

Statistics for Psychology

Professor: Justin Dainer-Best
jdainerbest@bard.edu
Office: Preston 104

Fall 2019

Course Number	Time	Location	Labs	Office Hours
PSY 203	M/W 11:50–13:10	RKC 103	T, 13:30–15:30 (RKC 100) Th, 10:30–12:30 (RKC 107) Th, 13:30–15:30 (RKC 107)	M, 15:00–16:00 & T, 16:30–17:30, or by appt.

Pre-requisites: Introduction to Psychology or its equivalent; an intention to major in psychology; and a passing score on part I of the quantitative diagnostic exam

1 Overview

In this course, you will be introduced to the basics of statistics for psychology. We will extensively explore the use (and misuse) of statistics in a data-rich world—focusing largely on conceptualizing and interpreting statistical inferences within psychology. In this course, we will cover basic topics in statistics including: data visualization, measures of central tendency and variability, hypothesis testing, correlation and regression, *t*-tests, analysis of variance, and chi-squared tests.

Note that there are URLs in this document that are links in the digital version, available on Moodle.

1.1 Objectives

By the end of the semester you should...

1. understand how we use the concepts of uncertainty and variability to draw inferences about samples
2. grasp the logic, strengths, and limitations of the null hypothesis significance testing approach to using statistics to answer psychological questions
3. understand the relationship among statistical significance, power, and effect size

4. when presented with a research design (as you will be during your time as a major at Bard!), be able to
 - (a) identify and conduct the correct statistical analysis in the R programming language and software package;
 - (b) interpret the output of those tests in order to draw a conclusion about research questions; and
 - (c) report the results of statistical analyses in colloquial language and in a manner appropriate for scientific publication
5. have a greater understanding of the role of statistics in public discourse.

1.2 Some FAQs about this course, and tips for success:

1. *Is this course primarily about numbers, math, and computations?*

There will be some computation. However, at heart, statistics are a tool for answering questions, and they are the most powerful tool in the psychologist's toolbox. Some of what you will learn in this class will be based on mathematical knowledge, of course, and you should not be shy of that. Nonetheless, we will try not to lose sight of the fact that statistics in psychology are fundamentally a way of answering questions about the mind and behavior, and those questions should remain at the forefront of your mind throughout the course.

2. *I want to be a _____ (see, e.g. therapist, social worker). Why do I need to take a class on statistics to major in psychology?*

You would be surprised how important statistics are to those working in the helping professions! An ability to interpret statistics—and to recognize when they are being used correctly—is in fact a key component in learning which treatments are effective, or how to best serve a patient. Further, statistics are integrated into other things you will need to do at Bard (coursework, your senior project) and beyond (understanding journalism, your finances, etc.).

3. *Should I make use of the course assistants, statistics study room, and the professor's office hours? I'm already passing the class.*

Yes! Office hours are not just about meeting with me after exams, and using the resources from the Learning Commons (including the study room and the course assistants) is strongly encouraged. Work with others! This might mean forming study groups with your classmates, as well.

Former students have found it really useful to work on their homework during the course assistants' office hours, so that they can ask questions as they go along. Work with your classmates, me, and the course assistants to see if you understand the material well enough to explain it to someone else.

4. *What do I do if I don't understand something early on in the semester?*

Stay up-to-date. The material is cumulative, so if a concept challenges you (especially early in the semester), address that right away by coming to office hours, speaking to a course assistant, or visiting the Learning Commons. Similarly, if you don't understand something during lab, ask for help from a course assistant or from me, so that you don't get stuck not feeling like you understood anything. (We'll discuss this further in lab, too.)

5. *Is it okay for me to use other resources besides the textbook, the slides, and my notes?*

Yes, please use outside resources. There are a lot of stats resources on the web. Make use of them. You may wish to watch videos from Khan Academy ([link](#)), for example . Further, here are a few additional textbooks that I've seen recommended (please note that these are **suggestions** and that I will not [frequently] be referring to them):

- Field, A., Miles, J., & Field, Z. (2012). *Discovering statistics using R*. London, UK: Sage Publications.
- Wheelan, C. (2014). *Naked statistics: Stripping the dread from the data*. New York: Norton.
- Poldrack, R. (2018, 2019). *Statistical thinking for the 21st century*. Retrieved from <https://statsthinking21.org/>
- Aron, A., Aron, E., & Coups, E. J. (2012). *Statistics for psychology*. (5th ed.) Upper Saddle River, NJ: Pearson/Prentice-Hall. ISBN 0136010571.
- Phillips, N. D. (2018). *YaRrr! The Pirate's Guide to R*. Retrieved from <https://bookdown.org/ndphillips/YaRrr/>

The Aron, Aron, & Coups book is one that was frequently used in past statistics courses; your classmates may have them lying around, and it is also available inexpensively online. The Poldrack and Phillips books are available online for free.

Additionally, there are *many* online resources available for learning and using R. I am happy to help you identify some that might work for you—this would be a great reason to come to my office hours, for example.

2 Materials

Primary text: Navarro, D. J. (2011, 2016, 2019). *Learning statistics with R: A tutorial for psychology students and other beginners*. Version 0.6. Retrieved from <https://learningstatisticswithr.com/>

We will be using a free, online textbook written by Danielle Navarro. This textbook has two primary benefits (beyond its being free and online): first, it is written focused on R; and second, it does a nice job of summarizing complex statistics in a brief format.

You should complete each reading *in preparation for class*, as listed below on the schedule.

Occasional supplementary readings may be posted on **Moodle**. More importantly, most assignments will be turned in via Moodle, and all lecture slides and code will be shared on Moodle. Your Moodle enrollment key is **correlationF19**, which is case-sensitive.

We will provide you with a basic calculator that you have to return at the end of the semester, but you are free to use your own. If you use your own calculator, it should be able to add, subtract, multiply, divide, and should have an eight digit display, memory, and a key for \sqrt{x} (x^2 is nice but not necessary). Graphing calculators and cell phone calculators are not permitted for exams.

3 Class Policies

3.1 Attendance

Because of the nature of the material, absences will likely incur a *de facto* penalty on exams because it is difficult to do well on tests without having attended class. We will move at a rapid pace; material that is missed due to absence will not be repeated in class or office hours. As importantly, late arrivals are disruptive to the class. Consistent patterns of lateness may lower your grade. Be on time. If you must miss a class, please let me know by sending me an email explaining your absence.

3.2 Accommodations & Accessibility

Bard College is committed to providing equal access to all students. If you anticipate issues related to the format or requirements of this course, please contact me so that we can arrange to discuss. I would like us to discuss ways to ensure your full participation in the course. Together we can plan how best to support your learning and coordinate your accommodations. Students who have already been approved to receive academic accommodations through disability services should share their accommodation letter with me and make arrangements to meet as soon as possible.

If you have a learning difference or disability that may relate to your ability to fully participate in this class, but have not yet met with the Disability Support Coordinator at Bard, you can contact their office by emailing disabilityservices@bard.edu; the Coordinator will confidentially discuss the process to establish reasonable accommodations. Please note that accommodations are not retroactive, and thus you should begin this process at the beginning of the semester if you believe you will need them.

Additionally, as my office in Preston Hall may be physically difficult to access, you may always request to meet with me in another location.

Lastly, it is important to me that we have an open, inclusive, and supportive learning environment for all students in this course. Please speak with me if you have any concerns or questions regarding issues of diversity, equity, or inclusion in the classroom.

3.3 Plagiarism

I expect you to be familiar with what plagiarism is and is not. You may not present someone else's work as your own without proper citation. You may not copy someone else's work. You may not simply reword text from another source without giving credit. Please cite others' work where relevant, and use your own writing. If you are not sure about the definition of plagiarism, or whether something constitutes plagiarism, please consult with me or with someone at Bard's Learning Commons. Students caught plagiarizing will be reported to the Academic Judiciary Board, will get no credit for the assignment, and may fail the course.

Exams, quizzes, and the written paper are to be completed independently. Homework assignments may be worked on with peers provided that you credit your study group. In preparing for exams, study groups are an excellent way to learn material. However, you should take care to ensure that you can respond to the questions independently.

3.4 Cell phones and laptops

Before class, you should silence your cell phone, and you should not be on your phone during class. (Please do not take notes on your phone.) In our M/W classes, no laptop computers are allowed unless you ask explicit permission. If you text or access materials unrelated to class during our class time, you are mentally absent from class.

In lab sessions, we will be using computers frequently. I encourage you to turn off your WiFi whenever possible, or at minimum to enable Do Not Disturb and ignore email and messages. Browsing unrelated materials is distracting to you and also to the people around you.

3.5 Late Assignments

Late assignments will immediately lose 10% of their grade, and another 10% for each additional day late. (e.g., a 20-point assignment will lose 2 points after the deadline, and an additional 2 points if turned in more than 24 hours after the deadline.) Quizzes and exams may not be completed after the deadline.

4 Installing R

R is installed on machines in several computer labs across campus. However, you will also likely want to install it on your personal machine (and you may bring your personal laptop to class, if you desire). I recommend installing both R and R Studio. Some instructions follow, and are repeated in more detail in the textbook.

1. Install R from <https://cran.r-project.org/>—it is available for Mac OS, Windows, and Unix-based operating systems. There are minor differences in R syntax for these operating systems.

2. Install R Studio from <https://www.rstudio.com/products/rstudio/download/>. Although not technically required, R Studio will be the interface that I use to teach in class.

You may also choose to install Jamovi from <https://www.jamovi.org/download.html>. I will *not* use Jamovi in class; however, Jamovi uses R as its back-end system and thereby may be useful to help you understand some basics of analysis. For more information on the relationship between Jamovi and R, please read about the ‘jmv’ package: <https://www.jamovi.org/jmv/>

5 Assignments and grades

Your grades in this course will come from **three exams**, regular **homework** assignments, Moodle **quizzes**, and a **final paper**.

Percent	Assignment
20%	Exam 1
20%	Exam 2
25%	Exam 3
15%	Moodle quizzes
10%	Homework assignments
10%	Final paper

Grades will be assigned according based on the following rubric (plusses and minuses will be assigned at the top and bottom of each range). I will only change this grading rubric in ways that will help you.

A-range: 90–100%	C-range: 70–80%	F: below 60%
B-range: 80–90%	D-range: 60–70%	

5.1 Exams

Exams are a good time for you to demonstrate your understanding of course materials. You may not make up exams (except in the case of unanticipated emergencies *with documentation* from the Dean of Students).

Exam will be in class on the date indicated on your syllabus. Exams are worth 20%, 20%, and 25% of your grade. However, to award improvement over the course of the semester, I will also calculate your grade weighting the final exam as 35%, and each individual midterm as 15%. You will receive whichever grade is higher.

Each exam will have an in class-written portion that presents an opportunity to show mastery of the underlying concepts and theories, and a lab exam that allows you to demonstrate your ability to perform and interpret statistics.

Lab exams are open-everything-but-another-person. In-class exams are “closed-book” except that you may also bring a 4”x6” index card with notes to the midterm exams, and an 8½x11” sheet of paper with notes to the final.

5.2 Moodle quizzes

There will be quizzes on Moodle for most topics. Your three lowest scores will be dropped, and the others summed to create a final quiz score. Quizzes must be taken within 24 hours of completion of the material marked with the phrase Moodle Quiz in the schedule below. (Note that the text in the schedule links to the relevant quiz, but quizzes will not be accessible until the day of class.) All quizzes are open-book and comprised of questions randomly selected from a larger set of questions (so each student will have a different quiz). You may not collaborate or ask for help on these quizzes (see 3.3 Plagiarism, above).

5.3 Homework

Homework for each chapter will be due in class, after we complete a particular topic. Homework assignments must be turned in in-class, and must be stapled and include your name.

5.4 Final paper

In your final paper, you will analyze the data analysis reported in a published psychology journal article. This assignment has three primary goals.

Help you to be a consumer. Class and exams provide the opportunity to show you understand and can use statistics. In reading published articles, it is crucial to understand and evaluate how the conclusions were derived, and to evaluate independently whether you accept the claims. In this assignment, you will be an active reader, and provide your analysis of the report of the data analysis and presentation.

Simulate the peer review process. Peer review is the primary mechanism by which papers in psychology are published. It is the ‘gatekeeper’ of the academic world, and aims to ensure that published work meets high standards. Typically, after a paper is submitted, an editor solicits expert reviews that assess the paper’s strengths and weaknesses. This assignment will give you a chance to be that expert.

Prepare you for moderation. Psychology moderators write a paper that summarizes and evaluates a psychology journal article. Part of your analysis should focus on the appropriateness of the analyses given: (1) the hypothesis being tested, (2) the study design, and (3) the features of the data set. This assignment will thus prepare you for Moderation Saturday.

Your analysis will focus on the results section. In 3–4 pages, you should:

- Briefly (1–2 paragraphs) summarize the research goals and method. Assume the reader is a psychologist unfamiliar with the paper.
- Summarize the analyses conducted. Be sure to state the null hypothesis (or hypotheses) even if the paper does not do so explicitly.
- The bulk of the paper will be spent on your critique. What you choose to focus on is up to you, but some suggested directions are:

- **Analyses.** Were the analyses appropriate—given the data, would you have conducted the same or different analyses? Why or why not?
- **Presentation.** Was the presentation of the results clear? Could the paper have benefited from other—or different—tables or figures that would have made the findings more clear? Were any figures or tables accurate representations of the findings?
- **Inferences.** Are the conclusions drawn from the analyses reasonable?

Other Guidelines

- The paper should be 3–4 double-spaced pages, and clearly written. You can organize your argument however you wish, but there should be a logical order to the paper. Be sure to include an introduction and conclusion to your main argument.
- Citations should be in APA format, and you should include a Reference list. You must work independently on the paper, but are free to consult with me. You may refer to any sources that you find useful (be sure to cite them).
- In the past, the strongest papers have focused on two or three areas in the analysis section, and fully developed and explained them. One “danger zone” is the temptation to analyze research methods rather than data analysis and statistics. Focus on the stats—you’ll have plenty of time to think about methods next semester in PSY 204.

6 Schedule

The schedule may change over the course of the semester. Changes to assignment dates will be announced via email and also changed on Moodle. You are responsible for keeping up with the readings, showing up to class prepared, and turning in assignments on-time.

Note that there are no labs the weeks of September 3 & 5 and October 15 & 17. Because of midway boards and Thanksgiving, there will be no Tuesday lab on November 19, but it will meet on November 26. You should also note that while I will not hold class on the Wednesday before Thanksgiving, the final exam will be on December 18th. This is not negotiable.

Chapters refer to the Navarro textbook; in the PDF of this document, they are links to the Bookdown version online (<https://learningstatisticswithr.com/book/>).

Day	Date	Topic	Reading	Due
Monday (T Th)	Sep 2 (Sep 3 5)	Intro (No labs)	Syllabus	
Wednesday	Sep 4	Statistical Concepts	Ch. 1; Ch. 2	Moodle Quiz
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Day	Date	Topic	Reading	Due
Monday	Sep 9	Central Tendency and Variability	Ch. 5	Moodle Quiz
T Th	Sep 10 12	Lab: Intro to R; hypothesis testing exercise	Ch. 3	
Wednesday	Sep 11	z -scores and probability; History of statistics	Ch. 9	Moodle Quiz
Monday	Sep 16	Estimating unknown quantities from a sample	Ch. 10.1–10.4	Moodle Quiz
T Th	Sep 17 19	Lab: Central tendency & variation	Ch. 4; 5.1; 5.4	
Wednesday	Sep 18	Hypothesis Testing	Ch. 11.1–11.5	
Monday	Sep 23	Hypothesis Testing; History of statistics	Ch. 11.6–11.7; 13.1	Moodle Quiz
T Th	Sep 24 26	Lab: Visual Displays of Information	Ch. 6	
Wednesday	Sep 25	Testing Hypotheses with Means of Samples; Class visit on visualizations		Moodle Quiz
Monday	Sep 30	Catch Up / Exam Review		
T Th	Oct 1 3	Lab Exam		Lab Exam
Wednesday	Oct 2	Exam		Exam
Monday	Oct 7	t -test for a single sample; History of statistics	Ch. 13.2	
T Th	Oct 8 10	Lab: t -test for a single sample	Ch. 13.2.2	
Wednesday	Oct 9	t -test for independent means	Ch. 3.3	
(Monday)	(Oct 14)	(Fall break)		
(T Th)	(Oct 15 17)	(No labs)		
Wednesday	Oct 16	t -test for independent means	Ch. 13.4	Moodle Quiz
Monday	Oct 21	t -test for dependent means	Ch. 13.5	Moodle Quiz
T Th	Oct 22 24	Lab: t -test for dependent and independent means	Ch. 13.3.6; 13.7	
Wednesday	Oct 23	Type I and Type II errors; Effect Size	Ch. 13.8–13.11; Aron, Coups, & Aron, Ch. 6	

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Day	Date	Topic	Reading	Due
Monday	Oct 28	Statistical Power; History of statistics	Ch. 11.8–11.9	Moodle Quiz
T Th	Oct 29 31	Lab: Academic Writing & Plagiarism	Moodle: Harvard College Writing Fellows	
Wednesday	Oct 30	Confidence Intervals and Uncertainty	Ch. 10.5; Poldrack Ch. 10	Moodle Quiz
Monday	Nov 4	One-way ANOVA	Ch. 14.1–14.6	
T Th	Nov 5 7	Lab: One-way ANOVA	Ch. 14.3	
Wednesday	Nov 6	One-way ANOVA	Ch. 14.7–14.12	Moodle Quiz
Monday	Nov 11	Catch Up / Exam Review		
T Th	Nov 12 14	Lab Exam		Lab Exam
Wednesday	Nov 13	Exam		Exam
(Monday)	(Nov 18)	(Midway Boards)	Psych Classes Cancelled	Due
(Tuesday)	(Nov 19)	(Midway Boards)	Psych Classes Cancelled	Due
Wednesday	Nov 20	Correlation and Regression; History of statistics	Ch. 15.1–15.5	
Thursday	Nov 21	Lab: Correlation	Ch. 5.7	
Monday	Nov 25	Correlation and Regression	Ch. 15.6–15.11	Moodle Quiz
Tuesday	Nov 26	Lab: Correlation	Ch. 5.7	
(Wednesday)	(Nov 27)	(Thanksgiving)		
(Thursday)	(Nov 28)	(Thanksgiving)		
Monday	Dec 2	Factorial ANOVA and Interactions; History of statistics	Ch. 16	Moodle Quiz
T Th	Dec 3 5	Lab: Chi Square	Ch. 12.6	
Wednesday	Dec 4	Chi Square	Ch. 12	Moodle Quiz
Friday	Dec 6			Final Paper
Monday	Dec 9	Bayesian Statistics	Ch. 17	
T Th	Dec 10 12	Lab Exam		Lab Exam
(Wednesday)	(Dec 11)	(Advising Day)		
Monday	Dec 16	Catch Up / Exam Review		
Wednesday	Dec 18	Final Exam		Final Exam