What Do Students Need to Know For A Successful Career

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GeoTECH

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Empowering Colleges:
Growing the Workforce

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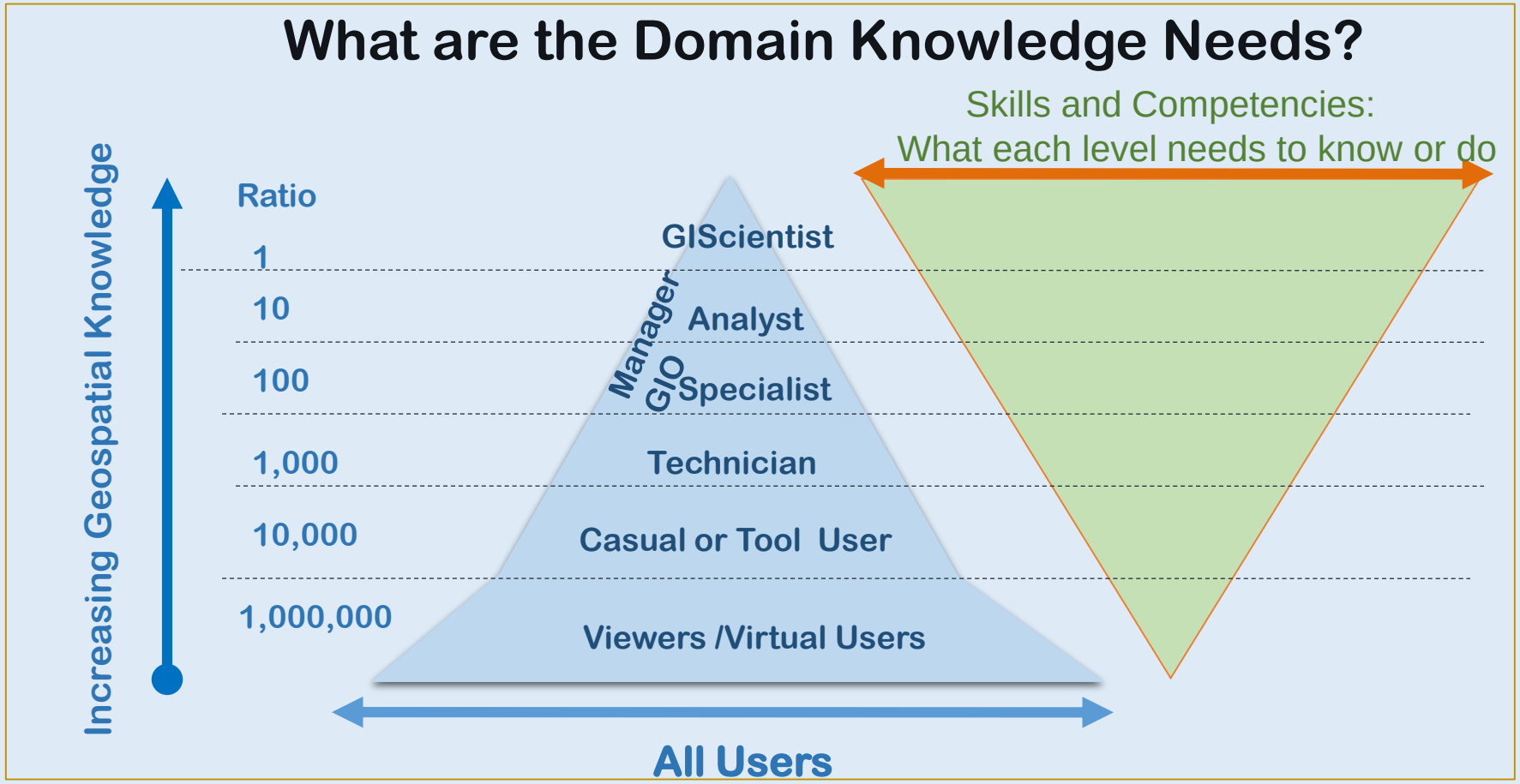
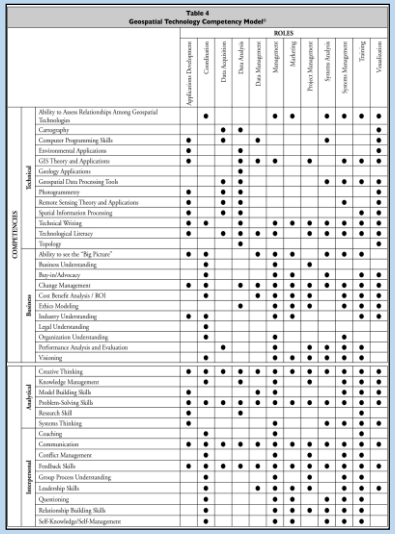
Can we identify the geospatial skills and competencies needed by students to successfully enter the geospatial technology workforce?

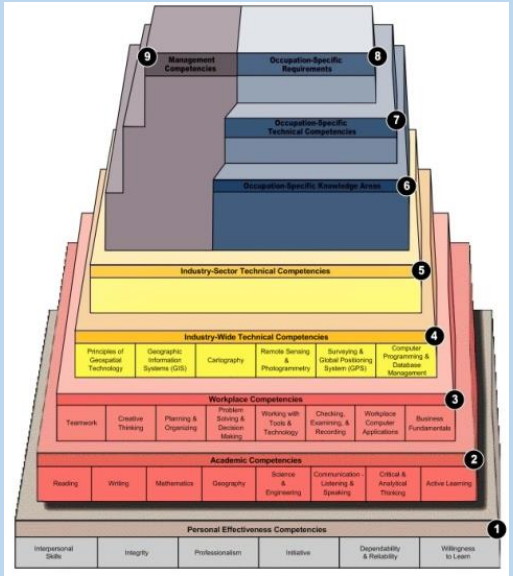
Can we create courses and programs to focus on those identified needs?

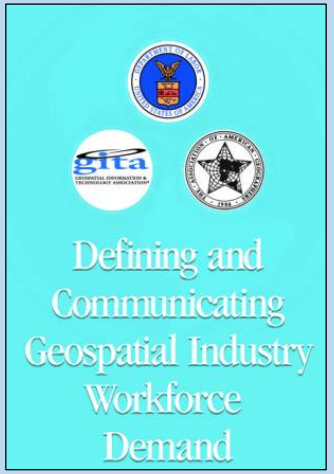
First lets look at the entire geospatial technology user community and the domain of their knowledge!

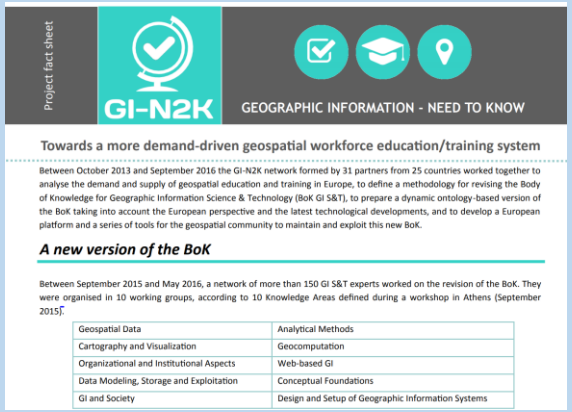


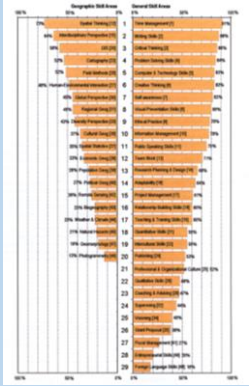
What are the resources available to fill in the right triangle?











Many past and on-going efforts to define skills and competencies of a "Geospatial Technology Domain"

Geo… …Model

- Industry def…
- Building Blo…
  - Personal…
  - Academi…
  - Workpla…
  - Industry…
  - Industry…
- Each block "…
- Updated in 2… updating in 2…
  - Out for P…

Core Geospatial Abilities and Knowledge

Critical Work Functions

- **Earth Geometry and Geodesy**
  - Discuss the roles of several geometric approximations of the earth's shape, such as geoids, ellipsoids, and spheres
  - Describe characteristics and appropriate uses of common geospatial coordinate systems, such as geographic (latitude and longitude), UTM and State Plane Coordinates
  - Explain the relationship of horizontal datums, such as North America Datum of 1983 (NAD 83) or the World Geodetic System of 1984 (WGS 84), to coordinate system grids and geometric approximations of the earth's shape
  - Describe characteristics and appropriate uses of common map projections, such as Transverse Mercator, Lambert Conformal Conic, Albers Conic Equal Area, Azimuthal Equidistant, and Polar Stereographic
- **Data Quality**
  - Discuss the elements of geospatial data quality, including geometric accuracy, thematic accuracy, resolution, precision, and fitness for use
  - In the context of a given geospatial project, explain the difference between quality control and quality assurance
  - Identify data quality and integration problems likely to be associated with geospatial and attribute data acquired with legacy systems and processes
  - Calculate and interpret statistical measures of the accuracy of a digital data set, such as Root Mean Square Error (RMSE)
- **Positioning Systems**
  - Describe the basic components and operations of the Global Navigation Satellite System (GNSS), including the Global Positioning System and similar systems
  - Explain the role of GNSS in location-based services
  - Collect and integrate GNSS/GPS positions and associated attribute data with other geospatial data sets
  - Describe characteristics and appropriate uses of inertial measurement systems

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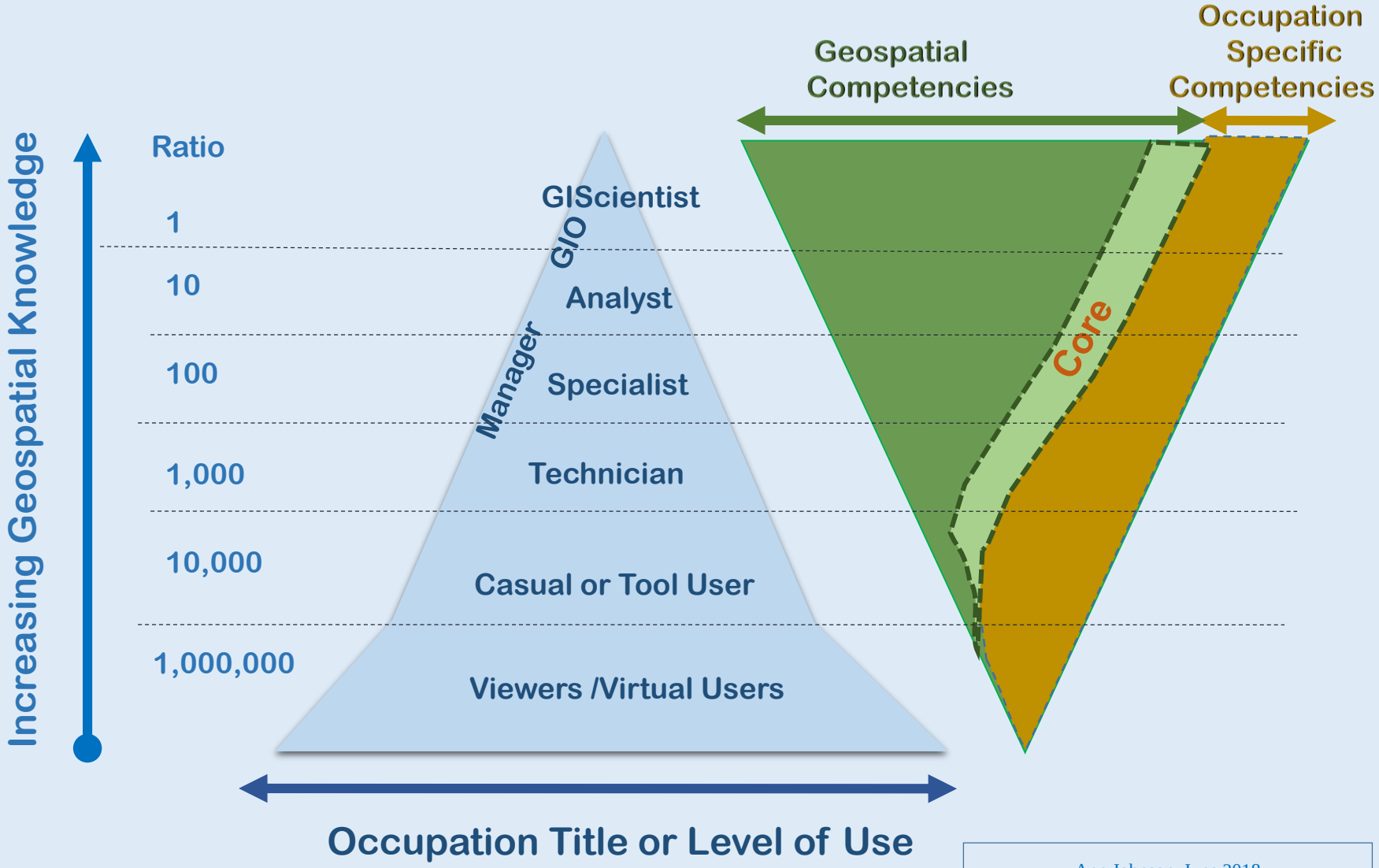
Domain, Core and Occupation Competencies



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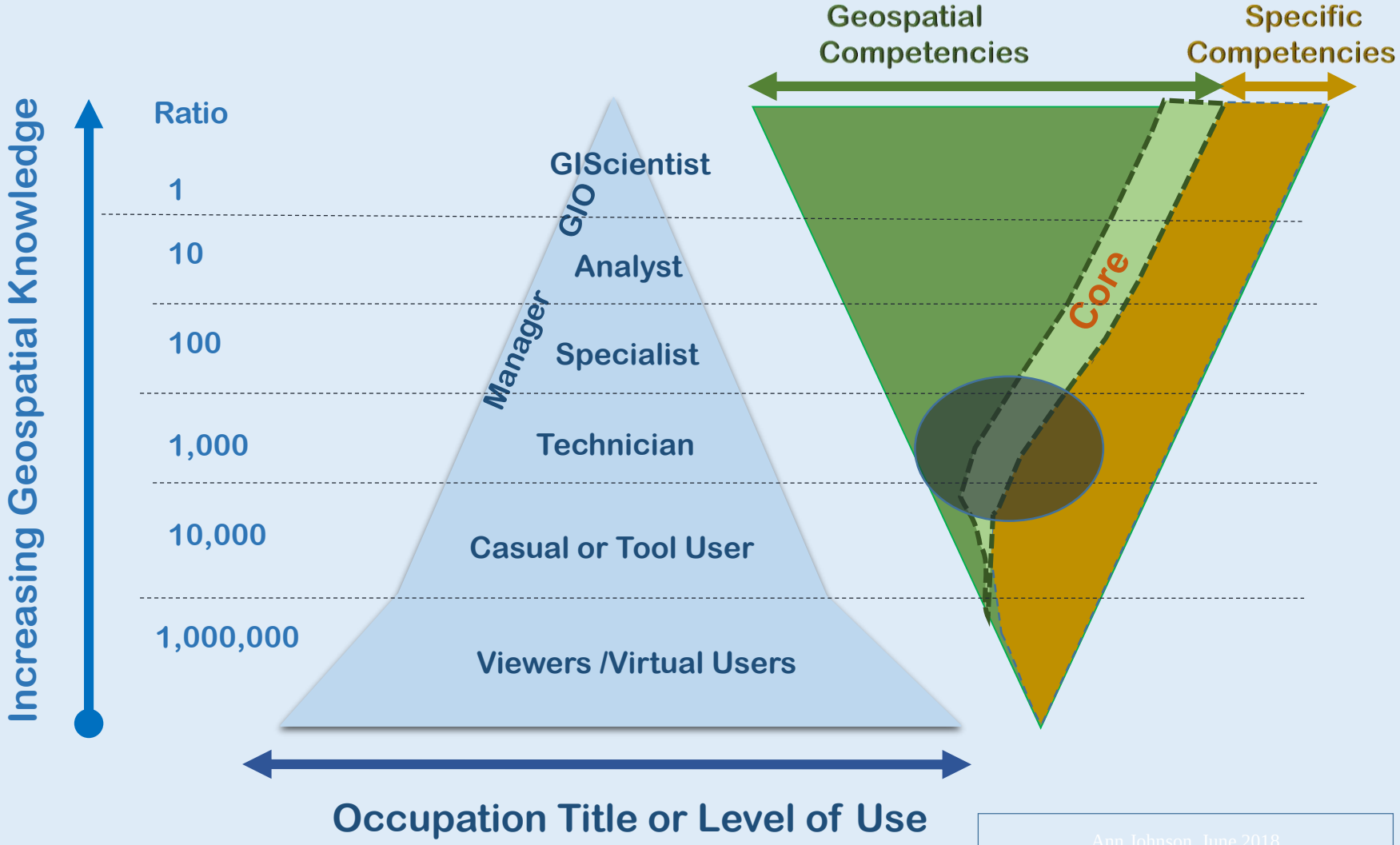
Entry Level Competencies



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Finding the Entry Level Competencies:

GeoTech Center "DACUM" Job Analysis

- Panels of expert workers are used to precisely describe & define job tasks + knowledge, skills, behaviors, tools, equipment
- 8 to 12 GIS Technicians, over two - 8 hour days

DACUM: Developing A CurriculUM used regionally for competency based education & training by industry, government & education

DACUM Research Chart for GIS Technician

January 15th – 16th, 2009

Duties	Tasks											
A Manage Tasks	A-1 Develop project scope	A-2 Develop project schedule	A-3 Document operating procedures	A-4 Create project status report								
B Manage Equipment	B-1 Maintain GPS & field equipment (e.g. digital camera, laser range finder, DMI)		B-2 Maintain Vehicle	B-3 Maintain plotter / printer	B-4 Maintain scanner							
C Gather Data	C-1 Define data requirements (e.g. domains)	C-2 Identify data sources / resources	C-3 Define data collection methods (e.g. GPS, air photo)	C-4 Acquire existing data (e.g. digital, hard copy)	C-5 Connect to external data sources (e.g. ODBC, GIS services)		C-6 Scan hard copy maps	C-7 Collect data using GPS	C-8 Collect data using field sheet			
D Process Data	D-1 Post process GPS data (e.g. differential correction)	D-2 Define data's spatial reference	D-3 Change data's spatial reference	D-4 "Heads-up" digitize data	D-5 Digitize data using COGO (e.g. metes & bounds)	D-6 Normalize data structure (e.g. schema)	D-7 Perform data conversions	D-8 Georeference data	D-9 Geocode addresses	D-10 Linear reference data	D-11 Derive new data (e.g. generate contours from DEM, data generalization)	
D Process Data (continued)		D-12 Edit attribute data	D-13 Edit spatial data	D-14 Evaluate spatial data accuracy	D-15 Validate tabular data	D-16 Validate spatial data (e.g. topology, build, verification)						
E Manage Data	E-1 Organize digital data (e.g. data library)	E-2 Organize non-digital data	E-3 Create / update metadata	E-4 Join tables (e.g. link, join, relate)	E-5 Perform spatial join	E-6 Post / reconcile edits (e.g. changes)	E-7 Archive data					
F Analyze Data	F-1 Perform viewshed analysis	F-2 Generate statistical reports	F-3 Model linear networks	F-4 Perform site selection	F-5 Identify shortest route	F-6 Identify service area	F-7 Conduct slope analysis	F-8 Identify least-cost path	F-9 Perform proximity analysis			
G Generate Deliverables	G-1 Create thematic maps (e.g. zoning)	G-2 Create reference maps (e.g. streets)	G-3 Create data analysis reports (e.g. tables, charts)	G-4 Develop presentations	G-5 Provide training	G-6 Create animation (e.g. 3D, 4D)						
H Professional Development	H-1 Conduct self-assessment	H-2 Participate in workshops & conferences	H-3 Obtain professional certification (e.g. GISP, ASPRS)	H-4 Cross-training (e.g. mentoring, coaching)	H-5 Research current/emerging trends (e.g. publications, on-line)		H-6 Attend training					

Tasks

Duties

General Knowledge

Geoprocessing methods
Relational databases (Informix, Oracle)
Spatial projections
Basic scripting (SQL, VB, HTML, Python, ASP,
GIS Industry standards
Client/company standards
Naming conventions
Raster / Vector
Export formats, properties & settings
Spatial awareness
Units of measure
Map scale
Plats & deeds
Industry jargon
Data sources
Google Earth (KML)
Adobe Illustrator
Crystal Reports
ZIP, GDB, Coverage, CAD, DGN, TXT, IMG, TIF, SID, Flash, PDF, GeoPDF, e00, PkZIP, RAR, TAR
Related Industries
Mathematics (geometry, statistics, trigonometry, algebra)
Legacy technology

Skills

Typing
Unit conversions
Creating models
Time management
Organizational
Troubleshooting
Problem solving
Basic computer
GPS operation
Laminating
Modify user interface
Microsoft office
Map reading
Adding data to a project (GIS, CAD)
Create TIN model
Interpolation
Cartographic license
Verbal & written communication
Burn to disk
FTP site
Create map book
Interpersonal
Plotter operation
Graphing & reporting

Worker Behaviors

Self-improvement
Networking
Creativity
Detail orientated
Willingness to learn
Analytical
Punctuality
Self-motivated
Enthusiastic
Multi-tasking
Team player
Diplomatic, tactful
Common sense
Positive attitude
Ethical
Independent
Logical, intelligent
Visionary
Abstract thinker (outside the box)

Tools, Equipment, Supplies and Materials

ArcGIS Desktop
Adobe Illustrator
AutoCAD
ERDAS Imagine
Microstation
Microsoft Office
GPS
Scanner/Plotter
Internet
Computer
Mobile devices (PDA)
Phone
Camera
Calculator
Vehicle
Software licensing

Future Trends

Web applications
GIS for the masses (Google, Wikipedia)
User created mashups & social networking
Pictometry
Broader use in other fields
Utility work / mapping
More access to data
Manage higher expectations
Quality control issues
More info. mapped
Greater accuracy
Lower price
Mapping abstract info (military, social science)
Emergency response GIS
GIS use in mobile devices

Acronyms

AI	Adobe Illustrator
ASPRS	American Society of Photogrammetry and Remote Sensing
CAD	Computer Aided Design
COGO	Co-ordinate Geometry
DEM	Digital Elevation Model
DMI	Digital mile indicator
Flash	Animation File-Adobe
GISP	Certified GIS Professional
GPS	Global Positioning Systems
ODBC	Open Database Connectivity
SWF	Shock Wave Flash
TIN	Triangulated Irregular Network
BMP	Bitmap file
DGN	Design file
DXF	Drawing Interchange Format
GDB	Geodatabase file
JPEG	Joint Photographic Experts Group
KML	Keyhole Markup Language-Google
MrSID	Seamless Image Database-LizardTech
PDF	Portable Document Format-Adobe
RAR	Compression /Archive File
SHP	Shapefile
TIFF	Tagged Image File Format
ZIP	Compression /Archive File

DACUM Research Chart: GIS Technician

DACUM Panel

Azar Khani, GIS Specialist III, Fulton County Government
Brannon Schnelle, GIS Analyst, Jordan, Jones & Goulding
Collin Horace, GIS Developer/Analyst, CH2MHILL
Donald I. M. Enderle, GIS Analyst, Photo Science Inc.
Dwight Lanier, GIS/Environmental Science Laboratory Coordinator, Gainesville State College
Eric McRae, Director, Information Technology Outreach Services
Lisa Jackson, Information Analyst III, Center for GIS, Georgia Institute of Technology
Lisbeth Ruiz-Nunez, Regional Resource Info. Coordinator, US Forest Service
Mark Lane, GIS Manager, Hall County Government
Melanie Tabb, GIS Administrator, Gwinnett County
Ron Pate, Registered Land Surveyor
Tripp Corbin, Vice President GIS, Keck & Wood, Inc.

DACUM Facilitators

John Johnson, GIS Workshop Facilitator
Carol Kraemer, Recorder

Sponsored by:

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Gainesville State College University System of Georgia

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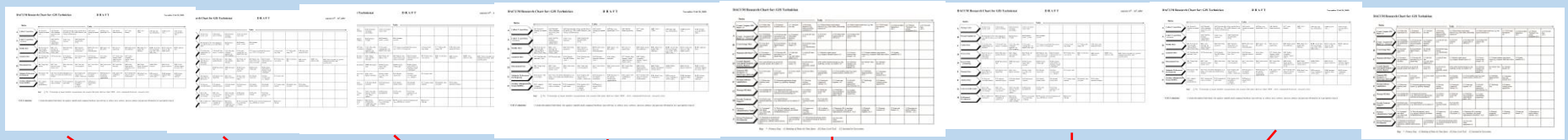
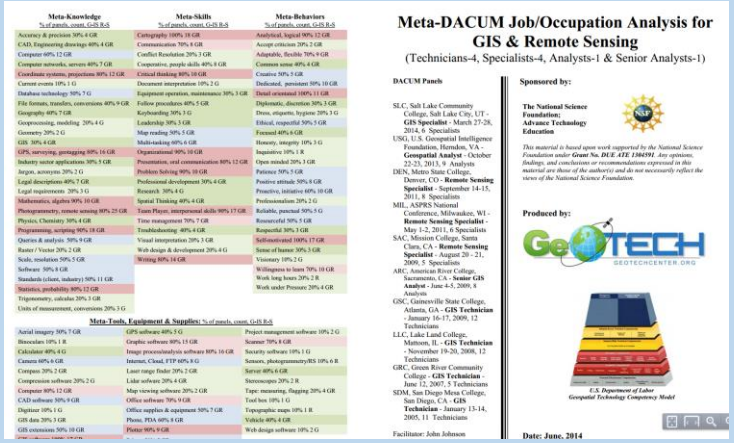
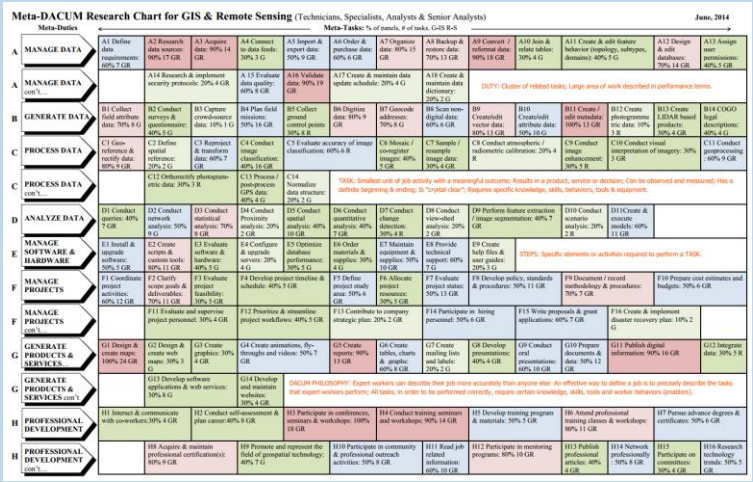
Meta-DACUM Methodology

By consolidating validated results from multiple DACUM analyses for a single occupation taken at various USA locations, we can identify a comprehensive list of competencies.







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Program Content Tool – 311 Competencies

Go to the GTMC Competency Model

Enter course name(s) in the columns to the right; cut/paste for additional columns or delete as

Enter 0 through 4 for each course based on the Scale Below

- 0 Not important for this course - do not include in this course
- 1 Slightly important for this course, include ony if time permits:
- 2 Important - include at an awareness level
- 3 Very Important; should be included at some level above awareness
- 4 Critically important, must be included in depth

3	T4	Datums and geoids	3	2	1		3	2	0	0	Cross Cutting (CC)
4	C3	Validate spatial and tabular data (e.g. topology, build, verification)	1	2	3		0	0	1	0	Cross Cutting (CC)
5	C	Define data's spatial reference	3	2	4		1	3	2	0	Cross Cutting (CC)
6	C	Transform spatial data (e.g. reprojections)	1	3	3		2	3	2	0	Cross Cutting (CC)
7	C	Apply appropriate projections	3	3	2		4	3	3	0	Cross Cutting (CC)
8	KNO	Describe different methods of indicating locations (e.g., decimal degrees, UTM)	3	2	3		2	1	0	0	Cross Cutting (CC)
9	G	Calculate scale transformations.	1	1	1		0	0	0	0	Cross Cutting (CC)
10	G	Resolve spatial conflicts.	2	2	1		3	0	0	0	Cross Cutting (CC)
11	G	Determine appropriate scale and projection	3	2	1		4	2	3	0	Cross Cutting (CC)
12	T2	Number Operations and Computation - addition, subtraction, multiplication, and division	2	2	0		1	2	0	0	Cross Cutting (CC)
13	T2	Number Systems and Relationships - whole numbers, decimals, fractions, and percentages	2	2	0		1	2	0	0	Cross Cutting (CC)
14	T2	Measurement and Estimation - measurement of time, temperature, distances, length, width, height, perimeter, area, volume, weight, velocity, and speed; unit conversion; numerical analysis to obtain approximate solutions when necessary	2	3	0		1	2	0	0	Cross Cutting (CC)
15	T2	Geometry - size, shape, and position of features using geometric principles to solve problems	2	2	0		1	2	0	0	Cross Cutting (CC)
16	T2	Mathematical Reasoning and Problem Solving - inductive and deductive reasoning, conjectures, arguments, strategies, and interpretation of results	1	2	0		0	2	0	0	Cross Cutting (CC)

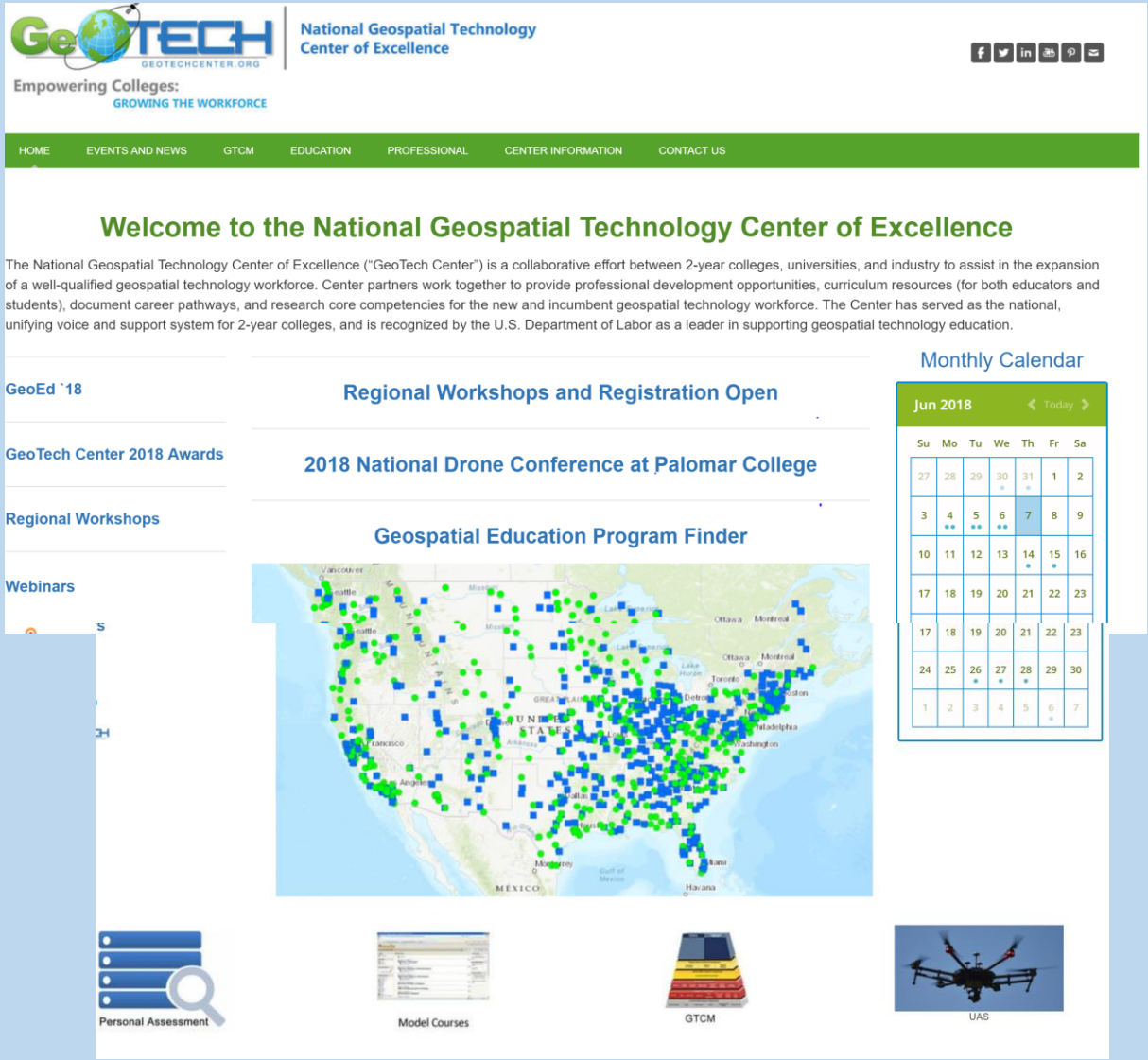
Overview | Educator Info | Definitions | Course Content Worksheet | Sheet1

GeoTech Center Model Course Content

- **Geo 100 – Awareness Stand alone Model Course**
- **“Model Courses & Certificate”**
  - GST 101 – Introduction to Geospatial Technology
  - GST 102 – Spatial Analysis
  - GST 103 – Data Acquisition and Management
  - GST 104 – Cartographic Design and Visualization
  - GST 105 – Introduction to Remote Sensing
  - GST 106 – Introduction to Geospatial Programming
  - GST 107 – Geospatial Web Application and Development
  - GST 108 – Capstone
  - GST 109 – Internship
  - GST 201 - Crime Analysis

Additional Curriculum Resources

- Concept Module Videos
  - Map projections, Datums, Statistics, Data Management
- Demonstration Videos
  - How to carry our specific tasks
- MOOC – Introductory Course
- Meta-DACUM
- Program Content Tool and Program Assessment Tool
- Starting a Geospatial Program



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Thank You!

Questions?

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