Faculty Notes/Instructor Notes

Overview of module

Course: Geography/Environmental Studies 250: Introduction to Earth Systems and Physical Geography

Course Information: two 75 minute classes per week, 24 students (all undergraduate) and one 3-hour lab section. Class content usually includes lecture and discussion, and lab content usually includes a short-lecture (20 min) then hands-on practice. This class is an introductory-level course, it is often taken by freshman and sophomores in the Geography and Environmental Studies major or by upper-classmen fulfilling their natural science general education requirement. This class attracts students across various disciplinary backgrounds, with various degrees of comfort with 'science' and using technology. This course assumes no prior knowledge of earth science, data collection, or data analysis. The course culminates in a final project, including a final manuscript and presentation where small project teams work on self-designed experiments to address team-determined hypothesis related to the physical environment,

Course objectives include*:

- Explain how interactions between hydrology, climate, soils, geology and vegetation shape local and global landform patterns.
- Collect, refine, analyze, and interpret earth-science data*
- Communicate the why, how, and so what of experiments you conduct through a traditional 'scientific manuscript' format*
- Understand how natural and anthropogenic processes influence Earth's atmosphere, hydrosphere, lithosphere, and biosphere over time
- Think critically; approach the world (particularly the media) with the cautious skepticism of a scientist
- Improve your written, oral, and visual communication skills*
- Appreciate the impressive simplicity and complexity of the natural environment that surrounds you

*Course objectives directly addressed by this module

Relationship to Course Syllabus and Content: This module was written for Excel, but can pretty easily be adapted for use in R. This was our third lab of the semester. It builds of two previous scaffolded assignments (data included in folders):

1. My lighthearted gif-filled walkthrough of Data Carpentry's "Data Organization in Spreadsheets for Ecologists" ("TidyDataPreAssignment1)
2. An assignment of 'field notes' loosely based on NEON-based Blandy Field Tick Count data, where students take poorly handwritten field data (to demonstrate the importance of creating a data collection protocol before going out into the field) and using the tidy data principles, organize them into a csv according to best practices they learned through the Data Carpentry Website. This assignment also familiarizes the students with NEON tick count data. ("TidyDataPreAssigment2_Ticks)

Objectives: At the end of this lab (which took one full lab 3-hour lab period), students should be able to

1. Define and distinguish between different types of data (quantitative and qualitative)
2. Explain what a correlation analysis is and when it should be applied
3. Explain what a t-test is and when it should be applied

4. Decide which graph is appropriate based appropriate graphs given different datasets and hypotheses
5. Understand that correlation does not imply causation

Files Included:

- Tck_fielddata.csv. A dataset of tick count data collected in three NEON Virginia sites (Smithsonian Conservation Institute [SCBI], Blandy Experimental Farm [BLAN]; and Mountain Lake Biological Station [MLBS]
- ExcelHelp.pdf – a file uploaded on Blackboard as a resource with common tips/tricks for using Excel
- PerformingATTestinExcel.pdf – a file uploaded to blackboard as a resource for how to perform a t-test in Excel
- NeonDataLab.docx – lab document (adjust as you see fit)

Challenges

Because we're working in a 3-hour lab, what's great is students can work together to problem-solve, and I can provide one-on-one support during the lab time. Challenges include troubleshooting different versions of Excel on the fly; differences in 'directions' between Macs and PCs; and the diversity in familiarity with tech; some of my students had never even opened Excel before. In my ideal world, I'd like to convert this to an R-based lab, but given the technical diversity in my student's background, I start with Excel.

Assessment strategy

Students are both graded on their graphs and answers to the lab questions; and then they are tested on this material during their first exam with a different dataset (in this case, it was on visitor-count data at some local outdoor recreation sites). Questions include:

- Classify each variable in Table 1 as qualitative or quantitative. For a bonus point, of the quantitative data, list the discrete quantitative data.
- What type of graph should you use to graph the relationship between how many visitors use the trails each day and daily precipitation? Why?
- What type of graph should you use to compare how many visitors use each trail? Why?
- What statistical test would you use to see if there is a significant difference between the number of people biking on trails versus hiking on trails. Why?
- What statistical test would you use to determine if there's a relationship between the number of visitors on the trails and average daily temperature. Why?

Students then have to put their data analysis skills into practice during their future labs and during their final projects.