ESP 178 - Applied Research Methods **Winter 2012**

Lecture: Haring 1204
T, R 12:10-1:30

Sections: Wickson 2120J
W 3:10-4:00
W 4:10-5:00
W 5:10-6:00

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W 1:00-2:00
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The purpose of this course is to train you in the fundamentals of research design in the social sciences. The phrase "research methods" possibly conjures up computers performing complex calculations, unintelligible tables of numbers, and mumbo-jumbo like "Bayesian chained equations." Don't let this fool you: despite modern innovations, the fundamental skills of good research will never change. They are

(i) the ability to identify mysteries that you want to solve, and
(ii) knowing the tools available to solve them.

We say "applied research methods" as in "applied karate;" you will actually be doing it yourself. We don't mean getting in fights with people (it rarely comes to that), but rather experiencing most of the major steps of a research process. You will formulate research questions, evaluate the research of others, work with data you collected yourself, and draw conclusions using the tools of modern scientific research (particularly the statistical tools). **Specifically, the two major learning objectives of this course are**

(1) to become familiar with the methods used by our research community (and their limitations),

To gain familiarity with and competence in various methods of research and argument, we will focus on the following concepts and skills: recognizing credible sources, conventions of citation, peer review, research ethics, qualitative methods, survey design, participant-observation, historical archives, aggregate data, time series, panel data, census data, samples and statistical inference, causation, simulation modeling, mathematical modeling, conceptual modeling, observational studies, experiments, natural experiments, the various meanings of "control", regression and correlation, null hypothesis testing and its limitations, using computers to do statistical analyses, and the virtues of "shoe leather".

(2) to become able to conceive of and propose a research project using said methods.

Professional research projects can require lots of money to carry out. Since the results of research tend to be very valuable to many people, researchers can make a comfortable living off this work, but only if they are able to successfully convince others to fund the project. This requires the *grant proposal*, an essay-length advertisement for why a funding agency or employer should give you money to carry out the project. Writing a good grant proposal is an indispensable skill. As such, we will simulate the experience of submitting a grant proposal to a national funding agency (this year, the National Science Foundation's Graduate Research

Fellowship Program, or NSF GRFP). The proposal will be divided into two parts, submitted throughout the quarter, and each of you will be responsible for reviewing your peers'. The final, complete draft will be submitted at the end of the quarter.

Prerequisites

We will be using personal response clickers in lecture, both to collect data and to pose problems. The clickers are available for purchase at the bookstore. The brand and model is: Interwrite PRS RF Clicker 11-00682-01-R. This should be the only clicker used on campus, so if you already have one, it's probably the correct kind. We do not recommend sharing a clicker with a friend, since you need to have your student ID entered into the clicker correctly to receive credit for your participation (students who share invariably end up losing credit by answering under their friend's ID).

This class requires frequent use of arithmetic operations - addition, subtraction, multiplication and division. A basic four-function handheld calculator is very useful, but not necessary, for the math we'll be doing, so feel free to bring one to class and to exams.

The problem sets you do at home will also require access to a computer running the open-source R statistical software package, free to download at http://cran.r-project.org/.

Some statistical knowledge is assumed (see course prerequisites in the UCD Course Catalog), but grading will favor clarity of reasoning and depth of analysis, rather than mastery of arcane statistical wizardry. For a good reference for the statistical concepts used in this class, please consider using the optional textbook (Freedman, Pisani and Purves) described below.

Readings

There is no required textbook for this course, but article-length readings will be posted on Smartsite as pdf's and will be necessary to complete certain problems in the problem sets, midterm and final. Lecture slides will be posted on Smartsite as pdf's. Two books are recommended as optional complements, and both are available on reserve at the Shields library.

For the statistical component of the course, I strongly recommend Freedman, Pisani and Purves' Statistics. While the material I present in lecture and in the handouts is sufficient for all the assignments, this text covers almost every topic in this course, and can help solidify concepts and provide additional exercises. The fourth edition is the most current, but is also expensive. The third edition is just as good for this class, and cheap copies (like, $4) are available on the internet. In addition, this book will be available on reserve at the Shields Library.

For writing the research proposal, I know of no better book than Booth, Colomb and Williams's The Craft of Research. This book walks the reader through the composition of every part of a project, and is particularly useful for students who are new to research papers. This book is also available on reserve at Shields.

Assignments and Grading

Course grades will be based on the midterm, final, the three papers, participation in lecture and discussion, writing the peer reviews, and five problem sets. The midterm and final will consist of multiple-choice and short-answer questions. The final exam will be cumulative, but with an emphasis on the course material after the midterm.

The various components of the research proposal (discussed in detail above) will constitute 50% of the course grade. The midterm and final are 15% and 20% of the course grade. In between these larger assignments, there will be five take-home problem sets, which together constitute 10% of your grade. The problem sets are designed to apply the concepts you learn in lecture and exercise the math skills necessary for understanding quantitative research papers, as well as prepare you for the questions on the midterm and final exam. As mentioned in the UC Davis General Catalog, this course requires students to have completed Statistics 103 or Sociology 106 or equivalent. For students who have dealt with some probability and statistics before, the quantitative questions in the problem sets are intended to be mostly review. Discussion sections will be held weekly by the TA, and participation in lecture and these sections will constitute 10% of the course grade.

To summarize, the course grades themselves are out of 1000 points, and made up of

five Problem Sets, each worth 20 points (so 100 pts total),
Paper 1, "Topics, Questions, and Relevance," worth 120 points,
Paper 1 Peer Review Comments, worth 30 points,
Paper 2, "Problems, Methods and Sources," worth 120 points,
Paper 2 Peer Review Comments, worth 30 points,
Paper 3, the final research proposal, worth 175 points,
the Midterm Exam, worth 150 points,
the Final Exam, worth 175 points, and
in-class participation (both lecture and section), worth 100 points.

Policies and Expectations

Attendance in section and lecture is necessary to receive participation credit. Unexcused, habitual lateness in either will factor into participation credit.

Plagiarism, which means passing off someone else's words or ideas as your own, is a serious form of cheating and will be punished as much as humanly possible, including a zero on the assignment and disciplinary action by Student Judicial Affairs.

To put it simply, late papers or problem sets will not be accepted. Because peer review assignments will be handed out the same class the papers are submitted, the papers must be turned in no later than the beginning of class on the day they are due (or accepted early, if you want). Students are also responsible for the peer reviews they are assigned whether or not they submitted a paper or are physically present in class to pick them up. A deadline is a deadline; if you know you are not going to meet it, contact me (Beheim) in advance (i.e. more than one day) and we can discuss the situation.

The final exam will be held on Thursday, March 22 from 3:30-5:30, in Haring 1204. Students who cannot attend the scheduled final exam must arrange to take it early.

Schedule	Events
Week 1	(PS = Problem Set)
Jan 10 - Introduction: Ways of Knowing	
Jan 12 - How to Ask Interesting Research Questions	
Week 2	
Jan 17 - Measuring Stuff	PS 1 Released
Jan 19 - Evaluating the Research of Others	
Week 3	
Jan 24 - Conceptual Models	PS 1 Due
Jan 26 - Mathematical and Simulation Models	
Week 4	
Jan 31 - Correlation and Causality	PS 2 Released
Feb 2 - Observational Research	Paper 1 Due
Week 5	
Feb 7 - Experimental Research	PS 2 Due
Feb 9 - Natural Experiments	Paper 1 Peer Review Due
Week 6	
Feb 14 – Research Ethics	
Feb 16 - Midterm	
Week 7	
Feb 21 - Regression	PS 3 Released
Feb 23 - Sampling Theory	Paper 2 Due
Week 8	
Feb 28 – Frequentist Inference	PS 3 Due, PS 4 Released
Mar 1 – Bayesian Inference	Paper 2 Peer Review Due
Week 9	
Mar 6 – Qualitative Methods	PS 4 Due, PS 5 Released
Mar 8 – Hypothesis Testing	
Week 10	
Mar 13 – Survey Design	PS 5 Due
Mar 15 – Complex Systems Science	
Final Exam: Thursday, March 22, 3:30-5:30 in Haring 1204	Paper 3 Due at Final