Challenges for GIS Education:
An Experiential Report

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Adrijana Car
German University of Technology in Oman
adrijana.car@gutech.edu.om
Sultanate of Oman and GCC region: recent GIS job market studies have identified lack of educated, skilled and qualified professional workforce for its growing GIS industry (e.g., reports on sustainable spatial strategy for Oman (Arora 2009; Al Nabhani and De, 2009; Al-Wardi 2011; Schrenk et al. 2012; ONSS 2014))
Requirements in the Sultanate of Oman: estimated 140 graduates per year (MSc level) are expected to find jobs in the GIS industry (Advanced Business Consultants 2012, p. 32)

<table>
<thead>
<tr>
<th>Potential Employers</th>
<th>Potential for employment</th>
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<tbody>
<tr>
<td>Government agencies</td>
<td>50</td>
</tr>
<tr>
<td>Oil and gas industry</td>
<td>30</td>
</tr>
<tr>
<td>Utility companies</td>
<td>20</td>
</tr>
<tr>
<td>(electricity, water, sewage, …)</td>
<td></td>
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<tr>
<td>Infrastructure development agencies</td>
<td>15</td>
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<tr>
<td>(including free zones)</td>
<td></td>
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<tr>
<td>Others</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>140</strong></td>
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Contents

- Experience in teaching GIS in Oman and the region
  - Challenges… and possible reasons for them
  - Approaches to solutions

- Contribution to discussion on Geocapacity
  - Difficulties in stepping on the next level and a challenge in procuring competent human resources
  - Education and training institutions playing their role effectively and producing the fit-for-job graduates
Teaching GIS

Undergraduate level

• Introduction to GIS course
  ▫ 4 different study programs
  ▫ 2-4 hours/week & 4-6 ECTS
  ▫ Includes
    ▪ GIScience foundations
    ▪ Completion of the ESRI Virtual Campus course “Learning ArcGIS 10”
    ▪ Project
  ▫ Spatial thinking concepts – space, representation and reasoning

• Grade
  ▫ Course work
    ▪ Assignments
    ▫ Online exams/certificate
  ▫ Short tests
  ▫ Project
Analysis of spatial relationship between hotels and attractions
Using GIS to analyze tourism related aspects in Oman

Introduction

Oman has developed into a well-known tourist destination due to its variety of attractions being man-made or natural. The Ministry of Tourism (MoT) has developed a GIS to collect, store and manage, analyze and map tourism related data. Using that data in our project, we aim to find and apply the best fitting analysis tools to find answers for the following objectives:
- What are the attractions within 5 km from a hotel?
- What are the areas which have the most number of attractions?
- Which hotels and attractions are located in a selected wilaya?

Method 3: Selection by attribute
Selection by attribute was used to select and show which hotels and points if attractions are within the same area/wilaya.

Analysis and results

The map below shows the locations selected within 5 km of hotels. This was done with method 1. The method answered “What are the attractions within 5 km from a hotel?”

The two images above illustrate selections that can be done using attributes of hotels and locations. The image on left is a selection of hotels and attractions in the area of Barka, the right one shows As Seeb area.

Conclusion

Various tools to approach the analysis of the spatial relationship between hotels and tourist attractions were found. The results showed three tools which can be used to see different point to point relations in ArcGIS. Due to data limitations, performing an analysis of the exact distance from a hotel to an attraction could not be done. In the future, to improve these results we would like to be able to answer questions such as:

- What is the distance between two locations?
- What is the nearest or farthest feature from something?
- What is the shortest street network route from some location to

References

For further reading:


Teaching GIS—Experience Made

What worked

• Project based learning
  ▫ students become active learners
  ▫ fosters team work
  ▫ mostly increases efficiency
  ▫ conducts a completion in time
  ▫ improves and develops different soft skills like rhetoric, communication and scientific presentations

Challenges

• Weak spatial thinking skills
• Thin geography background
• Difference in IT and geospatial technology literacy levels (Benimmas, Kerski & Solís 2011)

• Poor basic maths skills (Gallenkaemper et al. 2014)

• “Resistance to feedback” (Car, ND)
### Adequate Strategies for Instruction in Arab Countries

<table>
<thead>
<tr>
<th>Internal</th>
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<tbody>
<tr>
<td>- foundation program,</td>
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<tr>
<td>- teaching methodology</td>
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<tr>
<td>- curriculum</td>
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<tr>
<td>- faculty</td>
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<tr>
<td>- work and infrastructure</td>
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<table>
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<tr>
<th>External</th>
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<tbody>
<tr>
<td>- Previous educational background</td>
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<tr>
<td>- Individual hard work</td>
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(Al-Maskari, Al-Mukhini & Amzat, 2012)

### Key Factors in Conveying Knowledge at University Level

- active instead of passive learning,
- learning by doing (student centred learning),
- individualized learning (adapted to capabilities)
- peer/ adult tutoring (students help each other/ older help younger students)

(Baporikar & Shah, 2012)
How learning and education are sometimes blocked in the society ... (Gallenkaemper et al. 2014)

**There are safe options**
- plenty of fossil resources (oil & gas) and policies that focus on the exploitation of these instead of diversification of perspectives
- Omanization policies
- rewarding public sector (pension after 20 years of working), but a good final grade is required

**Family structure**
- families are rather large (although the birth-rate declined from over 7 to now at a bit over 2)
- “constant” disturbance by mobile devices
- social engagement
  - Sidani & Thornberry 2009

**Common practices in schools**
- emphasis on memorization rather than reflection and creative thinking
- teachers are an unquestioned authority and pupils actually prefer to be told exactly what they have to do instead of thinking by themselves
- teachers are expected to help students pass the course

**Obstacles**

**Further issues**
- schools emphasize on arithmetic and algebra
- geometric thinking and spatial sense and drawing capabilities are extremely poorly developed
- especially for freshmen: difficulties with English and writing from left to right
An Example from Gutech: Courses re-designed to enable learning

Bernhard Heim

Cybernetic Teaching Paradigm

(mandatory) lecture week
lecture lecture small tutorial

test results used for calibration

homework

oral feedback for calibration

(Gallenkaemper et al. 2014)
...and several key drivers for learning identified

- Human-human interaction is indispensable
- Clearly communicated expectations are essential
- Sustainable learning is pivotal

Success in MATH I

- Continuous Kaizen learning is key
  - Short learning units (with feedback loops/tests)
  - Carefully chosen repetitions (with feedback loops/tests)

- Balanced combination of traditional teaching and e-learning ("blended learning") leads to success

- No calculator

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The Geospatial Technology Competency Model has been developed by researching and analyzing publicly available resources, existing skill standards, competency-based curricula and certifications to provide an employer-driven framework of the skills needed for success in geospatial technology.

(Ball 2013)
Summary I

- At GUtech, and other universities in the Region, we deal with students lacking basic knowledge and skills.
- With respect to Mathematics and Science / GIScience, the existing (higher) educational systems have improvement potential.
- Although being quite time- & resources consuming, KAIZEN learning seems to be one doable solution.
Summary II

Social challenges

• For the Government the value of education is to make their citizens fit for the work environment
• For the Locals (citizens) the value of education is mainly to get a governmental job
• The still traditional family and social structures have not yet been activated to foster education
References


http://geospatialworld.net/FirstPerson/ArticleView.aspx?aid=23056#sthash.aMcTaqI2.dpuf, accessed on 15 March 2014


