Creating and Teaching Case Studies in a Web Design Project

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Purpose
In this exercise, students create case studies that examine hydrologic issues in a way that incorporates both the societal significance of these problems and the science involved in trying to solve them. Such an approach reinforces the utility and necessity of hydrologic study.

By presenting individual case studies, students learn hydrology by explaining and teaching it. Compiling and presenting data in a variety of forms encourages students to think critically about how to make data accessible. By using a web-based approach, students make connections among the data and the scientific and social issues of their cases. The data collection process pushes students to consider how they access data. In this exercise, students create case studies that examine hydrologic implications of coal-bed methane extraction proved valuable to the lead author in reviewing a grant proposal in 2003. Finally, the model outlined here can be used for many other topics, both within earth sciences and beyond. One such application is in connecting teaching resources with pedagogical techniques and educational research.

The Process
1) Select a newsworthy site or problem.
2) Determine if sufficient information to write a case study is available.
3) Collect and connect data (published maps and papers, USGS records, GIS data, news stories, etc.)
4) Determine hydrologic principles that can be demonstrated in case study.
5) Create and present a case study lab exercise that integrates diverse data.
6) Use web capabilities to compile and link data with student writing (final products were copied to CD, not posted to the Web).

The Product
Case studies compiled by hydrology students can be used in a variety of other classes, including introductory and environmental geology. Subsequent classes can review, update, and improve earlier case studies. One student’s 2002 case study on hydrologic implications of coal-bed methane extraction proved valuable to the lead author in reviewing a grant proposal in 2003. Finally, the model outlined here can be used for many other topics, both within earth sciences and beyond. One such application is in connecting teaching resources with pedagogical techniques and educational research.

Case Studies from 2002
Chetel, Lauren M., Saltwater in the Mississippi River, a threat to the drinking water of New Orleans, Louisiana: A case study.
Clark, Elizabeth, Branson, Missouri: Entertainment, country music, and hydrology?
Drummond, Benjamin, Water in the San Juan Islands (Washington).
Gendsaak, Andrew, Yucca Mountain, Nevada: A hydrologic case study.
Hall, Melissa, Bemidji (Minnesota): Toxics Project: USGS groundwater study.
Hunzicker, David, Pheasant Branch Marsh (Wisconsin): GIS mapping techniques to understand groundwater flow.
Nemitz, Eric, Saltwater intrusion on Cape Cod (Massachusetts): Threats to a coastal aquifer.
Nickerson, David, What’s the story on coal-bed methane (CBM) in Wyoming’s Powder River Basin.

Lessons Learned
This project emphasizes two ways in which the web is an important educational resource:
1) Connectivity
Framing a case study in the web-design format emphasizes the connections between types of data, data collection and analysis, and the relevancy of this analysis. Web pages can easily link newspaper articles about the economic issues of a case with a groundwater flow model and geochemical data of the area in question. Information regarding the collection methods of data can easily be included with the data itself.

2) Learning how to find data
Many types of available data are relevant to hydrologic study, however, locating these data is often complicated. The process of data compilation required students to search for web resources, books, articles, maps and government reports. Students must determine what types of data are necessary for understanding the case at hand. For example, most students were able to locate either well data or potentiometric surface maps from USGS Water Investigations Reports or USGS on-line water data. They learned how to locate and use library resources as well as how to search effectively for on-line data. They also learned how to write metadata for end-users of the case studies.

Branson, Missouri: Entertainment, Country Music, and Hydrology?

This title page outlines web site structure and includes links to all sections. Most student case studies included similar sections, and many had additional links to data pages (Clark).

Example of background information including schematic diagram (Gittings).

Example of background information including diagram (Drummond).

Example of background information including data and historic water levels were commonly selected data types (Nemitz).

Example of title page presenting background information and links to relevant figures (Drummond).

Example of background information including data types selected (Nemitz).

Example of lab exercise that uses simple mapping techniques to understand groundwater flow (Hunzicker).

Example of background information including affective quotes (ref. 1).

Example of background information including quotations, is relevant to the pedagogical function, creates empathy with the reader, serves a pedagogical function, requires that dilemmas be solved, has generality, and is short. "A good case tells a story, is set in the past five years, creates empathy with the central characters, includes quotations, is relevant to the reader, serves a pedagogical function, requires that dilemmas be solved, has generality, and is short" (ref. 1).

Example of background information including data types selected (Nemitz).

Example of data presentation including explanatory prose written by student, data-specific data and links to regularly updated data sources. Real-time water data and historic water levels were commonly selected data types (Nemitz).

Example of outline for class presentation. This case study uses a quotation to frame the issues. The outline includes links to data and structured lab exercises, as well as questions for discussion (Nickerson).

References