Creating Critical Thinkers in GIS Workshops

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MIT Libraries
Outline

• About MIT & GIS Services
• Introduction to GIS workshop
• Workshop development process
• Teaching methods and theories
• Workshop content
• Future plans & tips
GIS Services

- GIS lab
- Data purchasing
- GIS data repository, GeoWeb
- One-on-one help
- Workshops
Introduction to GIS workshop

• Held in the summer, fall, and winter
• 2 ½ to 3 hours
• Open to entire MIT community
Why revise it?

- Increase understanding of GIS concepts and provide more transferable skills
- Align with Libraries-wide DISJ goals
- Work toward the strategic plan for the Libraries
Workshop Development Process

- Peer coaching model
- Literature review & sharing
- Identify learning goals & skills
- Brainstorm lecture topics & activities
- Construct the workshop
- Lots of practice

From: http://acrlog.org/2017/06/19/peer-coaching-for-professional-learning/
Goals

Attendees will:

• Evaluate maps and data critically in order to understand potential biases caused by the creator, collection method, visualization techniques, etc.

• Document their research processes so that others clearly understand and interpret the methods, tools and data used.

• Learn the technical skills necessary to choose the appropriate software and use it to accomplish their task.
Teaching Methods & Theories

Scaffolding
• Break task into smaller parts
• Focus on prior knowledge

Segmented learning & retrieval
• Short activity or quiz after each section

Self-paced learning
• Hands-on tutorials

Use software to teach critical thinking skills
Workshop Content

• Overview of GIS & applications
• Understanding Maps & Data
• Designing Maps
• Software
• Exercise
• Discussion
Overview of GIS

Theoretical Overview

GIS takes real world spatial data
and treats different spatial features as individual “layers”
which can be assembled in any number or combination
and overlaid for analysis

Create Maps

U.S. population with Irish ancestry: 11.1%
Irish Ancestry as a Share of County

Conduct Analyses

Spatial Statistics

Clip

Buffer
Understanding Maps & Data

MassGIS Data: Licensed Google Ortho Imagery

Geospatial Data comes in different types:

- **Vector:**
  - Points, lines, and areas

- **Raster:**
  - Row and column matrix

Spatial or coordinate data that represent features with a known location or position.
# Understanding Maps & Data

<table>
<thead>
<tr>
<th>Concept</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data layers</td>
<td>Examine Google Maps, Use data layers in ArcMap</td>
</tr>
<tr>
<td>Characteristics and types of spatial data</td>
<td>Identify types of data layers in ArcMap</td>
</tr>
<tr>
<td>Tips for finding spatial data and metadata</td>
<td>Look at examples of metadata on websites, metadata “quiz”</td>
</tr>
</tbody>
</table>
Designing Maps

Making Great Maps

**Goal:** The County Chamber of Commerce shows the shortest and least costly route for the connector. They focus on property values:

- Equal interval
- Natural breaks
- Quantile

**Goal:** A community group contends the connector will devastate the African American community by cutting it in half:

**Goal:** A historical preservation group shows that historical properties in a historical district will be adversely affected:

**Goal:** The Oberlin Business Association argues the proposed road will siphon traffic and thus business away from their members:

Software

Web-based

- ArcGIS Online*
- Carto*
- Mapbox
- Google MyMaps
- ESRI StoryMaps*

*use an MIT account for more storage

Desktop

- ArcGIS Desktop (MIT only)
- ArcGIS Pro (MIT only)
- QGIS (Public)
- Specialized (Geoda, ENVI, CrimeStat, etc)
Exercise and Discussion

How 65 Bay St. was deemed part of a needy area
In the final map approved by state officials, 16 census tracts were linked together to connect the affluent Jersey City waterfront to impoverished and crime-ridden neighborhoods nearly four miles away. This allowed the project to qualify for low-interest loans through a U.S. visa program.

- Retrieval activity
- Self-paced
- Choice of ArcGIS or QGIS
- Open-ended: no “right” answer
- Shared some maps to reinforce critical thinking skills learned during workshop
Implementation and Feedback

- Two workshops were held in January 2018 with 39 total attendees
- Attendees were emailed a survey after the workshops. Respondents reported:
  - an increase in knowledge of all GIS concepts, with knowledge of GIS software options increasing the most
  - a better understanding of the data literacy and critical thinking skills that we were trying to teach, especially, “I understand how my map design can be used to influence the map audience.”
Looking ahead

- More retrieval activities & integration of critical thinking skills
- Plan ways to integrate other software
- Focus on documenting the research process in other GIS workshops
- Re-design more workshops, starting with GIS Level 2
- Provide activities that attendees can do on their own after the workshop to reinforce learning
- Review the workshops on an annual basis
Tips & Tricks

• Allocate and schedule lots of time for planning.
• Use the software as a way to teach concepts, rather than trying to teach how to use the software.
• Start with maps and mapping tools that attendees may already be familiar with and build on that knowledge.
• Integrate retrieval and testing activities frequently.
• Keep activities open-ended.
• Collect examples of maps and mapping stories.
• Allow for flexibility of activities, depending on time, the ability of participants, room set-up, etc.