Marketing of Spatial Thinking, Professional (Surveying) Education, and GI Science

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Overview

- Need for a spatially-aware population
- Progression or Cycle of GI learning
- Marketing messages
- Some Examples
- Emphasis on integration
  - Surveying with GIS
- What we are doing

Spatial Thinking

- One of Howard Gardner’s 9 intelligences
  - Spatial Intelligence: the ability to represent the spatial world internally in your mind – the way a sailor or airplane pilot navigates the large spatial world, or the way a chess player or sculptor represents a more circumscribed spatial world. Spatial intelligence can be used in the arts or in the sciences.
- Focus on spatial ways of thinking, in multiple secondary school courses e.g. Math, Art, History
- Later (near completion of high school) tools such as GPS, GIS can be introduced, to help connect spatial thinking to solving real problems
  - Bishop-Dunne HS (Dallas)

Average Age of Surveyors in USA is 57 – Building Programs for Lifelong Learning(?)

Joseph S. Toole
Associate Administrator of Professional Development
Federal Highway Administration
January 11, 2004
Need workforce to Think Spatially

- USA National Research Council report:
  - Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum
  - Essential to every person and to the workforce
  - Needs to be taught across subjects
  - Problem solving integrator/facilitator
  - GIS can be significant

Spatial Thinking (2)

- Need to improve knowledge of peoples, cultures, religions, languages around the world
- US military “human terrain”
- The NRC book contains some good nuggets
- But we can do better! Marketing = message.
  - Simple, fun, relevant...
- Goal: prepare future problem-solvers
- Also prepare college students who know to look for study programs centered around spatial technology
Need for spatial professionals

- As always, spatial professionals needed to collect and exploit land-oriented data
- Technology is advancing, changing how this process happens
- Spatial experts need to be more versed in integrating technologies and methods
- Education tending toward multidisciplinary structure
- Studies and career options need to evolve as well

Technology impacts how we work (right or wrong)

County, Wisconsin, more particularly described as follows: Commencing at the Southwest corner of the Southwest Quarter of the Southwest Quarter (SE ½ of SW ¼); thence easterly along the South line of the forty, 1,102 feet, more or less, to GPS waypoint, Lat. 43.827330, Long. -90.665967, which is the point of beginning; thence continuing easterly along the South line of said Section 30, 1,592 feet, more or less, to GPS waypoint, Lat. 43.827326, Long. -90.660929, thence Northerly 487 feet,
Parsons’ quote

Q: Google is working towards information available anyhow, anywhere, on any platform. Will Google encourage or develop live mapping applications for surveyors?

A: These days, anyone with a mobile phone is a surveyor, so if someone is out and about and discovers some feature that is not apparent in our maps, we will incorporate it and update our system. However, that is not strictly speaking surveying and we are not creating base data sets. That said, we have developed tools that are being used in parts of Africa and Asia simply because there is no other source of information available in these areas, but it is on a very small scale.
Data Integration

Data integration requires accurate data

GIS Users

Opportunities for surveyors

- Infrastructure management
- Asset management
- Utility distribution systems
- Transmission systems
- Facilities management
- Industrial facilities
- Environmental analysis
- Feasibility analysis
- Tax mapping
- Parcel management
- Zoning maps
- Addressing
- Emergency vehicle routing
- Land use planning
- Public safety
- Many, many more

Marketing = message (perception)

Surveying = standing outside: sun, rain, snow,....

OVG AT

What is the OVG?
- Member of the International Federation of Surveyors
- Member of the International Society of Photogrammetry and Remote Sensing (ISPRS)
- The OVG consists of several thematic sections and interest groups.
- The OVG counts around 600 members at the present.

What are the aims of the OVG?
- Federation of state and regional surveying organizations
- Exchange of knowledge and experiences among members
- Knowledge and expertise among members
- Promotion of the interests of Austria in all fields of the profession

What are the benefits for the OVG members?
- National and international network for surveying and geoinformation
- Access to all OVG publications and events
- Subscription to the OVG newsletter
- Individual membership in the OVG
- "SVT" magazine for members
- Participation in joint events with state associations
- Participation in Austrian and international congresses and conferences
- Participation in annual congresses
- Opportunity to publish papers in the OVG journal
- Participation in regional and national surveys
- Participation in projects and research activities
- Participation in lectures and seminars by guest lecturers

How to become a member of OVG?

Send an email with your request to the OVG secretariat
- Membership form and fee
- Membership fee: EUR 30
- Membership term: 1 year

Asset management

- Utility distribution systems
- Transmission systems
- Industrial facilities
- Zoning maps
- Parcel management
- Zoning maps
- Addressing
- Land use planning
- Public safety
- Many, many more

Fibiltility analysis

- Facilities management
- Industrial facilities
- Emergency vehicle routing
- Land use planning
- Public safety
- Many, many more

Environmental analysis

- Land use planning
- Public safety
- Many, many more

Industrial facilities

- Emergency vehicle routing
- Land use planning
- Public safety
- Many, many more

Many, many more
Many kids do not go outside 😊

Modern landscapes.....

FIG - Surveyor - A Definition

- A surveyor is a professional person with the academic qualifications and technical expertise to conduct one, or more, of the following activities;
  - to determine, measure and represent land, three-dimensional objects, point-fields and trajectories;
  - to assemble and interpret land and geographically related information,
  - to use that information for the planning and efficient administration of the land, the sea and any structures thereon; and,
  - to conduct research into the above practices and to develop them.
GIS as an Integrating Design Platform
Common Language to Share, Analyze and Communicate Knowledge of the Natural and Built Environments

- Database Centric
  - Data Management
  - Query
  - Extensible
  - Useful Toolbox
- Integration
  - Visualization
  - Computability
- Survey/Civil
- CAFM

Marketing case study

From video games to ....

A group of students working at a command Post for a mock search and rescue training at one of our state Parks

Bishop-Dunne high school
Dallas, Texas
A group of Search and Rescue team volunteers constructing hiking poles in the GIS lab.

A flyer for a recent case. Students cleared 3 fields for the Fort Worth, Texas police looking for Mrs. Furch. To this day she has not been found.

This is a photo of the UTM Tic map. The map shows the 25 meter grid over the area that is being searched in the 2-4-08 Glenda Furch Search.
Using ArcMap students generate 25 meter UTM vector grids that are then uploaded into our Garmin RINO GPS's.

During a grid sweep of a pond this set of car keys were found and cataloged as possible evidence in the case.

Lesson: integration

- Field work
- In-class data processing
- Problem solving
- Real-world problems
- Forensics! In High School...
- Posters, PPTs: marketing

Often the going it tough during our search operations due to rugged physical and man made challenges.
Surveyors – academic qualification and expertise (FIG)

- Academic Disciplines:
  - mathematics, astronomy, geography, physics, mechanics, metrology, statistics, geophysics and other scientific disciplines.
- Technology and Tools:
  - verniers, micrometers and circles; standard units of measurement; temperature devices and scales; tables for trigonometric and logarithms; angle and distance measuring devices; calculating devices; barometric devices and use of their readings; the determination of gravity values; tools to determine and depiction of elevation.
- Now and future:
  - Computer science, database creation and management, GIS, Remote Sensing and GPS, satellite systems and ground based sensors and sensor webs, and . . . . . .

Bologna Declaration (Erasmus and Socrates)

- **European Credit Transfer and Accumulation System (ECTS)**
  - Define Percentage of students
    - A excellent - outstanding performance with only minor errors 10%
    - B very good - above the average standard with some errors 20%
    - C satisfactory - fair but with significant shortcomings 35%
    - D sufficient - performance meets the minimum criteria 50%
    - F fail - some work required below the credit can be awarded
  - All - considerable further work required

- Aligning workload and credits to learning outcomes and competencies
  - 60 Credits for full academic year
  - ECTS Grading on a statistical basis – does NOT replace institution grade
  - Learning Outcomes - competency based system
  - 180 Credits for 3 year program for “first cycle degree” (Bachelor’s Degree)

- In USA – new Policy to limit 4 year degrees to 120 units – what gets “cut out”??
Cadastre, Roads, Orthophoto

Parcels  Orthophoto  Transportation

Subdiv 1  Subdiv 2  Etc.  Etc.

Survey 1  Survey 2  Survey A  Survey B

A framework onto which other layers can be positioned accurately

Sensor Networks
- Autonomous and interactive need positional accuracy
- More Data, More Often, More comprehensive

- Traffic
- Weather
- Monitors
- Satellites
- Aircraft
- Mobile
- Census
- Demographic
- Business
- Infrastructure
- Surveying
- Design

Sensor Networks
- Streams
- Seismic
- Tsunami
- Crime
- Disease
- Surveillance
- RFID
- Etc.

Creating Curriculum, Models and Competencies

- Examples from GIS and Geospatial
  - NCGIA GIS Core Curriculum
    - 3 course with notes
  - University of Southern Mississippi Geospatial Workforce Model
  - UCGIS Model Curriculum and Body of Knowledge
  - DACUMS at the workforce level

University Consortium for Geographic Information Science

- UCGIS founded in 1994
- Now more then 70 member institutions and affiliate members including AGILE
- Focused on GIScience Research and support for programs
- Challenges defined in 1997
  - One Educational challenge lead to the proposal for a Model Curriculum
“GI S&T” Model Curricula

- Focus on undergraduate (4 year) education
  - Addressed Marble’s “Rebuilding the Top of the Pyramid”
  - Attempt to recognize GI S&T within a broader academic context
- Domain of Model Curricula - GI S&T
  - Geographic Information Science
  - Geospatial Technologies
  - Applications of GI S&T
- Strawman document completed in June 2003 under Dr. Duane Marble by the UCGIS in
  - Work stalled due to lack of funding

How is the BoK different?

- GIS education must be addressed at more than the undergraduate level (4 year Bachelor Degree)
- Cross-cutting themes re-integrated into KAs
- Original Model Curriculum Sections (Paths, Mastery levels, pedagogy, implementation) moved to a future time
- Body of Knowledge now divided in 10 KA’s
  - Knowledge Areas
    - Units
      - Learning Objectives (modified Bloom’s Taxonomy)
      - Key Readings

Second Phase of UCGIS Model Curriculum Project

- Decision in 2004 to reinitiate effort under leadership of David DiBiase
  - Pennsylvania State University
  - Chair of Education Committee of UCGIS
- Formed a much smaller working group with a 3 year project proposal
- Limited Funding so redefined as a One Year effort to
  - Create a Body of Knowledge for GIS

Scope of BoK expanded to include:

- Knowledge Areas
  - Primary and secondary education
  - Undergraduate education
  - Graduate education
  - Postbaccalaureate and professionals education

- Formal education

- Informal (“free choice”) education

- Research and Development
  - Undergraduate education
  - Graduate education
  - Postbaccalaureate and professionals education

- System Design
  - Undergraduate education
  - Graduate education
  - Postbaccalaureate and professionals education

- Application Design
  - Undergraduate education
  - Graduate education
  - Postbaccalaureate and professionals education

- Modularity
  - Undergraduate education
  - Graduate education
  - Postbaccalaureate and professionals education

- Routine Use
  - Undergraduate education
  - Graduate education
  - Postbaccalaureate and professionals education

- Project Understanding
  - Undergraduate education
  - Graduate education
  - Postbaccalaureate and professionals education

- Learning Objectives (modified Bloom’s Taxonomy)
- Key Readings
Ten KA’s in the BoK – structured alphabetically

- AM. Analytical Methods (formerly Data Analysis)
- CF. Conceptual Foundations
- CV. Cartography and visualization
- DE. Design aspects
- DM. Data modeling
- DT. Data manipulation
- GC. Geocomputation
- GD. Geospatial data
- GS. GIS and Society
- OL. Organizational and institutional aspects

Example Unit, Topics, and Objectives

Unit AM4 Basic analytical operations (core unit)
This small set of analytical operations is so commonly applied to a broad range of problems that their inclusion in software products is often used to determine if that product is a “true” GIS. Concepts on which these operations are based are addressed in Unit CF3 Domains of geographic information and Unit CF5 Relationships.

Topic AM4-3 Neighborhoods
- Discuss the role of Voronoi polygons as the dual graph of the Delaunay triangulation
- Explain how Voronoi polygons can be used to define neighborhoods around a set of points
- Outline methods that can be used to establish non-overlapping neighborhoods of similarity in raster datasets
- Create proximity polygons (Thiessen/Voronoi polygons) in point datasets
- Write algorithms to calculate neighborhood statistics (minimum, maximum, focal flow) using a moving window in raster datasets

Topic AM4-4 Map algebra
- Describe how map algebra performs mathematical functions on raster grids
- Describe a real modeling situation in which map algebra would be used (e.g., site selection, climate classification, least-cost path)
- Explain the categories of map algebra operations (i.e., local, focal, zonal, and global functions)
- Explain why georegistration is a precondition to map algebra
- Perform a map algebra calculation using command line, form-based, and flow charting user interfaces

The GIS&T domain

Bodies of Knowledge in other domains
Second Edition of Body of Knowledge

- First edition needs expansion
- Some topics very lightly covered
- Some topics missing
  - Technology and applications
- Needs Global Input for 2nd Edition
  - Contact David DiBiase
- Need “Pathways” for different Disciplines and Applications

Case of Universidade Nova de Lisboa

- All-out marketing study and multiple campaigns
- Search for new students
- Dissemination to key high schools
- Professional marketing, aimed at the real market (kids)
- Participation at job fairs in Portugal, other European, Brasil
  - > Euro 25000 annually

Giving ontological meaning using a Semantic Network and a Visual Data Interaction Tool

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EXPLORING GIS&T BoK USING THE GISCIENCE CURRICULA DEVELOPMENT MODEL

1. Creating and professionalizing a marketing function to attract students (1)

ISEGI's other courses
- Handled together by ISEGI and ADISEGI
  - 12 courses from 1 to 5 days long
  - Including 2 in Q1
  - Non degree granting
- ADISEGI is a private, non-profit organization composed of
  - IBM
  - Fidelity Mundial Seguros
  - edp
  - ESRI Portugal
  - Accenture
  - INPME
  - SAS
  - UNISYS

Marketing of Geographic Information Institutes - Students acquisition
Case study: ISEGI-UNL

2. Marketing for degree in Information Management (7)

OBJECTIVES

- Increase visibility
- Create an image / identity
- Close ISEGI as 1st option
- Increase minimum access grades
- Increase student quality

Marketing of Geographic Information Institutes - Students acquisition
Case study: ISEGI-UNL

GISBrasil 2004
4th edition

Marketing of Geographic Information Institutes - Students acquisition
Case study: ISEGI-UNL
Other Initiatives

- USGIF (United State Geospatial Intelligence Foundation)
  - Need for more, better educated workforce GI Analysts
  - Accreditation of programs and recognition of student progress
  - Now online
  - http://www.usgif.org

- European Computer Drivers License for GIS
  - GIS, Cartography, Technology
  - Pilot announced in Italy

DACUM – Developing A Curriculum for a GIS Technician

A-2: Job Analysis

DACUM Research Chart for GIS Technician

<table>
<thead>
<tr>
<th>Duties</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Create GIS Data* (5)</td>
<td>A-1 Define units of work</td>
</tr>
<tr>
<td>B Create Image Data</td>
<td>A-2 Research existing data sources</td>
</tr>
<tr>
<td>C Materials GIS Data* (4)</td>
<td>A-3 Develop Data Structure e.g. database design, filtering, extraction, geometry, editing, table</td>
</tr>
<tr>
<td>D Conduct Spatial/Non-spatial Analysis (4) (Verte, Brown)</td>
<td>A-4 Define Process Relationships/Sequence</td>
</tr>
<tr>
<td>E Generate GIS Products* (3) (Verte, Brown, others)</td>
<td>B-1 Data Entry/Management</td>
</tr>
<tr>
<td>F Develop Software Applications</td>
<td>B-2 Use Images (3)</td>
</tr>
</tbody>
</table>

SCID SYSTEMATIC CURRICULUM & INSTRUCTIONAL DEVELOPMENT

Phases

A - ANALYSIS

A-1 Conduct Needs Analysis

A-2 Conduct Job Analysis

A-3 Conduct Task Verification

A-4 Conduct Performance Analysis

A-5 Conduct Content Analysis

B - DESIGN

B-1 Develop Competencies

B-2 Develop Learning Objectives

B-3 Develop Learning Activities

B-4 Develop Materials

B-5 Develop Tests

C - DEVELOPMENT

C-1 Develop Competencies

C-2 Develop Learning Objectives

C-3 Develop Learning Activities

C-4 Develop Materials

C-5 Conduct Tests for Training

D - IMPLEMENTATION

D-1 Implement Program

D-2 Conduct Student/Reader Survey

D-3 Conduct Program Evaluation

E - EVALUATION

Evaluation on SCID, please contact Dr. Som, 500-600-1234, Ext. 2-0488 or
**Marketing the Program and the Career**

- Need to capture interest on young students
- What's in a name? Geomatics?
- Mentor or provide outreach to young students
- Provide information on careers with income and benefits
  - Geodata integration!
- Connect with Industry
  - Curriculum design
  - Internships
  - Capstone Projects
- Connect with Professional Organizations

**Some Ideas and challenges**

- Capture what has been done
- Use the best part of many processes
  - BoK, DACUM, new tools, new names
- Share what is learned – FIG
- Integration (data) is the key!

**What we are doing**

- ESRI business up 10% last year
- January 2009 numbers also up, over Jan 2008
- Surveying/Cadastre, up 38%
  - Partly Google effect
  - Also new tools, double precision, etc.
- Focus on Infrastructure
  - US Stimulus Bill
  - A concern in general
  - Surveying plays major role
- Education focus at the company
  - Part of the company ethos
- Emphasis on promoting Spatial Thinking
- Support innovative Ed initiatives around the world
  - Nepal, Vietnam, Iraq, across Africa, …
  - Virtual Ed team (Europe)
- Participation in BoK2 and other similar projects
- Open to new ideas…
REMINDER:

Survey & Engineering GIS Summit
San Diego, July 11-14, 2009
www.esri.com/segsummit

Thank you for your attention

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