Software-specific and software-independent tutorials of GI S&T

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Dept. Earth & Environmental Sciences
Bachelor Course
‘Geographic Information Systems’

• 3 ECTS for concepts and algorithms
  o Interactive lectures

• 1 ECTS for ‘Practical GIS’: Exercises and assignments in solving geospatial questions by means of GIS-software
  o Preprocessing of geodata
  o Query, Transformation
  o Postprocessing, Symbolisation & Visualisation, Reporting

• Bachelor course – heterogeneous public
  o Final phase Ba BIW & Biology
  o Incoming and Outgoing ERASMUS-students
  o Ma-strengthening, Pre-doc
  o Credit contracts
  o VLIR-UOS (sandwich) students
‘Practical GIS’

• Until 2006-2007
  o ‘Traditional Approach’
  o Guided sessions in PC-room
  o Pre-installed CCSS4G
  o Ready-to-use geodata supplied
  o Step-by-step and illustrated tutorial for specific software (-version)
  o Assignments

• Problems
  1. Regular students cannot continue their work at home
  2. Remote students cannot be accommodated
  3. Students are not encouraged to acquire secondary skills
  4. Tutorials are rapidly out-of-date, intensive to maintain
Problem 1
Regular students cannot continue their work at home

• Possible solution
  o Replace CCSS4G by FOSS4G
    o FOSS4G can be downloaded and installed freely
      • Standardisation and quality of FOSS4G has increased
        → Equivalent to CCSS4G for basic level work
      + Students can work at own pace in and after class

• Students are assumed to have a personal computer
Problem 2: Remote students cannot be accommodated

• Possible solution
  o Solution to problem #1
    + Replace PC-class sessions by work@home
    + Organise non-compulsory feedback sessions
    + Use distance learning platform to
      + Provide instructions and data
      + Provide advice and feedback
      + Organise evaluation (Assignments)
  ➢ Supervised Self-Study (SSS)

• Students are assumed to have a personal computer + broadband internet connectivity
Problem 3
Students are not encouraged to acquire secondary skills

• Self- and peer-to-peer help; work with internet communities
  ➢ Possible solution = solution to problem #1 + 2

• Discover, explore and exploit alternative software; Install and manage software
  ➢ Possible solution = solution to problem #1 + 2
  + Make exercises and assignments software-independent

• Discover, explore and exploit alternative data sources; Download and manage data
  ➢ Possible solution = solution to problem #1 + 2
  + Make exercises and assignments data-independent
Problem 4

Tutorials are rapidly out-of-date, intensive to maintain

• Possible solution
  o Solution to problem #3
  + Develop software (version)-independent tutorials ~ conceptual exercises which do not contain any reference to specific software, CCSS4G nor FOSS4G

• Many software solutions are available with a high degree of standardisation in terms of interfaces, toolboxes, terminology, …
GIS-software is rapidly out-of-date but increasingly standardised.

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‘Practical GIS’ from 2007-2008 onwards

In-class + prescribed CCSS4G

SSS + prescribed FOSS4G

Answer to problems 1, 2 & (partially) 3?
➢ Test student satisfaction of different approaches
Student satisfaction of two approaches: SSS/FOSS4G versus In-class/CCSS4G

Fall-semester 2010-2011 (Hubeau et al., 2011b; Van Orshoven et al., 2010)

Analysis 1: Traditional In-class approach (TA) versus Supervised Self-Study (SSS) (Ba-course)
Analysis 2: Ba-course versus Ma-Course (SSS)
Analysis 3: With versus Without previous SSS-experience (SSS)
Analysis 4: CCSS4G versus FOSS4G
Summary of results of Ba/Ma-surveys

• Web survey in dec-10/Jan-11
• FOSS4G goes hand in hand with ‘Supervised Self Study’ (SSS)
• Mature students (Ma & post-Ma) are very happy with SSS & FOSS4G
• Undergraduates want/need more guidance
• Previous SSS-experience does not affect results
• FOSS4G equally appreciated as CCSS4G
  o PostgreSQL/PostGIS = highly appreciated
  o GRASS-plugin of QGIS probably explains lower appreciation in Ba-course
• Further use of FOSS4G by students, beyond the targeted courses, is limited but potential is recognised
LeGIO-project: OWP/2010/18

- Leuven Geografisch Informatie Onderwijs
- 1-nov-10 to 15-sep-12

- Development and evaluation of software-independent tutorials for SSS of GI S&T
  - Integrated answer to problems 1 to 4?
Evolution of G0M88A from 2010-2011 onwards

1. In-class + prescribed CCSS4G
2. SSS + prescribed FOSS4G
3. SSS + FOSS4G or CCSS4G to be selected by student

 Software-independent exercises
= Conceptual exercises
➢ Data are made available
Conceptual exercises  (Hubeau et al., 2011a)

Objectives:
- Promote acquisition of in-depth knowledge about GIS-concepts
- Stimulate exploration of applicable GIS-softwares
- Long-living tutorials
Conceptual exercises

3. Workflow

Buffer and overlay analysis
The purpose of the first assignment is to determine which land cover or land use classes occur in 100m wide zones along the river system of the Tabacay watershed. The Tabacay geographic database contains the geodataset rios.shp. The ESRI-Shapefiles section of the same database contains the shapefile coberturas.shp with land cover and land use information. We will use these two layers for this assignment.

- Create a new GIS-project.
- Import shapefiles rios.shp and coberturas.shp.
- Make also sure the Coordinate Reference System is WGS84/UTMzone17S.

Now, you will do a spatial vectorial data analysis on the two shapefiles in different steps.

1. Buffer analysis
The first operation is a buffer operation. The buffer-functionality is a Vector analysis and can be found at the geoprocess toolbox. A buffer is a proximity analysis.

- The input vector is rios.shp.
- The buffer distance is 100 map units (which is set up in meters).
- The new layer rios_buffer.shp needs to be displayed in the data view.
- Examine whether the expectations are met. How many polygons are in this geodataset? (Check the attribute table)

2. Overlay analysis
The second operation is to create an overlay of the intersection type between the coberturas geodataset and the new buffered river geodataset. An intersection is an overlay analysis. The operation is a spatial query: Intersect, rios.shp intersects with coberturas.shp.

- The input vector is coberturas.shp.
- The intersect layer is rios_buffer.shp.
- Call the output file as rios_intersects.shp.
- Load the new geodataset as a layer into the GIS-project.
Software-specific versus software-independent tutorials

Fall-semester 2011-2012 (Hubeau et al., 2012a)

Control group

- Software-specific exercises → QGIS Wroclaw 1.7
- Blended learning environment → SSS
- 10 Students - 8 Students

Test group

- Software-independent ‘conceptual’ exercises
- Distance education → SSS
- 11 Students

Practical exam with ArcGIS-software, unknown by all participants
Learning effectiveness

- **Learning effectiveness:** Comparison of the students’ performance:
  - Practical assignments (2)
  - Practical exam
  - Theoretical exam

- **Learning experience:** The perceived preparedness + total hours spent (**Efficiency**):
## Results

- **Learning effectiveness**

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<td>19.59/25</td>
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<td>Assignment 2</td>
<td>19.25/25</td>
<td>18.09/25</td>
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<td>Theoretical exam</td>
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## Results

### Learning experience

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<td>Number of hours worked</td>
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<td></td>
<td></td>
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<tr>
<td>&lt;20h</td>
<td>0%</td>
<td>38%</td>
<td>0.021*</td>
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<tr>
<td>20-40h</td>
<td>25%</td>
<td>18%</td>
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<tr>
<td>40-60h</td>
<td>25%</td>
<td>36%</td>
<td></td>
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<tr>
<td>&gt;60h</td>
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<td>9%</td>
<td></td>
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<td>What was your experience to work with an unknown GIS-software?</td>
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<td></td>
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<tr>
<td>Difficult</td>
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<td>Difficult</td>
<td>0.108</td>
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<td>Rather difficult</td>
<td>0%</td>
<td>Rather difficult</td>
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<td>Frightening at the beginning but challenging</td>
<td>100%</td>
<td>Frightening at the beginning but challenging</td>
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<tr>
<td>Great experience</td>
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<td>Great experience</td>
<td>9%</td>
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<td>Good</td>
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<td>Good</td>
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<tr>
<td>Very good</td>
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<td>Very good</td>
<td>55%</td>
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Results: Software independent tutorials

• “Lead to more in-depth knowledge + more easy adaptation to new GIS-software”
  o Not confirmed but software-independent approach seems to be equivalent

• “Require more effort by student”
  o Not confirmed: time efficiency is higher for the test group

• “Lead to higher student drop-out rate”
  o Not confirmed
Summary

- FOSS4G, SSS, Conceptual tutorials and their combination are well received by students (and staff)
- Current experience is encouraging further development and testing
- Validity of data-independency has not been tested yet but the hypothesis is clearly affirmative:
  - Searching, evaluating and acquiring valid geodata for providing geo-information and spatio-temporal decision support is a key issue for future professionals
  - Current research and policy efforts regarding Spatial Data Infrastructures pave the way.
Thank you

For presence and attention, comments, opinions, suggestions!