GEL 199 Research Basics for Undergraduate VIP fellows

This is a full year course
Course Summary

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Quarter 1:

Objectives:

Students will be able to analyze a scientific paper.
Students will be able to identify the hypothesis of a scientific paper.
Students will be able to ask scientific questions of their own and probe the literature for the answers.
Students will be able to create citation tables to tabulate their own scientific investigation.

Day of instruction	**In-class task**	**At home task**
1	Read abstract from Oster et al., 2012* sentence by sentence. Discuss each sentence with partner. Discuss each section with class.	Have students read abstract from Oster et al., 2015** and highlight different abstract sections with different colors.
2	Read introduction of Oster et al., 2012 and discuss the different paragraphs as a group. Identify the question guiding the research in the article.	Have students identify the question guiding the research in Oster et al., 2015.
3	Read discussion of Oster et al., 2012 and compare it to abstract. Ask the students what they observe.	Assignment 1: determine questions that guide students through Oster et al., 2012. Question examples: what is the uncertainty on each type of data? What do the authors conclude about each type of data?
4	Discuss citation tables and lead students through an example citation table.	Have students identify questions that could be the header of a citation table.
5	Discuss the citation table questions that the students came up with.	Have students refine citation table questions.
6	Based on students' citation table questions, assign 3 papers that will help them answer those questions.	Have students find 2 additional scientific papers that will help them answer their citation table questions.

7	Free work day.	Have students build citation table.

*Oster, J. et al. 2012. Response of a modern cave system to large seasonal precipitation variability. Geochemica et Cosmochemica Acta. 91:92-108.
**Oster, J. et al. 2015. Stalagmite records of hydroclimate in central California during termination 1. Quaternary Science Reviews. 127: 199-214.

Quarter 2:

Objectives:

Students will be able to rewrite a hypothesis from a paper of their choosing to be clearer.
Students will be able to write a hypothesis for their own research goals.
Students will be able to write an abstract around their hypothesis.
Students will be able to do basic statistical tests in Matlab and R.

Day of instruction	**In-class task**	**At home task**
1	Students should have a paper of their choosing ready. Discuss what a hypothesis is. They will identify the hypothesis in that paper. Discuss the hypothesis from each paper as a group. Why is that the hypothesis? Why was it written that way?	Re-write the hypothesis that they identified in class to either: make it clearer, put it into an if/then statement, or to make it more concise.
2	Have students write the "old" hypothesis from paper and their "new" hypothesis for that paper on board. Everyone reads them. Discuss.	
3	Discuss with students large scale "ifs" related to their research. Then, discuss large scale "thens" related to the tasks they would like to accomplish related to research. i.e. we work in climate change ➔ if California gets warmer ➔ what will that do to the proxy system you care about.	Have students brainstorm at home what at all of the "ifs" there are to their research.
4	Have students write in class an if/then statement of their	Have students refine hypothesis.

	work. Tell them that they have created a hypothesis.	
5	Discuss the Nature Magazine guide to summary paragraphs.	Have students analyze one of the graduate students abstracts in the lens of the Nature Magazine guide.
6	Discuss abstract analysis. Discuss how to build good abstract introduction sentences.	Have students write 2 sequential abstract introduction sentences and add their hypothesis as the 3rd sentence.
7	Have students peer edit the 3 sentences that each student wrote.	Students should incorporate their peers edits.
8	Lecture (basics of relevant stats): students t-test, rank correlation tests, smoothing of time-series, white-noise, translation to time-frequency domain.	Reading on each test.
9	Basics of coding in R	Practice codes in R
10	Basics of coding in Matlab	Practice codes in Matlab

Quarter 3:

Objectives:

Students will be able to critically assess data that they developed.

Students will be able to present on data that they developed to the scientific community.

Day of instruction	**In-class task**	**At home task**
1	Students will learn the basics of writing their own codes in R	Students will begin a code to do simple tests on already published data.
2	Students will learn workshop new codes in R, and troubleshoot with grad. Student.	Cont. building their own codes.

3	Final test on R code library: sharing a code with a peer to see if both can follow.	Any further refinement of codes necessary.
4	Learning the basics of building their own code in Matlab.	Have students begin to write simple code in Matlab.
5	Trouble shoot Matlab codes with grad. Student.	Cont. building code in Matlab.
6	Share code with peer. See if it makes sense to both students.	Refine code and save it to their library.
7	Basics of building figures in Adobe Illustrator	Build one figure in Adobe illustrator.
8	Peer review illustrator figure.	Build more figures in illustrator.
9	Practice presentations with peer feedback.	Incorporate peer feedback into presentations.
10	Presentation symposium with invited faculty and outside graduate students.	