Fiscal Unit/Academic Org	Geography - D0733
Administering College/Academic Group	Arts and Sciences
Co-adminstering College/Academic Group	
Semester Conversion Designation	New Program/Plan
Proposed Program/Plan Name	Master of Geographic Information Science and Technology
Type of Program/Plan	Professional degree program
Program/Plan Code Abbreviation	MGIST
Proposed Degree Title	Master of GIST

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program				33	
Required credit hours offered by the unit	Minimum			33	
	Maximum			33	
Required credit hours offered outside of the unit	Minimum				
	Maximum				
Required prerequisite credit hours not included above	Minimum				
	Maximum				

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

Program Learning Goals

- Explain fundamental concepts and practices of geographic information systems andadvances in geospatial information science.
- Manage geospatial data and databases.
- Visualize geospatial data using interactive maps and other effective methods.
- Develop insights into geospatial problems through data driven analysis and modeling approaches.
- Implement software components on GIS platforms with computer programming languages.
- Practice GIS theories and techniques on domain applications.
- Critically appraise the role and impact of a GIST professional in social, business, and community contexts.

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? Yes

Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs? No

DIRECT MEASURES (means of assessment that measure performance directly, are authentic and minimize mitigating or intervening factors)

Classroom assignments

- Embedded testing (i.e. specific questions in homework or exams that allow faculty to assess students' attainments of a specific learning goal)
- Pre- and post-testing

Evaluation of a body of work produced by the student

- Capstone course reports, papers, or presentations

INDIRECT MEASURES (means of assessment that are related to direct measures but are steps removed from those measures)

Surveys and Interviews

- Student survey
- Alumni survey
- Employer feedback or survey

Additional types of indirect evidence

- External program review
- Curriculum or syllabus review

USE OF DATA (how the program uses or will use the evaluation data to make evidence-based improvements to the program periodically)

- Analyze and discuss trends with the unit's faculty
- Analyze and report to college/school
- Make improvements in curricular requirements (e.g., add, subtract courses)
- Make improvements in course content
- Make improvements in course delivery and learning activities within courses
- Make improvements in learning facilities, laboratories, and/or equipment
- Periodically confirm that current curriculum and courses are facilitating student attainment of program goals

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Pre-Major

Does this Program have a Pre-Major? No

Attachments

- MGIST-proposal-all-01272022.pdf

(Program Proposal. Owner: Xiao,Ningchuan)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Xiao,Ningchuan	01/27/2022 04:36 PM	Submitted for Approval
Approved	Xiao,Ningchuan	01/27/2022 04:37 PM	Unit Approval
Pending Approval	Vankeerbergen,Bernadette Chantal	01/27/2022 04:37 PM	College Approval

THE OHIO STATE UNIVERSITY

Department of Geography
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January 27, 2022

Dear Members of the Curriculum Committee,

The Department of Geography would like to propose a new Master of Geographic Information Science and Technology (MGIST) degree. The field of Geographic Information Science and Technology (GIST) has witnessed increasing demands of professionals in public and private sectors in the last decade. The proposed professional program aims to train well-rounded GIST professionals with a comprehensive curriculum covering professionalism, cutting-edge technology, and applications. Attached please find our detailed proposal. The overall structure of the proposal follows the guidelines of the Chancellor's Council on Graduate Studies, as suggested by the Graduate School.

The Department of Geography is a leader in GIST higher education in the state and across the country. We are thrilled to submit this proposal. We believe this new program will allow us to help the next generation of GIST professionals to prepare for the technical and ethical challenges in the constantly changing world of spatial data. We are confident that this new program will make a stronger and more attractive Department of Geography at Ohio State.

Sincerely,

Ningchuan Xiao
Professor and Chair of Graduate Studies

THE OHIO STATE UNIVERSITY

College of Arts and Sciences Department of Geography

Proposal for a New Degree Program

"Master of Geographic Information Science and Technology"

Mode of Delivery: on campus and fully online

TABLE OF CONTENTS

Proposal for a New Degree Program

Master of Geographic Information Science and Technology (MGIST)

Mode of Delivery: fully online, on campus

BASIC CHARACTERISTICS OF THE EDUCATIONAL PROGRAM

1. Brief description of the disciplinary purpose and significance of proposed degree

The field of geographic information science and technology (GIST) is at the intersection of multiple disciplines that are the cornerstone of today's fast-moving society where data, especially spatial and temporal data, is crucial. These disciplines include, but are not limited to, cartography that studies the art and science of map making, cognitive science that concerns how humans perceive their geographic surroundings, computer science that has a focus on data and data processing, environmental sciences that investigate the processes in and between human and natural systems, geography that focuses on the spatial relationship between humans and their environments, remote sensing and photogrammetry for gathering and interpreting data obtained from remote sensors, and statistics that quests the meaning of data. Being such an interdisciplinary field, GIST has been an active and productive research area and a profession that has continuously witnessed high demands in the last decade.

In a professional setting, GIST is widely used in both public and private sectors. Government agencies, for example, actively seek GIST experts to tackle applications in areas such as transportation, natural resource management, healthcare, city and regional planning, and utility management. Departments of geographic information systems (GIS) are now commonly established at city and county levels across the country. In the private sector, companies and institutes increasingly recruit talents with GIST background to join or lead teams that involve spatial and temporal data sets. GIST is widely used in many industries such as banking, insurance, real estate, retailing, utility management, among many others. A detailed market analysis (discussed below) shows the existence and growing need of such a professional program is evident.

The Department of Geography currently offers an MA in Geography and students who are interested in GIST have been enrolled in this program. However, the MA program, whose curriculum consists of four required courses (Geographic Thought, Research Design, and Fieldwork or Advanced Spatial Data Analysis, and a graduate seminar) and a final exam on either a thesis or research paper, is research oriented and is not designed for students to advance their professional career in GIST.

Offering a professional master's degree in GIST, therefore, serves the increasing needs of GIST professionals who are in their early or mid-career and want to advance to the next level in the profession. In the meantime, the proposed degree will also help increase enrollments and streamline our overall GIST curriculums for our undergraduate and graduate programs.

2. Definition of the focus of the program

The GIST Body of Knowledge[1] compiled by the University Consortium of Geographic Information Science (UCGIS) provides a holistic view of the breadth and depth of the theory, methods, and applications in GIST.

[1] https://gistbok.ucgis.org/

Specifically, the Body of Knowledge identifies 10 fundamental areas that together encompass the competence of GIST professionals. These 10 areas include fundamental concepts (FC), programming and development (PD), domain application (DA), knowledge economy (KE), data capture (DC), analytics and modeling (AM), GIST and society (GS), computing platform (CP), data management (DM), and cartography and visualization (CV). GIST professionals draw strength from these areas when they analyze geospatial data and make decisions about human and environmental systems.

The goal of the proposed Master of GIST (MGIST) program is to train well-rounded GIST professionals with a comprehensive curriculum that encompasses the scope defined in the UCGIS Body of Knowledge. To achieve this goal, seven program learning outcomes are identified. Specifically, a successful student from this program should be able to

1. Explain fundamental concepts and practices of geographic information systems and advances in geospatial information science.
2. Manage geospatial data and databases.
3. Visualize geospatial data using interactive maps and other effective methods.
4. Develop insights into geospatial problems through data driven analysis and modeling approaches.
5. Implement software components on GIS platforms with computer programming languages.
6. Practice GIS theories and techniques on domain applications.
7. Critically appraise the role and impact of a GIST professional in social, business, and community contexts.

Each learning outcome listed above covers one or more of the ten areas in the UCGIS Body of Knowledge:

UCGIS GIS&T Body of Knowledge Area	Learning outcomes						
	1	2	3	4	5	6	7
FC: Fundamental Concepts	x						
KE: Knowledge Economy							x
CP: Computing Platform		x			x		
PD: Programming and Development					x		
DC: Data Capture		x					
DM: Data Management		x					
AM: Analytics and Modeling				x			
CV: Cartography and Visualization			x				
DA: Domain Applications					x	x	
GS: GIS&T and Society							x

3. Rationale for degree name

We use the term geographic information science and technology (GIST) broadly to refer to a field that has been called different names such as geographic information systems (GIS), geographic information science (GIScience), and geoinformatics. This professional degree program is specifically designed for professionals who wish to enhance their technical skills, to understand the profession, and to start or advance their professional careers. To graduate from the program, students must complete a capstone to demonstrate their skills and knowledge by integrating what they have learned during the degree coursework.

4. Curriculum outline

This is a brief outline of the program curriculum. More detailed explanation of the curriculum is provided below in the section called "Curriculum and Instructional Design." The curriculum of the proposed program

includes 15 courses (all 3 credit hours) that are organized into 4 categories or tiers. Students need a minimum of 33 credit hours to complete the program. The semesters, Autumn (AU) or Spring (SP), when these courses are offered are listed to the right.

Required core courses (12 hours):

• GEOG **5101** - GIS Professionalism and Ethics	AU	
• GEOG **5200** - Cartography and Map Design	AU	SP
• GEOG **5210** - Fundamentals of GIS	AU	SP
• GEOG **5225** - Geographic Applications of Remote Sensing	AU	

Intermediate elective courses (9 hours, choose 3 courses):

• GEOG *5103* Intermediate Spatial Data Analysis		SP
• GEOG *5201* Geovisualization	AU	SP
• GEOG *5212* Geospatial Databases for GIS	AU	SP
• GEOG *5222* GIS Algorithms and Programming	AU	SP
• GEOG *5229* Emerging Topics in GIS		SP

Advanced elective courses (9 hours, choose 3 courses):

• GEOG 6222 GIS Development		SP
• GEOG 6223 Web GIS Development	AU	
• GEOG 6226 Spatial Simulation and Modeling in GIS	AU	
• GEOG 6286 Geodemography: GIS in Social Science and Business Research		SP
• PUBAFRS 7555 Project Management in the Public Sector	AU	SP

Capstone project (3 hours):

• GEOG ***6299*** GIS Capstone Project	SP

5. Duration of the program

a) Students need a minimum of 33 credit hours (semester) to complete the proposed program.
b) The typical length of time for full time students to complete the program is 2 years (4 semester). The following table illustrates two scenarios where a student can follow a two-year plan, starting the program in either Autumn (AU) or Spring (SP), to complete the degree with the required 33 credit hours. Courses in the table are marked as **required**, *intermediate*, advanced, and ***capstone***.

Scenarios	AU	SP	AU	SP	AU
Start in Autumn	**5101** **5200** **5210**	*5212* *5222* **5225**	6226 6286 7555	*5229* ***6229***	
Start in Spring		**5200** **5210** **5225**	**5101** *5103* *5222*	*5201* 6222 6223	7555 ***6229***

6. Admission timing

The proposed date for implementation of the program is Autumn 2022. Admissions will be accepted for both Autumn and Spring semesters in each academic year.

7. Primary target audience for the program and admission requirements

We expect three groups of applicants:

- Students who are interested in pursuing their career goals in the GIST profession, either in the public sector or in the industry. This group includes students who are currently in various relevant undergraduate programs (e.g., geography, city and regional planning, geoinformatics, and geodetic sciences). Many of our past MA students have stated a professional degree (instead of an MA) will put them in a better position to find a job.
- Current GIST professionals who want to advance their career. The proposed MGIST curriculum is designed to provide comprehensive and in-depth coverage of GIST that will help them extend their knowledge and acquire advanced skills.
- Military personnel. Currently, thanks to the agreement between the Ohio State and the National Geospatial-Intelligent Agency (NGA) through a program called Emerging Scientists, two NGA students are already enrolled in the MA program with a concentration in GIST, and one additional application is pending. In the 2021-2022 academic year, five additional NGA students have enrolled in geography classes as non-degree seeking graduate students who will then formally apply to a master's program. They have clearly indicated that the breadth and depth of our GIST courses fit their career goals. Through conversations with graduate studies chair (Dr. Xiao), they clearly indicated that they would choose a professional degree if available.

Admission requirements. Students with a bachelor's degree with 3.0 or higher cumulative undergraduate GPA can apply for the proposed MGIS. Admission will be based on (1) a statement of purpose, (2) transcript, (3) cumulative GPA of 3.0 or higher, (4) curriculum vitae, and (5) two letters of recommendation from professionals or academia. An internet-based TOEFL score of at least 100 is required for international students.

8. Special efforts to enroll and retain underrepresented groups

Nationally, recruiting and mentoring graduate students from underrepresented minority (URM) groups has been a challenge for many graduate programs. While GIST is an interdisciplinary field, geography is a common "home" to this field, as the proposed program will be compared to the other programs that are typically in geography departments. A report from the American Association of Geographers (AAG), for example, shows that, in 2018, among all surveyed geography graduate students in universities in the United States, only 13 percent were in broadly defined URM groups of Black or African American, Hispanic or Latino, and American Indian or Alaska Native.

Since 2019, the enrollment of graduate students from underrepresented minority groups consists of 17.5 percent of all the graduate students in the department of geography at Ohio State. The following table details the graduate applications in the past three years:

	2019		2020		2021	
	Total	URM	Total	URM	Total	URM
Applied	75	3	102	10	86	7

Admitted	30	1	37	8	31	4
Enrolled	11	1	9	3	20	3

The Department of Geography is committed to recruit URM students. The department formed a standing Anti-Racism Committee in 2020. This committee consists of faculty representatives from each subfield in the department, one staff member, and one graduate student representative. The committee's charge includes promotion of diversity among department students, faculty, and staff, and a focus on equity and inclusion at every level of the department. The committee will help advise recruitment efforts of URM students

We make strategic efforts to recruit students from underrepresented groups. We believe a key to recruit is to reach out to prospective students and part of our plan is to work with various associations. For example, the Addressing Locally-tailored Information Infrastructure & Geoscience Needs for Enhancing Diversity (ALIGNED) project sponsored by the American Association of Geographers (AAG) is engaged with increasing diversity in the discipline of geography. The more flexible nature of an online program will also allow us to reach a population that we cannot currently service. There are also numerous local or regional organizations through which we can reach out to potential professionals. For example, the Ohio chapter of the Urban and Regional Information Systems Association (URISA) organized annual GIS conference and other educational events that attract statewide professional and student participants. The Ohio URISA also have local user groups across the state. These are overarching venues where our proposed program can reach out to potential applicants.

A key to retaining and graduating students from underrepresented groups is mentoring. The use of individual development plans (IDP) is proven to be effective in helping students stay on track to completing the graduate program on time. Starting Autumn of 2021, graduate students in the department are required to use an IDP as an important component of the mentoring process. This IDP is adopted from the best practices provided by the Michael V. Drake Institute for Teaching and Learning at Ohio State. The IDP covers a wide range of goals and needs for graduate studies, including research, professional development, coursework, job market prospects, communication skills, and funding. Each goal and need require a timeline and a plan about how to achieve it. All students enrolled in this proposed program will work closely with their faculty mentor on an IDP. Many faculty members of the department have participated in mentoring workshops organized by the Drake Institute and we will continue to encourage the faculty to participate in these workshops and share their experiences with the rest of the department. Students from underrepresented groups may face challenges that otherwise may not be obvious for other students. The use of IDP will allow us to check in with them to make sure their needs are addressed at a timely fashion.

Some living and educational costs may be disproportionally higher to URM students than others. There are multiple sources that can be helpful. The university has a food bank (Buckeye Food Alliance) and participates in the Supplemental Nutrition Assistance Program (SNAP). Faculty members in the department also work closely with the university library to push for open textbook that will significantly lower the cost on textbooks. The department constantly upgrades the hardware for the labs. We maintain site licenses for almost all cutting-edge software for GIST students to use on- and off-campus.

INSTITUTIONAL PLANNING FOR THE PROGRAM

1. Physical facilities, equipment and staff needed to support the program

The department currently has two main laboratories that are used for teaching purposes. Each of the labs has a capacity of 50 seats, and each seat has an update-to-date desktop computer. Multiple printers are connected to the computers. These labs are ideal for the 5000 level courses that are designed for both undergraduate and graduate students. In addition, the department has four classrooms of different sizes for 18 to 45 seats that are used for seminars and other classes. In addition, the department has a graduate computing lab with a capacity of 14 computers open to all graduate students with printers. All these teaching and computing facilities can accommodate the proposed program. Residence students in the proposed program will be able to access the lab and software. Online students will be able to access the software site licenses through OSU's VPN services.

2. Market for the new program

The GIST profession has been witnessing a high growth in employment opportunities. Obermeyer et al (2016) report in their research paper that geographic information systems (GIS) knowledge often is a must-have for public administration jobs.[2] The U.S. Bureau of Labor Statistics[3] estimates that employment of surveyors, cartographers, photogrammetrists, and surveying and mapping technicians grew 19 percent from 2008 to 2018, faster than the average for all occupations. This trend will continue in the next decade. According to a 2020 report by P&S Intelligence,[4] the global market of GIS is projected to reach $25.6 billion by 2030 with a 12.1 percent annual growth rate, due to the investment from governments and private companies. The largest share of the growth is in the United States. Geospatial technology is also one of the 14 high growth sectors identified by the U.S. Department of Labor, Employment & Training Administration in its High Growth Job Training Initiative report.[5]

In a market analysis of graduate programs (attached in Appendix) conducted in May 2019 by OSU's Office of Distance Education and eLearning (ODEE) using the CIP (Classification of Instructional Programs) code Geographic Information Science and Cartography (45.0702), the ratio between unique job postings and hires is 4:1 (page 7), indicating a strong employment demand in occupations that require GIST skills and background. The report also shows a strong growth in jobs at the rate of 6.8 percent nationally for 2018-2023 (page 7). From 2013 to 2017, the number of completions in all GIST programs increased 331.8 percent for distance offered programs and 47.9 percent for non-distance offered programs (page 5). Among all the completions, post-baccalaureate certificates consisted of 28.6 percent and master's degree 34.3 percent (page 5). It is also noticeable in the report that the only Ohio institute listed is Columbus State Community College, which does not offer graduate level degrees (note that some programs listed below in the section of Statewide Alternatives are relatively new and were not included in the ODEE search).

Nationally, universities such as Penn State University, University of South California, and Clark University have been running their professional master's degree or graduate certificate programs for at least more than a

[2] Obermeyer, N.J., Ramasubramanian, L. and Warnecke, L., 2016. GIS education in US public administration programs: Preparing the next generation of public servants. *Journal of Public Affairs Education*, 22(2): 249-266.
[3] https://www.bls.gov/
[4] https://www.psmarketresearch.com/press-release/global-geographic-information-system-market
[5] https://wdr.doleta.gov/research/FullText_Documents/2008-10%20HGJTI%20Implementation%20Report%20FINAL.pdf

decade. Penn State's programs in particular operate on a million-dollar revenue stream, according to personal communication with their director Dr. Anthony Robinson. Within Ohio, schools such as Kent State University have started their master of GIS program recently. These successful programs are a clear indication that the GIST profession has a strong demand in graduate level degrees. They also suggest that we do not exist in a zero-sum situation where each school competes on a fixed and limited pool of students. The reality is quite the opposite: more educational opportunities are needed within and beyond the state to accommodate the need for GIST programs.

3. Program assessment plan

We will assess the MGIST (Master of Geographic Information Science and Technology) program based on the seven learning outcomes (see Section 2 under Basic Characteristics of the Education Program) and how these outcomes are mapped to the courses (see the curriculum mapping in Section 1 under Curriculum and Instructional Design). We will use assessment results to understand how well our students meet the program learning goals, and to provide evidence-based curriculum design and improvements in the future. These assessments will also help us identify the strengths and weaknesses of the program, which in turn will help us improve the program. Both direct and indirect measures will be used for program assessment.

The direct measures are based on two main components. First, reports and presentations from the capstone project course (GEOG 6299) will be reviewed by faculty members to the relevance and rigor of the program. The following is a draft rubric that can be used to evaluate how the program learning outcomes are achieved using these materials. Faculty members may choose to evaluate a subset of the learning outcomes as a capstone project may not cover all outcomes (e.g., not all capstones will have a software development component, which is the focus of outcome 5). For each learning outcome evaluated, the work presented by the students will be evaluated and given one of the following three ratings:

- Exceeds expectations (5): the student shows not only all the traits in the Meets column, but also demonstrates the ability to go above and beyond what is taught in the classes in showing at least one trait listed in the Exceeds column.
- Meets expectations (3): the student shows at least one trait listed in the Meet column and is free of any trait in the "Does not meet" column.
- Does not meet expectations (1): the student shows at least one trait listed in the column.

These ratings are the typical grades that can be assigned based on the traits listed in the rubric, and faculty members can adjust their grade up or down based on the actual case.

Learning outcomes	Does not meet	Meets	Exceeds
1. Fundamentals	Only demonstrates bare minimal understanding of the concepts. Is unfamiliar with the use of GIS. Has limited knowledge about the field of GIST.	Demonstrates a clear command in both dept and breadth of the fundamental concepts. Shows confident use of GIS. Has a good understanding of the current field of GIST.	Shows all the traits listed in the Meet column. Demonstrates the ability to go beyond what is taught in the classes.

2. Geospatial data	Has minimal knowledge about geospatial data. Does not understand how geospatial data can be managed.	Is knowledgeable about many of the different kinds of spatial data. Can manage different data effectively.	Understands the vast geospatial data used in today's world. Knowledgeable in different technical approaches to managing spatial data.
3. Geovisualization	Makes unprofessional maps. Has limited understanding of how to choose appropriate visualization/mapping techniques for different data.	Makes professional maps. Can develop effective interactive maps.	Makes professional maps that clearly stand out among others. Can develop sophisticated interactive maps.
4. Analysis and modeling	Cannot choose the appropriate method for analysis. Lacks critical understanding of how spatial models work.	Able to choose the right method for analysis. Can conduct analysis effectively using appropriate software tools. Articulates analysis results. Able to run spatial model and articulate the results.	Able to communicate effectively with not only experts but also the general public about analysis and modeling results. Demonstrates novel use of existing methods and models. Can modify existing methods and models. Can develop new methods and models.
5. Development	Cannot write effective computer code for simple problems. Has limited understanding on how GIS development projects work.	Can write computer programs simple to moderate applications. Understands how GIS development projects work. Understands and practices different roles in a project setting.	Can write computer programs for large application involving large data sets. Demonstrates effective management skills in a team GIS development project.
6. Applications	Cannot identify the theories related to real world applications. Cannot identify a GIS solution to real world applications.	Articulates the needs of GIS for real world applications. Able to make connections between	Provides rich details about real world GIS applications. Articulates the pros and cons of the theories related to real world applications.

		spatial theory and applications. Able to design a GIS solution to address real world problems.	Able to communicate with the stakeholders and the general public regarding the use of GIS for real world applications.
7. Professionalism	Cannot recite GIST professional codes. Cannot discriminate between ethical and unethical behaviors in a professional setting. Cannot articulate the impacts of GIST on human societies.	Fully understands GIST professional codes. Recognizes the ethical issues in a professional setting. Practices ethical decision-making procedures.	Has all the traits in the Meets column. Understands the responsibilities as a GIST professional.

Second, assessments will be conducted in courses that are aligned with the specific outcomes in the curriculum map. Many of our undergraduate courses have already been using classroom assessment methods (e.g., embedded questions specifically related to program outcomes) and it should be relatively straightforward to implement that for 6000 level courses for the MGIST. Each program learning outcome is covered by multiple courses at different levels, which gives us a variety of ways to assess the outcomes. We also have courses (e.g., GEOG 5210) that are offered in all semesters, which gives us a good opportunity to assess some outcomes more frequently to provide a consistent baseline. Below is a timeline for learning outcome assessment in a two-year cycle (assuming the program starts in AU 2022). This timeline is tentative as the actual offering of the specific courses may change. But the principle is to assess the outcomes often and rotate between different courses in order to understand how the courses fulfill the program goals.

Learning Outcome	AU22	SP23	AU23	SP24
1	**5210** / **5225**	**5210**	**5210** / 6226	**5210**
2	*5212*	*5103*	*5212*	6222
3	**5200**	*5201*	6223	*5229*
4	**5225**	*5201*	6226	*5103*
5	*5222*	*5222*	6226	6222
6	**5225** / 6226	*5222*	**5225** / 6226	***6299***
7	**5101**	6286	**5101**	***6299***

Key: **required**, *intermediate*, advanced, and ***capstone***

In addition to the direct measures, we will survey students, alumni, and employers (using Qualtrics or similar tools) to obtain indirect measures about the program. These surveys will provide information about career outcomes of students, reviews on the curriculum or specific course syllabi, and comparison of our program with other similar programs in the state and nationwide. Within the first five years of the program, we may also consider conducting an external program review. This review will be based on a self-study of the strengths and areas for improvement of the program using the data collected. External reviewers will include local and

national GIST industry leaders, experts from other professional graduate programs, and alumni. We will follow OSU Office of Academic Affairs' Guide to Academic Unit Review to facilitate the external review.

Statewide Alternatives

Presently, at least eight Ohio institutes have different levels of GIST certificate and degree programs. Among them, University of Akron and Columbus State Community College only offer undergraduate certificates. Cleveland State University, University of Cincinnati, Miami University, University of Toledo, and Wright State University offer graduate certificates. These certificate programs only require 15-18 credit hours to finish and do not grant a degree. The only statewide alternative compared to the proposed program is from Kent State University that has a Master of GIS program.

The proposed Master of GIST program and the one from Kent State University both include required courses for fundamental GIS theories and elective courses for different concentrations. Specifically, the proposed program at OSU focuses on GIS programming, web GIS, spatial modeling, and geodemography. On the other hand, the master of GIS curriculum at Kent State University covers a range of topics with 19 elective courses. It is worth noting that 7 of these elective courses focus on the application of GIS in public health and behavioral sciences, which are not focused by our proposed program. Thus, we consider our proposed program and the Kent State's Master of GIS program as complementary.

Central Ohio is one of the fastest growing areas in the country. A professional degree in GIST at the center of the rapid population growth can well serve the professional needs in the local area, as well as regionally.

As discussed above, we do not regard the graduate level GIST education to be a zero-sum situation and there will be opportunities to collaborate with in-state colleagues. For example, the annual OHIO GIS meeting organized by URISA is a perfect venue for the GIST educators to exchange ideas and for our students to share their projects. Collaborating on other annual events such as the GIS Day[6] will also make all the programs grow stronger. Once approved, we plan to reach out to the statewide colleagues to discuss more collaboration opportunities.

Growth of the Program

The prediction of program growth is based on three main factors. First, we examined the data from our past applications to the MA program. In the past three years (2017 to 2021), we consistently have more than 10 applicants who are interested in GIST. This provides a baseline for future applications. Second, the agreement between Ohio State and NGA has contributed at least 2 part time students into our MA program and this will continue in the next few years. Third, we plan to increase our outreach efforts to make the proposed program highly visible to both current students, prospective students, and professionals.

Given the above factors, we anticipate a linear growth trend for full-time enrollments, from 5 in the first year to 20 in year four. We also anticipate 2 part-time (50 percent) enrollments each year from the NGA students. We aim to achieve a stable enrollment of 20 each year, which will make the program sustainable. The department is in discussion with the college about cost sharing so that a meaningful portion of the program income can be used to support program growth. The details of program growth are in the Fiscal Impact Statement in the Appendix.

[6] https://www.gisday.com/en-us/overview

CURRICULUM AND INSTRUCTIONAL DESIGN

1. Curricular content

The MGIST program consists of 15 courses that are organized into 4 tiers. Students need a minimum of 33 credit hours to complete the program. More explanation of these courses is in the next section.

COURSE #	TITLE	CREDIT
Required Core Courses (12 hours)		
GEOG 5101	GIS Professionalism and Ethics	3
GEOG 5200	Cartography and Map Design	3
GEOG 5210	Fundamentals of GIS	3
GEOG 5225	Geographic Application of Remote Sensing	3
Intermediate Elective Courses (9 hours, choose 3 courses)		
GEOG 5103	Intermediate Spatial Data Analysis	3
GEOG 5201	GeoVisualization	3
GEOG 5212	Geospatial Databases for GIS	3
GEOG 5222	GIS Algorithms and Programming	3
GEOG 5229	Emerging Topics in GIS	3
Advanced Elective Courses (9 hours, choose 3 courses)		
GEOG 6222	GIS Development	3
GEOG 6223	Web GIS development	3
GEOG 6226	Spatial Simulation and Modeling in GIS	3
GEOG 6286	GIS in Social and Business Research	3
PUBAFRS 7555	Project Management in the Public Sector	3
Capstone Project (3 hours)		
GEOG 6299	GIS Capstone Project	3

Note: The proposal for the online version of 5229 will be submitted in Spring 2022.

Each course will support one or more learning outcomes, as shown in the following **curriculum map**:

Courses	Learning outcomes						
	1	2	3	4	5	6	7
Core courses							
5101 GIS Professionalism and Ethics							x
5200 Cartography and Map Design	x		x				
5210 Fundamentals of GIS	x						
5225 Geographic Applications of Remote Sensing	x		x	x		x	
Intermediate courses							
5103 Intermediate Spatial Data Analysis		x		x			
5201 Geovisualization		x	x	x			
5212 Geospatial Databases for GIS	x	x					
5222 GIS Algorithms and Programming					x	x	
5229 Emerging Topics in GIS			x	x			x
Advanced courses							
6222 GIS Development		x			x	x	

6223 Web GIS Development			x		x		
6226 Spatial Simulation and Modeling in GIS	x		x	x	x	x	
6286 Geodemography: GIS in Social Science and Business Research							x
PUBAFRS 7555 Project Management in the Public Sector							x
Capstone project							
6299 GIS Capstone Project						x	x

2. Requirements to complete the program

Courses in the proposed curriculum are organized in four tiers. The four required core courses are must-have for every GIST professional as these courses cover the professionalism and ethics (5101), fundamental understanding of map making (5200), theory and methods of using geographic information systems (5210), and theory, methods, and applications of remotely sensed data (5225).

The intermediate elective courses consist of 5 courses and the students can choose any 3. The flexibility allows students to concentrate on a specific area if they want. For example, students who are interested in data analytics can choose 5103, 5212, and 5222, and for visualization they can choose 5103, 5201, and 5229. GEOG 5229 (Emerging topics in GIS) is designed to survey new technology and methods, and its recent offerings have covered topics such as advanced geovisualization, mapping census data, public health, and environmental modeling. Students can also start the path to get started with programming and database management by including 5212 and 5222 in their choices.

In the third tier, students, by choosing 3 out of 5 courses, can further develop their skills in a specific area, or choose a wide range of topics to broaden their skill sets. For example, those who choose the spatial data analytics in the intermediate tier can further hone their skills by having 6226 and 6286 in their choices. This tier also sees a strong curriculum in GIS programming, development, and management (6222, 6223, 6287).

Finally, students will work on a capstone project (6299) to complete the program. This project will be supervised by a faculty mentor and the students will identify a problem and design a strategy to address it. The public presentation of the project will be a highlight for the department and the program, as well as for the student's achievement.

The program advising sheet is attached in the appendix of the full proposal.

3. Description of a required culminating, or integrated learning, experience

GIS Capstone Project (GEOG 6299) is designed for students to showcase the knowledge learned and skills developed in the proposed program. Students are required to take this course to complete the program. Permission from the program director is needed for students to enroll in the capstone, a measure to make sure this is the last course taken in the program. During this course, students will intensively engage in the entire process of problem-solving using GIS, from identifying the problem and research method, literature review, collecting and processing data, developing and designing proper methods, analyzing data, to professionally presenting the results and findings. Students will choose a problem that reflects what they may address in a professional setting in industry, government agencies, non-government organizations, or research institutes.

To successfully complete the capstone project, students must contact their academic mentor and the program coordinator at least 2 months prior to the semester they plan to take this course. This leeway will allow students and their mentors to brainstorm the problem suitable for the capstone project and to determine the appropriate steps to take when this course starts. Students will then work individually with the mentor to

complete this course. In general, weeks 1-4 will be used to write a project proposal that details the problem and the methodologies to solve the problem. Weeks 5-12 will be used to concentrate on conducting data collection, analysis, and writing of the project report. In the last two weeks of the semester, students will submit a written document that details the project and make a public presentation to the department. The public presentation will be peer-reviewed.

INSTITUTIONAL STAFFING, FACULTY, AND STUDENT SUPPORT

1. Faculty

The department now has 4 tenured or tenure-track faculty members and 1 full time lecturer who are teaching GIST courses. We now have received approval from the College to fill two additional GIST positions in 2022: a tenure track assistant professor and a full-time senior lecturer. The curriculum of the proposed program includes 5000 level courses that are currently taught in our undergraduate GIS major. The 6000 levels courses are new (all approved). The two new hires will help us sufficiently cover these new courses.

Once the MGIST program starts, we plan to hire a full-time clinical faculty member in the first year and an additional lecturer in the third year. The clinical faculty member will provide required stability to the program from the beginning. Please see the Growth of the Program section for the rational and the fiscal impact statement (in the Appendix) for budget details.

2. Administration and Support

In the second year of the proposed program, we will create a steering committee to help guide the program's operation. All members of the committee will be from government agencies and the industry that represent the potential employers of GIST professionals. This committee will be extremely valuable to the direction and growth of the program as they understand the dynamics of the GIST profession in the real-world and are in the best position to guide the future direction of the program.

Internally, in the first four years of the program, a subcommittee of the Graduate Studies Committee in the department will handle the administrative tasks such as outreach, admission, and student progress review. One of the full-time instructors or faculty members will serve as the director of the program. We anticipate the program will reach a cohort of 20 enrollments per year by the fourth year. After that we will evaluate the needs of the program going forward and the possibility of hiring a full-time staff member as the program progresses.

ADDITIONAL PROPOSAL SECTIONS

1. Professional graduate degree programs

a) Special admission criteria

Instead of requiring 3 letters of recommendations from academia as we do in a MA or MS program, applicants to the proposed MGIST program will submit 2 letters from their professional contacts such as their supervisors or peers.

b) Field/clinical experience

This does not apply to the proposed program as our curriculum does not require field/clinical experiences.

c) Faculty qualifications

The faculty members and instructors associated with the proposed program have been trained in the GIST areas and have taught related courses (see the enclosed Faculty Matrix and 2-page CV's).

d) Accreditation

Presently, GIST courses in academic programs around the country are not accredited. In today's GIST profession, there are two major certification paths. The first is through the GIS Certification Institute (GISCI), a not-for-profit organization that accepts individual applications to its GIS Professional (GISP) certification program.[7] Individuals who pass the exam implemented by the GISCI become certified GISP. GISCI's certification, however, has not been a required credential for individuals to secure a job in the industry or government. And GISCI does not involve in accreditation of academic programs. The second path is through, ESRI, the leading GIS software vendor, that issues its own technical certification (similar to those by software companies like Microsoft and Oracle) for professionals who wish to establish their credentials in using ESRI's software and data products.

We do not anticipate that GIST accreditation will become reality in the near future. We will continue to monitor the dynamics of the GIST communities in terms of profession-wide certification and plan to play an active role in the process.

e) How are theory and practice integrated within the curriculum?

Each course in the curriculum typically contains lectures that discuss the theory in a specific subfield of GIST (such as color theory in a cartography class) and hands-on lab exercises that concentrate on the applications of theory in a lab setting. The curriculum also includes a capstone class in which students will choose to work on a specific topic through a project to showcase the knowledge and skills they have learned in the program.

f) National credit hour norm

There is no national credit hour norm for a GIST degree program. The number of credit hours vary among different institutes. For example, the Master of GIS program at University of Southern California requires 28 credit hours, while the similar program at Penn State requires 35 hours.

The 33 credit hours required to complete the proposed program is consistent with our Master of Arts program as well as the required hours by the graduate school of the Ohio State University.

[7] https://www.gisci.org/

g) Required culminating academic experience and student's professional preparation

A GIST professional in private or public sectors often needs to conduct data processing, analysis, and visualization for tasks that are fundamentally interdisciplinary. Our proposed degree program provides a comprehensive curriculum that gives students the opportunity to dive into the theory and methods in the fields while exploring concepts from different disciplines. We design our curriculum based on the GIST Body of Knowledge edited by the University Consortium of Geographic Information Science (UCGIS), which is also used by the GIS Certification Institute to design their certificate programs for GIS Professionals. Please refer to Section 2 under Basic Characteristics of the Educational Program in this proposal for how the learning objectives of the proposed program cover the 10 areas that deemed by the UCGIS for a well-trained GIST professional.

APPENDICES

List of Appendices

1. Course description
2. Advising sheet
3. Letters of support
4. Faculty matrix
5. Two-page vitae for each faculty member involved in the program
6. Fiscal impact statement
7. Market analysis
8. CCGS Online/blended delivery form

Appendix 1. Course descriptions

Core Courses

GEOG 5101 GIS Professionalism and Ethics. This course will help students address ethical decision questions and help them find their moral compass in the constantly changing geographic information science and technology profession. (Prerequisites: None.)

GEOG 5200 Cartography and Map Design. A study of the cartographic techniques of map compilation and design including generalization, symbolization, reproduction, and GIS-based mapping with an emphasis on thematic mapping. (Prerequisites: Not open to students with credit for 5200S, 580S, or 580.)

GEOG 5210 Fundamentals of GIS. This course introduces principles of geographic information systems (GIS) and their applications in spatial analysis and information management. (Prerequisites: Not open to students with credit for 5220, 607, CRPlan 5001, 607, or CivilEn 5001, 607.)

GEOG 5225 Geographic Application of Remote Sensing. This course introduces the fundamentals of remote sensing and its geographic applications. (Prerequisites: Not open to students with credit for 5270.)

Intermediate Elective Courses

GEOG 5103 Intermediate Spatial Data Analysis. Application of quantitative methods to geographic problems; spatial statistics, area sampling, maps of residuals, regionalization methods, and simulation maps. (Prerequisites: 4103 or introductory statistics course from Geography or other department.)

GEOG 5201 GeoVisualization. This is a topic-oriented course focusing on the examination of concepts, techniques, issues and applications of analytical cartography, interactive mapping, and scientific visualization of geographic data. (Prerequisites: 5200 or 5200S)

GEOG 5212 Geospatial Databases for GIS. This course focuses on designing, implementing, querying, and managing geospatial databases or persistent data stores where most entities have footprints in geographic space and time. (Prerequisites: 5210 and CSE 1114)

GEOG 5222 GIS Algorithms and Programming. This class is about coding. More specifically we learn how to program a computer to handle spatial data. (Prerequisites: None)

GEOG 5229 Emerging Topics in GIS. This course examines major recent developments in the theories, technologies, and/or applications of geographical information science. (Prerequisites: 5210. Not open to students with credit for 5224.)

Advanced Elective Courses

GEOG 6222 GIS Development. This course covers topics in developing GIS software tools and project management for GIS software development. (Prerequisites: 5222)

GEOG 6223 Web GIS Development. The goal of this course is to help students grasp the technology for the design and implementation of web GIS applications. (Prerequisites: 5210 and 5212)

GEOG 6226 Spatial Simulation and Modeling in GIS. This course is about the use of computational techniques to simulate the evolution of complex spatial systems such as ecosystems, transportation, weather/climate, cities, economies, societies and landscapes. (Prerequisites: None)

GEOG 6286 GIS in Social and Business Research. This course is designed to help students grasp advanced GIS methods for applications in business and social science using rich geographic and demographic data sets. (Prerequisites: 5210)

PUBAFRS 7555 Project Management in the Public Sector. This course exposes students to requirements for effective project management and the many challenges it presents. It introduces standards and methods for project management (PM), the application of tools, the basic, ancillary, "soft" skills for successful PM, public sector challenges, and strengths/limitations in a complex organic environment. (Prerequisites: None)

Capstone project

6299 GIS Capstone Project. The purpose of this course is for students to showcase the knowledge learned and skills developed in the GIS graduate program. (Prerequisites: Program director permission)

Appendix 2. Advising Sheet

College of Arts and Sciences

Master of Geographic Information Science and Technology
33 Credit Hours

Student Name: _____

Student OSU Email: _____

Program Advisor Name: _____

Required Core Course (4)

Course (Hours)	Use for Degree	Course Grade	Term/Year Completed
GEOG 5101 (3)	YES		
GEOG 5200 (3)	YES		
GEOG 5210 (3)	YES		
GEOG 5225 (3)	YES		

Intermediate Elective Courses (check 3 courses in the "Use for Degree" column)

Course (Hours)	Use for Degree	Course Grade	Term/Year Completed
GEOG 5103 (3)			
GEOG 5201 (3)			
GEOG 5212 (3)			
GEOG 5222 (3)			
GEOG 5229 (3)			

Advanced Elective Courses (check 3 courses in the "Use for Degree" column)

Course (Hours)	Use for Degree	Course Grade	Term/Year Completed
GEOG 6222 (3)			
GEOG 6223 (3)			
GEOG 6226 (3)			
GEOG 6286 (3)			
PUBAFRS 7555 (3)			

Capstone Project (1)

Course (Hours)	Use for Degree	Course Grade	Term/Year Completed
GEOG 6299 (3)	YES		

Substitutions Approved: _____

Program Advisor Signature _____

Date _____

Appendix 3. Letters of support

THE OHIO STATE UNIVERSITY

John Glenn College of Public Affairs

Robert T. Greenbaum
Associate Dean for Curriculum

350E Page Hall
1810 College Road
Columbus, OH 43210
614-292-9578
greenbaum.3@osu.edu
glenn.osu.edu

October 28, 2021

Ningchuan Xiao
Professor and Chair of Graduate Studies
Department of Geography
1036 Derby Hall, 154 N Oval Mall
The Ohio State University
Columbus, OH 43210

Dear Ningchuan,

The Glenn College is pleased to offer support for the proposed Master of Geographic Information Science and Technology (MGIST). It is clear that there is a need for such a program, and Ohio State's renowned Geography department is well-positioned to deliver this program.

The Glenn College is pleased that PUBAFRS 7555 Project Management is included as one of the advanced elective courses. We commit to offer the course multiple times per year, both in person and online.

We look forward to fast approval of this new degree.

Sincerely,

Robert T. Greenbaum
Professor

Appendix 4. Faculty Matrix

Instructor Name	Rank or Title	Full-Time (FT) or Part-Time (PT)	Instructor Qualification			Courses taught in the proposed program (Include course number and title)
			Degree Title, Discipline Institution, Year	Years of Teaching Experience In the Discipline/ Field	Additional qualifications (e.g., licenses, certifications)	
*Emily **CASTELLUCCI***	*Senior Lecturer*	*FT*	*PhD. Geography, U. of Georgia, 2016*	*5*	*None*	*GEOG 5200: Cartography and Map Design* *GEOG 5210: Fundamentals of GIS* *GEOG 5210: GeoVisualization* *GEOG 5212: Geospatial databases for GIS*
*Jay **JOHNSON***	*Instructor*	*PT*	*M.A. Higher Education and Student Affairs, The Ohio State University, 1995*	*11*	*Project Management Professional (PMP)*	*PUBAFRS 7555: Project Management in the Public Sector*
*Huyen **LE***	*Assistant Professor*	*FT*	*PhD. Planning, Virginia Tech U., 2019*	*2*	*None*	*GEOG 5229: Emerging topics in GIS*
*Desheng **LIU***	*Professor*	*FT*	*PhD. Environmental Science, U. of California at Berkeley, 2006*	*15*	*M.A. Statistics*	*GEOG 5225: Geographic application of remote sensing*
*Harvey **MILLER***	*Professor*	*FT*	*PhD. Geography, The Ohio State U., 1991*	*30*	*None*	*GEOG 5212: Geospatial databases for GIS* *GEOG 6226: Spatial simulation and modeling in GIS (previously 5226)*

Ningchuan ***XIAO***	*Professor*	*FT*	*PhD. Geography, U. of Iowa, 2003*	*18*	*None*	*GEOG 5101: GIS Professionalism and Ethics (new course; proposed by Dr. Xiao)* *GEOG 5200: Cartography and Map Design* *GEOG 5210: Fundamentals of GIS* *GEOG 5201: GeoVisualization* *GEOG 5222: GIS Algorithms and Programming* *GEOG 5229: Emerging Topics in GIS* *GEOG 6222: GIS Development (New course number; proposed by Dr. Xiao; previously taught as 5223)* *GEOG 6223: Web GIS Development (New course; proposed by Dr. Xiao; taught previously in a 5229 rotation)* *GEOG 6286: GIS in Social and Business Research (New course; proposed by Dr. Xiao)* *GEOG 6229: GIS Capstone Project (New course; proposed by Dr. Xiao)*

Appendix 5. Two-page vitae for each faculty member involved in the program

EMILY SNOW CASTELLUCCI

Department of Geography
The Ohio State University
1036 Derby Hall, 154 North Oval Mall
Columbus, OH 43210
castellucci.5@osu.edu

EDUCATION

Ph.D.	Geography, University of Georgia, Athens, GA	2016
M.S.	Geography, University of Georgia, Athens, GA	2012
B.A.	Geography, University of North Carolina, Chapel Hill, NC	2010

POSITIONS

Senior Lecturer	Department of Geography, OSU, Columbus, OH	2016-present
Instructor of Record	Department of Geography, UGA, Athens, GA	2013-2016
Teaching Assistant	Department of Geography, UGA, Athens, GA	2010-2015

TEACHING

COURSES TAUGHT:

Senior Lecturer, Department of Geography, The Ohio State University

COURSE ID	COURSE TITLE	SECTIONS	YEARS
GEOG 5200	Cartography & Map Design	x9	2016-2021
GEOG 5210	Fundamentals of GIS (2 sections)	x20	2016-2021
GEOG 5212	Geospatial Databases for GIS	x10	2016-2021
GEOG 2200	Mapping Our World	x1	2018
GEOG 5201	Geovisualization	x2	2017-2018

Instructor of Record, Department of Geography, University of Georgia

COURSE ID	COURSE TITLE	SECTIONS	YEARS
GEOG 3510	Cartography & Graphics	x4	2013-2016

Teaching Assistant, Department of Geography, University of Georgia

COURSE ID	COURSE TITLE	SECTIONS	YEARS
GEOG 3510L	Cartography & Graphics	x4	2011-2015
GEOG 4/6370E	Geographic Information Science	x6	2010-2015
GEOG 4/6350L	Remote Sensing of Environment	x1	2012

GUEST LECTURES:

2020, January 29. ArcGIS Pro: An Introduction. CRPLAN 6080, Advanced GIS for Professional Planning Practice, Zhenhua Chen, OSU.
2016, November 11. UGA's Interdisciplinary Certificate in University Teaching and Education Research. GRSC 7770, Graduate Seminar, UGA.

TEACHING-SPECIFIC TRAINING:

Instructional Redesign *(in progress)* Autumn 2021
Small Group Instructional Diagnostics (SGIDs) Spring 2020
GEOG 5210 with Teresa Johnson and Shadia Siliman
from the University Institute of Teaching and Learning (UITL)
Digital Flagship Educators Cohort, participant 2019-2020
Workshops (miscellaneous), attendee
Carmen and iPad: Best Practices for an Improved Student Experience 4 September 2019
Active Learning Workshop Series, attendee
Workshop #1 Introduction to Active Learning Strategies 28 January 2019
Workshop #2 Applied Active Learning Strategies 25 February 2019
Workshop #2 Technology-Enhanced Active Learning 25 March 2019
Teaching Support Program, University Institute for Teaching and Learning, OSU Autumn 2018

SOFTWARE TAUGHT:

Primary: ArcGIS Pro (previously ArcGIS Desktop, e.g. ArcMap, etc.), QGIS, and PostgreSQL with PostGIS via pgAdmin
Secondary: ArcGIS Online, QTReader, LAStools, and Microsoft Office (esp. Excel)

RESEARCH

Castellucci, E. S. (2016). Student-centered Geographic Information Science education: Flipping the classroom, graduate students on curriculum, and QGIS (Doctoral dissertation).
Snow, E. (2012). *Contextualizing high resolution satellite systems of the United States: the role of history, politics, and economy on technological development* (Master's thesis).
Snow, E. (2010). *From film to pixels: history of remote sensing in secret Cold War programs* (undergraduate honors thesis).

SERVICE

Faculty Advisor, Geography Club, Department of Geography, OSU, 2020-present.
Member, Strategic Planning Committee, Department of Geography, OSU, 2020.
Member, Geographic Information Science Committee, Department of Geography, OSU, 2016-2019.
Treasurer, Geography Graduate Student Association, Department of Geography, UGA, 2015-2016; member since 2010.

Jay Johnson, PMP

JAYVJOHNSON@GMAIL.COM
180 W. WEISHEIMER ROAD
COLUMBUS, OHIO 43214
(614) 257-8730

SUMMARY OF SKILLS AND EXPERIENCE

- Over 25 years of project management experience in higher education and public sector
- Taught project management workshops for over 10 years
- Served as project manager for the quarter to semester conversion in the Office of Academic Affairs
- Lead large-scale and ad-hoc research projects on Ohio State University metrics, including: economic impact, faculty/staff ratios, faculty/student ratios, college profiles, research expenditures, student retention and graduation.
- Designed, documented and implemented data input files and relational database to collect enrollment data resulting in the nation's first web-based statewide postsecondary student tracking system (Higher Education Information System).
- Facilitated statewide consultations to solicit business requirements from Regents executive staff, government agencies and college personnel for projects including calculations for the distribution of $1.7B in State Share of Instruction and Resource Analysis
- Write queries using Hyperion, MSoft Access, OBIEE and Tableau to extract legacy and current internal and external databases to respond to questions

EXPERIENCE

May 2009 - Present — The Ohio State University

Associate Director of Institutional Research:

- Led the creation of facts.osu.edu
- Coordinated review of academic departments
- Provided feedback on requirements for self-study and external review team visit
- Met with Provost, Senior Vice Provost, Dean and Department Chair to discuss recommendations and future actions
- Write queries using Hyperion, MSoft Access, OBIEE and Tableau to extract legacy and current internal and external databases to respond to questions
- Build dashboards and data visualizations using Tableau
- https://public.tableau.com/profile/jay.johnson#!/
- Manage the collection of data for Board of Trustees scorecards
- Analyze and summarize data about faculty, staff, research expenditures, students, enrollments and facilities

Acting Director of Continuing Education: July 2011 – April 2012

- Worked as part of transition team to align the mission of the Office of Continuing Education with the Office of Academic Affairs
- Discontinued functions and programs that were inconsistent with the new vision for the office
- Provided day-to-day oversight of office
- Drafted new position descriptions for new office
- Communicated results of review of office to staff and stakeholders

Semester Conversion Project Manager: *May 2009 – June 2012*

- Facilitated and resolved high-level and operational university issues as Ohio State transitioned from quarter to semester calendar
- Developed schedule and implemented solutions
- Communicated new developments and requirements to stakeholders
- Drafted and updated documentation to guide departments through course and program conversion
- Responded to questions from media, students, faculty and staff
- Led the planning and execution of the second Semester Summit
- Designed and updated the Semester Conversion website

September 2010 - present John Glenn College of Public Affairs

Instructor: MAPS Program

- Teach project management principles and framework to public sector employees
- Write and revise materials for custom training events

February 2008 - February 2009 Quick Solutions/ AEP

Senior Project Manager*:* Midwest Independent Transmission Systems Operator (MISO) Settlements and Scheduling Automation

- Led core team to implement settlements system for Midwest electrical utility market with a budget of $800,000.
- Created and updated project financials, work breakdown structure, gathered estimates and created project schedule and budget.
- Calculated project metrics and reported to sponsors.
- Compared and communicated project progress against forecasts.
- Leveled resources on project plan.
- Wrote quality assurance, risk management and communications plans
- Managed project scope and made changes through change control procedures.
- Managed subcontractors

November 2005 - February 2008 Ohio Board of Regents

Director of Higher Education Information System (HEI) and Residency Officer for the State of Ohio

- Led team and set strategic direction to collect, verify and analyze data about the collegiate enterprise for policy makers and researchers.
- HEI is Ohio's comprehensive data warehouse about higher education with data on over 2m students, degrees, courses, faculty/staff, facilities and finances of 37 public colleges and universities
- Selected, supervised and trained analysts, auditors and programmers to process, verify, store, analyze and audit data.
- Developed employee expectations, evaluated performance and recommended disciplinary actions.
- Assisted in the calculation and distribution of $1.6 billion of state share of instruction.
- Audited and recommended actions and enforced compliance among colleges and universities concerning enrollment and financial aid reporting.
- Oversaw data sharing agreements to ensure FERPA compliance
- Queried and analyzed data from data warehouse for ad hoc requests about students, courses and academic programs.
- Created process to review viability of two-year academic programs
- Trained users of HEI system and on logic behind Resource Analysis and distribution of State Share of Instruction
- Initiated and wrote 35 page training manual for staff.
- Created budget projections for fiscal year for unit.
- Interpreted and modified the Ohio Residency Rule (Ohio Administrative Code 3333-1-10)
- Developed and facilitated first advisory board for the residency rule consisting of collegiate legal counsel and the Attorney General's office
- Mediated residency disputes between students and universities

1994 - 2005 Ohio Board of Regents

Assistant Director of HEI, Business Analyst

- Designed, documented and implemented data input files and relational database to collect enrollment data resulting in the nation's first web-based statewide postsecondary student tracking system
- Facilitated statewide consultations to solicit business requirements from Regents executive staff, government agencies and college personnel.

- Wrote specifications for programmers to insure data validity and accuracy. Ran system and user acceptance tests to verify compliance against specifications.
- Designed and implemented audit software and procedures to determine compliance with state and federal financial aid and enrollment policies.

EDUCATION

- M.A. Higher Education and Student Affairs: The Ohio State University
- B. A. English: University of Nebraska at Kearney

TRAINING

- Project Management Institute, Project Management Professional (PMP)

PRESENTATIONS AND WORKSHOPS

- Instructor for *Project Management* workshops for John Glenn College of Public Affairs (2013 - present)
- Instructor for *Managing Continuous Improvement* workshop for John Glenn College of Public Affairs (2010 – 2012)
- Johnson, J. (May 2007) NCES/SHEEO Network Conference, *Developing a Seamless Transition for Transfer Students: Using XML Transcripts in Ohio*. St. Petersburg, Florida
- Sheehan, R., Horton, H., Gutowski, R., Johnson, J. (May 2000) Association of Institutional Research Annual Forum, *Design and Implementation of a Statewide Electronic Web-based Data Warehouse to Support Higher Education Decision Making: Ohio's Higher Education Information (HEI) System* Cincinnati, Ohio

REFERENCES

Available upon request

Huyen T.K. Le

Department of Geography, The Ohio State University
1110 Derby Hall | le.253@osu.edu | (614) 292-2764

Education

Virginia Tech, Blacksburg, VA 2019
Ph.D. Planning, Governance & Globalization / *Transportation Planning & Analytic Methods*

The University of Iowa, Iowa City, IA 2015
M.Sc. Urban and Regional Planning
Graduate Certificate in Transportation Studies

Hanoi Architectural University, Hanoi, Vietnam 2011
B.Eng. Urban Construction Management

Academic Appointments

The Ohio State University, Columbus, OH
Assistant Professor, Department of Geography 2019 – Present
Core Faculty, Sustainability Institute 2019 – Present
Affiliate, Translational Data Analytics Institute, STEAM Factory, EmPOWERment 2020 – Present

Teaching

Courses at OSU:
GEOG 2200.01: Mapping Our World (undergraduate), Spring '20-'22
GEOG 5229: Emerging Topics in GIS (undergraduate/graduate), Spring '22
GEOG 5300: Geography of Transportation (undergraduate/graduate), Autumn '19-'21

Course at Virginia Tech:
UAP 5114: Computer Applications in Planning (GIS) (graduate), Co-instructor, Fall '18

Selected Journal Articles

*Notes: * denotes graduate students that I mentored or otherwise directly supported. My last authorship means senior authorship on projects that I led or supervised.*

Braun, L.M., **Le, H.T.K.**, Voulgaris, C.T., Nethery, R.C. (2021) Healthy for whom? Equity in the spatial distribution of cycling risks in Los Angeles. *Journal of Transport and Health.*

Le, H.T.K., Carrel, A.L., **Shah, H.* (2021) Impacts of online shopping on travel demand: A systematic review. *Transport Reviews.*

Kar, A.*, **Le, H.T.K., Miller, H.J. (2021) What is essential travel? Socioeconomic differences in travel demand during the COVID-19 lockdown. *Annals of the American Association of Geographers.*

Hankey, S., Zhang, W., **Le, H.T.K.**, Hystad, P., James, P. (2020) Predicting bicycling and walking traffic using street view imagery and destination data. *Transportation Research Part D.*

Le, H.T.K., Carrel, A.L., Li, M. (2020) How much dissatisfaction is too much for transit? Linking transit user satisfaction, loyalty, and ridership using panel data. *Travel Behaviour and Society* 20 (2020) 144-154.

Le, H.T.K., Buehler, R., Fan, Y., Hankey, S. (2020) Expanding the positive utility of travel through weeklong tracking: Within-person and multi-environment variability of ideal travel time. *Journal of Transport Geography* 84(2020) 102679.

Le, H.T.K., Carrel, A.L. (2019) Happy today, satisfied tomorrow: Emotion – satisfaction dynamics in a multi-week transit user smartphone survey. *Transportation.*

Le, H.T.K., West, A., Quinn, F., Hankey, S. (2019) Advancing cycling among women: An exploratory study of North American cyclists. *Journal of Transport and Land Use*, 12(1), 355–374.

Le, H.T.K., Buehler, R., Hankey, S. (2019). Have walking and bicycling increased in the US? A 13-year longitudinal analysis of count data in 13 US metropolitan areas. *Transportation Research Part D: Transport and Environment. 69*, 329-345.

Le, H.T.K., Buehler, R., Hankey, S. (2018). Correlates of the built environment and active travel: Evidence from 20 US metropolitan areas. *Environmental Health Perspectives* 126*(7).*

Curriculum Developments

GEOG 5229: Emerging topics in GIS. Currently, spatial analytics in R and its applications are not part in our GIS curriculum. I am developing a new course to be taught in Spring 2022 with a focus on R programming and spatial analytics. This is a project-based course with real-world applications focusing on urban issues, including but not limited to transportation, environment, and public health.

Graduate student advising

PhD student advising: 3 on-going
PhD committee: 2 on-going
Masters committee: 1 completed

Selected Service

Member, Center for Aviation Studies Advisory Board (2021 -)
Member, Undergraduate Studies Committee, Department of Geography (2019 –)

BIOGRAPHICAL SKETCH

DESHENG LIU

Department of Geography, The Ohio State University
1036 Derby Hall, 154 North Oval Mall, Columbus OH 43210
Email: liu.738@osu.edu, Phone: 614-247-2775, Webpage: http://u.osu.edu/liu.738

(a) PROFESSIONAL PREPARATION

Wuhan University, Wuhan, China	Geographic Information Science	B.E.	2001
University of California, Berkeley, CA	Environmental Science	M.S.	2003
University of California, Berkeley, CA	Statistics	M.A.	2004
University of California, Berkeley, CA	Environmental Science	Ph.D.	2006

(b) APPOINTMENTS

2018− present	Professor, Department of Geography, Department of Statistics (courtesy), Department of Civil, Environmental, Geodetic Engineering (courtesy), The Ohio State University (OSU)
2018 – present	Faculty Member, Principal Investigator, Byrd Polar and Climate Research Center, OSU
2012 − present	Faculty Member, Environmental Science Graduate Program, OSU
2013 − 2018	Associate Professor, Departments of Geography and Statistics (courtesy), OSU
2012 − 2013	Associate Professor, Departments of Geography and Statistics, OSU
2006 − 2012	Assistant Professor, Departments of Geography and Department of Statistics, OSU

(c) COURSES TAUGHT

The Ohio State University

GEOG4103	Introductory Spatial Data Analysis (Instructor)
GEOG5210	Fundamentals of GIS (Instructor)
GEOG5225	Geographic Applications of Remote Sensing (Instructor)
GEOG8102	Advanced Spatial Data Analysis (Instructor)
GEOG8104	Advanced Remote Sensing (Instructor)
STAT3450	Basic Statistics for Engineers (Instructor)
STAT427	Introduction to Probability and Statistics (I) (Instructor)
STAT428	Introduction to Probability and Statistics (II) (Instructor)
STAT6530	Introduction to Spatial Statistics (Instructor)

University of California at Berkeley

ESPM72	Introduction to Geographic Information Systems (Graduate Student Instructor)
ESPM290	GIS for Environmental Sciences and Management (Guest Lecturer)
PH274	GIS and Remote Sensing in Public Health (Co-Instructor)

(d) SELECTED PUBLICATIONS

Park, Y., J.M. Guldmann, and D. Liu. 2021. Impacts of tree and building shades on the urban heat island: combining remote sensing, 3-D digital city and spatial regression approaches. *Computers, Environment and Urban Systems*, 88: 101655.

Zhao, Y., D. Liu, and X. Wei. 2020. Monitoring cyanobacterial harmful algal blooms at high spatiotemporal resolution by fusing Landsat and MODIS imagery. *Environmental Advances,* 2: 100008.

Liang, J. and D. Liu. 2020. A local thresholding approach to flood water delineation using Sentinel-1 SAR imagery. *ISPRS Journal of Photogrammetry and Remote Sensing*, 159: 53-62.

Kim, R.S., M. Durand, and D. Liu. 2018. Spectral analysis of airborne passive microwave measurements of alpine snowpack: Colorado, USA. *Remote Sensing of Environment* 205: 469-484.

Zhu, X., E.H. Helmer, F. Gao, D. Liu, J. Chen, and M.A. Lefsky. 2016. A flexible spatiotemporal method for fusing satellite images with different resolutions. *Remote S*ensing *of Environment* 172:165-177.

Wehmann, A. and D. Liu. 2015. A spatial-temporal contextual Markovian kernel method for multi-temporal land cover mapping. *ISPRS Journal of Photogrammetry and Remote Sensing* 107: 77-89.

Liu, J.K., D. Liu, and D. Alsdorf. 2014. Extracting ground-level DEM from SRTM DEM in forest environments based on mathematical morphology. *IEEE Transactions on Geoscience and Remote Sensing* 52(10): 6333-6340.

Cai, S., D. Liu, D. Sulla-Menashe, and M. Friedl. 2014. Enhancing MODIS land cover product with a spatial-temporal modeling algorithm. *Remote Sensing of Environment* 147: 243-255.

Liu, D. and S. Cai. 2012. A spatial-temporal modeling approach to reconstructing land-cover change trajectories from multi-temporal satellite imagery. *Annals of the Association of American Geographers* 102(6): 1329-1347.

Liu, D. and X. Zhu. 2012. An enhanced physical method for downscaling thermal infrared radiance. *IEEE Geoscience and Remote Sensing Letters* 9(4): 690-694.

Durand, M.T. and D. Liu. 2012. The need for prior information in characterizing snow water equivalent from microwave brightness temperatures. *Remote Sensing of Environment* 126: 248-257.

Liu, D. and F. Xia. 2010. Assessing object-based classification: advantages and limitations. *Remote Sensing Letters* 1(4): 187-194.

Liu, D., K. Song, J.R. Townshend, and P. Gong. 2008. Using local transition probability models in Markov random fields for forest change detection. *Remote Sensing of Environment* 112(5): 2222-2231.

Liu, D., M. Kelly, and P. Gong. 2006. A spatial-temporal approach to monitoring forest disease spread using multi-temporal high spatial resolution imagery. *Remote Sensing of Environment* 101(2): 167-180.

(e) SELECTED SYNERGISTIC ACTIVITIES

- Associate Editor, *Annals of GIS*; *Photogrammetric Engineering and Remote Sensing*.
- Editorial Board Member, *International Journal of Remote Sensing*; *GIScience & Remote Sensing*.
- Grant Panelist for *NSF*, *NASA*, *CASIS*, and *AAAS*.
- Invited Instructor, 3-day Short Course on *Spatial Data Analysis for Public Health*, Centers for Disease Control and Prevention (CDC), Atlanta, GA, 2012.
- Organizer, *Workshop on Spatial Statistics for Population and Health Research*, OSU, 2011.
- Invited Participant, *International Workshop on Global Land Cover Mapping*, 2011.
- Organizer, *Workshop on Remote Sensing Applications in Social and Environmental Changes*, OSU, 2010.
- Invited Participant, *Opening Workshop for the SAMSI Program on Space-time Analysis for Environmental Mapping, Epidemiology and Climate Change*, SAMSI, 2009.
- Invited Participant, *SWOT Hydrology Workshop*, 2008.
- Robert N. Colwell Memorial Fellowship, American Society for Photogrammetry and Remote Sensing, 2006.
- Earth System Science Fellow, National Aeronautical and Space Administration, 2003.

(f) GRADUATE STUDENTS ADVISING

PhD Chair: 5 completed, 4 current
Masters Chair: 14 completed, 1 current
PhD Committee: 20 completed, 11 current
Masters Committee: 16 completed, 1 current

NSF BIOGRAPHICAL SKETCH

NAME: Miller, Harvey

ORCID: 0000-0001-5480-3421

POSITION TITLE & INSTITUTION: Professor, The Ohio State University

(a) PROFESSIONAL PREPARATION -(see PAPPG Chapter II.C.2.f.(a))

INSTITUTION	LOCATION	MAJOR / AREA OF STUDY	DEGREE (if applicable)	YEAR YYYY
Kent State University	Kent, Ohio	Geography	BA	1985
Kent State University	Kent, Ohio	Geography	MA	1987
The Ohio State University	Columbus, Ohio	Geography	PHD	1991

(b) APPOINTMENTS -(see PAPPG Chapter II.C.2.f.(b))

2013 - present Professor, The Ohio State University, Columbus, OH

2015 - present Director, Center for Urban and Regional Analysis, The Ohio State University, Columbus, OH

2013 - present Bob and Mary Reusche Chair in Geographic Information Science, The Ohio State University, Columbus, OH

2013 - present Professor (courtesy), Knowlton School of Architecture, Columbus, OH

2001 - 2013 Professor, University of Utah, Salt Lake City, UT

1996 - 2001 Associate Professor, University of Utah, Salt Lake City, UT

1991 - 1996 Assistant Professor, University of Utah, Salt Lake City, UT

(c) PRODUCTS -(see PAPPG Chapter II.C.2.f.(c))

Products Most Closely Related to the Proposed Project

1. Miller H, Goodchild M. Data-driven geography. GeoJournal. 2014 October 10; 80(4):449-461. Available from: http://link.springer.com/10.1007/s10708-014-9602-6 DOI: 10.1007/s10708-014-9602-6
2. Miller H, Dodge S, Miller J, Bohrer G. Towards an integrated science of movement: converging research on animal movement ecology and human mobility science. International Journal of Geographical Information Science. 2019 January 15; 33(5):855-876. Available from: https://www.tandfonline.com/doi/full/10.1080/13658816.2018.1564317 DOI: 10.1080/13658816.2018.1564317
3. Miller H. Geographic information science I. Progress in Human Geography. 2017 May 15; 41(4):489-500. Available from: http://journals.sagepub.com/doi/10.1177/0309132517710741 DOI: 10.1177/0309132517710741
4. Miller H. Geographic information science II: Mesogeography. Progress in Human Geography. 2017 June 09; 42(4):600-609. Available from: http://journals.sagepub.com/doi/10.1177/0309132517712154 DOI: 10.1177/0309132517712154
5. Miller H. Geographic information science III: GIScience, fast and slow – Why faster geographic information is not always smarter. Progress in Human Geography. 2018 September 23; 44(1):129-138. Available from: http://journals.sagepub.com/doi/10.1177/0309132518799596 DOI: 10.1177/0309132518799596

Other Significant Products, Whether or Not Related to the Proposed Project

1. Liu L, Miller H, Scheff J. The impacts of COVID-19 pandemic on public transit demand in the United States. PLOS ONE. 2020 November 18; 15(11):e0242476-. Available from: https://dx.plos.org/10.1371/journal.pone.0242476 DOI: 10.1371/journal.pone.0242476
2. Li Y, Hyder A, Southerland L, Hammond G, Porr A, Miller H. 311 service requests as indicators of neighborhood distress and opioid use disorder. Scientific Reports. 2020 November 11; 10(1):-. Available from: http://www.nature.com/articles/s41598-020-76685-z DOI: 10.1038/s41598-020-76685-z
3. Liu L, Miller H. Does real-time transit information reduce waiting time? An empirical analysis. Transportation Research Part A: Policy and Practice. 2020 November; 141:167-179. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0965856420307229 DOI: 10.1016/j.tra.2020.09.014
4. Lee J, Irwin N, Irwin E, Miller H. The Role of Distance-Dependent Versus Localized Amenities in Polarizing Urban Spatial Structure: A Spatio-Temporal Analysis of Residential Location Value in Columbus, Ohio, 2000–2015. Geographical Analysis. 2020 May 12; :-. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/gean.12238 DOI: 10.1111/gean.12238
5. Song Y, Miller H, Stempihar J, Zhou X. Green accessibility: Estimating the environmental costs of network-time prisms for sustainable transportation planning. Journal of Transport Geography. 2017 October; 64:109-119. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0966692317300686 DOI: 10.1016/j.jtrangeo.2017.08.008

(d) SYNERGISTIC ACTIVITIES -(see PAPPG Chapter II.C.2.f.(d))

1. Chair, Mapping Science Committee, National Research Council, US National Academies of Sciences, Engineering and Medicine.
2. Member, Board on Earth Sciences and Resources, US National Academies of Science, Engineering and Medicine
3. Director, Center for Urban and Regional Analysis, The Ohio State University
4. Faculty Advisory Board, Sustainability Institute, The Ohio State University.
5. Affiliate Faculty, Translational Data Analytics, The Ohio State University.

NINGCHUAN XIAO

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E-mail: xiao.37@osu.edu

Education

2003 The University of Iowa, Iowa City, IA, Geography, Ph.D.
1999 Southern Illinois University, Carbondale, IL, Geography, M.S.
1995 Beijing University, Beijing, China, Geography, M.S.
1990 Hunan Normal University, Changsha, China, Geography, B.S.

Appointments

2016 - Present Professor, Department of Geography, Ohio State University
2009 - 2016 Associate Professor, Department of Geography, Ohio State University
2003 – 2009 Assistant Professor, Department of Geography, Ohio State University

Courses Taught

Course Title	*Course numbers*	*Years taught*
Fundamentals of GIS	607, 5210, 5220	2003-2016
Design and Implementation of GIS	687, 5223	2004-2021
GIS Programming and Algorithms	5222	2015-2021
Elements of Cartography Cartography and Map Design	580 5200	2006-2012 2015-2016
Spatial Simulation and Modeling	5221	2012, 2013
Numerical Cartography	680	2005
Geovisualization	5201	2015
Intermediate GIS	685	2008, 2009
Emerging topics in GIS - Web-based GIS - Mapping the census	688, 5224	2012-2014
GIS in Social Science and Business Research	686	2009
Special Topics in Quantitative Geography	983	2004-2007
Frontiers in Geographic Information Science	8200	2015, 2016
World Regional Geography	200	2004-2006

Representative Publications

Xiao, N. and Miller, H.J. 2021. “Cultivating urban big data.” In Shi, W., Goodchild, M., Batty, M., Kwan, M.-P., and Zhang, A. (Eds.) *Urban Informatics*. Springer. In Press.

Xiao, N. and Murray, A. 2019. “Spatial optimization for land acquisition problems: a review of models, solution methods, and GIS support.” *Transactions In GIS*. 23(4): 645-671.

Armstrong, M.P and Xiao, N. 2018. “Retrospective Deconstruction of Statistical Maps: A Choropleth Case Study.” *Annals of the American Association of Geographers*. 108(1): 179-203.

Xiao, N. 2016. *GIS Algorithms*. SAGE Publications.

Bao, S., Xiao, N., Lai, Z., Zhang, H., and Kim, C. 2015. “Optimizing watchtower locations for forest fire monitoring using location models.” *Fire Safety Journal*, 71: 100-109.

Xiao, N. 2012. “A parallel cooperative hybridization approach to the p-median problem.” *Environment and Planning B*, 39: 755-774.

Xiao, N., and Armstrong, M.P. 2012. “Towards a multiobjective view of cartographic design.” *Cartography and Geographic Information Science*, 39(2): 76-87.

Xiao, N. and Chun, Y. 2009. “Visualizing migration flows using kriskograms.” *Cartography and Geographical Information Science*, 36(2): 183-191.

Xiao, N. 2008. “A unified conceptual framework for geographical optimization using evolutionary algorithms.” *Annals of the Association of American Geographers*, 98(4): 795-817.

Curriculum and Pedagogical Developments

GIS Programming and Algorithms. Prior to 2015, our GIS major had not had systematical and rigorous training in coding in the curriculum. The GIS Programming and Algorithms class (GEOG 5222) was developed to fill in the gap and to help students develop their confidence in using computer code to complete the common operations that they would otherwise do using commercial software packages as a black-box. I wrote a book (*GIS Algorithms* by Sage Publications) and developed a github repository (github.com/gisalgs) for code and other applications for students and instructors around the world to use.

Web-based GIS. In Spring 2008, I started to offer a class with a focus on the use of web-based technologies to visualize and process geographic information. While this class has gone under different course numbers (GEOG 688, 687, 787, 5201, and 8200), its core curriculum has evolved and matured over the years under the title of web-based GIS. This class is designed to introduce the most recent advances in the area of GIS design and implementation on the web. Now this is formally included in the Master of GIST curriculum.

Graduate Students Advising

PhD Chair: 5 completed, 2 current
PhD Committee: 34 completed, 3 current
Masters Chair: 8 completed
Masters Committee: 21 completed

Services

Chair, Graduate Studies Committee, Department of Geography, OSU, 2019-present.
Associate Director, Center for Urban and Regional Analysis (CURA), OSU, 2018-present.

Appendix 6. Fiscal Impact Statement

	Year 1	Year 2	Year 3	Year 4
Projected Enrollment				
Head-count full time	5	10	15	20
Head-count part time	2	2	2	2
Full Time Equivalent (FTE) enrollment	6	11	16	21
Projected Program Income				
Tuition (paid by student or sponsor)	$71,568	$131,208	$190,848	$250,488
Externally funded stipends, as applicable				
Expected state subsidy				
Other income (if applicable, describe in narrative section below)	$77,856	$142,736	$207,616	$272,496
TOTAL PROJECTED PROGRAM INCOME:	$149,424	$273,944	$398,464	$522,984
Program Expenses				
New Personnel • Faculty (e.g. tenure-track, clinical, professional) Full _2___ Part Time ____ • Non-instruction (indicate role(s) in narrative section below) Full ____ Part time ____	$103,355 1.0 FTE Clinical Faculty	$106,456 1.0 FTE Clinical Faculty	$109,650 1.0 FTE Clinical Faculty $87,587 1.0 FTE Lecturer	$112,940 1.0 FTE Clinical Faculty $90,215 1.0 FTE Lecturer
New facilities/building/space renovation (if applicable, describe in narrative section below)				
Tuition Scholarship Support (if applicable, describe in narrative section below)				
Stipend Support (if applicable, describe in narrative section below)				
Additional library resources (if applicable, describe in narrative section below)				
Additional technology or equipment needs (if applicable, describe in narrative section below)				
Other expenses (e.g., Waived Tuition and Fees, travel, office supplies, accreditation costs) (if applicable, describe in narrative section below)				
TOTAL PROJECTED EXPENSE:	$103,355	$106,456	$197,237	$203,155
NET	$46,069	$167,488	$201,227	$319,829

Budget Narrative: We assume 50% of the enrollment are non-residents. Non-resident fees are listed as "other income." Salaries include a 3% AMCP increase per year.

Appendix 7. Market analysis

Program Overview

Geographic Information Science and Cartography

Emsi Q2 2019 Data Set

May 2019

Ohio

Parameters

Programs

Code	Description
45.0702	Geographic Information Science and Cartography

Regions

Code	Description
0	United States

Program Modality

Distance Offered Programs

Education Level

Any

Completions Year

2017

Jobs Timeframe

2018 - 2023

Job Postings Timeframe

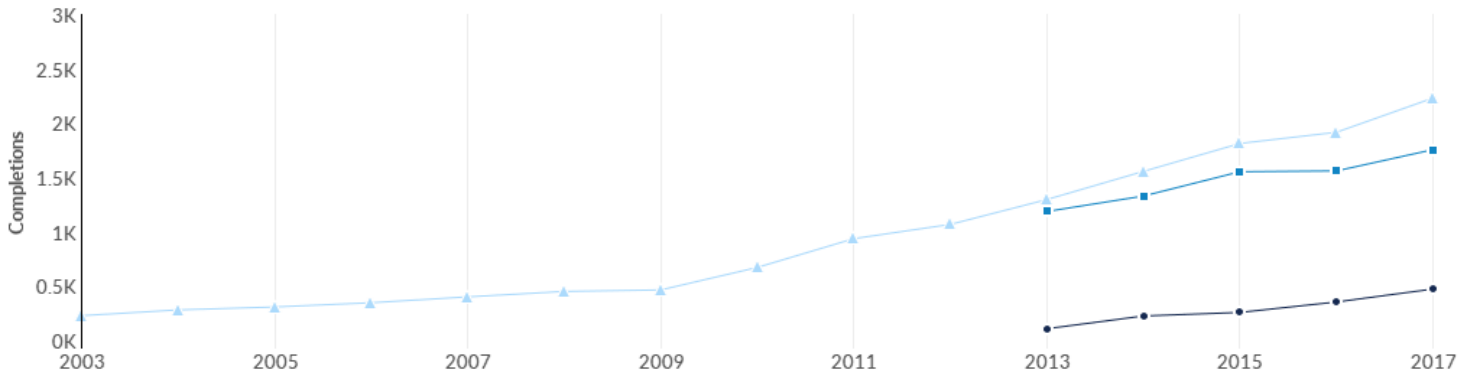
Sep 2016 - Feb 2018

Program Overview

	Completions (2017)	% Completions	Institutions (2017)	% Institutions
All Programs	2,233	100%	208	100%
Distance Offered Programs	475	21%	27	13%
Non-Distance Offered Programs	1,758	79%	155	75%

Institution	Distance Offered Completions (2017)	Growth % YOY (2017)	Market Share (2017)
University of Southern California	71	16.4%	14.9%
University of Utah	57	Insf. Data	12.0%
University of Arizona	52	23.8%	10.9%
Oregon State University	50	-15.3%	10.5%
University of Kentucky	37	Insf. Data	7.8%
American Sentinel University	20	-41.2%	4.2%
Northern Arizona University	20	17.6%	4.2%
Eastern Washington University	20	-4.8%	4.2%
University of Denver	18	Insf. Data	3.8%
Northwest Missouri State University	17	-48.5%	3.6%
Itasca Community College	14	0.0%	2.9%
Columbus State Community College	13	Insf. Data	2.7%
University of Central Arkansas	12	300.0%	2.5%
Southeast Community College Area	11	22.2%	2.3%
University of Connecticut	10	100.0%	2.1%
Collin County Community College District	9	-35.7%	1.9%
West Chester University of Pennsylvania	8	700.0%	1.7%
Roane State Community College	6	20.0%	1.3%
Michigan Technological University	6	-14.3%	1.3%
Community College of Philadelphia	5	Insf. Data	1.1%
Tennessee State University	4	300.0%	0.8%
Central Georgia Technical College	4	33.3%	0.8%
Kennesaw State University	4	300.0%	0.8%
Harrisburg Area Community College	3	50.0%	0.6%
Auburn University at Montgomery	2	-66.7%	0.4%
Loma Linda University	1	-50.0%	0.2%
University of Arkansas	1	Insf. Data	0.2%

Regional Trends



	2013 Completions	2017 Completions	% Change
Distance Offered Programs	110	475	+331.8%
Non-Distance Offered Programs	1,189	1,758	+47.9%
All Programs	1,299	2,233	+71.9%

Regional Completions by Award Level

Award Level	Distance Offered Completions (2017)	Percent
Award of less than 1 academic year	74	15.6%
Award of at least 1 but less than 2 academic years	11	2.3%
Associate's Degree	10	2.1%
Bachelor's Degree	42	8.8%
Postbaccalaureate certificate	136	28.6%
Master's Degree	163	34.3%
Post-masters certificate	34	7.2%
Doctor's Degree	5	1.1%
Award of at least 2 but less than 4 academic years	0	0.0%

Similar Programs

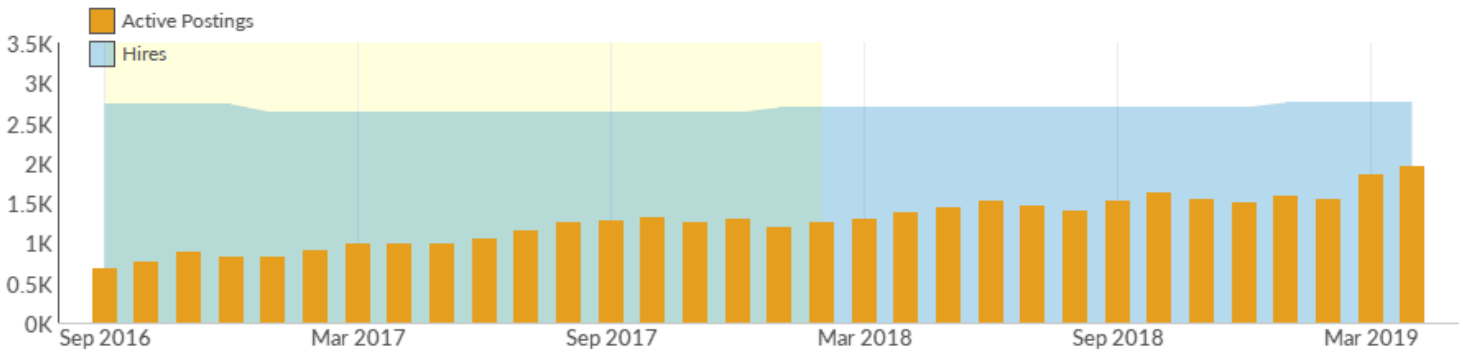
2	306
Programs (2017)	Completions (2017)

CIP Code	Program	Distance Offered Completions (2017)
15.0000	Engineering Technology, General	260
15.1102	Surveying Technology/Surveying	46

Job Postings vs. Hires

1,054	2,666
Avg. Monthly Postings (Sep 2016 - Feb 2018)	Avg. Monthly Hires (Sep 2016 - Feb 2018)

In an average month, there were **1,054** active job postings for *2 Occupations*, and **2,666** actually hired. This means there were approximately 3 hires for *2 Occupations* for every 1 active job posting.



Occupation	Avg Monthly Postings (Sep 2016 - Feb 2018)	Avg Monthly Hires (Sep 2016 - Feb 2018)
Surveying and Mapping Technicians	955	2,150
Cartographers and Photogrammetrists	99	517

Job Postings Summary

7,168	4 : 1	32 days
Unique Postings	**Posting Intensity**	**Median Posting Duration**
27,742 Total Postings	Regional Average: 4 : 1	Regional Average: 31 days

There were **27,742** total job postings for your selection from September 2016 to February 2018, of which **7,168** were unique. These numbers give us a Posting Intensity of **4-to-1**, meaning that for every 4 postings there is 1 unique job posting.

This is close to the Posting Intensity for all other occupations and companies in the region (4-to-1), indicating that they are putting average effort toward hiring for this position.

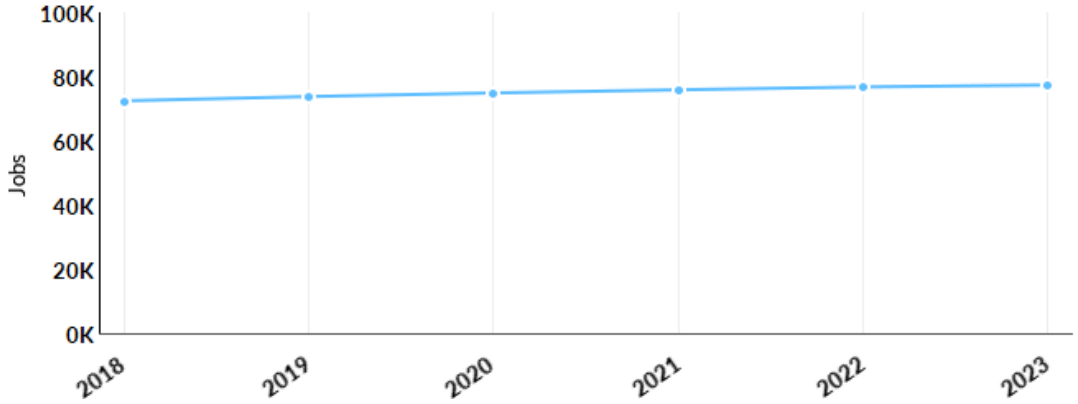
Target Occupations

72,397	+6.8%	$23.16/hr	8,418
Jobs (2018)	**% Change (2018-2023)**	**Median Hourly Earnings**	**Annual Openings**

Occupation	2018 Jobs	Annual Openings	Median Hourly Earnings	Growth (2018 - 2023)
Surveying and Mapping Technicians	58,173	7,106	$21.64/hr	+6.23%
Cartographers and Photogrammetrists	14,224	1,312	$30.56/hr	+9.10%

Growth

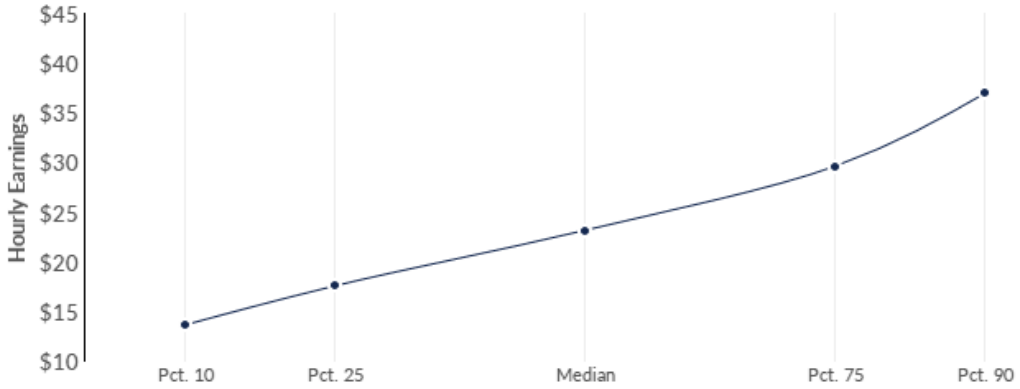
72,397	77,314	4,917	6.8%
2018 Jobs	2023 Jobs	Change (2018-2023)	% Change (2018-2023)



Occupation	2018 Jobs	2023 Jobs	Change	% Change
Cartographers and Photogrammetrists (17-1021)	14,224	15,518	1,294	9%
Surveying and Mapping Technicians (17-3031)	58,173	61,797	3,624	6%

Percentile Earnings

$17.56/hr	$23.16/hr	$29.61/hr
25th Percentile Earnings	Median Earnings	75th Percentile Earnings



Occupation	25th Percentile Earnings	Median Earnings	75th Percentile Earnings
Cartographers and Photogrammetrists (17-1021)	$24.24	$30.56	$38.90
Surveying and Mapping Technicians (17-3031)	$16.50	$21.64	$27.43

Top Companies Posting

Company	Total/Unique (Sep 2016 - Feb 2018)	Posting Intensity	Median Posting Duration
Aerotek, Inc.	1,697 / 279	6 : 1	15 days
Dewberry Consultants LLC	549 / 158	3 : 1	59 days
CARDNO LIMITED	664 / 111	6 : 1	65 days
BAE SYSTEMS PLC	568 / 98	6 : 1	66 days
Surveying and Mapping, Inc.	657 / 93	7 : 1	38 days
Stantec Inc.	324 / 88	4 : 1	46 days
Hatch Mott Macdonald, LLC	453 / 82	6 : 1	36 days
David Evans and Associates, Inc.	171 / 79	2 : 1	55 days
Bowman Consulting Group, Ltd.	184 / 76	2 : 1	45 days
McKim & Creed, Inc.	121 / 72	2 : 1	32 days
Timmons Group, Inc	180 / 65	3 : 1	41 days
Booz Allen Hamilton Holding Corporation	447 / 55	8 : 1	30 days
AMEC CONSTRUCTION LTD	263 / 53	5 : 1	39 days
Aecom	433 / 52	8 : 1	38 days
Arcadis U.S., Inc.	171 / 52	3 : 1	59 days
Pacific Gas and Electric Company	181 / 51	4 : 1	19 days
United States Department of the Army	142 / 49	3 : 1	14 days
Vanasse Hangen Brustlin Inc.	146 / 47	3 : 1	47 days
The Interior Company Inc	60 / 45	1 : 1	88 days
WS ATKINS PLC	85 / 44	2 : 1	75 days
Jacobs Engineering Group Inc.	181 / 41	4 : 1	56 days
Maser Consulting P.A.	127 / 41	3 : 1	53 days
Summit Design and Engineering Services, Pllc	252 / 40	6 : 1	48 days
Halff Associates, Inc.	130 / 39	3 : 1	49 days
Pennoni Associates Inc.	261 / 37	7 : 1	61 days
Psomas	184 / 37	5 : 1	50 days

TRC Companies, Inc.	139 / 37	4 : 1	45 days
Woolpert, Inc.	142 / 37	4 : 1	17 days
Huitt - Zollars, Inc.	205 / 36	6 : 1	41 days
Macdonald Mott Inc	140 / 36	4 : 1	38 days
Merrick & Company	93 / 35	3 : 1	33 days
Westwood Professional Services, Inc.	73 / 32	2 : 1	31 days
Langan Engineering and Environmental Services, Inc.	478 / 31	15 : 1	42 days
Sam	371 / 30	12 : 1	65 days
Larson Design Group, Inc.	153 / 29	5 : 1	50 days
Synerfac, Inc.	68 / 29	2 : 1	63 days
Michael Baker Corporation	77 / 28	3 : 1	49 days
Nana Regional Corporation, Inc.	113 / 28	4 : 1	59 days
Leidos Holdings, Inc.	215 / 27	8 : 1	56 days
Blackmon-Mooring Company	46 / 26	2 : 1	32 days
Federal Government	123 / 26	5 : 1	4 days
First American Financial Corporation	118 / 26	5 : 1	61 days
Pape-Dawson Engineers, Inc.	99 / 26	4 : 1	34 days
Parsons Brinckerhoff Group LLC	74 / 26	3 : 1	46 days
Pike Corporation	92 / 24	4 : 1	40 days
Surveying Co., Inc	130 / 24	5 : 1	20 days
Hunt, Guillot & Associates, L.L.C.	213 / 23	9 : 1	15 days
Kiewit Corporation	83 / 23	4 : 1	55 days
Nesco Resource	88 / 23	4 : 1	21 days
USDA Forest Service	42 / 23	2 : 1	9 days

Top Posted Job Titles

Job Title	Total/Unique (Sep 2016 - Feb 2018)	Posting Intensity	Median Posting Duration
Field Technicians (Architecture and Engineering)	8,071 / 2,057	4 : 1	33 days
Survey Party Chiefs	4,407 / 1,241	4 : 1	34 days
CAD Technicians	3,879 / 690	6 : 1	32 days
Surveyors	1,617 / 456	4 : 1	31 days
Instrumentation Technicians (Architecture and Engineering)	831 / 246	3 : 1	35 days
Cartographers	838 / 237	4 : 1	33 days
Civil Engineers	397 / 147	3 : 1	30 days
Instrument Designers	439 / 133	3 : 1	29 days
Entry Level Electrical Engineers	279 / 80	3 : 1	49 days
Quality Assurance Engineers (Architecture and Engineering)	362 / 64	6 : 1	29 days
Field Engineers (Architecture and Engineering)	208 / 61	3 : 1	54 days
Field Technicians (Life, Physical, and Social Science)	235 / 55	4 : 1	29 days
Geospatial Analysts	352 / 55	6 : 1	66 days
Interviewers	164 / 55	3 : 1	21 days
Engineering Technicians (Architecture and Engineering)	166 / 53	3 : 1	31 days
Operations Technicians (Architecture and Engineering)	152 / 50	3 : 1	44 days
Drafters	165 / 39	4 : 1	34 days
Construction Technicians (Architecture and Engineering)	107 / 36	3 : 1	23 days
Office Technicians	123 / 33	4 : 1	17 days
Environmental Services Technicians (Architecture and Engineering)	113 / 29	4 : 1	25 days
Technician Assistants	40 / 29	1 : 1	88 days
Geographic Information Systems (GIS) Analysts	282 / 28	10 : 1	58 days
Carpet Cleaning Technicians	47 / 27	2 : 1	3 days

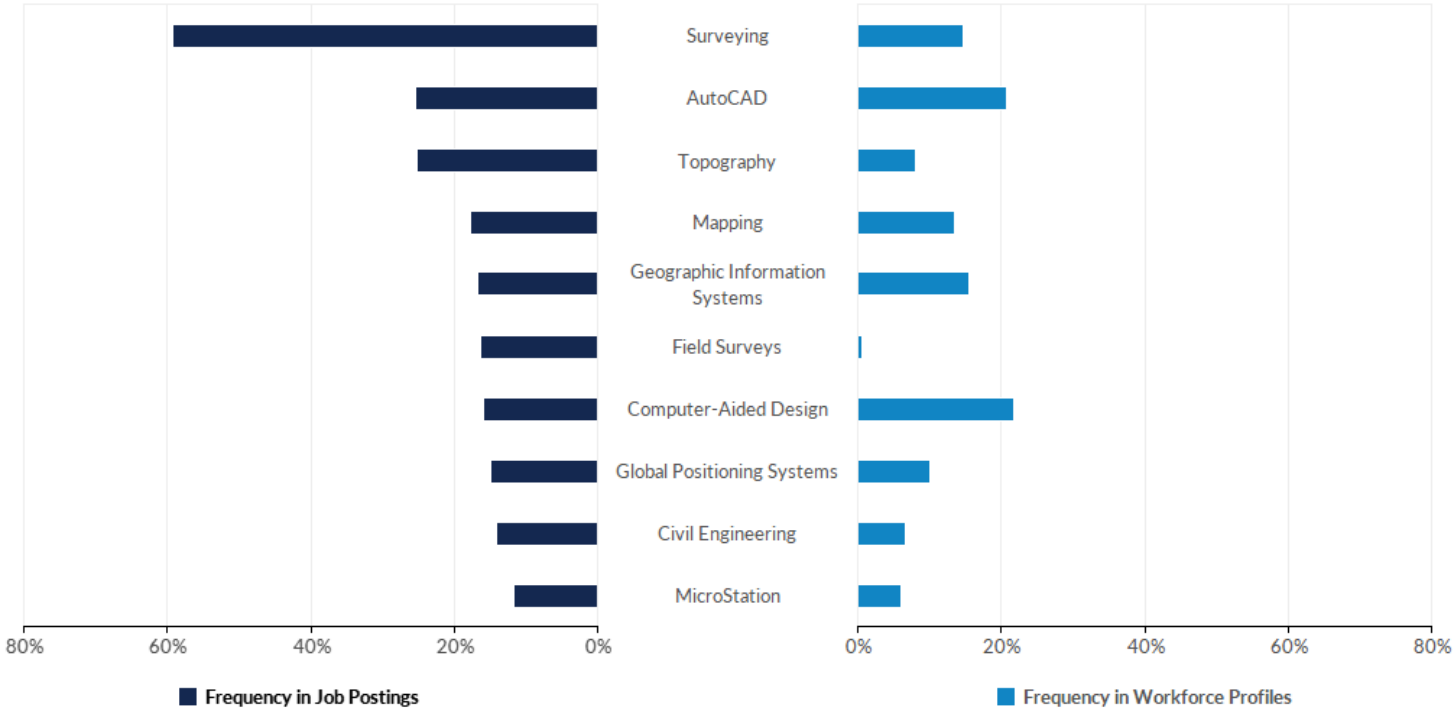
Engineering Interns	73 / 23	3 : 1	33 days
Quality Control Leads	92 / 23	4 : 1	22 days
Counterintelligence Officers (Protective Service)	49 / 21	2 : 1	6 days
Data Center Technicians	49 / 21	2 : 1	15 days
Geotechnical Engineers	146 / 21	7 : 1	58 days
Office Clerks	64 / 21	3 : 1	43 days
Digital Technicians	48 / 20	2 : 1	21 days
Pharmacy Technicians	110 / 20	6 : 1	34 days
Crew Leads	39 / 18	2 : 1	31 days
Data Entry Clerks	77 / 17	5 : 1	27 days
Project Administrative Staff	59 / 17	3 : 1	23 days
Research Analysts (Life, Physical, and Social Science)	65 / 17	4 : 1	29 days
Distribution Supervisors (Production)	38 / 16	2 : 1	63 days
Design Engineers (Architecture and Engineering)	62 / 15	4 : 1	19 days
Imagery Analysts	44 / 15	3 : 1	17 days
Maintenance Technicians (Architecture and Engineering)	62 / 14	4 : 1	18 days
Project Engineers (Architecture and Engineering)	27 / 14	2 : 1	86 days
Project Managers (Computer and Mathematical)	77 / 14	6 : 1	45 days
Computer Aided Design (CAD) Technicians	33 / 13	3 : 1	26 days
Electronics Technicians	37 / 13	3 : 1	44 days
Clinical Documentation Specialists	39 / 12	3 : 1	12 days
Crew Chiefs (Installation, Maintenance, and Repair)	41 / 12	3 : 1	15 days
Environmental Engineers	60 / 12	5 : 1	17 days
GIS Analysts	49 / 12	4 : 1	39 days
Human Resources Assistants	69 / 12	6 : 1	13 days
Statisticians	23 / 12	2 : 1	32 days

Equipment Technicians (Installation, Maintenance, and Repair)	21 / 11	2 : 1 	24 days

The following provides insight into the supply and demand of relevant skills by comparing the frequency of skills present in job postings against skills present in today's workforce. Along with Emsi's job posting analytics, this comparison leverages Emsi's dataset of more than 100M online resumés and profiles. All resumés and profiles used in these comparisons have been updated within the last three years.

**The skills associated with workforce profiles represent workers of all education and experience levels.*

Top Hard Skills



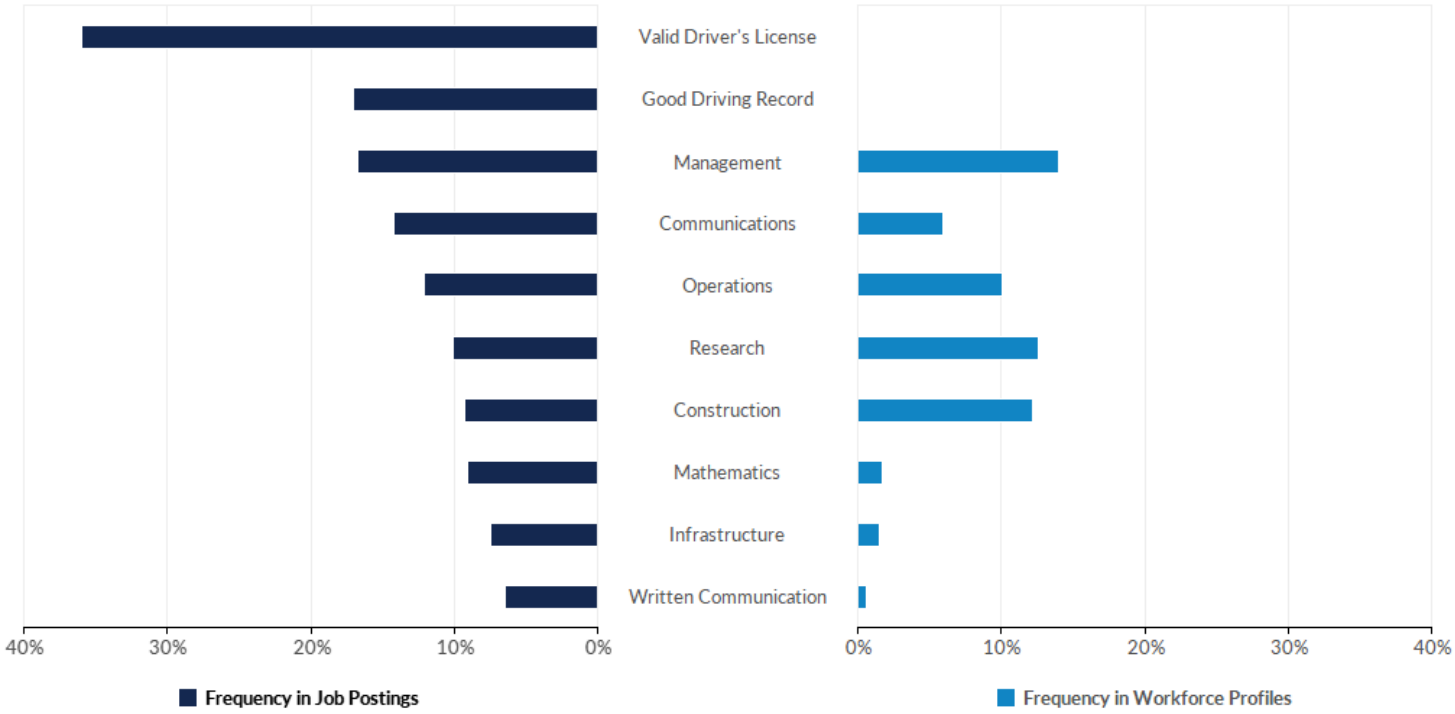
Top Hard Skills

Skill	Frequency in Postings	Postings with Skill / Total Postings (Sep 2016 - Feb 2018)	Frequency in Profiles	Profiles with Skill / Total Profiles (2017 - 2019)
Surveying	59%	4,249 / 7,168	15%	480 / 3,253
AutoCAD	25%	1,816 / 7,168	21%	678 / 3,253
Topography	25%	1,808 / 7,168	8%	265 / 3,253
Mapping	18%	1,272 / 7,168	13%	439 / 3,253
Geographic Information Systems	17%	1,195 / 7,168	15%	502 / 3,253
Field Surveys	16%	1,168 / 7,168	1%	20 / 3,253
Computer-Aided Design	16%	1,144 / 7,168	22%	707 / 3,253
Global Positioning Systems	15%	1,074 / 7,168	10%	329 / 3,253

Civil Engineering	14%	1,014 / 7,168	7%	216 / 3,253
MicroStation	12%	833 / 7,168	6%	198 / 3,253
Total Station	11%	824 / 7,168	3%	113 / 3,253
Elevation	9%	654 / 7,168	4%	124 / 3,253
ArcGIS (GIS Software)	7%	516 / 7,168	11%	351 / 3,253
Trigonometry	7%	514 / 7,168	0%	12 / 3,253
Geometry	7%	502 / 7,168	0%	10 / 3,253
Land Development	7%	472 / 7,168	4%	135 / 3,253
Data Collection	7%	468 / 7,168	3%	98 / 3,253
Laser Scanning	6%	436 / 7,168	1%	18 / 3,253
Professional Services	6%	414 / 7,168	0%	9 / 3,253
Cartography	5%	386 / 7,168	9%	285 / 3,253
Land Surveyor In Training	4%	305 / 7,168	0%	0 / 3,253
Algebra	4%	275 / 7,168	0%	13 / 3,253
Lidar	4%	270 / 7,168	3%	87 / 3,253
Construction Management	4%	251 / 7,168	3%	99 / 3,253
Product Quality Assurance	3%	238 / 7,168	2%	76 / 3,253
Hydrographic Survey	3%	235 / 7,168	0%	15 / 3,253
Landscape Architecture	3%	231 / 7,168	0%	4 / 3,253
Profit Sharing	3%	225 / 7,168	0%	0 / 3,253
Remote Sensing	3%	209 / 7,168	3%	103 / 3,253
GPS Navigation Devices	3%	205 / 7,168	0%	6 / 3,253
Surveys	3%	203 / 7,168	6%	188 / 3,253
Data Processing	3%	201 / 7,168	0%	11 / 3,253
Survey Methodologies	3%	197 / 7,168	2%	73 / 3,253
Calculations	3%	187 / 7,168	1%	22 / 3,253
Disability Insurance	3%	184 / 7,168	0%	0 / 3,253
Engineering Design Process	2%	178 / 7,168	1%	43 / 3,253

Personal Protective Equipment	2%	177 / 7,168	0%	13 / 3,253
Subsurface Utility Engineering	2%	177 / 7,168	0%	0 / 3,253
Microsoft Access	2%	171 / 7,168	5%	165 / 3,253
Oil And Gas	2%	168 / 7,168	2%	49 / 3,253
Information Systems	2%	164 / 7,168	0%	13 / 3,253
Stereophonic Sound System	2%	161 / 7,168	0%	0 / 3,253
Photogrammetry	2%	160 / 7,168	1%	45 / 3,253
Digital Data	2%	159 / 7,168	0%	0 / 3,253
Strategic Partnership	2%	153 / 7,168	0%	0 / 3,253
Digital Mapping	2%	152 / 7,168	1%	23 / 3,253
Geospatial Analysis	2%	147 / 7,168	0%	15 / 3,253
Geography	2%	145 / 7,168	3%	89 / 3,253
Coordinate Geometry	2%	142 / 7,168	0%	0 / 3,253
Aerial Photography	2%	141 / 7,168	1%	39 / 3,253

Top Common Skills



Top Common Skills

Skill	Frequency in Postings	Postings with Skill / Total Postings (Sep 2016 - Feb 2018)	Frequency in Profiles	Profiles with Skill / Total Profiles (2017 - 2019)
Valid Driver's License	36%	2,576 / 7,168	0%	0 / 3,253
Good Driving Record	17%	1,217 / 7,168	0%	0 / 3,253
Management	17%	1,201 / 7,168	14%	455 / 3,253
Communications	14%	1,019 / 7,168	6%	195 / 3,253
Operations	12%	868 / 7,168	10%	327 / 3,253
Research	10%	724 / 7,168	13%	411 / 3,253
Construction	9%	664 / 7,168	12%	398 / 3,253
Mathematics	9%	653 / 7,168	2%	55 / 3,253
Infrastructure	7%	536 / 7,168	2%	50 / 3,253
Written Communication	6%	462 / 7,168	1%	21 / 3,253
Detail Oriented	6%	460 / 7,168	0%	0 / 3,253
Innovation	5%	387 / 7,168	1%	27 / 3,253

Microsoft Office	5%	379 / 7,168	18%	585 / 3,253
Verbal Communication Skills	4%	300 / 7,168	0%	9 / 3,253
Computer Literacy	4%	298 / 7,168	2%	63 / 3,253
Interpersonal Skills	4%	290 / 7,168	1%	30 / 3,253
Problem Solving	4%	279 / 7,168	5%	153 / 3,253
Microsoft Excel	4%	264 / 7,168	18%	582 / 3,253
Writing	3%	230 / 7,168	3%	86 / 3,253
Office Suite	3%	215 / 7,168	0%	6 / 3,253
Program Management	3%	204 / 7,168	1%	44 / 3,253
Investigation	3%	193 / 7,168	1%	18 / 3,253
Microsoft Outlook	2%	176 / 7,168	5%	155 / 3,253
Information Technology	2%	172 / 7,168	2%	81 / 3,253
Leadership	2%	164 / 7,168	13%	427 / 3,253
Fine Motor Skills	2%	160 / 7,168	0%	1 / 3,253
Spreadsheets	2%	147 / 7,168	1%	33 / 3,253
Word Processor	2%	136 / 7,168	0%	12 / 3,253
Coordinating	2%	134 / 7,168	3%	94 / 3,253
Customer Service	2%	119 / 7,168	14%	462 / 3,253
Career Development	2%	117 / 7,168	0%	7 / 3,253
Time Management	2%	117 / 7,168	4%	135 / 3,253
Spanish Language	2%	113 / 7,168	2%	59 / 3,253
English Language	2%	109 / 7,168	3%	95 / 3,253
Punctuality	1%	105 / 7,168	0%	2 / 3,253
Real Estates	1%	103 / 7,168	1%	27 / 3,253
Mentorship	1%	98 / 7,168	1%	40 / 3,253
Training And Development	1%	97 / 7,168	1%	34 / 3,253
Physics	1%	97 / 7,168	1%	26 / 3,253
Presentations	1%	92 / 7,168	3%	91 / 3,253

Creativity	1%	89 / 7,168	0%	0 / 3,253
Microsoft PowerPoint	1%	86 / 7,168	11%	354 / 3,253
Reliability	1%	85 / 7,168	0%	4 / 3,253
Chinese Language	1%	80 / 7,168	0%	6 / 3,253
Microsoft Windows	1%	76 / 7,168	4%	120 / 3,253
Map Reading	1%	73 / 7,168	0%	0 / 3,253
Decision Making	1%	70 / 7,168	1%	36 / 3,253
Microsoft Word	1%	65 / 7,168	12%	384 / 3,253
Quality Assurance	1%	65 / 7,168	2%	67 / 3,253
Microsoft Internet Explorer	1%	64 / 7,168	0%	1 / 3,253

Top Qualifications

Qualification	Postings with Qualification
Certified Survey Technician	84
Certified Benefits Professional	33
Certified First Responder	31
Professional Engineer	19
Transportation Worker Identification Credential (TWIC) Card	19
Drone Pilot Certificate	13
Licensed Professional Engineer	13
Certified Photogrammetrist	11
CompTIA Security+	8
Certified Nurse Practitioner	8
Licensed Vocational Nurses	7
Commercial Driver's License (CDL)	7
Certified Internal Auditor	5
Certified Safety Professional	4
CompTIA A+	4
Advanced Life Support	3
Certified Mapping Scientist	3
Certified Instrumentation Specialist	3
Certified Application Counselor	3
Certified Medication Technician	3
Cisco Certified Design Associate	2
CompTIA Network+	2
Certified Veterinary Technician	2
LEED Accredited Professional (AP)	1
Certified Information Systems Security Professional	1
Certified Lodging Security Supervisor	1
Certified Novell Engineer	1

Certified Nursing Assistant	1
Certified Public Accountant	1
Chartered Financial Analyst	1
Certified Financial Risk Management	1
Microsoft Certified Professional	1
Nurse Practitioner	1
Project Management Professional Certification	1
Professional Wetland Scientist	1
System Operator Certification	1
Certified Residential Specialist	1

Appendix A - Data Sources and Calculations

Institution Data

The institution data in this report is taken directly from the national IPEDS database published by the U.S. Department of Education's National Center for Education Statistics.

Emsi Job Postings

Job postings are collected from various sources and processed/enriched to provide information such as standardized company name, occupation, skills, and geography.

Occupation Data

Emsi occupation employment data are based on final Emsi industry data and final Emsi staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates also affected by county-level Emsi earnings by industry.

Location Quotient

Location quotient (LQ) is a way of quantifying how concentrated a particular industry, cluster, occupation, or demographic group is in a region as compared to the nation. It can reveal what makes a particular region unique in comparison to the national average.

State Data Sources

This report uses state data from the following agencies: Alabama Department of Industrial Relations; Alaska Department of Labor and Workforce Development; Arizona Department of Administration, Office of Employment and Population Statistics; Arkansas Department of Workforce Services; California Labor Market Information Department; Colorado Department of Labor and Employment; Connecticut did not provide us with a data source; Delaware Office of Occupational and Labor Market Information, Delaware Wages 2004; District of Columbia Department of Employment Services; Florida Department of Economic Opportunity; Georgia Department of Labor, Workforce Information and Analysis, Occupational Information Services Unit; Hawaii Department of Labor and Industrial Relations, Research and Statistics Office; Idaho Department of Labor; Illinois Department of Employment Security, Employment Projections; Indiana Department of Workforce Development; Iowa Workforce Development; Kansas Department of Labor, Labor Market Information Services, Kansas Wage Survey; Kentucky Office of Employment and Training; Louisiana Department of Labor; Maine did not provide us with a data source; Maryland Department of Labor, Licensing and Regulation, Office of Labor Market Analysis and Information; Massachusetts Executive Office of Labor and Workforce Development; Michigan Department of Labor and Economic Growth, Bureau of Labor Market Information and Strategic Initiatives; Minnesota Department of Employment and Economic Development; Mississippi Department of Employment Security; Missouri Department of Economic Development; Montana Department of Labor and Industry, Research and Analysis Bureau; Nebraska Workforce Development; Nevada Department of Employment, Training and Rehabilitation, Information Development and Processing Division, Research and Analysis Bureau; New Hampshire Department of Employment Security; New Jersey Department of Labor and Workforce Development; New Mexico Department of Labor, Bureau of Economic Research and Analysis; New York Department of Labor, Division of Research and Statistics; North Carolina Department of Commerce, Labor and Economic Analysis Division; North Dakota Job Service, Labor Market Information Center; Ohio Department of Job and Family Services, Labor Market Information Division; Oklahoma Employment Security Commission; Oregon Employment Department, Oregon Labor Market Information System; Pennsylvania Department of Labor and Industry, Center for Workforce Information and Analysis; Rhode Island did not provide us with a data source; South Carolina Employment Security Commission, Labor Market Information Department; South Dakota Department of Labor, Labor Market Information Division; Tennessee Department of Labor and Workforce Development, Research and Statistics Division; Texas Workforce Commission; Utah Department of Workforce Services; Vermont did not provide us with a data source; Virginia Employment Commission, Economic Information Services; Washington State Employment Security Department, Labor Market and Economic Analysis Branch; West Virginia Bureau of Employment Programs, Research Information & Analysis Division; Wisconsin Department of Workforce Development, Bureau of Workforce Information; Wyoming Department of Employment, Research and Planning

Appendix 8. CCGS Online/Blended Delivery Form

Ohio | Department of Higher Education

Mike DeWine, Governor
Randy Gardner, Chancellor

CHANGE REQUEST FORM
ONLINE OR BLENDED/HYBRID DELIVERY

This form must be used when a CCGS member institution intends to deliver 50% or more of a degree program via electronic or other distance learning means. This form should be used when changing delivery modes of a previously approved program, or as supplemental information when seeking approval for a new program that proposes to use this delivery mode.

This form must be submitted through the institution's CCGS representative. In order to ensure sufficient time for review, please submit all requests **at least four weeks prior to an upcoming meeting of the CCGS**. Documents may be submitted as PDF or Microsoft Office documents (e.g., Word or Excel).

Institution offering the degree program: The Ohio State University

Degree designation (*e.g. M.S. in Biotechnology*): Master of Geographic Information Science and Technology

In order to make this request, please confirm that the program will satisfy the following criteria:

☒ Program will use Quality Matters or similar metric-driven online course design/assessment tools

☒ All instructors will be trained in offering online content and online assessments

☒ The offering university has an institutionally approved plan for securing authorizations to deliver distance learning content in other states (e.g., NC-SARA membership).

☒ The offering university has approved all online courses for this program as academically appropriate for graduate study

Is this degree program subject to approval/accreditation by a governing body beyond ODHE and HLC (e.g., CAEP, CCNE, ABET, AACSB)?

☒ No

☐ Yes (*If yes, please name the accrediting body here.)*

Does this degree program include the creation of original research or scholarship?

☒ No

☐ Yes (*If yes, please complete question 1 on the following Supplementary Information form.)*

Does this degree program include an experiential component (e.g., clinical or professional development experience)?

☒ No

☐ Yes (*If yes, please complete question 2 on the following Supplementary Information form.)*

Will the program be offered in partnership with a third-party commercial on-line service provider?

☒ No

☐ Yes (*If yes, please provide name of provider and their responsibilities [e.g., content creation, recruitment, admissions, advising])*

Approximately what percentage of program content will be completed on-line? __100%_____

The person listed below verifies that this request has received the necessary institutional approvals and that the above information is truthful and accurate.

_____
Signature (Chief Academic Officer or Delegate – e.g., Graduate Dean)

_____
Typed Name & Title

_____
Date of Approval

SUPPLEMENTARY INFORMATION FORM

1.) ***A.*** *On a separate page, describe how program faculty will oversee and direct original research performed by students in the program. At a minimum, address the following areas:*

- *how students will gain access to required facilities and resources*
- *how students will be trained in necessary procedures*
- *how students will present their progress*
- *how the progress and quality of student projects will be assessed*

Include any additional information needed to provide assurance that the quality of the research performed will be equivalent to the face-to-face offering of this degree.

All the courses in the proposed program will have an approved online version. For students in the online program, we will require them to have their own computers. All the necessary software and database management systems will be provided to them through site licenses managed by the Ohio State University.

Most of the courses in the proposed program include final projects that will help students develop their research experience. Specifically, students will demonstrate their research in the capstone project course (GEOG 6299) where they articulate the problem, identify the methods to solve the problem, analyze the problem, and finally present the findings to the public. The capstone is the last course students will take in the program and at this point they should have already been trained to understand the necessary methods and procedures, as well as the ecosystem of the project (data, agencies, software, users and stakeholders, etc.). To take on the capstone project, students are required to work with a faculty advisor who will help guide the project. The quality of the project is evaluated by a written document and a public presentation. The latter will also be peer reviewed.

We will use an individual development plan (IDP) to help students make good progress. As already discussed in the main text of the proposal, the IDP covers important goals and needs of each student, including research, professional development, coursework, job market prospects, and communication skills. Each goal and need require a timeline and a plan about how to achieve it. This is a proven approach to success for graduate students. The graduate studies committee and its subcommittee for this program will review the IDP of each student and will communicate with the students with our feedback about their progress.

B. *On a separate page, describe how program faculty will mentor students, and how students will participate in the socialization that is necessary for the effective scholarly exchange of ideas at the level appropriate for the degree sought. At a minimum, address the following areas:*

- *how students will select a primary mentor and members of any required oversight committee*
- *frequency of any mandatory interactions between program faculty and students*
- *opportunities that exist for students to develop and refine ideas through scholarly exchange with faculty and others in the field*
- *career development opportunities will be provided*

Include any additional information needed to provide assurance that student mentoring will be effective and assure professional competence and exposure in the field.

The proposed is a professional degree and the students in the program are not required to have a committee. A faculty member will serve as the advisor to supervise students' progress. The advisor will work with the students on their IDP (see above) to closely monitor their progress.

Students are required to meet with the advisors at least twice in an academic year through the process of the IDP: at the beginning of the year to discuss the goals and needs, and at the end of the year to review progress. During the capstone project, students are also required to discuss with the advisor more frequently, though the actual frequency may vary, based on a schedule agreed upon between the student and the advisor.

The department runs a regular colloquium series (given by invited guest speakers) and a graduate colloquium series (given by current graduate students). All graduate students in the proposed program will be required to participate in these events. We have the technology to make these events accessible to students in the online program.

All students will take a required course of GIST Professionalism and Ethics (GEOG 5101). This course requires students to develop their professional profile and interview a professional.