafted tasks and assignments either individually or in groups gives students the opportunity to first acquire skills, and in turn apply these to gather information and create knowledge.

Virtual globe environments are well suited for active learning on multiple levels, some simple skills-level tasks include:

- Use a globe to collect geospatial measurements, and to georeference ('geotag') one's own observations.
- Define placemarks and attach more information including links to tell a story.
- Create a logbook or diary of a field trip or vacation using a virtual globe framework, linked with an encyclopedia, a photo and video collection etc, everything tied together along the trip's track.
- Design and develop an annotated fly-through to introduce students at a partner school to your own regional environment.
- Some platforms facilitate the design of thematic maps, which are much better understood when semi-transparently overlaid with a topographic background.

Simple building blocks like these create confidence, many students will be keen to not only explore the virtual representation of their world, but to start telling their own 'localized' stories and along the way generate a lot of insights and substantial new knowledge.

Virtual Globes and Web 2.0

The traditional separation of author ('teacher') and reader ('learner') as well as the distinction between set content and communication dialogue has been removed by the recent emergence of Web 2.0 or the 'Social Web', typically perceived as a highly interactive environment with participative roles for everyone.
'Web 2.0' (O'Reilly 2005, and Alexander 2006) came along in the form of web-logging ('blogging'), with the availability of Wikis (Lamb 2004), user opinions driving sales and booking platforms and entire sub-cultures built on video clips and discussions about them.

Online learning currently is in the process of being transformed from a 'knowledge delivery paradigm' into a participative paradigm of collective knowledge construction, facilitated by skilled moderators (teachers) and suitable platforms (Strobl 2007 a, b). For Geographic learning, the authors claim that virtual globes (and more generally, Geographic Information Systems) are key media platforms underpinning the GeoWeb 2.0 from a digital learning perspective.

Just explore ideas like tight coupling between wikis and virtual globes, geotagging discussion forums or jointly created georeferenced image collections. We already observe the first signs that geotechnologies lead to a 'democratisation of knowledge', will certainly change the grassroots of learning and ultimately influence our societies' perception of local as well as worldwide phenomena in currently unforeseen ways.

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