GISP Survey Reveals Support for Certification Exam

We have all faced the awkwardness of the question, "What do you do for a living?" There is no short answer. The geospatial community faces a daunting task: defining itself. The U.S. Department of Labor included geospatial technology as one of its 12 high-growth job areas, but has no such job defined in its standard list of position titles and duties.

To be sure, portions of the geospatial community have existed for a long time, even hundreds of years. Surveyors and cartographers are well-established professions, but represent limited corners of the geospatial field. What about the rest of us, whose job duties do not lend themselves to a single-word description?

Amid growing pressure from the surveying community and a need to recognize the GIS practitioners who meet a standard of qualification, certification of GIS professionals arrived on the scene four years ago with the formation of the GIS Certification Institute (GISCI) and its GIS Professional certification program. The GISP certification is based on a portfolio of experience, education, and professional contributions. An experience-only option is available through a grandfather provision that is in effect for the first five years of the program. This option recognizes the limited formal education and professional participation available when many of today's professionals entered the geospatial workforce, and substitutes long experience and the lessons it teaches for formal education and contributions to the profession. More than 1600 GISPs have been certified through the three-part and experience-only options.

The GIS&T Body of Knowledge

One of the difficulties faced by the Institute is identifying the relevancy of an applicant's education and experience. A review committee of GISPs can be called upon to interpret and judge the relevancy of an applicant's submittal, but no clear rubric of valid choices was available until recently. That situation changed with release of the *Geographic Information Science & Technology Body of Knowledge* in 2006 by the University Consortium for Geographic Information Science (UCGIS), and published by the Association of American Geographers. This publication is the latest in a 20-year sequence of curriculum development efforts undertaken by a number of education-oriented bodies.

The *Body of Knowledge* describes the recommended content for academic programs in the GIS&T field. It subdivides the educational components into three sub-domains (geographic information science, geographic information technology, and the application of that science and technology) comprised of 10 knowledge areas. The knowledge areas are further subdivided into numerous knowledge units, 25 of which have been designated as core curriculum components. GISCI is considering modification of the GISP certification program to include these core knowledge units in the certification process. Such an application is fully anticipated by the *Body of Knowledge*, which includes professional certification as one of six areas of application.

Motivating this contemplated change to the certification program is concern on the part of some that too many GISPs may have a limited range of competency. The experience component of the GISP certification program requires only that the work fall within the range embraced by the

geospatial field. Particularly with those GISPs certified through the grandfather option, the range of knowledge acquired through work experience may not be broadly based. For example, someone who was certified on the basis of 20 years of work experience maintaining property maps may not have competence in other common areas of the geospatial field. A competency-based certification program would likely require some evidence that the applicant had useful knowledge of the core competency units in the *Body of Knowledge*.

Another concern is the need to strengthen the profession by subjecting it to the same rigor employed in most other professions; i.e., a requirement to pass an examination of relevant knowledge before being recognized as competent to be a member of that profession.

Before embarking on any effort to modify the GISP certification program to incorporate a competency component, the GISCI Oversight Committee authorized a survey of GISPs to ascertain whether competence in the core units was common. In addition, the survey polled GISPs on the questions of whether the core units should be included in the process of judging the suitability of applicants for the GISP credential, either through portfolio evidence or a formal examination based on the core units.

Knowledge Survey Results

More than 550 GISPs responded to the survey through an online service. They were asked to rank their own competence in a range of 1-5 for each of the core units taken from the Body of Knowledge. The five scoring options were:

5 – Expert Knowledge
4 – Very Knowledgeable
3 – General Knowledge
2 – Somewhat Knowledgeable
1 – No Knowledge

The next step was to evaluate survey results. This was done for the knowledge unit portion of the survey by comparing the range of responses against an admittedly high standard of no more than 10% of the respondents saying they had less than general knowledge of a core knowledge unit (reported Level 1 or 2). Ten units failed to meet that standard. In decreasing order of stated competency, they are listed here (the percent of respondents with each reported level of competency follows a list of topics within the knowledge unit):

89.7% - Coordinating Organizations (professional organizations; publications; the geospatial community; the geospatial industry; federal agencies and national and international organizations and programs; state and regional coordinating bodies) – 5 (18.6%), 4 (40.3%), 3 (30.8%), 2 (9.8%), 1 (0.5%)

89.5% - Institutional and Inter-institutional Aspects (spatial data infrastructures; adoption of standards; technology transfer; spatial data sharing among organizations; openness; balancing data access, security, and privacy; implications of distributed GIS&T; inter-organizational and vendor GIS) – 5 (18.2%), 4 (39.5%), 3 (31.7%), 2 (9.8%), 1 (0.7%)

88.8% - Aerial Imaging & Photogrammetry (nature of aerial image data; platforms and sensors; aerial image interpretation; stereoscopy and orthoimagery; vector data extraction; mission planning) – 5 (13.8%), 4 (39.6%), 3 (35.4%), 2 (9.6%), 1 (1.6%)

86.9% - Earth Geometry (history of understanding Earth's shape; geoids; spheres and ellipsoids) – 5 (12.1%), 4 (34.1%), 3 (40.7%), 2 (12.0%), 1 (1.1%)

84.6% - Representation Transformation (impacts of transformations; data model and format conversion; interpolation; raster resampling; vector-to-raster and raster-to-vector conversions; coordinate transformations) – 5 (13.6%), 4 (34.7%), 3 (36.3%), 2 (13.6%), 1 (1.8%)

82.9% - Domains of Geographic Information (space; time; relationships between space and time; properties) – 5 (13.9%), 4 (29.1%), 3 (39.8%), 2 (13.9%), 1 (3.2%)

81.4% - Basic Analytical Methods (point pattern analysis; analyzing multidimensional attributes; kernels and density estimation; cartographic modeling; spatial cluster analysis; multi-criteria evaluation; spatial interaction; spatial process models) – 5 (12.7%), 4 (30.5%), 3 (38.2%), 2 (15.2%), 1 (3.4%)

80.1% - Elements of Geographic Information (discrete entities; events and processes; fields in space and time; integrated models) – 5 (12.7%), 4 (31.4%), 3 (36.0%), 2 (16.1%), 1 (3.8%)

80.0% - Vector & Object Data Models (geometric primitives; the spaghetti model; the topological model; classic vector data models; the network model; linear referencing; object-based spatial models) – 5 (13.8%), 4 (33.0%), 3 (33.2%), 2 (15.5%), 1 (4.5%)

70.7% - Tessellation Data Models (grid representations; the raster model; grid compression methods; the hexagonal model; the TIN model; resolution; hierarchical data models) – 5 (6.8%), 4 (22.0%), 3 (42.0%), 2 (23.6%), 1 (5.7%)

If a 15% threshold had been used, four of the 10 reported problem knowledge units would have been omitted. Only the last listed unit has a reported knowledge level of 1 (no knowledge) higher than 5%. Still, the bottom three are especially troubling, as they represent the most fundamental aspects of geospatial data. While it is possible that a significant portion of the GISP community lacks such fundamental knowledge, it is equally possible that what they fail to understand is the terminology, not the concepts. In all cases, and regardless of the real reason for these knowledge units having such low levels of useful knowledge, any real deficiency should be correctible with a little education.

The vast majority of the GISP community appears to possess useful knowledge of the core areas contained in the *Body of Knowledge*. At least with regard to what GISPs seem to know, it is consistent, although it may not be all-inclusive. There could be other core knowledge areas found among GISPs that are not included in the *Body of Knowledge*. It is also reasonable to conclude that there are general skills required of all professionals that are not unique to the geospatial community and, therefore, not included in the *Body of Knowledge* but should still be used in judging the competence of a GIS professional.

Applying the Body of Knowledge

The next question is whether the *Body of Knowledge* is a useful guide for establishing a competency-based certification program. As suggested by the Oversight Committee, the portfolio process would be supplemented by the applicant's being asked to confirm that he or she has a working knowledge of each core unit by indicating the education course or work experience where that knowledge was gained. (A requirement to list such courses and work experience is already part of the application process.) The results of the poll here were conclusive:

- 18.9% - Use all core competency units to determine certification
- 71.8% - Use a percentage of core competency units to determined certification
- 9.4% - Don't use the core knowledge units to determine competency

More than 90% of the GISPs responding to the survey said they wanted to include at least some of the knowledge units in the certification process. When asked whether the way to do so was through an examination, the results were:

- 30.0% - Yes, this should be an immediate priority
- 54.3% - Maybe, but it should be studied further
- 15.7% - No, the current portfolio system should be continued indefinitely

Thus, almost 85% of the respondents say that a test is probably a good idea, perhaps even a priority for immediate adoption. The GISPs were then asked, if an exam component is included, how should it be applied:

- 18.5% - Every applicant should have to take the exam
- 42.3% - Applicants should have to take the exam coupled with a shorter version of the portfolio
- 21.7% - Applicants should have a choice between an exam and a portfolio certification
- 9.7% - Don't add an exam to the process

For this question, more than 90% said that an exam should be added to the process in some manner, with the largest vote going to a portfolio component being used as a gatekeeper for applicants to take the exam. The second-largest vote went to providing an exam option for people who presumably do not meet the portfolio requirements. Either way, a clear majority (60.8%) of GISPs support the universal requirement for a test.

Lastly, the GISPs were asked whether, if an exam were added, it should be based on the *Body of Knowledge*. The results here amount to a mandate:

- 84.5% - Yes
- 15.5% - No

This question received the largest number of comments (112). Most common was a concern that the *Body of Knowledge* was too academic and needed to be converted to "street language" before

it was applied via an exam. That shortcoming can be readily corrected. But there is another problem that will require more extensive work: the *Body of Knowledge* only suggests the questions to be asked, not the answers. The profession needs to provide those answers.

In addition, although all the core units probably need to be included in the exam, they should not be applied with an equal weight. Some knowledge is more important than others. Using an exam allows an applicant to have imperfect knowledge of some units yet still exceed the minimum score for certification. Absent an exam, it is difficult to implement the option to use only a percentage of the core units, which would require GISCI to select the core units that an applicant need not have useful knowledge and still be certifiable.

What Next?

GISPs responding to the survey appear to support competency-based certification as an immediate step to improve the credential. They also appear to support exam-based certification, likely with a portfolio-based threshold to qualify for the exam, as a long-term solution. GISCI now needs to decide how to accommodate the survey results in the certification process.

Before GISCI starts down that road, it will be necessary to restate the core knowledge units into practical language that clearly specifies what needs to be known by applicants in order to receive certification. A way to provide education for applicants and continuing education for existing GISPs is also advisable to ensure a uniformly qualified set of GISPs. Because it is likely that years will be required to devise an acceptable exam, the competency-based certification process currently being considered by GISCI is a reasonable next step to creating a uniformly competent GISP community. The process of developing exam questions and answers covering GIS&T knowledge can also begin soon.

More than the core units may be required to guide this task. Other areas for examination may also be justified—topics that are either not part of the core group or are outside the *Body of Knowledge* entirely. Skills and abilities that may be described by professional practice standards are equal in importance to knowledge of the science and technology upon which they are based. The profession must define those standards. Ultimately, a two-step process may be required where recent graduates take a GIS&T test, and then a professional application test is required following a period of work experience, much as is done for the engineering profession.

It is a lot to do in a short period of time; however, without all geospatial professionals defining our profession, others may do it for us. For example, state legislatures have been persuaded to expand the scope of the state-licensed practice of surveying to include all other geospatial activities. Four states—Iowa, Mississippi, North Carolina, and South Carolina—have adopted language in the last few years that says the licensed practice of surveying includes, "creating, preparing, or modifying geographic information systems." A majority of states include a significant portion of the geospatial profession, such as "the preparation and perpetuation of maps by any means" or the extraction of data from aerial images within the scope of licensed surveying.

A better approach seems to be for the entire geospatial community to collectively define its entire reach, and then to group those knowledge, skills, and abilities into logical segments of the

geospatial profession. Under this scenario, rather than preserving the total realm of surveyor licensing at the state level, we would create a national license standard that applies to all geospatial professionals—things included in the Body of Knowledge, perhaps—and restrict to the state level and the license process it administers those practices specific to the laws of each state. Some areas of specialization may also exist at a national level; e.g., photogrammetry, database design, project management, spatial analysis, etc.

The poll of GISPs indicates that we can use the Body of Knowledge to work toward a more inclusive definition of a broad geospatial profession that consists of several areas of practice based on a clear set of knowledge, skills, and abilities. Let's get started.

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