Geospatial Instructional Interaction Complexity

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The GILC score orders the complexity of common instructional tasks with ArcGIS Online. It is intended to provide a relative weighting of tasks during the delivery of instructional materials to mainstream (non-GIS) teachers during direct instruction with an ArcGIS Online map.

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Overview

This score orders the complexity of common instructional tasks with ArcGIS Online. It is intended to provide a relative weighting of tasks during the delivery of instructional materials to mainstream (non-GIS) teachers during direct instruction with an ArcGIS Online map.

The scales are loosely derived from the 2015-2016 development and field-testing of the ConnectEd GeoInquiries (http://www.esri.com/geoinquireis) and can be used to quantify the relative complexity of delivering a GeoInquiry or similar activity. To calculate a geospatial instructional interaction complexity (GIIC) score, sum the scores from each task in an activity. For example, if an activity asks teachers to discuss a map by observing it, then zoom to a location, and then change a base map, the GICS for the activity would be 6 (e.g. order 1= 1 point, order 2 = 2 points, and order 3 = 3 points).

Why evaluate instruction in this way? The GIIC score is intended to help curriculum developers limit or even increase complexity in designing geospatial materials, in an evolving technical platform where it is very easy to "over-engineer" instruction for the mainstream. In essence, the scale helps content developers recognize the cognitive load of the instructor.

What are GeoInquiries?

GeoInquiries are short, standards-based inquiry activities for teaching map concepts that are in the most commonly used textbooks in the United States. GeoInquiries use ArcGIS Online to teach subject matter content and require only a classroom with a computer (or device) and a projector. Any teacher can use a GeoInquiry, regardless of their prior experience with GIS.

Esri has released the Earth Science collection of geoinquiries – a set of 15 activities that span the curricular calendar in middle school, earth science. From topographic maps and plate tectonics in the fall to weather and climate in the spring; these activities should offer something to K12 Earth science teacher (or physical geography teacher) at any time.

The U.S. History GeoInquiry collection has also been released.. Throughout the fall, we will be releasing more of these activities, with the full collection available in the fall of 2015, activities now available include: The 13 Colonies, WWII D-Day, The Underground Railroad, Westward Expansion, and many others.
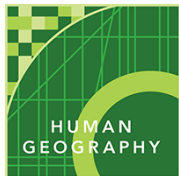
 The Advanced Human Geography (APHG) geoinquiry collection officially released in January 2016 and includes 15 activities that use ArcGIS Online to teach fundamental human geography concepts, against the College Board's Advanced Placement benchmarks.

More geoinquiry collections are planned for 2016.

The GIIC score: Geospatial Instructional Interaction Complexity

To score an activity, count each occurrence of an instructional interaction and sum. Interactions that require multiple clicks through hidden or complex interface elements increase the cost of the interaction and raise the activity's GIIC. Lengthy or complex activities increase the GIIC. Activities with large numbers of data layers tend to increase the GIIC.

GIIC scoring:

Order 1: 1 point
1. Visual observation only
   - Visually describe patterns or trends in the map data
   - Visually identify map features

Order 2: 2 points
1. Basic map navigation, pan, and zoom
   - Change extent by panning
   - Change scale by zooming
   - Visually navigate a space
   - Return to a "home" or starting position on a map
   - Recognize multi-scale data, where different data may be sued to represent the same construct at different scales
2. Activate the Contents, Legend, or About pane.
   a. With the Details pane open, click the appropriate submenu button (button may or may not have a text label).
3. Turning a layer on or off
   - Requires finding the Content pane and clicking checkbox next to a layer

Order 3: 3 points
1. Change a Basemaps
   - Recognize multi-scale data, where different data change to represent the same construct at different scales
2. Use the Identify tool
   - Requires visible layer and potentially sorting through results of multiple info boxes (from multiple layers)

Order 4: 4 points
1. Use a Bookmark
   - Changes to a pre-set scale, extent, and visible data
2. Map Extent
   - Recognizes out of extent map layers (automatically turning layers on-off)

Order 5: 5 points
1. Add a layer
   - Add a layer of pre-built data from a keyword search
2. Change a layer's transparency
3. Use a layer's time slider
   - Turn on layer; press play; pause; stop. Data are x, y, and t.

Order 6: 6 points
1. Measure
   - Measure a point, line, or polygon with the Measure tool
2. Set visible extents
   - Set visible range of map layer
3. Create map notes (existing layer, points only)
   - Use a map note layer and add points (only)

Order 7: 7 points
1. Show table, sort data, or get statistics
   - Show the data table for a layer
   - Sort table data based on column
   - Show statistics for a column of data
2. Create map notes (new layer, points only)
   - Create a map note layer and add points (only)

Order 8: 8 points
1. Customize symbology
   - Change a map layers symbology, including color, size, shape, or mapped attribute
2. Use map notes (existing layer, lines and polygons)
   - Create a line or polygon map note
3. Add Layer from File

Order 9: 9 points
1. Filter table
   - Create a formula for restricting the data viewed
2. Create map notes (create layer, lines and polygons)
   - Create a line or polygon map note
3. Configure a data layer's pop-up menu

Order 10: 10 points

1. Analysis operations using an ArcGIS Online Organizational account

Sample scoring of existing materials

Example 1: Activity with a high GIICS

Target instructional time required to complete the activity: 15 minutes

Activity flow:

ASK:

- Contents pane: 2
- Layer on/off: 2
- Observe map: 1
- Layer off: 2
- Use bookmark: 4
- Map observation:1
- Map observation:1

ACQUIRE:

- Layer off: 2
- Change case map: 3
- Zoom: 2
- Map observation: 1
- User bookmark: 4
- Use time slider: 5
- Map observation: 1

EXPLORE:

- Layer on: 2
- Map query (identify): 3
- Measure (linear): 6
- Layer off: 2
- Bookmark: 4
- Layer on: 2
- Map observation: 1

ANALYZE:

- Zoom: 2
- Layer on: 2
- Map observation: 1

ACT:

- Bookmark: 4
- Layer on: 2
- Map observation: 1
- Layer on: 2
- Layer on: 2
- Map observation: 1
- Map observation: 1
- Map observation: 1

Activity's sum score: 70 points

Activity's GIIC: 70 points/ 15 minutes = 4.6

Interpreting the GIIC Score

The sum of values, divided by the activity's target time, creates the activity's GIIC score. Interpreting the GIIC score should be considered with respect to the target audience (mainstream, novice, developing, or advanced, etc.).

While a score of 4.6 may be too high for mainstream users, it could be quite comfortable for experienced educators using GIS. Alternatively, a GIIC score of 2 may seem too boorish to teachers familiar with GIS.

GIIC score interpretation for GeoInquiries: 15-minute activities for mainstream educators
- **2** and less: Activity may not include enough GIS
- **2.5**: Lower limit
- **3**: Lower end of the *sweet spot*
- **4**: Higher end of the *sweet spot*
- **4.5**: Upper limit
- **5** and higher: Activity includes too much GIS and will likely cause frustration or failure