Applied Statistics for Public Service

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Office hours by appointment via email on Zoom or in-person

Teaching Philosophy

I aim to inspire students to become mission-driven public leaders who engage meaningfully with communities, uphold ethical standards, and apply evidence-based solutions to complex, real-world policy challenges. By emphasizing inclusive engagement, critical thinking, and applied learning, my teaching equips students with the analytical tools, ethical foundation, and practical problem-solving skills needed to lead effectively and equitably in today's dynamic governance landscape.

Course Overview

Statistics is the study of how best to collect, analyze, and draw conclusions from data to solve a problem. Policymakers use evidence from big data and statistics to assist their decision-making for social problems. Scientists seek to understand the world by carefully collecting data and using rigorous statistical analysis. This course is designed to provide students with the skills and knowledge necessary to collect, understand, analyze, interpret, and criticize datasets for the purpose of studying and understanding public service. At the end of this course, students will learn basic concepts of statistics, data, and statistical inference. Students will also have the skills to conduct basic analyses of data in R software. Throughout the course, students will be expected to connect the statistical skills they learn with their own interests in public service problems.

Course Competencies

- To lead and manage in public governance (NASPPA Competency #1)
    - Students will learn basic leadership skills and how their personal leadership style can be improved in order to prepare them to excel as leaders in public organizations.
- To articulate, apply, and advance a public service perspective (NASPPA Competency #4)
    - Students will learn how to apply method and statistical skills from the textbook and class into their real-world problem analysis in the public sector.
- To communicate and interact productively with a diverse and changing workforce and citizenry (NASPPA Competency #5)
    - Students will learn how to effectively summarize, assess, and communicate technical and professional information through both oral and written media to a diverse audience.
    - Students will demonstrate the ability to work productively and collaboratively in diverse teams.

Course Learning Objectives

At the completion of the course, students will be able to:

- Understand and use elementary statistics (descriptive statistics, statistical inference, etc.) to explore, describe, and analyze problems in public service settings.
- Understand basic concepts of statistics, including confidence interval, probability, sampling, and regression.
- Locate, download, import, and analyze secondary data for public service.

- Use statistical software, such as R, to clean and analyze quantitative data.
- Understand how research, data collection, variable construction, and analysis are socially constructed activities with limitations.
- Communicate about statistical results for a lay audience.

Course Materials

Required textbook

Diez et al. (2019). OpenIntro Statistics.
Webb, R. (2021). *Mostly Harmless Statistics (2nd ed.)*. Portland State University.
Triola, M. (2022) *Elementary Statistics (14th ed.)*. Pearson.

Required Software: RStudio

Optional

Salsburg, D. (2002). *The lady tasting tea: How statistics revolutionized science in the twentieth century*. Macmillan.

Summary of Assignments

Assignment	Percentage/Points	Evaluation Details
Participation and Attendance	100	25 points will be deducted for one absence.
Problem Set Assignment*8	50*8=400	Cover weekly topics.
Take-home Mid-term Exam 1	150	Cover modules in previous weeks
Take-home Mid-term Exam 2	150	Cover modules in previous weeks
Final Report	200	Rubric will be provided in Canvas.
TOTAL	1,000	Final grades will be posted by May 10.

Participation and Attendance [100 points, 10%]

Class attendance and participation account for 10% of your final grade. Regular attendance is essential for your success in this course. If you anticipate missing more than five class sessions, you are strongly encouraged to reconsider your enrollment in this course. I understand that some of you might be out of two and have personal issues during the semester. You may have up to **two excused absences** per semester without penalty **if you notify me the personal reasons at least 48 hours in advance**. For **each additional absence beyond two**, **25 points will be deducted from your total grade** unless the absence is due to a documented illness or serious situation. In all other circumstances not explicitly covered above, the instructor reserves the right to make case-by-case decisions in accordance with these guidelines.

Students are expected to thoroughly prepare for each class session and to participate actively and constructively in class. You will be assigned to small groups to engage in discussions on in-class work and assignments. This will allow you to express your viewpoints while benefiting from a variety of perspectives. Contributions to class discussions must be substantive and demonstrate that you have read the course materials or conducted additional research. I value a good attitude, passion, and process in the learning environment. I will consider these aspects in all assignments.

Assignment 1 [50 points, 5%]

1. R software installation
2. Use R to solve a basic statistical problem set.

Assignment 2: Understand Variables [50 points, 5%]

1. Distinguish different types of variables.
2. Distinguish different types of datasets, such as cross-sectional, panel, and experimental designs.

Assignment 3: Data Description and Visualization [50 points, 5%]

1. Enter dataset into R and use basic functions to describe and visualize the data.
2. Identify and interpret descriptive statistics.
3. Write a one-page, data-informed comparative policy brief.

Assignment 4: Probability, Population, and Sampling [50 points, 5%]

1. Estimate probabilities.
2. Calculate Z-scores and use them to assess probability.
3. Review and use math rules to understand the logic of probability.
4. Define and use both theoretical and empirical probability.
5. Use logic and simple math to estimate empirical probabilities.

Assignment 5: Statistical Estimation, Population, and Sampling [50 points, 5%]

1. Estimate point estimation and confidence intervals for the population.
2. Specify null and alternative hypotheses formally.

Assignment 6: Chi-square Test [50 points, 5%]

1. Specify null and alternative hypotheses formally for the Chi-square test.
2. Use R to calculate the Chi-square test and test your hypotheses.
3. Explain key findings from the Chi-square Test in layperson's terms for policy makers.

Assignment 7: ANOVA [50 points, 5%]

1. Specify null and alternative hypotheses formally for the ANOVA.
2. Use R to calculate the Chi-square test and test your hypotheses.
3. Explain key findings from the Chi-square Test in layperson's terms for policy makers.

Assignment 8: Correlation and Regression [50 points, 5%]

1. Specify null and alternative hypotheses formally for the correlation and regression.
2. Use R to calculate correlation and regression coefficients, statistical significance, and model fit.
3. Interpret coefficients with attention to magnitude, direction, and confidence level.
4. Explain key findings in layperson's terms for policy makers.

Mid-term Exams [300 points, 30%]

This Course has **two exams**. All exams will be open-booked but timed. For each test, you will have 120 minutes to complete 40 multiple-choice and true/ false questions. You will have a 7-day window to decide when to take each test. However, only one attempt is allowed (once you start a test, you cannot pause and resume the timer). Taking exams after their dues is not allowed. Please plan your time wisely and carefully review and understand Canvas materials and assigned chapters before taking the exams. Only two tests will be counted toward your final grade. One of the lowest scores will be dropped.

Final Report [200 points]

The final paper is a medium-length written assignment (1,500–2,000 words) that allows students to apply statistical analysis methods from the course to analyze a real-world problem in public management or

governance. The goal of this assignment is to encourage students to use what they learn from the class to apply on practical problem-solving.

Format:

- 5 pages maximum, single-spaced, 12-point Times New Roman font, 1-inch margins.
- Include at the top left of the page
  TITLE: [Your Title for This Essay]
  FROM: [Your Name]
  DATE: [Submission Date]

Grading

Grading Procedure

Grades reflect your effort, the quality of your performance in class discussions, and the completion of assignments. Each student is responsible for monitoring their own progress and grades throughout the course. I will not notify students individually if their progress is unsatisfactory. Please review the grading criteria for each assignment carefully. Graded work will be returned and available in the Gradebook within one week of the assignment's due date.

Grade Scale

This course uses a +/- grading system as defined below.

Grade	Percentage	Points Range
A+	97.00 % – 100 %	970 – 1000
A	94.00 % – 96.99 %	940 – 969
A-	90.00 % – 93.99 %	900 – 939
B+	87.00 % – 89.99 %	870 – 899
B	84.00 % – 86.99 %	840 - 869
B-	80.00 % – 83.99 %	800 – 839
C+	76.00 % – 79.99 %	760 – 799
C	70.00 % – 75.99 %	700 – 759
D	60.00 % – 69.99 %	600 – 699
E	Below 60.00%	Below 600

Course Participation and Absences

Attendance and participation in class activities is an essential part of the learning process; thus, students are expected to attend class regularly. Some absences are, however, unavoidable.

Excused absences for classes will be given without penalty to the grade in the case of any of the following five reasons: (1) University-sanctioned and/or university-approved activities (e.g., artistic performances, participation in research conferences, intercollegiate athletic activities, student government, required class field trips, etc.); (2) religious holidays; (3) military work performed in the line- of-duty; (4) jury duty or similar governmental obligation (a copy of the summons or other official paperwork must be provided); and (5) illness, quarantine or self-isolation related to illness as documented by a health professional.

When any of the first four reasons conflict with class meeting times, students are responsible for informing the professor of the reason for the absence at least one week in advance of the absence.

Accommodations for those assisting in government declared disaster incidents will also be considered. The student should provide the course instructor with an accommodation request accompanied by an explanation of the disaster-related deployment and anticipated timeline for any such deployment.

Besides the reasons above, you may have up to **two excused absences** per semester without penalty **if you notify me the personal reasons at least 48 hours in advance**.

Excused absences do not relieve students from responsibility for any part of the course work required during the period of absence. Faculty will provide accommodations that may include participation in classes remotely, access to recordings of class activities, or make-up work.

If there is a disagreement as to whether an absence should be accommodated, the instructor and student should contact the academic unit chair immediately for resolution.

Course Evaluation

Students are expected to complete the course evaluation. The feedback provides valuable information to the instructor and the college and is used to improve student learning. Students are notified when the online evaluation form is available.

Due Dates, Late, or Missed Assignments

If an urgent situation arises, please notify the instructor *before* the assignment is due whenever possible. All published due dates follow **Arizona Time (Mountain Standard Time year-round)** and are considered firm.

Extensions may be granted but must be arranged in advance with the instructor and may incur a penalty. Late work will be accepted with a deduction of **1 point per day**, for up to **five days** after the due date. Assignments submitted more than five days late **will not be accepted**.

If you experience an emergency or know ahead of time that you will be unable to meet a deadline, it is your responsibility to communicate with the instructor as early as possible.

Extra Credit

There are no formal extra credit assignments in this course. However, I value a positive attitude, genuine engagement, and consistent effort throughout the learning process. These qualities will be taken into consideration when evaluating assignments and determining final grades.

Citation Style

Students are required to use the citation style and format of the American Psychological Association (APA). Review the APA Referencing and Citation Guide or the APA Citation Style tutorial. It is acceptable to cite legal materials (cases, statutes, regulations, etc.) in accordance with the style specified in the Bluebook: A Uniform System of Citation in all papers.

Generative AI

Generative Artificial Intelligence (GenAI) is a form of artificial intelligence that can create high-quality audio, images, text, video, 3D models and other content. GenAI programs are not a replacement for human creativity, originality, and critical thinking. While adhering to any policies on the use of GenAI in this course, students utilizing GenAI content in their assignments, including in their practicum placements, must provide clear and comprehensive descriptions of the GenAI used. Students utilizing GenAI techniques should be aware of potential ethical implications and must adhere to relevant ethical guidelines and ensure that their work respects privacy and confidentiality. If the scholarly work involves human subjects, appropriate informed consent procedures must be followed. Scholarly work must be the student's own, and not present others' ideas, data, words or other material without adequate citation, i.e., any use of GenAI must not breach academic integrity and plagiarism standards. Students should be cautious of incorrect or inaccurate information, as well as bias in GenAI generated content; the use of person-first and bias-free language is critical. Review, fact-check, and edit material produced by GenAI. The student is ultimately accountable for all submitted work.

If you are in doubt as to whether you are using GenAI appropriately in this course, reach out to your instructor.

Please adhere to the following policy when using GenAI in this course:

In this course, we have a lot of practice on coding and programming, exploring the statistical packages in R. Generative AI (e.g., ChatGPT) is helpful to help you understand codes, develop codes, and revise code to get what you need in statistics. At this point, you are encouraged to use Generative AI for coding and programming purposes. However, it is prohibited to use generative AI to solve the assignment problems and questions and then submit the resulting high-quality answers as your responses. It is possible for you to work on the problems and then use generative AI as a tool to help address some of those coding and programming issues when you try to find the answers and results.

Additionally, generative AI tools may be used for limited writing purposes such as copyediting, grammar checking, and improving phrasing. These tools may also be used for brainstorming, provided that you clearly cite when and how the tool was used. Examples of citing AI language models are available at the ASU Library (https://libguides.asu.edu/c.php?g=1311696&p=9700102).

However, the use of generative AI tools for producing original written content is strictly prohibited. All assignments must reflect your own analytical thinking and writing.

Course Structure and Schedule

This course meets twice a week. Here is an outline of the material we may cover. We may vary from this schedule depending upon the time the professor feels we need to spend on any topic. Therefore, use this schedule with the caveat that assignments may be changed by the professor for any given class session.

Weeks / Dates	Topics	Assignments & Readings
WEEK1	• **Introduction to Course** • **Introduction to R**	**Readings:** • Self-Introduction (in-class activity, not graded) • Syllabus • R software Lab **Assignments:**

		****Self-Introduction (in-class activity, not graded)**
WEEK2	• **Data in Everyday Life** • **Understanding Variables** • **Measuring Variables** • **Type of Data and Data Collection**	**Readings:** • Webb, Chapters 1, 2 • OpenIntro, Chapters 1 & 2 **Assignments Due:** ****Assignment 1 Due**
WEEK3	• **Descriptive Statistics** (Mode, Median, Mean, Range, Variance, Standard Deviation) • **Visualization (**Histograms, box plots)	**Readings:** • Webb, Chapters 2, 3 • OpenIntro, Chapters 1 & 2 **Assignments Due:** ****Assignment 2 Due**
WEEK4	• **Probability** • **Random variables** • **Central Limit Theorem** • **Independent and identically distributed**	**Readings:** • Webb, Chapters 4, 5, 6 • OpenIntro, Chapters 3 & 4 **Assignments Due:** **** Assignment 3 Due**
WEEK5	• **Statistical Estimation** • **Population** • **Sampling** • **Point Estimation** • **Interval Estimation** • **P-values**	**Readings:** • Webb, Chapters 7, 8, 9 • OpenIntro, Chapter 5 **Assignments Due:** **** Assignment 4 Due**
WEEK6	• **Testing Hypothesis** • **Null-Hypothesis** • **Alternative Hypothesis**	**Readings:** • Webb, Chapters 7, 8, 9 • OpenIntro, Chapter 5 **Assignments Due:** ****Assignment 5 Due**
WEEK7	• **Non-parametric Test 1** • **Pearson Chi-Square**	**Readings:** • Webb, Chapter 10 • OpenIntro, Chapter 6 **Assignments Due:** ****Prepare for Mid-term Exam 1**
WEEK8	• **Mid-term Exam 1**	**Assignments Due:** ****Take Home Exam**
WEEK9	• **Fall/Spring Break**	**Assignments:** ****Go Hiking, Swimming, and Fishing. Happy Fall/Spring Break!**
WEEK10	• **Non-parametric Test 2** • **One-Way ANOVA** • **Two-Way ANOVA**	**Readings:** • Webb, Chapter 11 • OpenIntro, Chapter 6 **Assignments Due:**

		****Assignment 6 Due**
WEEK11	• **Independent Samples t-tests**	**Readings:** • Webb, Chapters 8, 9 • OpenIntro, Chapter 7 **Assignments Due:** ****Assignment 7 Due**
WEEK12	• **Correlational Tests** • **Pearson Correlations**	**Readings:** • Webb, Chapters 12 • OpenIntro, Chapter 8 **Assignments Due:** ****Assignment 8 Due**
WEEK13	• **Introduction to Regression** • **Simple Linear Regression** • **R squared**	**Readings:** • Webb, Chapters 12 • OpenIntro, Chapter 8 **Assignments Due:** ****Prepare for Take Home Exame**
WEEK14	• **Multiple Linear Regression** • **Regression Diagnoses** (regression function, outliers, homoskedasticity, error terms)	**Readings:** • OpenIntro, Chapter 9
WEEK15	• **Mid-term Exam2**	**Assignments Due:** ****Take Home Exam Due**
WEEK16	• **Final Report Workday and Q&A**	**Assignments Due:** ****Final Report Due**

Notes

1. Please turn off the sound of your cell phone before the class starts.
2. No email response from the instructor during the weekend.
3. It is your responsibility to check information on the class website.
4. The syllabus is subject to change by the instructor.
5. Professional Writing Standards: All writing must use professional language (no slang). Grades will reflect grammar, spelling, and overall presentation. Papers and other written work must be well-developed, logically consistent, and concise to capture the attention of busy decision-makers. For example, an "A" paper should be free of grammar or spelling errors, be logically organized, and easy to follow. All quotations and significant paraphrases must be properly cited—plagiarism will not be tolerated.
6. Deadlines: All assignments must be turned in on time to receive credit. It is your responsibility to ensure assignments are submitted by the deadline. Computer-related problems (e.g., "my email isn't working" or "I wasn't near my computer") are not acceptable excuses.

