



UN1920: The How-Tos of Research

Spring 2021
4 credits

Instructor Information

Instructor: Prof. Lila Davachi, Ph.D. (she/her/hers)
Class Time: TBA
Class Location: TBA

Office: 371 Schermerhorn Ext.
Office hours: TBA
ld24@columbia.edu

Lead Teaching Assistants

Ana DiGiovanni, B.A. (she/her/hers)
Email: amd2323@columbia.edu
Github: anad1216
OSF Profile: osf.io/kv9w3
Office: 219 Schermerhorn
Office hours: TBA

Anna Vannucci, M.S. (she/her/hers)
Email: anna.vannucci@columbia.edu
Github: avannucci
OSF Profile: osf.io/6yprf
Office: 409A Schermerhorn
Office hours: TBA

If these hours do not work with your schedule, please let us know and we will work out a time to meet with you. We encourage you to attend office hours, and want to make sure that you have the tools necessary to succeed in this course.

Target Student Population

This course is designed for undergraduates who are majors or intend to major in psychology and/or neuroscience and behavior at Columbia University. Students are not required or expected to have prior research experience, but should be interested in joining a lab to conduct research. The enrollment cap is 20-30 undergraduates.

- **For psychology majors/concentrators:** this course fulfills the integrative/applied elective course requirement
- **For psychology majors completing the Senior Thesis Research Intensive track:** this course fulfills the research methods requirement
- **For neuroscience and behavior majors:** this course fulfills the P3 statistics / methods requirement

Prerequisite: Psychology W1001 or W1010 or equivalent introductory psychology or neuroscience course. An introductory statistics course is recommended, but not required (UN1610, UN1001, UN1101, UN1201, UN1660, or equivalent).

General Description and Course Goals

This course has two overarching goals:



Acquire **a toolbox of research skills** including knowledge on how to: conduct a literature review, generate research questions/hypotheses, write a research proposal, use R for data cleaning, analysis, and visualization, administer surveys on Qualtrics, create behavioral tasks in Psychopy, and practice reproducible science.



Complete an independent research proposal through scaffolded assignments and provide peer review to others to help **demystify the research process**.

What this course is not: This course is not a statistics course. We will review some of the more common research designs and related basic analytic methods. However, we will not review ALL statistical methods or delve deeply into statistical theory.

Learning Objectives



Students will recognize different **methods for conducting research in neuroscience and psychology**, and get an **introduction to common skills** that are needed to conduct such research (e.g., R, Psychopy, Qualtrics, Github, mTurk/Prolific)



Students will conduct, organize and summarize an in-depth **literature review** of a topic of interest and formulate a novel **research question** that addresses a gap in knowledge. Students will **design a study** that addresses the questions of interest.



Students will learn to **communicate** their research to the public and academics through reproducible science practices and assignments that focus on science communication.

Students will articulate the issues of diversity and representation in psychology and neuroscience, recognize the work of scientists who were historically marginalized based on race, ethnicity, gender, etc., and explain how bias is perpetuated in research practices.

How this Course is Structured

This course will have an **asynchronous** component in which you interact with the material and lectures on your own before coming together in class. This class will be primarily **skills-based**. The programming aspect of this course will occur in the **software “R.”** For some of the skills labs, we will use R to apply the analytic techniques we learn to example datasets.

A fundamental part of this course will be writing a brief research proposal. This proposal will help you engage in the scientific process. Details about the assignments can be found in a different document called “Independent Research Proposal Guidelines.”

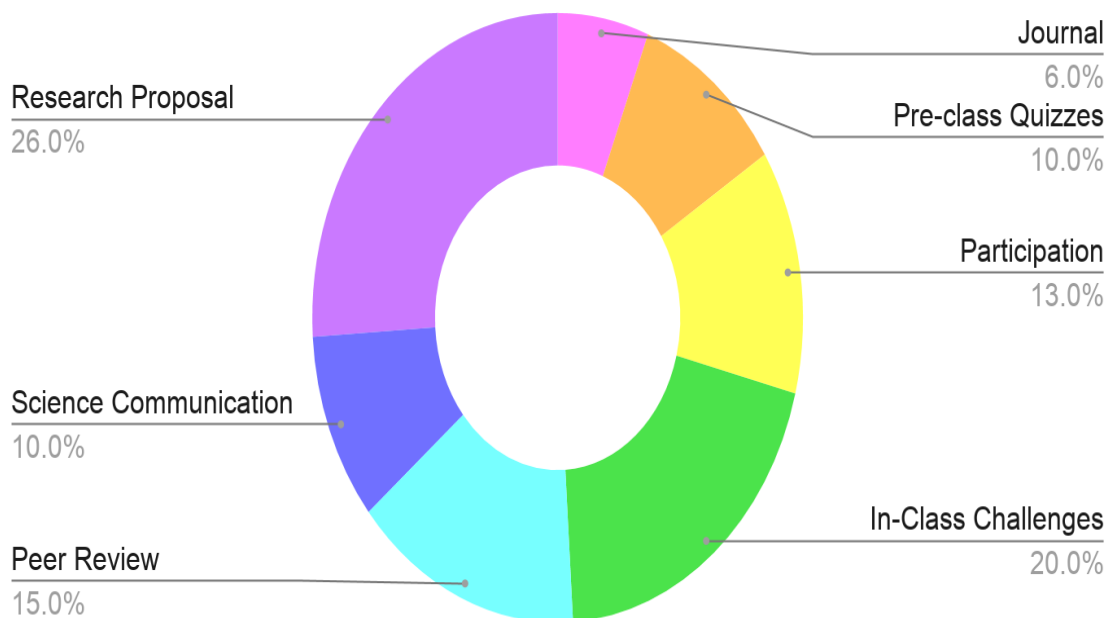
Required Texts and Multimedia

There is no required textbook for this course. All readings, mostly in the form of research articles, will be supplied on Courseworks. The citations for the weekly readings and videos are supplied below in the weekly schedule portion of the syllabus.

Course Assessment Overview

Grade Breakdown

A+	A	A-	B+	B	B-	C+	C	C-	D	F
100-97	96-93	92-90	89-87	86-83	82-80	79-77	76-73	72-70	69-60	59-0



Course Assessment Details



Journal of an Emerging Investigator (6%) - LOs #1-4

The journal of an emerging investigator comprises 100-200 word entries of your personal reflections, reactions, ambitions, etc. as you go through this course. Quality journal entries will be thoughtful reflection about how the course intersects with your personal journey as an emerging investigator.

- ❖ You will have **3 journal** assignments throughout the semester.
- ❖ Each journal entry will be worth two points
 - 2 = complete, 1 = late, 0 = incomplete



Pre-Class Quizzes (10%) - LO #1-4

You will complete **11 pre-classes quizzes** based on the preparation material (readings, videos, etc.) for the class that day. You can use all course material when completing quizzes. These quizzes are meant to be non-stressful.

- ❖ You will be allowed **2 attempts**, and the higher grade will count.
- ❖ You can **drop your lowest** quiz grade, for a total of 10 quizzes, meaning **each quiz will be worth 1 point**.



Participation (13%) - LO #1-4

Participation is crucial to the functioning of this class and will take many different forms. Participation is important to this course because one of the primary goals is to gain hands-on experience in research methods and equip you with tangible skills that will be meaningful in your future research endeavors.

Respect is critical for us to collectively create a nurturing classroom environment. To make our learning environment safe, comfortable, and conducive for everyone, we will:

- ❖ Learn each other's names
- ❖ Use one another's preferred pronouns
- ❖ Avoid racist, sexist, derogatory, heterosexist, and/or classist language
- ❖ Create space for growth
- ❖ Listen attentively to others
- ❖ Respond to one another with compassion and understanding
- ❖ Be vulnerable and take learning risks

During class, we will do in-class challenges where you need to have familiarity with the material. We expect that you will bring your ideas and questions to class. We recognize that some students may be more comfortable than others talking in class, and that all students bring unique strengths and experiences. You can demonstrate participation by being attentive, taking notes, and working with your team in different roles. You will be assigned to have different roles during in-class challenges, such as the **moderator**, someone who leads the discussion of course content; the **scribe**, someone who will draft the assignment material as you progress through the exercises; the **challenger**, someone tasked with being the skeptic and bringing up alternative points; and the **reflector**, someone who drafts a 100-200 word reflection about the group process. You will rotate through these roles throughout the semester.

Each week, you will earn 1 point towards your participation grade (13 weeks for 13% of your grade). If you are ever concerned about your ability to participate in class or your participation grade, we encourage you to come to us so that we can work out a plan.



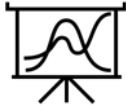
In-Class Challenges (20%) - LO #1-2

We will have **20 in-class "challenges"** where you will split into groups to complete assignments as a team. At the end of class, you will be expected to turn in your material/responses as a group. You can earn **1 grade point per challenge**, for a total of 20% of your total grade. Note that this is **NOT graded on correctness**, but just **EFFORT** to complete each component of the task.



Peer Review (15%) - LO #2

Throughout the semester, you will be asked to submit assignments related to your final research project. For **two** of these assignments, a core component will be peer review. Specifically, you will be asked to read, edit, and provide thoughtful comments to your fellow classmates on their projects. Each peer review is worth 7.5% of your final grade.



Science Communication (10%) - LO #3

Being able to communicate the relevance and impact of your ideas and discoveries will enhance the impact of your work. You will present your research proposal in the form of a **scientific poster in a mini research conference** we will hold at the end of the course.



Research proposal (26%) - LO #2

A core component of this course is a final research proposal in the form of an Open Science Foundation (OSF) Preregistration with the AsPredicted template. You will have sequenced assignments throughout the course (see weekly schedule for details/due dates: [assignments in blue](#)) that will be **un-graded** but that you will receive both **peer and instructor feedback** on. These assignments will build up to your final research proposal. Your research proposal will be partially graded on your evidence of reflection on and incorporation of this feedback you receive throughout the course.

Schedule and Assignments Overview: At-A-Glance

**Note: detailed weekly schedule can be found in another document called "Detailed Weekly Schedule"*

Week	Class	Videos	Readings	In-Class Challenge	Assignments Due
1. welcome and introduction	1a. Introduction	--	--	-- <i>activity: create class participation guidelines</i>	--
	1b. Importance of diversity in research	<u>Ted talk: The untapped genius that could change science forever</u>	<u>Hruschka et al. (2018) PNAS</u>	#1: Identify pressing questions in the study of psychological, behavioral, and neural diversity	Read 1 article Watch Ted talk Pre-class quiz #1
2. Establishing scientific knowledge: recognizing bias in science	2a. General research ethics and bias in Science	pre-recorded lecture: Main principles of practicing ethical research	*** <u>What Not to Do: Clark et al. (2020) Psych Sci</u>	#2: Case studies of common ethical gray areas throughout the research process	Read 1 article Watch 1 video Pre-class quiz #2
	2b. Reproducible science practices	<u>YouTube Video: Data sharing</u> Pre-recorded lecture: Replication and practicing reproducible science	<u>Allen & Mehler (2019) PloS Biology</u> <u>#bropenscience is broken science</u>	-- <i>activity: create github and osf accounts; bash shell basics</i>	Read 1 article Watch 2 videos
3. How to generate a research hypothesis and conduct a literature review	3a. Components of a clear research question	Pre-recorded lecture: independent & dependent variables, covariates, moderation & mediation	--	#3: create research questions based on questions of high interest to society and the lay public	Journal #1 Watch 1 video Pre-class quiz #3
	3b. How to conduct a literature review	Pre-recorded lecture: how to conduct a literature review and use Zotero to store relevant papers	<u>Allen (2008) J Cell Sci</u>	#4: conduct literature search for research question from 3a and summarize one paper in a table	Read 1 article Watch 1 video
4. Common methods in psychology and neuroscience research	4a. Human research methods	Pre-recorded lecture: cross-sectional & longitudinal designs; surveys, behavioral tasks, MRI, fMRI	<u>Rosen et al. (2019) Dev Cog Neurosci</u> OR <u>van Zomeren et al. (2004) J Pers Soc Psychol</u>	#5: post-hoc preregistration of Rosen or van Zomeren paper using the <u>AsPredicted</u> template	Read 1 article (pick 1) Watch 1 video Pre-class quiz #4
	4b. Non-human animal research methods	Pre-recorded lecture: experimental designs; optogenetics, stereotaxic surgery, single unit recording, biochemical assays	<u>Saez et al. (2015) Neuron</u> OR <u>Carcea et al. (2019) BioArXiv</u>	#6: post-hoc preregistration of Saez or Carcea paper using the <u>AsPredicted</u> template	Read 1 article (pick 1) Watch 1 video Pre-class quiz #5

Week	Class	Videos	Readings	In-Class Challenge	Assignments Due
5. Sampling, recruitment, and the Institutional Review Board (IRB)	5a. Sampling and recruitment	Pre-recorded lecture: sampling techniques, sampling bias, and recruitment	Rad et al. (2018) PNAS	#7: Population vs. Samples -- Excel exercise to see happens when your sample is not representative of the population	Proposal: research question of interest Watch 1 video Read 1 article Pre-class quiz #6
	5b. How do you obtain approval for your study?	Pre-recorded lecture: what an IRB is and components of an IRB application on Rascal	Example of an approved IRB protocol by Rascal	#8: write one component of an IRB application for an example study	Watch 1 video Read IRB protocol Pre-class quiz #7
6. Online data collection methods	6a. Designing surveys in Qualtrics	Pre-recorded lecture: writing good surveys and a how-to of Qualtrics	--	#9: Design a survey on Qualtrics with 3-5 assigned questionnaires	Journal #2 Watch 1 video Pre-class quiz #8
	6b. Online Participant Recruitment and Studies: mTurk and Prolific	Pre-recorded lecture: introduction to mTurk and Prolific	Hauser et al. (2018) PsyArXiv	#10: Excel exercise to compare results with and without filtering out problematic responses	Read 1 article Watch 1 video Pre-class quiz #9 Proposal: Literature review table of 10 strong references
7. Introduction to programming: Git and R	7a. Version control: Git basics	Pre-recorded Git tutorial: git basics using bash commands	--	#11: Practice git basics (fork, create git repository, clone, pull, commit, push, merge)	Watch 1 video Pre-class quiz #10
	7b. Introduction to R	Pre-recorded R tutorial: download R, install packages, and introduction to R basic commands	--	#12: live coding with programming fundamentals (variables, data types, etc.)	Watch 1 video Download R to laptop and install packages
8. How to explore and clean data in R	8a. Descriptives and data cleaning	Pre-recorded R tutorial: descriptives statistics, histograms, scatterplots and correlation	--	#13: R descriptive statistics and visualization with example dataset	Watch 1 video R tutorial markdown
	8b. Data cleaning using tidyverse	Pre-recorded R tidyverse tutorial: pipes, filter, mutate, rename, ifelse, case_when, group_by, drop_na	--	#14: Tidyverse data cleaning challenge with example dataset	Watch 1 video R tutorial markdown
9. How to analyze and interpret data in R	9a. T-tests and plots in R	Pre-recorded R tutorial: t-tests and visualizations with ggplot (box-plots, bar charts, raw jitter)	--	#15: Coding challenge with example dataset	Watch 1 video R tutorial markdown Proposal: background and hypotheses

Week	Class	Videos	Readings	In-Class Challenge	Assignments Due
9. How to analyze and interpret data in R	9b. Regression and plots in R	Pre-recorded R tutorial: regression with visualizations in ggplot (plots of regression model output)	--	#16: Coding challenge with example dataset	Watch 1 video R tutorial markdown
10. Creating behavioral tasks with Psychopy	10a. Task design and creating stimuli	Pre-recorded lecture: common behavioral task designs; how to download Psychopy	Tardell-Stoll et al. (2020) Neuropsychologia OR Silvers et al. (2020) Dev Sci	#17: Create instructions and stimulus files for use in Psychopy for example behavioral task	Watch 1 video Read 1 article (pick 1) Pre-class quiz #11
	10b. Build behavioral tasks with Psychopy	Pre-recorded lecture: Psychopy builder to create behavioral task and github	--	#18: Build the task with Psychopy builder mode using the design and stimulus sets from session 10a	Watch 1 video
11. Peer review	11a. Introduction to peer review	Pre-recorded lecture: peer review	Raff (2013) How to become good at peer review	-- <i>Activity: Presentations of research design and verbal feedback</i>	Watch 1 video Proposal: methods presentation (5-min)
	11b. Doing peer review	--	PloS Peer review checklist AND How to write peer review	Peer review #1 of methods outline	Proposal: methods outline
12. Science communication	12a. Importance of science communication	Pre-recorded lecture: Different methods of science communication Ted talk: Talk nerdy to me	Lewis & Wai (2020) PsyArXiv	#19: Evaluate a research study reported in the media.	Read 1 article Watch 2 videos Proposal: full draft of OSF preregistration
	12b. Practicing science communication	Pre-recorded lecture: how to create and present a scientific poster Tedx talk: Communicating science	--	#20: Draft lay summary of a scientific article and accompanying visual on it for the public	Watch 2 videos Peer review #2 of 1 full proposal
13. Mini research conference	13a. Research presentations and student opportunities	--	--	-- <i>Activity: poster presentations and sharing research and science communication opportunities</i>	Proposal: scientific poster presentation
	13b. Research presentations and wrap-up	--	--	-- <i>Activity: poster presentations and course reflections</i>	Journal #3
Finals period					OSF preregistration

Policies, Resources, and Additional Information

Office Hours

We strongly encourage you to come to office hours. Please come visit us even if you don't have something specific to talk about. We love to talk about science, research, and discussing your academic and professional trajectories.

Attendance

Regular class attendance is expected, especially because learning depends upon the preparedness and participation of us all.

- ❖ You may miss **1 class period** without excuse, justification, or grade penalty.
- ❖ **Two or more** unexcused absences will result in a **2% reduction** in your overall course grade per day missed beyond the "free" absence.
- ❖ The most important thing is to keep us informed of any absences, lateness, or early departure--anticipated or otherwise.
- ❖ To have an excused absence, you will need documentation sent to us from your Dean, the Office of Disability Services (ODS), or a medical professional. There may be other reasons for an excused absence, so please reach out to us in advance for approval.

Class Material

Because of the long and entrenched history of racism and misogyny in science, this course may cover some material you find potentially alarming, contentious, or harmful. If you need support and/or would like to talk to someone about questions or concerns relating to any of the topics we cover in this course, we encourage you to reach out if you need help.

Extra credit

Occasionally, students ask about opportunities to allay their grade-related concerns. For this reason, we are offering an opportunity for **1 extra credit point** on your final grade. To earn extra credit, you can take something that you've learned in class and make it accessible or useful to someone in the real world. Some examples include: YouTube R coding tutorials; Infographics depicting the research process; Memes or GIFs related to class content; TikTok videos to teach a concept; or a Children's picture book; among countless other possibilities.

Students with Disabilities

Please let us know if you have a disability that may necessitate an accommodation or the use of auxiliary aids and services in class. To receive disability-related academic accommodations, students must first be registered with their school Disability Services (DS) office. Information is available online for the [Columbia](#) and [Barnard](#) registration processes. Refer to the appropriate website for information regarding deadlines, disability documentation requirements, and [drop-in hours](#) (Columbia)/[intake session](#) (Barnard).

For this course, students are not required to have testing forms or accommodation letters signed by faculty. However, students must do the following:

- The Instructor section of the form has already been completed and does not need to be signed by the professor.
- The student must complete the Student section of the form and submit the form to Disability Services.
- Master forms are available in the Disability Services office or online: <https://health.columbia.edu/services/testing-accommodations>

Improve your writing

If you would like to learn to write better, we encourage you to take advantage of the free individualized writing instruction that is available to all students at the [Writing Center](#). Writing consultants will meet with you at any stage in the writing process for your research proposals.

Statement on Academic Integrity

The intellectual venture in which we are all engaged requires faculty and students alike the highest level of personal and academic integrity. As members of an academic community, each one of us bears the responsibility to participate in scholarly discourse and research in a manner characterized by intellectual honesty and scholarly integrity. . . .

In practical terms, this means that, as students, you must be responsible for the full citations of others' ideas in all of your research papers and projects; you must be scrupulously honest when taking your examinations; you must always submit your own work and not that of another student, scholar, or internet agent."

From the Faculty [Columbia University Faculty Statement on Academic Integrity](#)

Cheating on assignments and plagiarism are very serious violations within the academic community. You are expected to do your own work on all assignments for this class. Neglecting to cite sources in a paper is considered plagiarism. Copying text from another student, another paper, or the internet is considered plagiarism. Please check with us if you have any questions about what is or is not OK.

And finally, as part of this academic community you are expected to always act in accordance with the Columbia honor code. Any student found cheating or plagiarizing in this class will be reported to Columbia's Office of Judicial Affairs and Community Standards for evaluation and academic discipline. If you have questions about any aspect of academic integrity at Columbia, please refer to the following links if you have any questions about [academic integrity at Columbia](#) or about [sanctions or the judicial process](#).

Counseling and Psychological Services

The [Counseling and Psychological Services \(CPS\) Center](#) at Columbia (Lerner Hall, 8th floor) is a safe place for students to talk about any concerns they may have. CPS offers free and confidential therapy and psychiatric care, which is provided in a safe environment where students can address issues that may be keeping them from attaining their academic goals. For appointments, call (212) 854-2878; For after-hours assistance, call (212) 854-9797 or contact Public Safety at (212) 854-5555.

Student Privacy Statement

Students may disclose personal information through class discussions. It is expected that the class will respect the privacy of their classmates. The information disclosed in this class should not be repeated or discussed with other students outside of the course.

Should this course be held in a virtual setting, the **Zoom** class sessions will be recorded. The recording will capture the presenter's audio, video and computer screen. The recordings will only be accessible to students enrolled in the course to review materials and password protected. These recordings will not be shared with or accessible to the public. Breakout rooms will **not** be recorded.