Course Overview

Description

Quantitative investigations of social problems apply statistical methods to examine policy-relevant propositions about public life. Such investigations may include calculations of health risks for specific populations, examinations of traffic patterns to identify inefficiencies, assessments of educational opportunities, or evaluations of the effectiveness of specific instructional practices. By quantifying observations and comparing numeric representations of social phenomena against statistical (and often moral and normative) standards, quantitative researchers seek to inform policymakers and influence the policymaking process.

The purpose of this course is to help students expand their knowledge of quantitative methods, apply their knowledge to policy-relevant questions (especially in the area of education), and evaluate critically the claims of those who use quantitative research to promote policies and practices. Students examine a range of methodological strategies used by quantitative researchers to investigate social problems and programs using secondary data analysis and quasi-experimental designs. Issues of causality and validity will be explored, as well as questions about the usefulness of quantitative evidence in promoting just and effective public policies. Although the focus of the course will be on educational matters, students from other disciplines with applied quantitative traditions will also find the course relevant to their area of study.
Pedagogical Approach

A basic premise of the course is that students acquire a deeper understanding (and hopefully appreciation) of quantitative methods through actual investigations of social problems and policies. Consequently, students are required to design relevant analyses, implement these analyses, interpret results, and communicate policy considerations to classmates and the instructors. The basic datasets for the course are the National Education Longitudinal Study (NELS) and the Civic Education Study (CivEd). NELS is a general-purpose, longitudinal survey conducted by the National Center for Education Statistics (NCES). It is the third in a series of major studies conducted by NCES to investigate “the educational, vocational, and personal development of students at various grade levels, and the personal, familial, social, institutional, and cultural factors that may affect that development.” CivEd is a cross-national survey designed to “identify and examine, in a comparative framework, the ways in which young people are prepared to undertake their role as citizens in democracies.”

We derived two smaller datasets from NELS:88. The first dataset focuses on the base year and two additional waves of student data: 1988, 1990, and 1992, when students were 8th, 10th, and 12th graders. Students can use these data to examine student learning over time, as well as the role of family background and school experiences in shaping achievement and academic development. The second dataset focuses on postsecondary concerns. This dataset includes two waves of student data: 1992 and 1994, when students were 12th graders and two years out of high school. Students can use these data to examine the role of family background and high school experiences on postsecondary attitudes and behaviors, including employment and participation in postsecondary institutions. The CivEd dataset includes survey data from students and teachers in the United States, Poland, England, and the Czech Republic. These data were collected in 1999 and 2000 and may be used to examine the role of family background and school experiences on students’ civic attitudes and knowledge. Students may gain access to the full NELS:88 dataset from NCES and the full CivEd dataset from the International Association for the Evaluation of Student Achievement (IES). For more information about the NELS study, go to http://nces.ed.gov/surveys/nels88/; for information about the CivEd study, go to http://www.wam.umd.edu/~jtpurta/.

Prerequisites

Because this is not a course in statistics, students must already have acquired an understanding of statistical reasoning and basic statistical techniques before enrolling in the course. At a minimum, students should have a statistical background that includes a basic understanding of theories of measurement, measures of central tendencies and variance, theories of probability, population sampling, and hypothesis testing. We require that students complete EDMS 645 (or its equivalent) and recommend (strongly) that students complete EDMS 646 (or its equivalent) prior to taking this course. Students who have more advanced knowledge of ordinary least squares (OLS) and logistic regression may find the course especially useful if they have not had an opportunity to apply these techniques using a nationally representative dataset. A basic understanding of quantitative research designs and statistical software (e.g., SPSS) is also very helpful, though not a prerequisite for the course. Students who are uncertain about whether they have the necessary prerequisites should discuss their prior preparation with the instructors.
Expectations and Requirements

Attendance. On occasion the need may arise for a student to miss class. If this occurs, it is the student’s responsibility to: 1) notify the instructor of his or her absence (in advance, if possible); 2) collect assignments or notes from colleagues; and 3) make arrangements to submit written assignments. There also may be occasions when a student is late for class (or needs to leave early); however, please recognize that this is a fast-paced class and missing class time may jeopardize your ability to complete course requirements.

Course Readings and Homework. Students should plan not only on attending all classes but also on setting aside additional time to complete required readings, analytic exercises, and a final project. Because the course places a heavy emphasis on the actual application of statistical techniques, students will have to spend time outside of class exploring datasets, constructing measures, running statistical analyses, and writing up results. Students are asked to complete six analytic exercises and a final study or project. Because most assignments are sequential, keeping up with assigned deadlines is critical. Late assignments may result in the lowering of a student’s grade. We strongly discourage incompletes.

Writing Quality and Style. When preparing written assignments students are expected to express their thoughts in a clear and concise manner. Emphasis should be placed on clarity of expression and accuracy of interpretation. Written assignments should be proofread carefully for grammatical and spelling errors and thoughts and quotes that are not your own should be cited properly. While APA (6th edition) format is preferred for citations, other recognized formats (e.g., Chicago) may be used as long as they are consistently applied throughout the text.

Course Assignments. Students’ final grades will be based on three components. Handouts outlining the details and expectations for written assignments will be distributed roughly two weeks prior to the due date.

* Exercises (60%). During the course, students complete six exercises. The exercises include: (1) missing data analysis, (2) interpretation and presentation of quantitative analyses, (3) development of a research proposal, and (4) three memos that critique an article that uses one of the research techniques that we discuss in class. Students may do these exercises individually or, with the permission of the instructors, in teams of two. Each exercise represents 10% of the student’s grade. Additional information about each exercise can be found on ELMS.

* Final Study (40%). The final study or project is meant to be a summative experience for students who take the course. Students will design and complete a quantitative analysis of a policy-relevant question using one of the class datasets, or, with the approval of the instructors, an alternative dataset. The results of the study are to be presented in a 15-20 page paper suitable for presentation at a professional conference. Papers should mirror the format of a journal article and include a brief description of the problem or phenomena under investigation, a brief overview of the theoretical framework guiding the research, a description of the data and relevant measures used in the study, an explanation of the analytic strategy or method, a presentation of results, and a brief discussion of the study’s implications. Students will present their papers to classmates during the final week of the course. As with the exercises, students may complete their

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final projects individually or, with the permission of the instructors, in teams of two. The paper will account for 35% of the student’s grade and the in-class presentation will account for 5%.

**Our Responsibilities.** Just as we have high expectations for each of you, we also have high expectations for ourselves. This is a demanding course for students and instructors. You should expect that we will:

- Be prepared for class, read and return your work in a timely manner, be interested and engaged in your work, and meet with you (in person, by phone or Email) individually or in groups (upon request) to answer questions and address concerns as they may arise.

- Remember that each of you brings a different background and level of experience (and interest) to this course and, as a result, work to provide all students with the support they need to master the course material.

- Help you develop your personal research interests and identify sources of additional substantive and methodological expertise that might help you pursue your interests.

**Grading Scale**

We’ll provide you with a general grading rubric for each assignment. The final grade for the course will be the weighted average of the grades for the six exercises, the final paper, and the paper presentation (see student responsibilities for the weights). We will also provide comments to help you see how an exercise, paper, or presentation could be improved.

**General Instructional Policies**

**Religious Holidays.** The University System of Maryland policy (Assignments and Attendance on Dates of Religious Observance) provides that students should not be penalized because of observances of their religious beliefs: students should be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. Additional information on this policy may be found at the following URL: [http://www.faculty.umd.edu/teach/attendance.html#religious](http://www.faculty.umd.edu/teach/attendance.html#religious).

Students will not be penalized because of observances of their religious beliefs. Whenever possible, students will be given reasonable time to make up academic assignments missed due to participation in a religious observance. It is the student’s responsibility to inform the instructor as soon as possible of any intended absences for religious observances.

**Code of Academic Integrity.** All students are expected to abide by the code of academic integrity throughout this course and all other courses offered at the University of Maryland. Academic dishonesty, including cheating, fabrication, and plagiarism will not be tolerated and will be reported to the Student Honor Council. The full text of the University’s honor code is available at [http://osc.umd.edu/OSC/AcademicHonorPledge.aspx](http://osc.umd.edu/OSC/AcademicHonorPledge.aspx). Students, who have questions about the code, or their obligations under the code, should contact the student honor council chair at studentconduct@umd.edu.

**Documented Disabilities.** A student with a documented disability or any other special need who wishes to discuss academic accommodations should contact the instructors as soon as possible. The University is obligated, whenever possible, to provide appropriate
accommodations for students with disabilities. Students who have questions about their rights or accommodations may contact Disability Support Services (4-7682). Additional information about the University’s policies regarding documented disabilities may be found at the following URL: http://www.faculty.umd.edu/teach/disabilities.html.

**Course Evaluations.** Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to the tenure and promotion process. CourseEvalUM will be open for you to complete your evaluations for spring semester during late April and be open until the end of the semester. You can go directly to the website (www.courseevalum.umd.edu) to complete your evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing the summary reports for thousands of courses online at Testudo.

**Materials**

**Required Text.** Three books are required for the course. All books can be purchased online (e.g., Amazon.com, Barnesandnoble.com) or, hopefully, at the University bookstore.


**Other Readings.** Articles and reports that feature recent applications of quantitative research methods to education issues and policies also will be assigned. Where possible, electronic copies (e.g., PDF) versions of these articles will be made available on course’s ELMS Course Site. Students also are encouraged to bring in their own examples of quantitative research being used to inform policy and practice (e.g., those encountered in newspapers, magazines, journals, reports, or similar outlet) for in-class discussion.

**Additional Resources.** We’ve identified two types of additional resources that you may find helpful. The first type includes relevant books that you may want to examine to deepen your understanding of the content we cover in the course. You need not purchase any of these books; we’ve provided the list in case you want to pursue some of the topics covered in the course in greater depth.

A second set of resources are recommended websites that discuss quantitative applications and statistical software. We’ve found the site at the University of California-Los Angeles (UCLA), http://www.ats.ucla.edu/stat/, especially helpful. The site is very comprehensive and provides links to a wide range of quantitative techniques and applications. We’ll highlight those that deal with the use of SPSS syntax (rather than the pull-down menus) as part of the course.


• Tufte, E.R., (1970). *The quantitative analysis of social problems*. Reading, MA: Addison-Wesley. This is one of the first textbooks to discuss the use of quantitative techniques to examine social problems and policies. Interesting comparison to newer works.

**Statistical Software**

Class lectures and assignments will feature the use of SPSS or Stata, software packages that conduct a range of data management and statistical analyses. SPSS is available at many University of Maryland locations on multiple platforms. Stata is a little more difficult to find. Students may find it helpful to purchase or rent their own copy of software because doing so will make it possible to work with data off campus. SPSS is sold in modules and for this class we recommend the GradPack of SPSS. See [http://www.journeyed.com](http://www.journeyed.com) for options regarding SPSS. See [http://www.stata.com/order/new/edu/gradplans/campus-gradplan/](http://www.stata.com/order/new/edu/gradplans/campus-gradplan/) for options regarding Stata. A 12 month SPSS license is available for about $100; a 6 month Stata license is available for $69 and a 12 month license for $98. We will discuss how to gain access to the software and datasets from on and off campus during the first class.

**Schedule**

The schedule is organized around some basic designs associated with conducting a quantitative study. We begin by discussing the challenges associated with education research in general and examining causal relationships in particular, including designs that use random experimental models. We then discuss the two “work horses” of quasi-experimental designs – linear regression and logistic regression – as well as some technical issues associated with secondary data analyses of general-purpose surveys (e.g., weights and missing data). We move through some of the more advanced causal designs and strategies next, including propensity scoring, instrumental variables, and sensitivity analyses. Bring your laptops with you to class because we will devote some time running software on exercise data. Readings are posted for the week that they are due.

**Week 1, January 30th**

**Overview.** We’ll begin with an overview of the course and syllabus, and we will address some logistical issues, such as gaining access to the various datasets, statistical software, and our ELMS website. We’ll discuss some of the challenges associated with conducting meaningful quantitative studies on policy-relevant phenomenon.
Readings due this week. No specific readings for this week. Nonetheless, you may want to review the descriptions of the datasets we will propose to use in class. See the websites identified under Pedagogical Approach.

Week 2, February 6th

What does scientific research in education mean? Education research is a contested domain. All too often policymakers and researchers from other areas of study describe education research as lacking rigor, unscientific, or primarily advocacy based. We’ll discuss some of the challenges associated with conducting rigorous education research, including the some of the standards that have been proposed by leading researchers in the field. The first reading lays out “scientific principles for education research,” while the second reading provides a critique of those principles. Be prepared to participate in this debate in class.

Readings due this week.

Chapters 1-5, Scientific research in education.

Berliner, Education research: The hardest science of all (ELMS).

Chapters 1-2, Methods matter.

Supplemental readings.


Week 3, February 13th

Thinking about causality. The National Research Council identified three types of questions -- descriptive (what is happening), causal (what caused it to happen), and process (how is it happening). We’re going to focus primarily on causal designs, in part because these designs require some of the more rigorous conditions, and they typically involve quantitative analyses of data. Today we’re going to discuss the conditions under which valid causal inferences can be made, and we will discuss why random experimental designs are considered to be the “gold standard” for making this type of inference.

Readings due this week.

Chapters 1-2, Estimating causal effects.

Chapters 3-5, Methods matter.

Cook, Randomized experiments in educational policy research (ELMS).

Supplemental readings.

Hoxby & Turner, Expanding college opportunities for high-achieving, low income students (ELMS, M).
Finn & Achilles, Answers and questions about class size: A statewide experiment (ELMS, M).

**Week 4, February 20th**

**Secondary-data analysis.** We’ll discuss some of the challenges of using general-purpose survey data for education research. Much education research makes use of government collected data, such as the data collected by the National Center for Education Statistics; however, these data lend themselves imperfectly to exploring many education phenomena of interest. We’ll discuss large-scale survey data and some of the specific challenges that it poses for determining the internal and external validity of studies. **Memo on random assignment due (all students).**

Readings due this week.

Chapter 6, *Methods matter*.

Croninger & Douglas, Missing data and institutional research (ELMS).

Thomas et al., Weighting and adjusting for design effects in secondary data analyses (ELMS).

Supplemental readings.


**Week 5, February 27th**

**Quasi-experimental designs-Continuous outcomes.** It is not always possible to do a random experiment, so researchers often rely on quasi-experimental designs to approximate random experimental designs. Using statistical controls to equate groups, these models seek to create conditions that allow for stronger causal inferences about data. When the outcome is continuous (e.g., achievement), linear regression is one of the mainstays of this approach. We’ll review the basics of linear regression and several articles that use this approach; we’ll also discuss the strengths and weaknesses of linear regression in making causal claims. **Exercise on missing data and external validity due.**

Readings due this week.


Jeynes, Education policy and the effects of attending a religious school (ELMS).

Boyd et al., How changes in entry requirements alter the teacher workforce and affect student achievement (ELMS).

Supplemental readings.

Week 6, March 6th

Quasi-experimental designs-Binary outcomes. Quasi-experimental designs can be used with a wide range of outcomes, including non-linear outcomes. We’ll look at how the use of logistic regression attempts to create comparable groups similar to what random experimental designs attempt to do. We’ll review the basics of linear regression and several articles that use this approach; we’ll also discuss the strengths and weaknesses of logistic regression in making causal claims.

Readings due this week

Lee et al., Culture of sexual harassment (ELMS).

Croninger & Lee, Social capital and dropping out of high school (ELMS).

Supplemental readings.


Osborne, Bringing balance and technical accuracy to reporting odds ratios (ELMS).

Week 7, March 13th

Regression discontinuity. Thresholds or cut-off points are a common technique for determining who receives and does not receive a particular set of educational opportunities (e.g., admission to a gifted and talented program or acceptance for a summer remedial program). Regression discontinuity attempts to leverage the similarity of individuals around a cut off to determine if individuals who received the educational services have different educational outcomes from those who did not. We’ll demonstrate the use of regression discontinuity in class, and we will discuss its strengths and weaknesses as an analytic strategy for determining causation. Exercise on regression (linear or logistic) due.

Readings due this week.

Chapter 9, Methods matter.

Pages 52-54, Estimating causal effects.

Niu & Tienda, The impact of the Texas top ten percent law on college enrollment: A regression discontinuity approach (ELMS).

Supplemental readings.

Reardon et al., Effects of failing a high school exit exam on course-taking, achievement, persistence, and graduation (ELMS, M).
Week 8, March 20th

SPRING BREAK (no class)

Week 9, March 27th

**Difference-in-difference and interrupted time series designs.** In this class we discuss “natural experiments.” These are cases where the researcher does not design the study, but rather there is some plausibly exogenous intervention that allows us to study the causal effect of a particular treatment or policy. Such designs usually require that we have longitudinal or panel data. We’ll demonstrate the use of this method and discuss its strengths and weaknesses. **Final project proposal due. If you choose to critique the Reardon article from Week 7, it will be due this week, too.**

**Readings due this week**

Chapter 8, *Methods matter.*

Dynarski, Does aid matter? Measuring the effect of student aid on college attendance and completion.

**Supplemental readings.**

Dee, The impact of No Child Left Behind on student achievement (ELMS, M).

Wong et al., No Child Left Behind: An interim evaluation of its effects on learning using two interrupted time series each with its own non-equivalent comparison series (ELMS, M).

Week 10, April 3rd

AERA (no class).

Week 11, April 10th

**Propensity score matching.** Propensity scoring uses observed characteristics to address the possibility of selection bias in studies. The logic of propensity scoring is similar to matching, only it uses regression analysis to develop more complex and arguably more precise matches. Propensity scoring also introduces some desirable efficiencies in regression models because it allows for the selection and use of a large number of covariates associated with the outcome and groupings. We’ll demonstrate the use of propensity score matching in class, and discuss their strengths and weaknesses as an analytic strategy in studies. **If you choose to critique one of the supplemental readings from Week 9, it will be due this week.**

**Readings due this week.**

Chapter 12, *Methods matter.*

Rosenbaum, Dropping out of high school in the United States (ELMS).

Supplemental readings.

Center for Research on Education Outcomes, Multiple choice: Charter school performance in 16 states (ELMS, M).

Reardon et al., The effect of Catholic schooling on math and reading development in kindergarten through fifth grade (ELMS, M).

Week 12, April 17th

Instrumental variables. The inclusion of an instrument variable is an analytic tool used to address the potential bias posed by omitted variables. Unlike propensity scores, which used observed characteristics to create statistically equivalent groups, instrumental variables seek to equate groups on unobserved characteristics. Instrumental variable designs are often also used to measure “treatment on treated” effects when there is not full compliance in experimental designs. We’ll demonstrate the use of instrumental variables in class, and discuss their strengths and weaknesses as an analytic strategy in studies. If you choose to critique one of the supplemental readings from last week, it will be due this week.

Readings due this week.

Chapters 10-11, Methods matter.

Pages 46-48, Estimating causal effects.

Angrist & Krueger, Does compulsory school attendance affect schooling and earnings (ELMS)?

Bound et al., Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak (ELMS).

Supplemental readings.

Ananat, The wrong side(s) of the tracks: Estimating the causal effects of racial segregation on city outcomes (ELMS, M).

Bettinger et al., The role of information and simplification in college decisions: Results from the FAFSA Experiment (ELMS, M).

Week 13, April 24th

Sensitivity analysis. Besides the designs that we have discussed, researchers also use “post-hoc” analyses to rule out alternative explanations and various possibilities for mis-specified models. These analyses can take multiple forms, but, as a group, examine some of the basic assumptions associated with analytic and design decisions. We’ll examine a number of studies that include sensitivity analysis, and we will consider how these analyses can strengthen (or challenge) the robustness of results. If you choose to critique one of the supplemental readings from last week, it will be due this week.
Readings due this week.


Supplemental readings.

Harding, Counterfactual models of neighborhood effects: The effect of neighborhood poverty on dropping out and teenage pregnancy (ELMS, M).

Week 14, May 1st

Wrapping it up. During this course we have tried to cover some of the major challenges and strategies for using quantitative studies to inform policy. The week before your final presentations will review the methodological lessons presented during the course, and we will alert you to some important issues that we have not covered (e.g., treatments within nested structures). If you choose to critique the Harding article from last week, it will be due this week.

Readings due this week.

Chapter 7, 13, Methods matter.

Chapter 5, Estimating causal effects.

Supplemental readings.

Chapter 14, Methods matter.

Week 15, May 8th

Presentation of final projects. Students will present their final projects to classmates. During this class, we will complete course evaluations, discuss additional opportunities to acquire expertise in applying quantitative methods to the study of education policies and practices, and discuss the possibilities and limitations of using quantitative research to shape and influence policy. Final papers will be due by Thursday, May 15th.