The effect of GIS lessons on spatial thinking

A case study from Singapore
Outline of Presentation

- Part 1: Research Design
- Part 2: GIS Learning
- Part 3: Choice of Technology
Part 1: Research Design
Questions Asked

1. Should GIS skills be taught during geography lessons?
2. Do GIS lessons result in learning gains?
3. How should GIS be featured in the geography curriculum?
1. Should GIS skills be taught during geography lessons?

2. Do GIS lessons result in learning gains?

3. How should GIS be featured in the geography curriculum?
Spatial Thinking Ability Test

- Developed by Lee Jongwon and Robert Bednarz
- 16 MCQs, 8 spatial thinking skills
- Measures students’ mastery of skills in AAG
- Teachers’ Guide to Modern Geography
- Pre- and Post-tests slightly different questions testing same thinking skills
DIRECTIONS: Answer questions on the basis of the street map below.

1. If you are located at point 1 and travel north one block, then turn west and travel three blocks, and then turn south and travel two blocks, you will be closest to point.

   (A) 2
   (B) 3
   (C) 4
   (D) 5
   (E) 6

6. Find a map (A~E) having a strong positive correlation with the map on the left. ____
(Choose closest one)
Results

- Control Group = 55
- Experimental Group = 20
  - 10hrs of GIS learning

<table>
<thead>
<tr>
<th></th>
<th>Gain</th>
<th>Effect Size</th>
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<tbody>
<tr>
<td>CONTROL</td>
<td>-0.89</td>
<td>-</td>
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<tr>
<td>EXPERIMENTAL</td>
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<td>0.16</td>
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Part 2: GIS Learning
Guided Problem-based Learning

- ‘Structured’ environment
- Step-by-step approach to illustrate the functions of QGIS
- Hands-on experience with QGIS in the development of hazard maps
Laying the Groundwork – Lesson 1

• Lesson objectives:
  • A range of basic GIS skills required in the successful execution of the PBL-GIS lesson

• Lab-based sessions and take-home component
Guided PBL - Lessons 2 & 3

- Introduction to the problem
- Student Artifact – Mt. Rainer Hazard Map
  - Includes demographic data
  - Identifies areas-at-risk
  - Identifies evacuation shelters
    - ‘Hub-distance’ analysis
    - ‘Shortest Path’ analysis
Student Artefacts

- Hazard Map
- Written report
Why are some evacuation centres not suitable?

“Some of the above evacuation centres are inside the buffer zone, which means that they might be affected by hazards when the volcano erupts. Supplies need to reach the centres efficiently, through roads or by air, hence these centres need to be near airports so that supplies can reach them quickly.”
Part 3: Choice of Technology
Choice of Technology

Constraints

- Overwhelming GIS software user interface
- Difficult to install software in SSOE machines
- High cost of proprietary GIS software
## Comparison of GIS Software

<table>
<thead>
<tr>
<th></th>
<th>ArcGIS</th>
<th>QGIS</th>
<th>Google Map/Earth</th>
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<tbody>
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<td>Proprietary Software</td>
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<td>Open Source Software</td>
<td>Free Online Tool</td>
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Choice of QGIS

- Free
- Scalable
- Low entry barrier for experimentation
- Support from open-source community
- Easy to deploy in schools as well as for students to work at home
Question & Answer
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