

# Quantitative Political Analysis

Sean J. Westwood

**Location:** Silsby 126

**Office Hours:** Monday 3:00–5:00 PM EST by appointment

**Appointments:** <https://calendar.app.google/DHS6U5GH5DX9wWrh6>

## Course Overview

This course introduces practical uses of AI in research. You will learn to interpret published work, generate clear summaries, and support your own scholarship. The goal is to provide a shared foundation of AI skills that helps level differences in prior experience.

The growing amount of available quantitative data is changing the way we understand and engage in politics, how we implement policy, and how organizations across the world make decisions. In this course, we will learn the fundamental tools of quantitative analysis and apply them to a wide range of political and policy oriented questions. How do we predict presidential elections? Did economic voters bring Hitler to power? How does the ideology of the Supreme Court change over time? These are just a few of the questions we will work on in the course.

Students are not expected to have any programming, advanced math or statistical knowledge. The course will be centered around assignments that will help build skills from scratch. Students will leave the course equipped for work in any setting that requires a social scientific approach to data science, from policy non-profits to government, from Silicon Valley to Wall Street and beyond. There are no formal prerequisites for this course.

## Teaching in the Age of AI

AI has fundamentally changed the world, and we need to work WITH it, not against it. Some professors are pretending AI doesn't exist, others are dejected by its rise, but our job is to teach students the skills they actually need. AI is what you will use in the real world—that is what this class embraces and teaches.

The traditional approach to teaching quantitative methods—memorizing syntax, debugging code line by line, struggling with programming details—is becoming obsolete. In 2025, successful data analysts don't spend their time remembering whether it's `filter()` or `subset()`. Instead,

they focus on the intellectual work: understanding what questions to ask, designing appropriate analyses, interpreting results correctly, and communicating findings effectively.

Rather than memorizing programming syntax, we focus on:

- **Understanding concepts** and their applications to real political problems
- **Interpreting results** and their political implications in context
- **Asking the right questions** and designing appropriate research strategies
- **Working effectively with AI** to accelerate analysis and overcome technical barriers
- **Verifying logic** and critically evaluating AI suggestions for accuracy
- **Recognizing limitations** of both data and analytical methods
- **Communicating findings** clearly to diverse audiences

## Assessment

Midterm Exam	25%
Final Exam	25%
Quizzes (8 total)	30%
Assignments and Participation	20%

## Exams and Quizzes

All exams and quizzes are **closed book** and conducted **on paper**. Quizzes are 10–15 minutes each, administered once per week starting in Week 2. No quiz during midterm week or final week.

**Class assignments:** On most class meetings, you will be given an assignment to work through. The content will be a mixture of multiple-choice, fill-in-the-blank, and matching questions, along with tasks that require reasoning and interpretation. You will have access to a computer for these assignments. You will not submit them for credit, but it will not be possible to pass quizzes and exams without completing them.

## Class Format & Required Tools

Class will be a mixture of lecture and hands-on exercises.

- **During lecture portions:** Class will be closed computer/no devices to maintain focus
- **During hands-on portions:** Laptops required for coding exercises and AI-assisted analysis

**Required Tools:** **R** (statistical programming language), **Positron** (modern IDE optimized for data science), **Claude Plus subscription** (AI assistant for coding and analysis)

**Book:** There is no book. I will provide all needed materials.

## Weekly Schedule

### Week 1: Introduction to Quantitative Political Analysis

#### 1/6 – Class 1: Introduction to Quantitative Political Analysis

- What quantitative political analysis is and why it matters
- Data analysis applications to real political problems
- Role of AI in modern political analysis

#### 1/8 – Class 2: Introduction to R and Data Frames

- Basic R operations with variables and vectors
- Examining data frames
- Effective AI assistance for R programming

**R Functions:** `library(tidyverse)`, `read_csv()`, `glimpse()`, `head()`,  
`mean()`, `table()`, `summary()`

### Week 2: Working with Data

#### 1/13 – Class 3: Working with Real Data

Quiz 1

- Exploring real political datasets
- Data manipulation with tidyverse
- Handling missing values (NA) properly
- Correlation vs. causation

**R Functions:** `filter()`, `select()`, `arrange()`, `names()`, `is.na()`,  
`!is.na()`

#### 1/15 – Class 4: Summary Statistics

- Central tendency: mean, median, mode
- Measures of spread: range, variance, standard deviation
- When each measure is appropriate

**R Functions:** `group_by()`, `summarise()`, `median()`, `sd()`, `n()`, `ggplot()`, `geom_histogram()`, `geom_density()`, `geom_vline()`

### Week 3: Research Designs

#### 1/20 – Class 5: Transforming and Creating Variables

Quiz 2

- Creating and modifying variables with `mutate()`
- Conditional logic and recoding data
- Logical operators and data transformation

**R Functions:** `mutate()`, `case_when()`, `if_else()`, `pull()`, `n_distinct()`, `across()`, `recode()`

### 1/22 – Class 6: Research Designs

- Experimental vs. observational designs
- Natural experiments
- Cross-sectional vs. longitudinal data
- Design tradeoffs and internal validity

**R Functions:** `count()`

## Week 4: Regression and Causal Inference

### 1/27 – Class 7: Causality

**Quiz 3**

- Three requirements for causation: association, temporal ordering, no confounding
- Spurious correlations and confounding variables
- Using AI to identify alternative explanations

### 1/29 – Class 8: Modern Causal Inference

- Fundamental problem of causal inference
- Average Treatment Effect (ATE) calculation and interpretation
- Randomized experiments and difference-in-differences design

## Week 5: Advanced Regression

### 2/3 – Class 9: Linear Regression

- Linear relationships and OLS intuition
- Model fitting and interpretation
- Political applications of regression

**R Functions:** `lm()`, `broom::tidy()`

### 2/5 – Class 10

**MIDTERM EXAM**

## Week 6: Multivariate Analysis

### 2/10 – Class 11: Multivariate Models

**Quiz 4**

- Controlling for confounding variables
- Partial relationships and model building
- Multiple predictors

## 2/12 – Class 12: Categorical Predictors and Interactions

- Dummy variables and reference categories
- Interpreting categorical predictors in regression
- Interaction terms and conditional relationships
- When and how to use interaction terms

**R Functions:** `factor()`, `levels()`

## Week 7: Data Visualization and Experimental Design

### 2/17 – Class 13: Plotting Data

**Quiz 5**

- Grammar of Graphics principles
- Line plots for time series data
- Scatter plots for relationships
- Box plots for group comparisons

**R Functions:** `scales::percent_format()`, `geom_line()`, `geom_point()`,  
`geom_smooth()`, `geom_boxplot()`

### 2/18 (X-hour 5:30-6:20) – Class 14: Experimental Design in Political Science

- Types of experiments: vignette, conjoint, and economic games
- Within-subjects vs. between-subjects designs
- Typical  $2 \times 2$  factorial designs
- Control group strategies and placebo effects
- Design considerations: survey length and respondent fatigue
- Random assignment and treatment implementation

## Week 8: Introduction to Statistical Significance

### 2/24 – Class 15: Working Toward Statistical Significance?

**Quiz 6**

- Understanding populations vs. samples
- Why sampling creates uncertainty
- How sample size affects confidence
- Margin of error and its calculation
- The logic of hypothesis testing

### 2/25 (X-hour 5:30-6:20) – Class 16: What is Statistical Significance?

- Standard deviation vs. standard error
- Variability in samples vs. variability in estimates
- Systematic method to distinguish real effects from noise
- Political examples: polls, gender gaps, campaign effects

## **Week 9: Statistical Inference**

### **3/3 – Class 17: Statistical Tests**

**Quiz 7**

- The t-distribution and its uses
- One-sample t-tests for single means
- Two-sample t-tests for comparing groups
- Regression t-tests for coefficients
- Common pitfalls in hypothesis testing

**R Functions:** `tibble()`, `rnorm()`, `sample()`, `replicate()`

### **3/5 – Class 18: Confidence Intervals**

- From t-statistics to confidence intervals
- Interpreting confidence intervals correctly
- Precision: narrow vs. wide intervals
- Communicating effect size AND uncertainty

**R Functions:** `t.test()`, `confint()`, `broom::glance()`

## **Week 10: Actually Using AI**

### **3/10 – Class 19: Final Preparation and Practice**

**Quiz 8**

**Final Exam**

**Wednesday, March 12 @ 9:00 AM**

## **Mandatory Disclosures**

### **Dartmouth's Academic Honor Principle**

All students are expected to abide by Dartmouth's Academic Honor Principle. For detailed information, please visit: [dartmouth.edu/judicialaffairs/honor](http://dartmouth.edu/judicialaffairs/honor)

### **Accessibility Needs**

Students with disabilities who may need disability-related academic adjustments and services for this course are encouraged to see me privately as early in the term as possible. Students requiring disability-related academic adjustments and services must consult the Student Accessibility Services office (Carson Hall, Suite 125, 646-9900).

Once SAS has authorized services, students must show the originally signed SAS Services and Consent Form and/or a letter on SAS letterhead to their professor. As a first step, if students have questions about whether they qualify to receive academic adjustments and services, they should contact the SAS office. All inquiries and discussions will remain confidential.

For detailed information regarding expectations of the faculty to ensure accessibility for all students, please visit: [Dartmouth's Student Accessibility Services](#)