Chapter 70
Nurturing a Geospatially Empowered Next Generation

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ABSTRACT

For new generations of citizens in all countries, a level of proficiency in geospatial concepts and skills will be required to realize the potential of professional and developmental opportunities. The teaching of geospatial skills links into traditional science, technology, engineering, and mathematics (STEM) curriculum objectives, community-wide concerns and initiatives, and global citizenship. Therefore, by the pre-university and undergraduate level, it is desirable for each student to have acquired such competencies. Free and open-source tools that are accessible and affordable in most areas of the world, along with data availability, offer an opportunity to support teaching such a curriculum. Here, core geospatial concepts are introduced, along with available data and tools. Then, using three scenarios, it is shown how the core concepts can be applied to different settings for educational purposes.

INTRODUCTION AND BACKGROUND

In order to educate the next generation of geographic information system (GIS) users, this chapter organizes all learning objectives based upon the core concepts outlined by Kuhn (2012). These concepts are summarized in Table 1.

This chapter will explain these core concepts using three scenarios on different continents. These scenarios contain the basic structural underpinning for pedagogical units that can be developed by teaching staff for use with their classes and within the locally applicable curricular framework. The scenarios can be generally adapted to a large variety of settings. This approach demonstrates that the

Table 1. Core concepts of spatial information from Kuhn (2012)

Concept		Question
Spatial	Location	Where are you? Where is "here"?
	Neighborhood	What is nearby?
	Field	What qualities are associated with "here"?
	Object	What properties define the things that are here?
	Network	On what links and pathways can physical goods or information travel?
	Event	What spatio-temporal change occurred?
Information	Granularity	On what scale and resolution is the spatial information provided?
	Accuracy	How correct is the spatial information?
	Meaning	How to interpret it? What does it imply?
	Value	What is its relevance? How does it relate to other societal values?

questions behind the concepts are the same regardless of the environment in which the learning takes place. However, depending on the context, these questions can be answered in very different ways. To begin, a comprehensive set of available data and tools are presented. Then, the application of some easily accessible tools are demonstrated via the scenarios.

DATA

Any educator who wishes to incorporate geospatial learning goals into his or her teaching practice will be confronted with the question of where to find, and how to select, the appropriate data and tools to bring the scenarios and activities to life. The data will be of a type for use with GIS or geospatially capable software. The availability of professional development opportunity for educators to acquire and develop the requisite skills is critical for a wide-spread rollout of a geospatial curriculum. Pioneers and innovators, though, will find a wealth of opportunities on the internet for independent study, thanks to the strong ethos open-source software and open-data among both developers and data providers (such as local, regional and national government entities, as well as public research institutions) in this area.

Geospatial data can be broadly divided into two categories: raster and vector data. Raster data are images composed of many picture elements known as pixels. Each pixel contains location information as well as a pixel value or pixel attribute (e.g. brightness, height, etc.). Vector data represent geographic features such as points, lines or polygons. The information content is linked with the geolocation as well as the attributes of the data set.

Geospatial data are stored in a number of formats. Most images, or so-called raster data, are stored in the GeoTIFF format that keeps both data and metadata – the information that describes the data, specifically its georeference information – in a single file. The equivalent for point information, also referred to as vector data, is the shapefile format. However, in the recent past the personal geodatabase format is increasingly used within the most widely used commercial GIS package, ArcGIS. Though a personal geodatabase provides flexibility and makes it easier to retrieve and analyze data, it is a proprietary database format and, therefore, not likely to become a generally accepted standard. A large variety of text

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