Developing Information Technology Fluency within the Context of Science Inquiry

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To Do this activity online, go to http://www.umsl.edu/~edujpolm/scilit.html

Overview

Technological tools involving computers and networking are increasingly important tools for practicing scientists' inquiry. Such technologies are also increasingly prevalent in science inquiry as practiced in upper elementary and middle schools. But teachers are not always aware of how they can help their students develop technological fluency for science inquiry. This session explores ways that teachers can facilitate students becoming effective, critical users of computer and networking technologies for search, analysis and representation of findings in science.

A. Developing Questions, e.g., "Why is it hotter in some places?" and Brainstorming Ideas

1) The *technologies* I recommend considering in this phase are images, animations, and concept mapping software. *To Do: Look at the animation, brainstorm ideas, & record on concept map*
2) Revealing and refining thoughts and ideas with electronic concept maps can be an advantage over paper, but only if one or more of the following is the case:
   a) flexibility of rearrangement is utilized
   b) neatness of layout is valued
   c) concept map will be re-examined and modified later

Helpful resources:

Free concept mapping software for Windows and Mac – Cmap – they also have good descriptions of concept mapping principles in their documentation section - http://cmap.ihmc.us/
The most popular commercial concept mapping software - http://www.inspiration.com
Well-designed commercial software for Mac OS X – Omnigraffle - http://www.omnigroup.com/applications/omnigraffle/
Read-Write-Think web-based tools - http://www.readwritethink.org/student_mat/
Animation generated with Worldwatcher
Free software - http://www.worldwatcher.nwu.edu/software.htm
Curriculum - http://www.worldwatcher.nwu.edu/curriculumMS.htm

B. Searching for Information and Data

1) You'll need to help students get beyond just asking the question literally. (I tried typing "Why is it hotter in some places?" in google.com, ask.com, and Ask Jeeves for kids, with varying results)
   a) When they get something resembling the answer, may think they're done when they aren't
   b) When they get too many results, can be overwhelmed
2) What would help you answer the question?
   a) Related ideas from brainstorming
   b) Hunches and hypotheses to follow up on
3) Gleaning information from searches
   a) Learning to scan web content pages and search results pages
   b) Learning to use links page collections
   c) Evaluating credibility

Helpful resources:
Literacy Matters - http://www.literacymatters.org/content/research/intro.htm
Critical Evaluation Worksheet –
Simpler - http://school.discovery.com/schrockguide/evalmidd.html
More complex - http://www.sofweb.vic.edu.au/internet/workshet.htm
Distances between cities - http://www.mapcrow.info/ (found by searching google for "map distance from city to ocean", then following "Maps and Globes" on bottom page of returns, then searching on the resulting links page for "distance")
Google Maps – http://maps.google.com (used to find cities)
Current weather, lat-long, and elevation of cities – Weather Underground - http://www.wunderground.com/ (found by searching google for "elevation of dubuque iowa")

C. Analyzing data

1) The *technologies* we will use in this phase are static maps, and Excel software. To make your own maps, you would use a GIS (see Worldwatcher above).
   To Do: Analyze online images "temp-diff-july-january.jpg", "US-city-temp-Jan.jpg", "US-city-temp-Jul.jpg". Then analyze Excel file "mean-monthly-temp.xls"
2) Thinking through how to arrange the data for exploration and analysis
   a) It's not just a matter of choosing the graph type (although that matters)
      i) Bar
      ii) Line
      iii) Scatter
      iv) Pie
   b) What's next to what – especially with scatter (X axis is first column, Y axis is second)
   c) Selecting discontinuous sections
   d) Labels
   e) Sorting
3) The goal is making ***claims*** & understanding how strong ***warrants*** and evidence are for them

Helpful resources:
Using ArcView GIS in Education – The Mapping the Environment Project, Missouri Botanical Garden - http://www.mobot.org/education/mapping/
Create-A-Graph – free but somewhat tedious for making graphs, but they also have good descriptions of what different types are good for - http://nces.ed.gov/nceskids/graphing/

D. Representing data for oneself and others

1) Goals: Communicate in a community, and build knowledge
2) Principles
   a) Keep It Simple (e.g., 3-D doesn't usually help)
   b) Don't mislead (axis scales on graphs, biased selection of data)
3) Beyond either "PowerPoint is a magic bullet" or "PowerPoint is evil"
4) Multimedia literacy – expressing oneself with words, images, video, and sound

Helpful resources:
Misleading graphs - http://www.emints.org/ethemes/resources/S00001344.shtml
Good graphs and charts - http://lilt.ilstu.edu/gmklass/pos138/datadisplay/goodcharts.htm
"PowerPoint is evil" - Edward Tufte - http://www.wired.com/wired/archive/11.09/ppt2.html
PowerPoint "redeemed" – David Byrne - http://www.wired.com/wired/archive/11.09/ppt1.html
Multimedia literacy - George Lucas interview - http://www.edutopia.org/foundation/lucas.php