

# GEO391 (Research Techniques)

Winter Quarter 2014 | Department of Geography | DePaul University

Time: Mon/Wed 4:20-5:50 pm

Location: SAC 224 (GIS Lab), LPC

## 1. Instructors

- Instructor: Sungsoon (Julie) Hwang (home page: <http://gis.depaul.edu/shwang/>; email: [shwang9@depaul.edu](mailto:shwang9@depaul.edu); phone: (773)325-8668; office: 990 W Fullerton Room# 4513; office hours: Mon/Tue/Wed 2-3 pm or by appointment)
- Teaching assistant: Peter Collins (email: [PCOLL14@mail.depaul.edu](mailto:PCOLL14@mail.depaul.edu); lab hours: TBA)

## 2. Course description

GEO391 provides an introduction to basic research methods and analytical techniques in geography. We will largely focus on statistical data analysis after getting an overview of research concepts and methods. Topics include quantitative and qualitative techniques which can be applied to the analysis of spatial phenomena. The course is divided into research concept & design, descriptive statistics, and inferential statistics applied to geographic problems. Prerequisite is GEO241 or instructor consent.

## 3. Learning Goals

- Understand what constitutes scientific approach to geographic research
- Understand how scientific research in geography is conducted, with focus on sampling, and data collection
- Learn to use statistics in summarizing variables
- Understand concepts of probability and hypothesis testing
- Comprehend inferential statistical tests to compare means (difference of means tests)
- Comprehend inferential statistical tests to examine relationships between variables (correlation)

## 4. Learning Outcomes—After completing all requirements of GEO 391, you should be able to

- Formulate a research question cogently, and devise research strategies appropriate for a research question
- Articulate relative strengths and weaknesses of different data collection methods—behavior observation, archives, and explicit report
- Calculate descriptive statistics, including mean, standard deviation, mean center, and standard distance
- Choose inferential statistical tests appropriate for a research question, test hypothesis, and interpret test results appropriately
- Critique a research appropriately with regard to validity and reliability

## 5. Course Readings and Required Materials

- Daniel R Montello and Paul C Sutton [MS], 2013, *An Introduction to Scientific Research Methods in Geography & Environmental Studies*, The Second Edition, Sage Publications (ISBN: 9781446200759) - required
- J. Chapman McGrew Jr. and Charles B Monroe [MM], 2000, *An Introduction to Statistical Problem Solving in Geography*, The Second Edition, Waveland Press (ISBN: 9781577666332) - required
- Calculator: you can use a calculator tool in your cell phone or in computers if you don't have a calculator

## 6. Course Outlines and Tentative Schedules

Date	Topic	In-class group exercises
1.06	Course overview	
1.08	1. Scientific approach to geography	1. Discuss the extent to which research is 'scientific' and 'geographic'
1.13	2. Research concepts and sampling	2. Identify constructs and cases, and devise sampling design given a research problem
1.15	3. Data collection methods	3. Discuss a relative strength and weakness of different data collection methods
1.20	4. Reliability and validity	4. Discuss the extent to which research is 'reliable' and 'valid'
1.22	5. Descriptive statistics	Mean, standard deviation
1.27		5. Calculate descriptive statistics manually and in SPSS
1.29	6. Descriptive spatial statistics	6. Calculate descriptive spatial statistics in ArcGIS
2.03	7. Probability	7. Calculate probability based on normal distribution
2.05	8. Hypothesis testing	8. Test hypothesis: sample mean difference test
2.10	9. Difference of means tests	Independent/dependent samples t-test
2.12		ANOVA
2.17		9. Conduct mean difference tests manually and in SPSS
2.19	10. Correlation	Pearson's correlation coefficient
2.24		10. Conduct correlation analysis manually and in SPSS
2.26	Project	Research proposal due
3.03	Project	
3.05	Project	
3.10	Project presentation	Report due
3.12	Project presentation	
3.19	<b>Final (2:45-5:00 pm)</b>	

## 7. Grading scheme

Components	Points (/100)	Description
Exercises	<b>30</b>	10 group exercises in class. Each exercise is worth 3 points
Exam	<b>30</b>	Comprehensive; closed-book
Project	<b>30</b>	Proposal (5) + presentation (5) + report (20)
Participation	<b>10</b>	Attendance, class discussion, and participation to group exercises

**Exercises:** 3 persons will be paired to work on exercises designed to reinforce concepts covered in readings and lectures. The format varies from reflecting on fundamental research concepts, calculating statistics manually, to interpreting analysis results in SPSS. If groups can't complete exercises in the class, it is expected that groups complete exercises on their own. I suggest you work with a lab assistant during lab hours. Unless noted otherwise, exercises are due on D2L in a week from the date when exercises are handed out.

**Exam:** There will be one comprehensive exam during a final exam week. Exam is closed-book. The format of a final exam will vary from writing an essay to conducting analysis in SPSS.

**Project:** You are to propose and conduct a mini geographic research amenable to quantitative analysis during the last two weeks of the quarter. You should submit one-page research proposal, and present your work before classmates. By week 10, submit a three-page report (excluding figures) that addresses the purpose of a study, research hypotheses, data collection, data analysis, and findings. Detailed guidelines will be provided later.

I recommend that you (a) choose a familiar topic so that you don't have to spend bulk of time in reviewing literature and familiarizing yourself with data; (b) focus on research questions that can be tested. For example, it will be easier to examine change in temperature than in religious views because temperature is more robust to measurement than religious views and temperature data is easy to collect (i.e., available from NOAA website). Project can be done either individually or in group.

In the previous quarter, students have written about whether diversity has increased or decreased by newly drawn wards boundary in Chicago, how abortion rates are associated with political affiliation in US States, whether Wicker Park has gentrified, and so on. Note that all these papers test one or more research hypotheses based on empirical data by employing an appropriate statistical technique.

The report will be graded on the basis of (a) appropriate uses of fundamental research concepts (e.g., research question is grounded in theory, appropriate research design strategies are selected, research design is reliable and valid); (b) appropriate uses of statistics (e.g., descriptive statistics is appropriately used; appropriate statistical tests are chosen; results are appropriately interpreted).

**Participation:** assigned according to the criteria below

- A (9 - 10) = Student is present in all or nearly class meetings, and prepared, at all times, to respond to questions. Student is an active participant in small group activities, in and out of class, and in class-time activities stays on task.
- B (8 - 9) = Student participates as above, 75% of the time.
- C (6.5 - 8) = Student does not volunteer comments; responses demonstrate vague familiarity with course readings. Student is a passive member of small group activities and/or does not stay on task during class-time activities.
- D (5 – 6.5) = Student never volunteers, cannot respond to direct questions, keeps silent during class discussions and is unable to summarize readings if asked.
- F (0-5) = Student misses many class sessions and/or sits silently in classes when present, or is disruptive and non-participatory in the classroom.

**Grading scale:** A = 93-100%; A- = 90-92.99%; B+ = 87-89.99%; B = 83-86.99%; B- = 80-82.99%; C+ = 77-79.99%; C = 73-76.99%; C- = 70-72.99%; D+ = 60-69.99%; D = 50-59.99%; F = 0-49.99%

**Late Work Policy:** Late work will be accepted with 20% of the total grade deducted for each day being late. Extensions can be requested if needed, but will be only granted if excused. This policy applies to exercises only. Although I will accommodate to ongoing progress in the class, if group exercises are not completed in class, it is expected that your group will complete exercises in time through collaboration outside of the class.

**Makeup Exam/Incomplete Grade Policy:** A makeup exam or an incomplete grade can be arranged or granted only when credible dire and documented medical or family situations arise and these circumstances are communicated in a timely fashion.

**Attendance/Absentee Policy:** Consistent with university's policy, all students are expected to attend class meetings. Unless absence is explained on medical or compassionate grounds (documentation is required), absence from any classes is grounds for a grade adjustment.

## 8. Detailed plan of the class: readings and learning objectives by module

### Module 1: Introduction to a Scientific Approach to Geography

Read chapter 1 of Montello and Sutton (MS1).

- Discuss what qualifies as *science*.
- Define geography as a discipline, and differentiate *regional* vs. *systematic* approach to geography
- Differentiate *positivistic* vs. *post-positivistic* approach to geography.

### Module 2: Research Concepts

Read MS2 (fundamental research concepts) and MS9 (sampling)

- Define terms used in research—*theory, hypothesis, model, construct, variable* and *case*.
- Differentiate four *levels of measurement*--*nominal, ordinal, interval, ratio*--with examples.
- Differentiate *population, sampling frame* and *sample*.
- Describe different *sampling design* (e.g., simple random sampling, stratified random sampling, cluster sampling) with both non-spatial and spatial sampling cases in mind.

### Module 3: Research Design: Data Collection Methods

Read MS4 (data collection), MS6 (behavioral observations and archives), and MS7 (explicit reports)

- Distinguish between *primary* data sources and *secondary* data sources.
- Differentiate *quantitative* methods and *qualitative* methods, and discuss strengths and weaknesses of each method.
- Describe different types of data collection in geographic research {*behavioral observation, archives, explicit reports, census*}, and discuss relative strengths and weaknesses of the respective method.
- What do *U.S. Census* data look like and how can they be obtained?

### Module 4: Reliability and Validity

Read MS12 (reliability and validity)

- Describe the difference between *precision* and *accuracy*.
- Define *reliability*, and discuss methods to improve reliability.
- Differentiate three types of *validity* (construct validity, internal validity, external validity) with examples.

### Module 5: Descriptive Statistics

Read chapter 3 of McGrew and Monroe (MM3)

- Describe measures of central tendency--*mode, median, and mean*--appropriate for data in different levels of measurement.
- Describe measures of dispersion--*interquartile range, mean deviation, variance, and standard deviation*.

### Module 6: Descriptive Spatial Statistics

Read MM4 (descriptive spatial statistics)

- Describe spatial measures of central tendency—*mean center, median center*
- Describe spatial measures of dispersion—*standard distance*

### Module 7: Probability

Read MM5 (probability): skim through binomial and Poisson distribution

- Describe probability terms and concepts—event, outcomes, relative frequency, rules of probability, and *probability distribution*
- Describe *z score*
- Describe characteristics and appropriate use of the *normal distribution*

### Module 8: Hypothesis Testing

Read MM7:97-99 (estimation in sampling) and MM8 (elements of inferential statistics)

- Describe basic concepts in hypothesis testing—*null hypothesis, type I error, significance level, test statistics, and p-value*
- Test hypothesis (sample difference of means test) using *p-value approach*

### Module 9: Mean Difference Tests

Read MM9 (two-sample and matched-pairs difference tests) and MM10 (three-or-more-sample difference tests)

- Describe objective and test statistic of *two-sample difference of means test* (aka. Independent samples t-test)
- Describe objective and test statistic of *matched-pairs difference test* (aka. Dependent samples t-test)
- Describe objective and test statistics of *ANOVA*

### Module 10: Correlation

Read MM13 (correlation)

- Describe different ways to conduct correlation analysis—graphing (*scatter plot*), mapping, and *correlation coefficient*
- Describe objective and test statistic of *Pearson correlation coefficient*

## **9. Miscellaneous**

**Academic Honesty and Plagiarism:** Academic honesty and integrity are expected at all times. Academic dishonesty, such as cheating or copying during exams, will be punished severely. Plagiarism – using someone else’s work without acknowledgment and, therefore, presenting their ideas or quotations as your own work – is strictly forbidden. DePaul University officials will be informed of any instance of academic dishonesty and notification will be placed in your file. Please read the DePaul Academic Integrity Resources page (<http://academicintegrity.depaul.edu/Resources/index.html>) for definitions and explanations of plagiarism and the University’s Academic Integrity expectations for students. Cutting and pasting text taken directly from a web-site without appropriate referencing and quotation marks is plagiarism and is forbidden. Submitting work that has any part cut and pasted directly from the internet is grounds for an automatic grade of zero.

**Accommodations:** Any student who requires assistance is asked to contact the University's Center for Students with Disabilities (CSD) (Phone 773/325-1677, TTY 773/325-7296, Fax 773/325-7396, <http://studentaffairs.depaul.edu/studentswithdisabilities>). They will be able to assist both student and faculty. If you have a condition that requires accommodation from the Productive Learning Strategies program (PLuS Program) please contact them at the Student Center room 370 (Phone 773/3251677 or online: <http://studentaffairs.depaul.edu/plus/>)

**University Center for Writing-Based Learning:** Collaborates with writers from all disciplines, backgrounds, levels of expertise, and roles within the University community. Their goal is to help develop better writers along with better writing and reflection through continual revision. If you need assistance with writing assignments, they can be contacted at: 773.325.4272 (LPC) or [wcenter@depaul.edu](mailto:wcenter@depaul.edu)

## **10. Department of Geography Learning Goals—GEO 391 addresses 1), 5), 6), and 7).**

Courses in the Department of Geography teach students:

- 1) Understand spatial patterns and processes of modification of the Earth's physical and cultural landscapes
  - a. As social constructions.
  - b. As systems that link the Earth with human society in interdependent, dialectical relationships, and
  - c. Through mapping and visualization.
- 2) Understand the concept of scale as a spatial phenomenon that ties the local, the regional, the national, the transnational, and the global in a system of interaction.
- 3) Understand the phenomenology of the discipline of Geography—most importantly, "space", "place", "landscape," "region," and "location".
- 4) Distinguish that spaces, places, and so on, may have both objective and subjective/symbolic dimensions.
- 5) Develop research and writing competences that would allow you to:
  - a. Formulate a cogent research question about the spatial character of a physical, socio-cultural, or environment-societal phenomenon,
  - b. Write about it in ways that reflect analytical and critical thinking, and
  - c. Ethical concern over social and environmental justice, consistent with the University's social mission.
- 6) Engage competently in qualitative and quantitative spatial analysis, and with exercises that are concerned with explaining spatial regularities (for example, the spatial calculus behind the location of retail commerce in Chicago, or transnational flows of capital).
- 7) Learn the basic utility and use competently one or more of the information technologies that are now redefining the logistical limits of spatial analysis: geographic information systems (GIS) and remote sensing.
- 8) Achieve greater general knowledge of the world, its regions, its physical systems, its cultures, and political-territorial divisions.