

Developing a Seamless Geospatial Education Model

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Abstract: Today, GIS is offered at all levels of the educational spectrum, including K-12, 2-year, 4-year, and graduate programs. Transitioning from one education level to the other has always been a challenge. This paper presents a seamless geospatial education and training model developed at Gainesville State College. The paper discusses the modeling process together with articulation agreements developed among the three education systems and industry in Georgia to support seamless geospatial education.

Many 2-year colleges presently have or are implementing and developing Geospatial Technology (GT) education/training programs. While most of these programs are highly successful in helping to meet the growing workforce development needs for the geospatial technology industry, many face difficulties in regard to transfer of their GT coursework to 4-year institutions. Gainesville State College, historically a two-year unit of the University System of Georgia, has taken a rather unique approach in addressing the transfer problem and is working with technical colleges and high schools in the state to develop a seamless GT educational model. The basis for demonstrating the equivalency of course work in the seamless model is the University Consortium for Geographical Information Science (UCGIS) Body of Knowledge (BoK).

Two-year Colleges and Geospatial Technology Training/Education:

Geospatial Technology (GT) has been identified as one of the top three growth areas for the US workforce in the 21st century^{1,4}. According to the US Department of Labor Employment and Training Administration, "The industry remains focused on 4-year and advanced degrees."¹ However, to meet industry growth and requirements within the applications arena in particular, employers need to examine alternatives to the traditional pipeline. These alternatives include training provided by technical and community colleges. More and more two-year colleges are developing and implementing education/training programs in geospatial technology.

The Educational Context: A lack of articulation of course work between different educational levels is a national problem that affects all academic disciplines.. According to author or agency in charge, "the historical split between different levels of education in the United States have made coordination difficult with early-childhood education, elementary and secondary schooling, and postsecondary and training institutions often operating in separate silos, with different rules, different financial structures, different accountability systems, and different expectations for success"². The above mentioned report also examined state efforts to connect the K-12 education system with early learning, higher education and industry. Based on a possible fifteen key alignment policies,

Georgia is in the top ten states in the United States in regard to K-12 articulation. However, that success is tarnished by a lack of coordination and alignment between the technical colleges and the four-year institutions in Georgia.

Education in Georgia: There are three public educational agencies or departments in the state of Georgia: 1) the Georgia Department of Education (GDE), which oversees the K-12 system, 2) the Georgia Department of Technical and Adult Education (GDTAE), which oversees 22 technical colleges, and 3) the University System of Georgia (USG), which oversees 35 colleges and universities. While articulation pathways are well established between the GDE and the GDTAE, there is little to no transfer of technical coursework from technical colleges to USG institutions. Two-year colleges in the USG collaborate with technical colleges by providing general education coursework for an Associate of Applied Science (AAS) degree. Several USG institutions offer the Bachelors of Applied Science (BAS). However, junior/senior level coursework in the BAS is in management rather than in a technical area.

Geospatial Technology Education in Georgia: Geospatial capacity building in Georgia has historically been and is still primarily a function of the four-year colleges and universities. These programs only offer upper division and graduate courses. Gainesville State College began offering a certificate in GT almost ten years ago and is still the only USG two-year institution to offer coursework in GT. In the GDTAE system, Ogeechee Technical College is the only technical college that offers a certificate in GT. Forsyth High School is the only school that has a GT program in the GDE system.

In the spring of 1997, Gainesville College was one of seventeen two-year institutions nationwide awarded a mentorship grant from the National Science Foundation Advanced Technology Education Program and Phi Theta Kappa. The grant, "*Improving Science and Technology Education at Community Colleges*", provided a tested GIS curriculum, GIS educator contacts, and access to former NSF funded projects related to GIS education from across the country. The grant was a success by all accounts. The College established and met two goals in the grant, to integrate GIS into environmental science and biology classes, and to develop an introductory course in GIS. By spring semester 1998, GC had developed an introductory GIS course and GIS applications were in place in numerous science courses. One of the most significant spin-offs of the grant was the establishment of a service learning component. In the fall of 1998, the College was awarded the TERRIFIC award from the Georgia Economic Developer's Association for its continued development of service learning initiatives. This award is given once per year to an outstanding program within the University System of Georgia. In 1999, the success of the NSF/PTK grant led to the development of the GC Certificate in GIS at a time when GIS programs at 2-year colleges were virtually non-existent.

The GIS certificate at Gainesville State College includes five courses; Geographic Information Science, Spatial Analysis in GIS, Fundamentals of Cartography and Earth Measurement, Data Acquisition and Conversion in GIS, and Fundamentals of Remote Sensing . In addition to these five courses, each student must complete one of the following: Special Topics in GIS, Service Learning in GIS or Internship in GIS. The GSC GIS certificate is one of the more comprehensive programs in the state and the feedback from most employees of GSC graduates indicates that GSC GIS students are generally better prepared technicians than students from other programs. The job placement rate for certificate recipients that seek work is above 90%.

The GSC GIS certificate program is highly successful. Several factors contribute to this success. (a) The GSC certificate program is a unique blend of training & education and is more comprehensive than other programs in the state. (b) All students are required to complete a service learning course, a special topics course or an internship. (c) The internships, service projects and permanent placement of graduates are and have been in a variety of employment settings in government and industry. These include the U.S.D.A. Forest Service, the U.S. Army Corps of Engineers, the Natural Resource and Conservation Service, the Georgia Department of Transportation, the Georgia Department of Natural Resources, the Georgia Poultry Laboratory, the Atlanta Botanical Gardens, Gwinnett County (Ga.) Public Utilities, the City of Gainesville (Ga.) Public Utilities, Hall County (Ga.) Public Utilities, Hall County Fire Services, and a large variety of private companies both local and out of state. Feedback from students on their experiences provides an invaluable evaluation tool for timely upgrade and modification of courses and curricula. (d) The introductory GIS course is offered in the general core curriculum and acts as a significant recruitment tool into the certificate, drawing students from a variety of disciplines.

Historically, there were three significant problems with the GIS certificate program. First, most jobs within the state required a B.S. degree. Thus while graduates were highly sought after, they were in a dead end track with little chance of promotion. Second, significant articulation barriers existed since GC GIS courses were offered at the sophomore level and GIS courses at other institutions were offered at the junior/senior level or above. And third, while both the reputation of the program and demand for GC GIS students were strong, approximately half of students lacked a solid foundation in science, engineering, and mathematics. There was a need to produce GIS graduates that could communicate well with the professional engineers and scientists that were the source of the GIS input data.

The solution to these problems was to apply for a change in designation from "college" status to "state college" status and offer an applied B.S. degree in GT. To facilitate the development of a B.S. degree, GC established the Institute for Environmental and Spatial Analysis (IESA) in 2001. The goals of the IESA are education, training and service in geospatial technology and environmental

science with an emphasis on water resources. Water resources were a natural focus for the Institute since GSC is located on Lake Sidney Lanier, a 36,000 acre lake managed by the U.S. Army Corps of Engineers. Lake Sidney Lanier is the primary drinking water source for the Greater Metropolitan Atlanta Region, a region that is rapidly outgrowing its water resources. The Environmental Spatial Analysis Lab at GSC is the heart of the IESA since geospatial technology is the key analytical tool used in watershed characterization and management.

In 2001 a certificate in Environmental Science was developed composed of five courses: Land Use & Conservation, Soils & Hydrology, Ecology of Wetlands & Streams, Limnology, and Environmental Chemistry. These ESCI courses emphasize field methods & GT applications. The two certificates (GIS & ESCI) were combined as the basis for a B.S. degree in Applied Environmental Spatial Analysis (AESA). Two additional GIS courses, Digital Image Processing and Application Development in GIS were added to the degree as well as a capstone course in Watershed Characterization.

The AESA degree is composed of a focused curriculum built on a firm foundation in science (biology, chemistry, geography, geology and physics) and mathematics. The educational base for this degree is composed of four components seamlessly integrated with a core of geospatial technology. The components of Geographic Information Science, Remote Sensing (RS), Global Positioning Systems and Information Technology (IT) combine to make up the field of Geospatial Technology. The fourth component is environmental science which focuses on water resources. The overall goal for the degree is to produce a geospatial technologist that is able to assist as a team member in the conduct of watershed characterization and management projects. However, while the program has an environmental focus the geospatial technology skills can be applied to other areas. The University System of Georgia approved the B.S. in Applied Environmental Spatial Analysis and the newly designated Gainesville State College began offering the new degree in the fall semester 2006.

The Solution to the Articulation Dilemma: To increase GT education in Georgia, a seamless GT education pathway must be developed. In order to accomplish this, GSC has developed a partnership with Ogeechee Technical College (OTC), Central Georgia Technical College (CGTC) and Forsyth High School (FHS). GSC has worked collaboratively with FHS on their GT program. Today, students who complete the Forsyth program receive credit for the first course in the GSC certificate program by taking an exit exam. Over the past year, GSC has collaborated with OTC, CGTC and FHS to develop the seamless geospatial education model using the University Consortium for Geographical Information Science (UCGIS) Body of Knowledge (BoK) document as a guide. The Geographic Information Science & Technology (GIS&T) BoK is a product of the UCGIS model curriculum initiative. This effort by the UCGIS Education Committee is the first edition of a continuing work to define the BoK for the domain of geographic information science and technology. The domain is

partitioned into knowledge areas, units, and topics. Each topic includes educational objectives specific to that topic with different levels of mastery. Competencies are being developed for three levels, Technician I, II, and III, which respectively relate to the high school, two-year certificate, and BS levels. Technician Level I, which equates to the FHS GT program, is only partially complete. GSC is working with FHS and the GDE to develop a standard curriculum using the BoK as well as the Virginia Department of Education's "Geospatial Technology Competency-Based Task List". Technician Level II, which equates to the OTC certificate program, is virtually complete and these courses are transferable into the GSC BS program. GDTAE requires a single standard curriculum for all technical areas and the OTC GT program will be the standard for all other technical colleges in Georgia. Technical Level III equates to the GSC BS degree.

Summary: This project will create seamless geospatial education pathways from high schools to technical colleges to 4-year institutions in the State of Georgia. Each participating technical college will partner with a high school in close geographic proximity. Each technical school/high school team will be selected from a unique geographic and economic region of Georgia. This selection method will include rural, suburban, metropolitan, and inner city institutions from across the state. This geographic and economic diversity will provide excellent opportunities for participation by students and faculty from underrepresented groups. Once course equivalency for this seamless model is established using the UCGIS's Body of Knowledge, it will become more attractive for other USG institutions to participate in this seamless model.

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