GeoTech Center’s Goal

• Seek synchronization between what is taught in geospatial programs and what is needed by the geospatial industry
  • Achieve this goal by aligning what is taught and industry needs

• Accomplish this at the macro level by helping to complete the first five tiers of the DOL Geospatial Technology Competency Model (GTCM)
  • Defined geospatial technology as an industry
  • Identify the sectors of the geospatial industry
    • Established foundation of the all-important Tier 5 of the GTCM model
    • Permit us to move forward with the upper-levels of the GTCM (Tiers 6-9)
      • Tier 6: Sector-specific occupations (i.e. GIS Technician)
GeoTech Center’s Goal

• Create a Meta-DACUM of all of the knowledge, skills, and aptitudes of a single Standard Occupation Code (SOC): GIS Technician
  • Compiled a rank-order list of competencies
  • Select the top (x) number of competencies from this finite subset
  • Identify these as the “common core” competencies for this specific occupation

• Meta-DACUM analysis was vetted and reviewed by industry experts
  • Coordinated with the GIS Certification Institute (GISCI) Working Group
  • Maintained a tight working relationship with industry leaders
    • Proposing to do the same now for another occupation
      • Remote Sensing Technician
Geographic Information Science & Technology (GIS&T)  
*Body of Knowledge*

- **GIS&T : Body of Knowledge**
  - Created by the University Consortium for Geographic Information Science (UCGIS)
  - Distributed by the Association of American Geographers (AAG)

- The Body of Knowledge describes what topics (subjects) relate most to GIS&T
  - Body of Knowledge for GIS&T, divided into knowledge areas, which were subdivided into units, then into topics
    - Knowledge Area: Two letter code and description
    - Unit: Number and title with a brief description
    - Topic: Unit number and individual number and descriptive title
GIS&T: Body of Knowledge

- Knowledge Areas
  - Analytical Methods (AM)
  - Conceptual Foundations (CF)
  - Cartography and Visualization (CV)
  - Design Aspects (DA)
  - Data Modeling (DM)
  - Data Manipulation (DM)
  - Geocomputation (GC)
  - Geospatial Data (GD)
  - GIS & T and Society (GS)
  - Organizational and Institutional Aspects (OI)
GIS&T: Body of Knowledge

- Model Curricula was originally conceived as a tool primarily for academics, but the BoK can serve many purposes
  - Used as a course evaluation tool for the GISCI Certification
    - BoK will be used in an update process

- Additional functions
  - Initial curriculum development (DACUM)
  - Curriculum review
  - Program evaluation and assessment
  - Professional certification
Developing A Curriculum (DACUM)

• A DACUM is widely used as an occupational analysis tool
  • Typically involves a two-day workshop
  • Panel of 5-12 expert workers (with the help of a trained facilitator)
  • Systematically constructs a DACUM Research Chart
    • Profiles their job or occupation
    • Includes a comprehensive list of their duties

• The foundation for the DACUM process is threefold
  • Expert workers can define their occupation most accurately
  • The best way to define an occupation is to describe the tasks workers perform
  • All tasks demand the use of certain knowledge, skills, abilities (KSAs)
Developing A Curriculum (DACUM)

- Work tasks are statements which concisely describe work activities
  - Consist of a single action verb, an object and a qualifier
  - Tasks represent the smallest unit of a job activity with a meaningful outcome
    - “create map template”
      - Assigned task will result in a product, service or decision
      - Tasks consist of two or more steps and can be observed / measured

- Conducted DACUM analysis for the job of GIS Technician
DACUMs for a GIS Technician

• Completed a DACUM review and update
  • These DACUMs provide an occupation-specific definition of one SOC
  • Information can be used to help complete the upper levels of the GTCM
  • John Johnson conducted a statistical examination of historical DACUMs
    • Dating back a decade
    • Across many areas of the country
    • Combined with his recent DACUMs

• The process can be repeated for each of the industry sectors’ occupations, over time, helping to complete the GTCM for the DOLETA

• DACUM Research Chart: GIS SPECIALIST – 1997
Developing A CurriculuM (DACUM)

• Eight separate DACUM job analyses were conducted
  • Generating a total of 476 job tasks
  • These were grouped into 55 “metatasks”

• The metatasks are defined by the actual tasks they represent
  • Each is associated with a specific number of tasks and DACUM panels
    • “geocode data” is associated with 5 work tasks from 4 DACUM panels
    • “design and create maps” came from 34 work tasks and 8 DACUM panels

• The 476 job tasks were validated by a survey providing additional information on their importance and learning difficulty
Body of Knowledge & Developing a Curriculum

- Connection between the BoK & DACUM Duty Categories
  - Correspondence of BoK and Meta-DACUM (Cross-referenced)
  - GIS Technician Task Summary (DACUM Analysis)
  - Meta-DACUM Chart
## DACUM Validation

### Gainesville State College, GIS Technician - Task Verification Survey

**HOW IMPORTANT ARE THESE TASKS TO THE JOB PERFORMANCE OF A GIS TECHNICIAN? (177 Responses)**

<table>
<thead>
<tr>
<th>Task</th>
<th>n/a</th>
<th>Number of Responses</th>
<th>Importance</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-12 Edit attribute data</td>
<td>1</td>
<td>3</td>
<td>32</td>
<td>141</td>
</tr>
<tr>
<td>D-13 Edit spatial data</td>
<td>3</td>
<td>4</td>
<td>33</td>
<td>137</td>
</tr>
<tr>
<td>G-2 Create reference maps (e.g. streets)</td>
<td>1</td>
<td>5</td>
<td>49</td>
<td>122</td>
</tr>
<tr>
<td>G-1 Create thematic maps (e.g. zoning)</td>
<td>2</td>
<td>6</td>
<td>50</td>
<td>119</td>
</tr>
<tr>
<td>C-4 Acquire existing data (e.g. digital, hard copy)</td>
<td>0</td>
<td>4</td>
<td>61</td>
<td>112</td>
</tr>
<tr>
<td>D-2 Define data’s spatial reference</td>
<td>1</td>
<td>11</td>
<td>46</td>
<td>119</td>
</tr>
<tr>
<td>D-3 Change data’s spatial reference</td>
<td>2</td>
<td>12</td>
<td>54</td>
<td>109</td>
</tr>
<tr>
<td>D-8 Georeference data</td>
<td>0</td>
<td>12</td>
<td>58</td>
<td>107</td>
</tr>
<tr>
<td>E-4 Join tables (e.g. link, join, relate)</td>
<td>0</td>
<td>9</td>
<td>63</td>
<td>105</td>
</tr>
<tr>
<td>H-6 Attend training</td>
<td>0</td>
<td>5</td>
<td>75</td>
<td>97</td>
</tr>
<tr>
<td>E-5 Perform spatial join</td>
<td>2</td>
<td>12</td>
<td>61</td>
<td>102</td>
</tr>
<tr>
<td>C-2 Identify data sources / resources</td>
<td>0</td>
<td>11</td>
<td>66</td>
<td>100</td>
</tr>
<tr>
<td>C-7 Collect data using GPS</td>
<td>3</td>
<td>11</td>
<td>67</td>
<td>96</td>
</tr>
<tr>
<td>D-14 Evaluate spatial data accuracy</td>
<td>0</td>
<td>13</td>
<td>64</td>
<td>100</td>
</tr>
<tr>
<td>B-1 Maintain GPS &amp; field equipment (e.g. digital camera, laser range finder, DMI)</td>
<td>7</td>
<td>12</td>
<td>65</td>
<td>93</td>
</tr>
<tr>
<td>D-7 Perform data conversions</td>
<td>1</td>
<td>10</td>
<td>72</td>
<td>94</td>
</tr>
<tr>
<td>D-9 Geocode addresses</td>
<td>1</td>
<td>12</td>
<td>67</td>
<td>97</td>
</tr>
<tr>
<td>D-15 Validate tabular data</td>
<td>4</td>
<td>6</td>
<td>80</td>
<td>87</td>
</tr>
<tr>
<td>E-6 Post / reconcile edits (e.g. changes)</td>
<td>3</td>
<td>12</td>
<td>69</td>
<td>93</td>
</tr>
<tr>
<td>D-1 Post process GPS data (e.g. differential correction)</td>
<td>4</td>
<td>10</td>
<td>73</td>
<td>90</td>
</tr>
<tr>
<td>D-4 &quot;Heads-up&quot; digitize data</td>
<td>8</td>
<td>15</td>
<td>61</td>
<td>93</td>
</tr>
<tr>
<td>D-16 Validate spatial data (e.g. topology, build, verification)</td>
<td>5</td>
<td>12</td>
<td>70</td>
<td>90</td>
</tr>
<tr>
<td>E-3 Create / update metadata</td>
<td>1</td>
<td>17</td>
<td>64</td>
<td>95</td>
</tr>
</tbody>
</table>
Meta-DACUM Analysis

• The Meta-DACUM analysis seeks to identify a comprehensive set of tasks which are currently performed by GIS Technicians in the U.S.
  • This was done by consolidating the results of five DACUM Research Charts recently conducted for this job in various U.S. locations
  • The tasks represent the combined input of over fifty GIS Technicians who have systematically identified the work that they perform at their jobs
  • Once validated
    • Results can serve as a foundation for the curriculum development process
    • Basis for developing a set of common core competencies for GIS Technicians

• GIS Technician: Meta DACUM TASK Ranking
• GIS Technician: Meta DACUM Core Tasks
• Meta-DACUM Task Analysis
Curriculum Self-Assessment Worksheets

• PROTOTYPE: Version 0.1 June 13, 2010 (Based upon the GTCM)
  • http://www.careeronestop.org/competencymodel/

• These worksheets help educators assess how their curricula align with workforce needs in the geospatial industry
  • Each worksheet consists of a matrix corresponding to one of the five tiers of the DOL's Geospatial Technology Competency Model
  • Matrix rows list key competencies and critical work functions identified by workforce analysts and geospatial professionals
  • Columns represent the array of courses and other formal educational experiences included in a curriculum
  • Curriculum Self-Assessment Worksheets
Geospatial Technology Competency Model (GTCM)

- On June 18, 2010 the U.S. Department of Labor Employment and Training Administration (DOLETA) released an updated GTCM
  - Panel of geospatial professionals completed the GTCM begun by DOLETA in 2008
    - The GTCM consists of five “tiers” of industry competencies
    - Portrays “geospatial” as an interdisciplinary field
    - It asserts that industry-specific geospatial expertise is built upon a foundation of more generally applicable competencies
      - Tier 5—Industry Sector Technical Competencies (Page 19)
  - An earlier GTCM, prepared by the University of Southern Mississippi with support from DOLETA and NASA, laid the foundation for later efforts
  - The GTCM culminates more than a decade of work to formally characterize the nature of geospatial expertise
GTCM and the Body of Knowledge (BoK)

- Relationship between the GTCM and the Geospatial BoK (2006)
  - The Geospatial BoK is an comprehensive listing of formal educational objectives related to geospatial information science
  - The GTCM is more generalized and tries to focus on those competencies and tasks that a geospatial professional may encounter over the span of a career

- The DOL can note both the demand and skill sets for geospatial professionals
- Establish a position for geospatial technology relative to other professions
- Define core competencies (a preexisting shortcoming within the profession)
- Create job classification based upon a defined skill set
  - Develop the workforce necessary to meet the demands in this industry
A competency model is a descriptive tool that identifies the competencies needed to operate in a specific role in job, occupation, organization, or industry.

The GTCM defines the core competencies and skill sets that every person working in the geospatial profession should possess.
Personal Effectiveness

Competencies applicable to occupations and industries at national scale
Geospatial Technology Competency Model (GTCM)

Academic Competencies

Competencies needed by all occupations within an industry
Geospatial Technology Competency Model (GTCM)

Workplace

Competencies needed by all occupations within industry segment
Geospatial Technology Competency Model (GTCM)

Industry-Wide Technical Competencies specific to an occupation identified by Department of Labor partners
Geospatial Technology Competency Model (GTCM)

Industry - Sector Technical

Requirements for specialized degrees, licensure, or certification
Geospatial Technology Competency Model (GTCM)
# Geospatial Technology Competency Model (GTCM)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpersonal Skills</td>
<td>Integrity</td>
<td>Professionalism</td>
<td>Initiative</td>
<td>Dependability &amp; Reliability</td>
<td>Willingness to Learn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>Writing</td>
<td>Mathematics</td>
<td>Geography</td>
<td>Science &amp; Engineering</td>
<td>Communication Listening &amp; Speaking</td>
<td>Critical &amp; Analytical Thinking</td>
<td>Active Learning</td>
<td></td>
</tr>
<tr>
<td>Teamwork</td>
<td>Creative Thinking</td>
<td>Planning &amp; Organizing</td>
<td>Problem Solving &amp; Decision Making</td>
<td>Working with Tools &amp; Technology</td>
<td>Checking, Examining &amp; Recording</td>
<td>Workplace Computer Applications</td>
<td>Business Fundamentals</td>
<td></td>
</tr>
</tbody>
</table>
Body of Knowledge and GIS Certification

- **Body of Knowledge**
  - Created by the University Consortium for Geographic Information Science (UCGIS)
  - Distributed by the Association of American Geographers (AAG)

- **GIS Certification**
  - Administered by the GIS Certification Institute (GISCI)
  - Describes the core competencies required for professional practice
    - Educational courses relate to the knowledge areas
      - Each of the knowledge areas provides a general description of the topics covered and lists the relevant GIS&T Body of Knowledge topical units
      - Each of the 11 topical areas describes a part of the knowledge required for the general practice of the GIS profession
Body of Knowledge / GIS Certification Institute

- GIS Certification Institute 11 knowledge areas (Bok & GISCI)
  - Geospatial Analysis or Analytical Methods
  - Modeling of Features or Processes in Space or Time
  - Data Visualization and Cartography
  - Database Development and Design
  - Data Transformations or Manipulation
  - Data Generalization and Aggregation
  - Georeferencing, Coordinate Systems, and Data Quality
  - Remote Sensing and Photogrammetry
  - Data Quality, Metadata, and Data Transfer
  - Ethics and the Role of the GIS Professional in Society
  - Coordinating Organizations and the Role of the Professional
GISCI Professional Competency Working Group

• The DACUM (Occupational Analysis) methodology
  • A brainstorming session used to describe an occupation by practitioners
    • Typical regional and temporal in nature
    • Results of are validated through a separate process

• Data from DACUM exists in the following forms:
  • Raw – precompiled data collected from meetings and discussions
  • Un-validated – compiled into charts per region (and time)
  • Validated – regional verification process of un-validated data and charts

• DACUM analysis is expected to yield information that can be used to ascertain relative positions in GIS, as well as tasks and duties performed.
GISCI Professional Competency Working Group

• Tasked with documenting core competencies for the GIS Professional
  • Intent was to help guide the certification process
    • These competencies can be synthesized into statements of knowledge, skills and abilities (KSA's) that can be used to help ensure that all certified professionals demonstrate minimum standards of capability
    • They can be used to identify attributes required to certify professionals and further be used to assess future certification requirements
  • Collaborating with the GeoTech Center as it develops technician-level standards
  • Working Group must go beyond the technical requirements to fully define the scope of competencies required for professional practice
    • GIS Technician would likely be working toward professional certification
The Working Group is reviewing the work that has gone before to define the requirements of the GIS profession.

- Develop four specific deliverables:
  - A plan of action that includes delivery dates for other products
  - A set of core competencies that describe the GIS profession
    - The Working Group may also describe areas of specialization within the GIS profession and/or describe multiple levels of competency
  - Statements of required knowledge, skills, and abilities (KSAs)
    - Based on the required competencies
    - CC-1: Core Competency Checklist
  - A portfolio or test that can be used to judge the competency of GISP applications relative to the adopted KSAs
GTCM & GIS Certification Exam

• How does the effort to create a GTCM relate to the guidelines issued by the GISCI, for certification as a GIS professional?
  • Those pursuing a GISP gather materials into a portfolio detailing educational achievement, professional experience and service to the geospatial community

• But the certificate is issued without an exam. Why?
  • There has never been a competency model with a sufficient level of detail to specify the job functions that fall under each job.

• The GTCM will hopefully be used to more thoroughly stipulate job functions and occupations, so a certification exam could be created
Citation

• #3  ESRI (http://www.esri.com/news/arcuser/0706/curricula.html)
Developing Core Competencies for the GIS Professional

Rodney Jackson, GISP
Central Piedmont Community College

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