STEM 580: An Introduction to Data Science Methods in Education - Syllabus

Last updated: 2023-07-08

Key Information

Meeting Time and Place

Mondays, 12:00 - 2:30 pm (online and synchronous; see schedule below for specific class dates)

Credit Hours

3

Faculty Contact Information

Dr. Isabella Velasquez

Dr. Maryrose Weatherton

Course Links

Zoom: [MR to setup, add link]

Slack: [thoughts?]

GitHub: https://github.com/utkeds/f23-founds-eds-1

Canvas: https://utk.instructure.com/courses/184613

Course Description

Intended to support graduate-level students to be able to apply data science methods to topics of teaching, learning, and educational systems. Introduces students to the data science software and programming language R. Course activities focusing on preparing, using, and visualizing complex data sources for analysis using the tidyverse suite of R packages. Data ethics are foregrounded. Includes an introduction to text analysis/Natural Language Processing. No pre-requisites or programming experience is required.

A key element of this class is that students will have the opportunity to bring their own data from their research projects for use in this class. In this way, they will have immediate application for the concepts learned in the course. If no data is immediately available from the student's research, students can use one of hundreds of freely available datasets to complete coursework or students can use datasets provided to them.

In all, this course will provide scaffolding to help students become proficient in a few sophisticated data science techniques, and it will give students sufficient foundational knowledge to pick up new data science skills on their own after the course is through. This course will serve as a foundation for later data science in education, including the second foundations class, data visualization, and machine learning and the capstone course.

Learning Objectives

The objectives for the proposed course are for students to be able to:

- Install, set up, and use R and RStudio
- Use reproducible workflows (so that analyses can easily be modified and then carried out again by the analyst or others) with R Markdown
- Develop foundational skills - focused around the tidyverse R packages - to prepare and explore data sources for analysis
- Understand how issues of equity, privacy, and ethics are central to data science in education
- Develop a personal learning and development plan related to data science in education
- Begin a portfolio of work from this class that you can add to later
- Pursue an independent project to work toward a relevant professional goal

Format and Learning Environment

This class will be taught in a fully-online format. We will use Zoom for synchronous (or at-the-same-time) class. We will also use a number of tools for asynchronous communication, including a) Slack, b) GitHub, and c) features of the Canvas course learning management system.

Communication

You will generally receive a response to messages within 24 hours during the work week (Monday - Friday). We ask for you to please try to respond within 24 hours during the work week, too. You can contact us via email (above) or Slack (preferred).

How to Be Successful in This Course

Don't hesitate to ask questions! Learning to do data science is challenging for everyone, and reaching out for support and assistance is imperative. My late assignment policy is that as long as you submit the assignment before we grade it, you will receive full credit. However, we may grade assignments very soon after they are due. For assignments received after the due date, 5% from the grade you otherwise would earn will be subtracted from your final grade for each day late.

Required Equipment

You will need a computer (Mac, Windows, or Linux are fine!) on which you can install applications, but you do not need a computer with any particular specifications (speed, storage, etc.) beyond what you use for other courses: whatever you have will work for this course.

LETTER GRADE	PERCENTAGE

Grading Scale

LETTER GRADE	PERCENTAGE
A	93.01-100
A-	90.01-93
B+	87.01-90
B	83.01-87
B-	80.01-83
C+	77.01-80
C	73.01-77
C-	70.01-73
D	60.01-70
F	60 and below

Course Grade

ASSIGNMENT	PERCENT OF GRADE	POINTS
Readings	12.5%	10 / week for 15 weeks = 150 points
Weekly Assignments	32.5%	30 / week for 13 weeks = 390 points
Professional Development Plan	5%	60
Mini Project	12.5%	150
Data Ethics Statement	12.5%	150
Final Project	25%	300
Total:	100%	1,200

Learning Activities

- **Participation: weekly classes.** Each class will have a consistent structure.
  - *Complete reading, discussion, and any assignment(s)* before class
  - *Answer the eliciting question* in groups at the beginning of each class and discuss as a class (30 minutes)
  - Listen, answer questions, and code-along with the *introducing new ideas* portion of class (30 minutes)
  - *Code-along* using built-in data to get a feel for the code you will be using (30 minutes)
  - Time to *start on the assignment for the next week with a peer/peers*(30 minutes)
  - Ask any questions or have independent work time (30 minutes)
- **In-class programming.** At the core of this class is programming in R. We will develop R programming skills for data wrangling, exploration, and visualization together by doing various in-class programming activities. We will complete these activities as a whole class, in small groups, or in pairs. Semi-structured activities will give us a chance to discuss, better understand, and practice our programming skills.

- **Weekly assignments**: Weekly tasks that involve combining reading about relevant theory and prior research, working through fundamentals in a guided practice model. These will be submitted as R documents, HTML files, or images.
- **Mini project:** This independent project will involve the application of theory and programming to create various visualizations from an already-existing data set. Your work will be shared with other students and the instructor to provide you with opportunities to provide and receive constructive critique (and to revise your work, as is the case with all visualizations!).
- **Data ethics statement:** You will explore visualizations created by others for #tidytuesday and apply newly learned skills together with the theory and programming learned in class to a provided data set to create various visualizations from a provided data set. Your work will be shared with other students and the instructor to provide you with opportunities to provide and receive constructive critique and revise your work.
- **Professional development plan:** Develop a plan for your continued professional data science learning.
- **Final project:** You will complete a final project that involves developing visualizations for your own data or a data set of your choice. The goal of this project is to create a publication-ready visualization that demonstrates what you have learned throughout the course.

Generative Artificial Intelligence

Open AI's GPT-4 and other generative artifcial intelligence tools like it (e.g., Google's Bard) can be immensely helpful when it comes to programming in R and other languages. We encourage their use, but ask that you add a note to anything you submit in which you have used a generative artificial intelligence tool about how you have used it to provide context to us and to help us to learn how these tools are useful.

Timeline

Week	**Date**	**Focal Question and Topic**	**Assignments Due Before the Next Class**
1	August 28	What's this course about? Introducing the course and ourselves	Week 1 Assignment: Install R and R Studio, Primer
2	September 4	What's all the fuss about data science? Doing things we could not easily do without advanced *graphics*	Week 2 Assignment: Creating faceted plots with ggplot2
: 3	September 11	What's all the fuss about data science? Doing things we could not easily do without *coding*	Week 3 Assignment: Joining
4	September 18	What counts as data? Accessing and describing social media data	Week 4 Assignment: Accessing and describing Facebook data
5	September 25	What counts as data? Accessing and describing public internet data	Week 5 Assignment: Accessing and describing Wikipedia data

6	October 2	What are the core skills I need to work with data? Fo undational skills, Part 1a	Week 6 Assignment
7	October 9	What are the core skills I need to work with data? Fo undational skills, Part 1b	Week 7 Assignment
8	October 16	What have I done?!? Presenting Mini Project	Mini Project
9	October 23	What are the core skills I need to work with data? Fo undational skills, Part 2a	Week 9 Assignment
1 0	October 30	What are the core skills I need to work with data? Fo undational skills, Part 2b	Week 10 Assignment
1 1	November 6	How can I prepare for the final project? Learning more and creating data products	Week 11 Assignment
1 2	November 13	How can I use text as data? Tokens and f requencies	Data Ethics Statement
1 3	November 20	How can I use text as data? Sentiment	Week 13 Assignment
1 4	November 27	How can I use text as data? Term co- occurences	Week 14 Assignment
1 5	December 4	How can I share my work? Blogdown and GitHub	Week 15 Assignment
1 6		Presenting Final Projects	Final Project

University Policies

Academic Integrity

An essential feature of the University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity.

Title IV Policy

University of Tennessee faculty are committed to supporting our students and upholding gender equity laws as outlined by Title IX.

Please be aware that if you choose to confide in a faculty member regarding an issue of sexual harassment (including sexual assault, dating violence, domestic violence, and stalking), sexual exploitation, and retaliation (prohibited conduct) we are obligated to inform the University's Office of Title IX. They can assist you in connecting with all possible resources both on- and off-campus.

If you would like to speak with someone confidentially, the Student Counseling Center (865-974-2196) and the Student Health Center (865-974-3135) are both confidential resources.

For additional resources and information, visit titleix.utk.edu.

University Civility Statement

Civility is genuine respect and regard for others: politeness, consideration, tact, good manners, graciousness, cordiality, affability, amiability and courteousness. Civility enhances academic freedom and integrity, and is a prerequisite to the free exchange of ideas and knowledge in the learning community. Our community consists of students, faculty, staff, alumni, and campus visitors. Community members affect each other's well-being and have a shared interest in creating and sustaining an environment where all community members and their points of view are valued and respected. Affirming the value of each member of the university community, the campus asks that all its members adhere to the principles of civility and community adopted by the campus: http://civility.utk.edu/.

Disability Services

Any student who feels s/he may need an accommodation based on the impact of a disability should contact Student Disability Services in Dunford Hall, at 865-974-6087, or by video relay at, 865-622-6566, to coordinate reasonable academic accommodations.

Your Role in Improving Teaching and Learning Through Course Assessment

It is our collective responsibility to improve the state of teaching and learning. During the semester, you may be requested to assess aspects of this course either during class or at the completion of the class. You are encouraged to respond to these various forms of assessment as a means of continuing to improve the quality of the UT learning experience.

Basic Needs

Any student who faces challenges securing their food or housing and believes they may affect their performance in the course is urged to contact the Dean of Students (974-HELP or viahttps://dos.utk.edu/) for support. Furthermore, please contact the instructor if you are comfortable doing so.

The instructors reserve the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes.