ORGANIZING GEOSPATIAL TECHNOLOGY LEARNING FOR INTERDISCIPLINARY URBAN STUDIES EDUCATION

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Abstract: This article introduces an on-going effort to establish a GIS certificate program to organize relevant teaching and research resources for a geospatial technology-supported urban studies education. The project starts from recognizing the challenge in integrating all related disciplines for interdisciplinary urban studies education due to its multidisciplinary nature. To address this challenge, the project identifies the common interest and need among related disciplines: all require an understanding of geographical patterns of study subjects. The article discusses the efforts of establishing a GIS certificate program as a framework for learning organization and community building, which include selection of participating academic disciplines, curriculum design, program implementation, and outreach activities. Increased student enrolment and activities indicate that the GIS certificate program can effectively organize teaching and learning resources for interdisciplinary urban studies education.

1 INTRODUCTION

As the only comprehensive higher education institution in the Kansas City metropolitan area, an industrial and economic centre in central United States, the University of Missouri – Kansas City (UMKC) commits itself to excellence of education in urban studies. This is a challenging task because urban studies involve multidisciplinary efforts across academic units, such as environmental research, socioeconomic analysis, business investigation, policy studies, and public health service. Facing this challenge, the professors of relevant disciplines sought to identify the common interest among them in order to develop interdisciplinary collaborations. As all of the academic disciplines require, more or less, an understanding of geographical patterns of study subjects in research and teaching, they identified geospatial data analysis as the common approach in relevant teaching, learning, and research for all the disciplines. The consensus was reached to establish a computer-supported geospatial technology education program that organizes teaching and learning resources of the participating disciplines for interdisciplinary education. Consequently, Advanced Certificate Program in Geographic Information Systems (GIS) ("the GIS certificate program") was established in 2006. This program has successfully enrolled a large number of students. The program helped innovating curricula of participating disciplines and facilitated participating professors to integrate their research interests and findings into teaching, which have significantly promoted interdisciplinary urban studies education. This article introduces the organization of the GIS certificate program, its curriculum design, and its implementation. It also discusses how to integrate research into teaching and learning and how to outreach professional communities to expand the learning community beyond the university campus.

2 ORGANIZING GEOSPATIAL TECHNOLOGY LEARNING COMMUNITY

GIS is one of the most pervasive of today's information technologies. Increasingly, our society relies on geospatial information about the location of people, resources, things, and events (Chang, 2010). Additionally, access to geospatial data has become universally available with rapid evolution of Internet-based tools (Scharl and Tochtermann, 2007; Tanaka, *et al*., 2011). Increasing demands for GIS-

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related techniques provide new opportunities in higher education. Traditional geospatial analyses, such as geographic visualization, environmental mapping, urban planning, location-based socioeconomic studies, disease surveillance, crime location analysis, and public information management can now be conducted with GIS-related techniques. Like many other higher education institutions, more and more academic disciplines (academic departments and degree programs) at UMKC have developed GIS-based disciplinary courses. However, how to effectively organize individual geospatial technology-based courses into an interdisciplinary teaching and learning framework has become a challenging task. At UMKC, involved professors believed that accomplishing this task required a new thinking for learning organization. For this, the decision was made to establish a GIS certificate program as a framework to build a geospatial technology learning community.

Figure 1 shows the conceptual design of the learning community: an overarching GIS certificate program that internally integrates any academic discipline which can contribute geospatial technology-based courses at UMKC and externally links to professional communities (industries, businesses, governmental agencies, and organizations). Accordingly, the student body of the program comes from two sources: regular degree-seeking students and working professionals. The GIS certificate program organizes all of the discipline-based geospatial technology teaching and learning by setting up the core courses and the elective courses toward the completion of the certificate program. As learning support, the program hosts workshops joined by professors, students, geospatial technologies professionals, and business leaders to promote collaborations between academic programs and professional communities. The GIS certificate program also coordinates student internships at industries and agencies to help them to gain practical experiences. Through all of these efforts, the geospatial technology learning community was successfully supported.

Establishing such a GIS certificate program involved the following procedures: selection of participating academic disciplines, curriculum design, program implementation, and outreach activities.

The participating academic disciplines were selected based on two considerations: The discipline can contribute to an area of urban studies, and it can offer or develop geospatial technology-based disciplinary courses. Consequently, the certificate program embraces six academic disciplines: Geosciences, Urban Planning, Sociology, Economics, Criminal Justice & Criminology, and Computer Science. More disciplines can be included when they meet the selection criteria. The program's coordinating committee consists of the involved professors of the participating disciplines. Table 1 shows the geospatial technology-based courses contributed by these academic disciplines.

Table 1: Participating disciplines and curriculum.

Disciplines	**Program Curriculum**
Geosciences	• *Introduction to GIS* • *Advanced GIS* • *Environmental Remote Sensing & Digital Image Analysis* • *Spatial Data Analysis* • *Satellite Climatology* • *Advanced Topics in GIS & Remote Sensing*
Urban Planning	• *Advanced GIS for Urban Planning* • *Quantitative Planning Methods & Techniques*
Sociology	• *Spatial Thinking in Social Science*
Economics	• *Economic Statistics*
Criminal Justice & Criminology	• *Advanced GIS for Crime Analysis*
Computer Science	• *Database Design, Implementation & Validation* • *Data Structure & Algorithms*

The GIS certificate program is open to any regular students and working professionals who have had appropriate academic backgrounds. Their admission applications are evaluated for approval by the program director. There is no time limit for the students to complete this certificate program. In order to obtain the certificate, the student needs to finish five relevant courses as listed above with a grade point average (GPA) of 3.0 or above, including two required core courses: Introduction to GIS and Advanced GIS. Students can select freely elective courses and receive academic advice and other support through any participating disciplines.

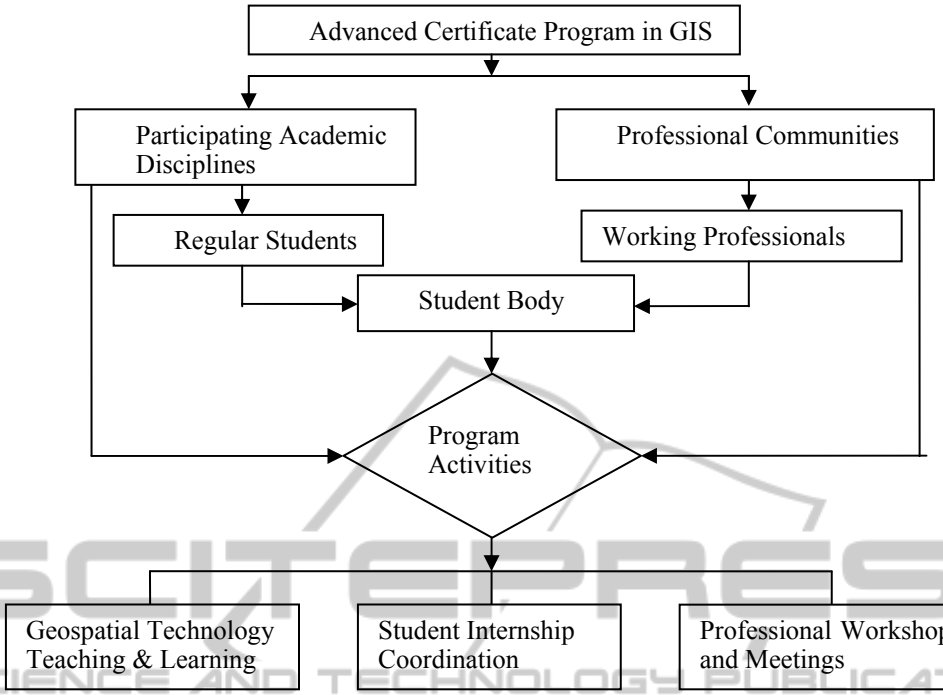

Figure 1: Conceptual design of learning community.

3 INNOVATING GEOSPATIAL TECHNOLOGY TEACHING AND LEARNING

A successful interdisciplinary education program, which is based on integration of individual geospatial technology courses, must be built up on teaching and learning innovation. To reach this goal, the following measures have been taken: (1) Integrating the participating professor's research into his/her teaching, (2) guiding students to conduct research as part of their course learning, and (3) providing web-based teaching and learning support.

Located in a metropolitan area, almost all the participating professors have conducted their research in relation to urban issues which are location-based and implementable with geospatial techniques. In their teaching, the professors demonstrated their research issues and findings to the students as case studies, future research issues, and / or innovative geospatial methods. Motivated students were guided to conduct class projects as part of their certificate courses. The students were supervised by their course instructors to learn how to identify research issues, develop technical approaches, implement research, and present research findings. The class research projects are required to be conducted with the geospatial methods learned from specific geospatial technology courses. To better support the students who want to pursue an in-depth research, the GIS certificate program has developed independent study courses at both graduate and undergraduate levels – *Advanced Topics in GIS and Remote Sensing*. This course allows a participating student to design and conduct his/her own research independently. The student usually determines a research topic of his/her interest with the corresponding instructor. At the end of the course, the student submits the project report to the instructor for evaluation. To facilitate computer-supported teaching and learning with geospatial techniques, the GIS certificate program has developed and maintained a central geospatial database which resides on the university's website for students to have access. The database serves as a geospatial data warehouse that stores professors and students' past project data or the data from other sources, which may be useful for students' future projects. The GIS certificate program also collects digital satellite images, which are used for students to learn satellite remote sensing techniques and study urban landscape changes. Additionally, the UMKC Library has developed a web-based library guide specifically for geospatial technology information inquiry and acquisition, which covers

digital journals and online publications, web links of various geospatial data sources, and geospatial events. In the past several years, the students developed a large number of computer-supported geospatial research projects which covered almost all areas of urban studies and were innovatively integrated with their disciplinary course learning.

The effectiveness of the described geospatial technology learning organization was justified by increasing student enrolment with the GIS certificate program. To further measure the effectiveness of the students' learning, a learning assessment method is under development, which is based on evaluations of students' coursework and research projects in relation to specific learning goals / sub-goals.

4 EXPANDING THE LEARNING COMMUNITY BEYOND THE UNIVERSITY CAMPUS

The Kansas City metropolitan area has a large community of geospatial technology research, development, and application. Several leading geospatial mapping companies are headquartered in the region, such as Garmin International, Inc. (a world leading GPS company). ESRI, Inc. (a world leading GIS developer) has its regional office in Kansas City. Many companies, businesses, and governmental agencies in this region have been using geospatial techniques like GIS for their projects and operations, such as city planning, engineering projects, and environmental management.

The GIS certificate program considers that it would be very beneficial to expand university's geospatial technology learning community beyond the university campus by developing close collaborations with the region's professional communities. To reach this goal, the program has developed various joint activities that involve professors, students, working professionals, and business leaders for collaborations.

The GIS certificate program hosted annual geospatial information events, including GIS users meetings, GIS business forums, and / or public workshops. During these events, professors, students, geospatial professionals, governmental officials, and business managers presented new technologies, research projects, and policy opinions. These activities helped students to connect themselves to relevant businesses and professional communities, better understand societal needs, and develop internships or employment relationships with industries, businesses, and agencies.

The GIS certificate program also invited geospatial professionals, scientists, and business leaders to provide guest lectures to the community of learners.

5 CONCLUSIONS

With a geospatial technology-oriented curriculum and organized learning-support activities, the GIS certificate program effectively organizes teaching and learning resources of relevant academic disciplines for interdisciplinary education.

Integrating research into teaching and learning motivates students to explore computer-supported geospatial methods to solve real world problems through their course studies.

The geospatial technology learning community that bridges the university and professional communities facilitates students' connection to relevant businesses and professional organizations and helps them to better understand technology advancement, societal needs, and job market.

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