Syllabus

PSY 652: Methods of Research in Psychology I » Colorado State University

Instructor: Kimberly L. Henry, Ph.D.

COURSE DESCRIPTION & OBJECTIVES

In this course, you will study and master the fundamentals of data science. Data science is an interdisciplinary field that aims to produce insight from data. Our focus will be on using data science to illuminate, understand, and address a wide range of issues relevant to social and behavioral sciences. This approach not only highlights the importance of data science for social good but also demonstrates its broad applications across different domains. This will take several forms:

Over the course of the semester, you will:

1. **Learn to Use R for Data Analysis:** Gain proficiency in using R, a powerful statistical software, to conduct comprehensive data analysis. You'll produce polished reports using Quarto for RStudio, an essential skill for modern data scientists.

2. **Construct Data Visualizations:** Develop the ability to create compelling data visualizations that effectively describe data, revealing patterns and insights that might not be immediately apparent in raw data.

3. **Wrangle and Prepare Data:** Acquire skills in data wrangling, which involves cleaning, transforming, and preparing data for analysis. This is a crucial step to ensure that your data is accurate and ready for sophisticated analysis.

4. **Analyze Data:** Engage in various data analysis techniques, from basic descriptive statistics to more advanced inferential methods. You will learn how to choose the appropriate methods for different types of data and research questions.

5. **Interpret and Describe Findings:** Learn to interpret your analysis results accurately and describe your findings in a clear and concise manner. This skill is essential for communicating your results to diverse audiences, including policymakers, stakeholders, and the general public.

6. **Illustrate Uncertainty in Statistical Estimates:** Understand how to illustrate and communicate the uncertainty inherent in statistical estimates. This includes constructing confidence intervals, conducting hypothesis tests, and explaining the limitations of your analyses.

7. **Produce and Present New Insights:** Develop the ability to not only generate insights from data but also to present these insights effectively to others. You will learn to craft narratives around your findings, making them accessible and compelling to your audience.

8. **Apply Data Science to Real-World Problems:** Throughout the course, you'll apply your skills to real-world datasets and problems. This practical experience will reinforce your learning and demonstrate the impact of data science in addressing critical societal issues.

By the end of this course, you will have a solid foundation in data science, equipped with the skills and knowledge to tackle complex problems in the social and behavioral sciences. You'll be prepared to contribute to meaningful change in society through data-driven insights and solutions.

COURSE MODULES

We will work through 18 modules:

1. Introduction to the Tools
2. A No-Code Introduction to Describing Data
3. Data Visualization
4. Data Wrangling
5. Basic Rules of Probability
6. Probability Distributions
7. Understanding Populations through Sampling and Descriptive Statistics
8. Quantifying Uncertainty for Descriptive Statistics
9. Confidence Intervals (Frequentist and Bayesian Approaches)
10. Simple Linear Regression for Predictive Modeling
11. Multiple Linear Regression for Predictive Modeling
12. Quantifying Uncertainty with Regression Models (Frequentist and Bayesian Approaches)
13. Categorical Predictors in Regression Models
14. Moderation in Regression Models
15. Fitting Non-Linear Effects in Regression Models
16. Null Hypothesis Significance Testing
17. Regression Model Assumptions and Remediation
18. Causal Inference

TEXTBOOK / COURSE READINGS

All readings are available at the course website or on Canvas.

COURSE MATERIALS & EQUIPMENT

We will use RStudio and R via the Posit Cloud. Directions for setting up an account and accessing the course materials are included in the Module 1 handout on the course website.

PARTICIPATION/BEHAVIORAL EXPECTATIONS

We will utilize a flipped classroom model in this course. This means that, instead of traditional lectures, the onus is on you, the students, to work through each Module independently before we meet for our class sessions. It is vital that you dedicate between 2 to 5 hours on each Module and ensure that you've completed your study by the specified due date for the corresponding Module Quiz. This preparation is not merely a formality — it's essential for your active participation and productivity during our in-class activities. Class sessions will be dedicated to applying what you've learned from the Modules, allowing us to dive deep into practical exercises and discussions. Please prioritize this self-study to make the most of our in-person meetings.

Engagement with the material for PSY 652 will take several forms:

1. Working through the Module materials.
2. Taking the Module quizzes.
3. Practicing data science techniques during Lecture and Lab.
4. Completing 2 in class exams.
5. Producing a personal data science project of your choosing.

GRADE COMPONENTS (and % of total grade)

- Module Quizzes (25%)
- Apply and Practice Exercises (20%)
- Exams (30%)
- Personal Data Science Project (15%)
- Student Engagement (10%)

DESCRIPTION OF COURSE COMPONENTS

1. **Module Quizzes.**
   Students will take one quiz at the end of each Module. The quizzes assess understanding of the concepts presented in the Module handouts (including text and videos). Each quiz has a 60-minute time limit once started. Students may use any course-provided materials and RStudio in the Posit Cloud to complete the quiz. However, students may **not**:

   - Communicate with others about the quiz.
   - Copy, store, or compile quiz questions.
   - Use artificial intelligence tools to complete the quiz.

   It is essential to work through the Module handout before taking the quiz — attempting the quiz without prior study will likely result in a poor score and defeats the benefits of a flipped classroom teaching style. The first quiz attempt must be completed by the due date posted in Canvas. Two additional attempts are permitted until the date of the next exam, and the average of all attempts will be recorded. A 24-hour waiting period is required between attempts.

2. **Apply and Practice Activities.**
   In-class and lab-based hands-on activities will help students apply what they've learned using real R code and real datasets. Students will use RStudio in the Posit Cloud — an online environment pre-loaded with all course materials. Most activities will be completed during scheduled sessions, but occasional outside work may be required.

3. **Exams.**
   There will be two in-class exams. Each will take place during a single class period. Exams will be closed-book and closed-note.

   - **Exam 1:** Covers Modules 1–9
   - **Exam 2:** Covers Modules 10–18

4. **Personal Data Science Project.**
   Students will complete a personal data science project designed to reinforce the full data science workflow — from procuring and cleaning data to analyzing and presenting findings. The goal is to give students hands-on experience with best practices in data science while working with data that is personally or professionally meaningful.

   Students will:

   - Identify and procure a dataset of interest (public, advisor-provided, or self-collected).
   - Import and clean the data using R.
   - Conduct descriptive analyses to understand the data.
   - Interpret the findings.

- Use insights from this exploration to propose a follow-up study using either predictive modeling or causal inference.
- Document the entire process in a reproducible **Quarto notebook**.
- Present a 15-minute summary of their work to the class.

5. **Student engagement.** The student engagement component of the grade reflects your active participation and involvement throughout the course. This includes several key expectations that support a productive and collaborative learning environment: consistent attendance, timely submission of assignments, and active participation during class and lab sessions. These behaviors not only enhance your own learning but also contribute to the overall success of the class. If you need to miss a class, please notify the instructor(s) as early as possible.

Please keep a copy of all work created for the course, including work submitted through Canvas course learning management system.

GRADING POLICY

- A+ 100% to 96.67%
- A <96.67% to 93.33%
- A- <93.33% to 90.0%
- B+ <90.0% to 86.67%
- B <86.67% to 83.33%
- B- <83.33% to 80.0%
- C+ <80.0% to 76.67%
- C <76.67% to 70.0%
- D <70.0% to 60.0%
- F <60.0% to 0.0%

CANVAS INFORMATION & TECHNICAL SUPPORT

Canvas is where course content, grades, and communication will reside for this course.

- Login for Canvas
- Canvas Support

For passwords or any other computer-related technical support, contact the Central IT Technical Support Help Desk.

- phone: 970-491-7276
- email: help@colostate.edu

The Technical Requirements page identifies the browsers, operating systems, and plugins that work best with Canvas. If you are new to Canvas quickly review the Canvas Student Orientation materials.

ACADEMIC INTEGRITY & CSU HONOR PLEDGE

This course will adhere to the CSU Academic Integrity/Misconduct policy as found in the General Catalog and the Student Conduct Code. Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, I will ask that you affirm the CSU Honor Pledge as part of completing your work in this course. Further information about Academic Integrity is available at CSU's Academic Integrity - Student Resources.

UNIVERSAL DESIGN FOR LEARNING/ACCOMMODATION OF NEEDS

I am committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning.

The materials in this course are designed to be accessible to all students. If you encounter any material that is not accessible, please reach out to me directly so we can address the issue promptly.

If you are a student who will need accommodations in this class, please contact me to discuss your individual needs. Any accommodation must be discussed in a timely manner. A verifying memo from The Student Disability Center may be required before any accommodation is provided.

The Student Disability Center (SDC) has the authority to verify and confirm the eligibility of students with disabilities for the majority of accommodations. While some accommodations may be provided by other departments, a student is not automatically eligible for those accommodations unless their disability can be verified and the need for the accommodation confirmed, either through SDC or through acceptable means defined by the particular department. Faculty and staff may consult with the SDC staff whenever there is doubt as to the appropriateness of an accommodative request by a student with a disability.

The goal of SDC is to normalize disability as part of the culture of diversity at Colorado State University. The characteristic of having a disability simply provides the basis of the support that is available to students. The goal is to ensure students with disabilities have the opportunity to be as successful as they have the capability to be.

Support and services are offered to student with functional limitations due to visual, hearing, learning, or mobility disabilities as well as to students who have specific physical or mental health conditions due to epilepsy, diabetes, asthma, AIDS, psychiatric diagnoses, etc. Students who are temporarily disabled are also eligible for support and assistance.

Any student who is enrolled at CSU, and who self-identifies with SDC as having a disability, is eligible for support from SDC. Specific accommodations are determined individually for each student and must be supported by appropriate documentation and/or evaluation of needs consistent with a particular type of disability. SDC reserves the right to ask for any appropriate documentation of disability in order to determine a student's eligibility for accommodations as well as in support for specific accommodative requests. The accommodative process begins once a student meets with an accommodations specialist in the SDC.

EXTENUATING CIRCUMSTANCES

During the semester, if you experience extenuating circumstances that require special consideration, such as a medical emergency or a significant personal issue, you are required to make an appointment with Student Case Management. The office will evaluate your situation and, if necessary, recommend accommodations to support your continued success in this course. Please ensure that you contact Student Case Management at your earliest convenience to allow ample time for assessment and arrangement of any necessary accommodations. Upon approval, Student Case Management will forward an Instructor Notification to me outlining the recommended accommodations or adjustments. It is your responsibility to follow up with me to discuss how these accommodations will be implemented in our course. Your well-being is important, and resources are available to help you manage your academic and personal responsibilities effectively during challenging times.