Can Undergraduate Geography Programs Meet The Expanding Demand For Geo-Spatial Analysts: A Case Study And Cause For Concern

William L. Hamilton, Ph.D.
Professor
Department of Geography
Salem State College
352 Lafayette Street
Salem, MA 01970
william.hamilton@salemstate.edu
(978)542-6228

ABSTRACT: The need for geo-spatial analysts is increasing as spatial technologies evolve and find an ever-expanding market within public and private sectors. An annual requirement of over 70,000 geo-spatial positions for the next decade is projected. As such, a problem may exist in meeting that demand within our higher education institutions. Specifically, can geography programs provide analysts in the required numbers with the necessary capabilities? A study of recent curriculum changes in one geography program, if exemplary of other large departments, indicates demands for geo-spatial analysts will not be adequately met in either quantity or qualification.

1. INTRODUCTION

A question generated by the explosive growth in geo-spatial technologies is can higher education meet the projected demand for spatial analysts. Current projections show geo-spatial technology revenues increasing from five billion to thirty billion dollars for 2006 (ETA, 2005). Clearly, the acceleration in evolving spatial technologies including the expanded use of RADAR, LIDAR, and higher resolution multiband imagery is both fueling employment demand and opening new application opportunities. Existing business and engineering firms are continuing to increase the use of technologies that require more geo-spatial information. These evolving technologies coupled with the timing of natural catastrophes (hurricane Katrina) and cultural disasters (terrorism and war) have, through a coincidence in history, created an unprecedented demand for not only product, but for highly trained geo-spatial analysts. Indeed the following projections are impressive.

- Estimates of 75,000 new hires annually within the field of geo-spatial technologies for the next decade (ETA, 2005).

- Much of the existing labor force of highly trained geo-spatial analysts will reach retirement within the next decade (Gewin, 2004).

- The need for geo-spatial intelligence has expanded greatly due to the demands of homeland security and the military (Gewin, 2004).

- U.S. Department of Labor and the U.S. Department of Education listed geo-spatial technology as one of twelve emerging sectors at the national level that:

    - are projected to add substantial numbers of new jobs
    - significantly impact the economy
    - impact the growth of other industries
    - are being transformed by other technologies
    - are emerging business that are projected to grow

(ETA, 2005)

This projected demand for both product and analyst is of critical import to sustaining a viable U.S. geo-information market as one invigorates the other. The more end users the greater demand for innovative, efficient, and higher resolution geo-science technologies (imagery, GPS, etc.) which, in turn, generates greater use and the need for more analysts. This need for analysts and their importance in the national market is so critical that the U.S. Department of Labor has taken the nearly unprecedented step of convening both studies and training initiatives for geo-science analysts (Sietszen, Jr., 2004).

Geography departments have a unique opportunity to help meet the demand as a curriculum based on regional studies, cultural traits, physical analysis, and geo-information science combines the requisite cognitive and technical skills essential to developing geo-spatial analysts. Unfortunately geography may be missing an occasion to demonstrate the power of the field as spatial technologies and associated curricula have filtered into other disciplines; one wonders has geography lost it identity through assimilation. The tired phrase that everything is geographic or that geography is found in all subjects (while possibly correct as evidenced by the rapidly expanding spatial market) has lulled the discipline into not maintaining the integrity of its identity. The above noted pressures driving the geo-spatial market may correct this problem if geography departments are willing to embrace the necessary science and math and develop integrated curriculums ***within*** their own discipline and sometimes within their own departments to meet the demands for geo-spatial analyst.

This paper discusses the degeneration of a geography curriculum which not only ignores the currently expanding job potential for well-trained geographers as geo-spatial analysts but also the National Geography Standards (National Geographic Research and Exploration, 1994). The reasons for curriculum erosion are not easily determined but are probably a combination of ideology and pressure to maintain enrollments. If this degeneration is common to other large geography programs the discipline will lose a unique opportunity to re-establish its presence in the geo-sciences and, perhaps more importantly, brings into question whether sufficient numbers of analysts will be available to meet future demand.

2. HISTORY OF PROGRAM AND PROBLEM

The program in question is the Geography Department at Salem State College (SSC), Salem MA. This author is the senior faculty member with twenty three years of service and is responsible for the creation of the Digital Geography Lab (Hamilton, 1989), the Masters Degree in Geo-Information Science, (Hamilton and Pappathanasi, 1994) and numerous courses in Geo Information Science (Hamilton, Pappathanasi, Talbot, 1995). In 1982, the Association of American Geographers (AAG) rated the SSC Geography Program as the top undergraduate teaching program in the country. Geography at SSC has always enjoyed large numbers of majors that at one time numbered over two hundred. The department always had a split personality with the bulk of the majors in a travel and tourism (mostly travel) geography concentration and the cartography major and small enrollments in its urban economic and environmental geography concentrations. As the travel industry became more Internet based the numbers in travel and tourism declined while those of the cartography-geographic information systems major increased. In phase with this shift came the retirement of the senior faculty who had created the department and their concurrent replacements of newly hired geography faculty.

In the 1997-1998 academic year, the faculty began realigning the curricula with a series of changes the results of which are as follows:

- B.S. Geography Degree requiring four 100 (freshmen level) and one 200 (sophomore level) course. Additional seven courses of non-sequenced geography electives.

- B.A. Geography Degree in Regional Studies requiring four 100 (freshman level) courses, two 200 (sophomore level) courses and six courses of non-sequenced geography electives.
- B.S. Geography Concentrations in Natural Resource Management, Environmental, Travel & Tourism, and Regional Development & Planning.
- A Cartography & GIS Major

In academic years 2000-01 and 2001-02 this author noticed reduced enrollments in GGR320 Geographic Information Systems and that the class population was increasingly comprised of non-geography majors. Indeed, in one semester, the geography majors were the minority discipline in the course population; an oddity, as GIS is required for all majors except those matriculating in the B.S., B.A Geography degrees, and travel and tourism concentration. This significant shift in required course enrollments was the impetus for the following analysis.

3. ANALYSIS AND FINDINGS

This author analyzed the number of geography majors (exclusive of cartography majors) enrolled in department courses from 1998 through 2005. The following are those findings:

- Over 94 % of the graduating geography majors are enrolled in the BS. Geography (no concentrations)
- Because most of the undergraduate majors are enrolled in the B.S. Geography there are insufficient numbers to run the required courses in the various concentrations. In effect, there are no concentrations.
- Approximately 75% of graduated geography majors courses were taken at the 100 and 200 level (freshman –sophomore).
- Graduates, on average, take only two junior level courses and one senior level course if they take any.
- Some of graduating geography majors enrolled in no 300 (junior) or 400 (senior) level courses.
- Those graduated majors who did take 400 level courses many times did so without any 300 or 200 level courses.

3.1 National Geography Standards

The SSC geography classes were categorized according to the National Geography Standards used in secondary schools (National Geographic Research & Education, 1994). Once classified the course types selected by students were determined with the following results.

- Geography majors course selection is almost 84% human, area studies, or introductory (predominately 100 level) core courses, 5% physical geography and 4% geographic information science.

3.2 The Cartography Major

In 2002 two faculty proposed the cartography major require mathematics, computer programming, and photogrammetry. At this writing, by departmental fiat, those changes have not been allowed.

4 NEGATIVE INERTIA TO SUBSTANTIVE CHANGE

4.1 External Review

Initial research results were presented to the department and college administration in 2003. In part, that presentation triggered an external review in December 2004 by a prominent US geographer, educator, and past president of the Association of American Geographers and the National Council for Geographic Education. The following are excerpts from the reviewers' recommendations and departmental response relative to the topic of this paper at the time of this writing:

- *Evaluator Recommendation*: "Reduce the number of concentrations or tracks in the program – maybe simply a BA track, and a BS track with various specialties including one in geospatial intelligence." (Evaluator, 2005).

  Departmental Response: Concentrations have not been reduced. BS has no specialties and department will not use the term intelligence as it has a "military connotation".

- *Evaluator Recommendation*: "Ensure that there is a good balance of human and physical (or environmental resource courses) required in the curriculum." (Evaluator, 2005).

  Departmental Response: As the numbers indicate, students take little or no physical geography courses.

- *Evaluator Recommendation*: "Explore carefully the need for some type of quantitative analysis or related common spatial analysis course for all students." (Evaluator, 2005).

  Departmental Response: The only required spatial analysis and quantitative geography courses are at the 100 and 200 level respectively. Neither course provides the advanced skill sets essential to geo-spatial analysts. Further, for the majority of geography majors, these are the only spatial analysis/quantitative geography courses for which they will enroll.

  There is a 400 level quantitative geography course which includes topics through principal components analysis. However, that course is not required and is normally taken only by cartography majors.

- *Evaluator Recommendation*: "Ensure that advance level courses (created through renumbering of lower level courses) have advance rigor reflective of the more advanced numbering (with appropriate prerequisites as needed)." (Evaluator, 2005).

  Departmental Response: The Department is renumbering their courses so to appear that students are taking more advanced level courses. As for course rigor, no cogent dialogue as to what a 300 or 400 level course should require has occurred and any such discussion may be useless due to faculty union contract rules and "academic freedom".

4.2 Programmatic Personnel Restructuring

Upon presentation of the first curriculum review in May 2003 the following programmatic restructuring of personnel occurred within a relatively short time.

- ❖ One faculty specializing in geo-spatial intelligence resigned for not being allowed to teach introductory courses that increase the number of cartography majors, not being allowed to teach courses in his specialization, and lack of progress in altering the cartography major curriculum to include required courses in computer programming, mathematics, and photogrammetry.

- ❖ This author was removed as the graduate coordinator of the MS Geo-Information Science program and informed he would no longer teach the introductory or intermediate GIS courses (the intermediate course he created and taught for sixteen years) or Introduction to Geography (a course which generates cartography majors).

- ❖ Replacement of faculty specializing in photogrammetry has not occurred.

5 CONCLUSIONS AND OBSERVATIONS

Given the course enrollment statistics and the demands detailed in section one, SSC geography majors are ill prepared for geo-information science careers. Indeed, given their uneven geographic curricula coupled with the preponderance of low-level courses one wonders what career paths their degrees will enable.

Unfortunately, as I talk with colleagues from other geography programs the aforementioned scenario is not uncommon. This is not to say there are no viable undergraduate programs preparing students for geographic careers, simply, there seems to be an evolving trend away from the necessary academic rigor to prepare geographers for the demands of the twenty-first century.

The problem is in both the numbers and ideology. As previously stated, geography is now given a unique opportunity to merge its cultural, regional, physical, and technical fields to meet the oncoming demand for geo-spatial analyst. If geography is to maintain its identity and presence in the geo-information sciences, it must take the following actions:

- ❖ Remove the age-old division between cultural and physical geography and use the geo – science technologies to merge them into a formidable analysis system.

- ❖ Recognize that geo-information science is a discipline (not "tools" as some of the SSC faculty call them) in which geographers have a significant role if they want it.

- ❖ Stop the adage that geography is everywhere and everything is spatial. Unless geographers work to identify themselves their field of study will continue to be assimilated into other disciplines. The rapid realignment of physical climatology into meteorology departments after the relevance of short period climate variations to long term forecasting was discovered and remote sensing and geographic information systems having a predominant presence in environmental engineering and natural resource departments within the academy are but two examples.

- Geography must introduce higher levels of math and science into its undergraduate curricula. The evolving technologies that are the seedbed for future geographic employment demand knowledge of the hard sciences and mathematics. Just as some of the early GIS techniques practiced in the 1970's at the graduate level are now performed by high school students; geographers must realize the power of their discipline can now only be unleashed through the use of technology which demands understanding of engineering and mathematics. To ignore these, as SSC geography has, dooms the graduate from any real progression in the field.

Finally, the numbers of geo-spatial analysts required in the near future are staggering. Geographers must decide now and take action soon if they want a significant role in the rapid expansion of geo-information science. This is a lot to ask from a discipline that is fractured and adrift. Indeed, the odds are against geography if past actions are an indication of future activity. If geography stays indecisive and/or cannot defeat it ideologies another discipline, as in the past, will reap the rewards spawned by the demand for geo-spatial analysts.

As for SSC Geography, one can only hope that, over time, they too will modify their curriculum enabling graduates to compete successfully in the geo-spatial intelligence arena.

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