EDUC 8240: QUANTITATIVE METHODS II

SCHOOL OF EDUCATION
UNIVERSITY OF COLORADO
SPRING 2005

Details

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Lectures: Tuesday/Thursday 1:00-2:15 p.m.; EDUC 334

Lab: Wednesday 10:30-11:30 a.m.; EDUC 334

Office Hours: Monday 1:00-2:00; Thursday 2:30-3:30

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Quote describing findings from a national study of 2003 charter school performance:

> *In mathematics, fourth-grade charter school students as a whole did not perform as well as their public school counterparts [in 2003]. In reading, there was no measurable difference in performance between charter school students in the fourth grade and their public school counterparts as a whole. -NCES*

Quote describing findings from a national study of 2003 charter school performance:

> *Charter schools are succeeding in their mission to provide an educational alternative more likely to lead to student proficiency, according to a study released today by Harvard economist Caroline Hoxby. Across the nation, charter school students are more likely to be proficient in math and reading than students in the nearest comparable regular public school. –Heritage Foundation*

Do charter schools work? Whom should we believe?

Quantitative methods are often employed to address problems in education, psychology, and the social sciences. As demonstrated above, however, results from quantitative studies often confuse and obfuscate rather than provide clarity. The field of statistics provides a variety of powerful analytic tools – as with any power tools, however, expertise and caution are necessary for responsible use.

A general class of statistical methods – known collectively as the "General Linear Model" ("GLM") – provides the basis for analyzing data from randomized experiments, quasi-experiments, surveys, and correlational/observational studies. Two special cases of the GLM – multiple regression and ANalysis Of VAriance (or "ANOVA") – are common to social science research and will receive the bulk of our attention. We will especially focus on how to incorporate regression and ANOVA into the unified GLM framework. In doing so, this course will cover the GLM in detail – from positing alternative hypotheses

to specifying and comparing models based on these hypotheses, to assessing the fit of various models, and finally to interpretation within the substantive context of interest.

Course content is structured in a progressive manner. Data analysis – which is where many statistics courses begin – is meaningless if your data is junk (i.e. – your study is not "valid"). Thoughtful design of research studies and measurement of variables is essential to "valid" research. Therefore, before we do anything truly quantitative, we'll review how to best design research studies. With these basics down we'll progress to using statistical methods to answer inferential questions.   Topics will include testing of group differences and relationships between variables, and summarizing and presenting statistical results. Examples typical of contemporary social science research will ground the introduction and application of new ideas and methods.

The object of this course is to provide the context and experience necessary to build quantitative reasoning skills. Students leaving this course should be able to carry out quantitative methods responsibly and read others' quantitative research with informed skepticism.

Required Text

R.J. Shavelson. Statistical Reasoning for the Behavioral Sciences. 3rd ed. Allyn & Bacon (1996)

Books should be available at the CU Bookstore; that said, you may find a used copy at a much better price online (a good starting point for an online search is http://www.campusi.com/ or http://www.addall.com/).

An Additional Resource: Wadsworth Workshops

http://psychology.wadsworth.com/workshops/workshops.html

These interactive web-based lessons in statistics and research designs can provide a helpful review of basic material. If you find holes in your recall, please check these out

Grading Policy

For evaluation and grading, performance on course activities will be weighted approximately as shown below.

Task	Weight
Weekly take-home problems (ungraded but mandatory)	30%
Problem Sets (2-3)	70%

Performance expectations for each problem set will be included as part of the assignment's instructions. If you believe your performance on a particular activity does not reflect your true mastery of the material covered therein, you are welcome to submit a supplementary memo addressing this fact (along with a revised version of your assignment, if applicable).

Course Schedule

Week	Dates	Topic	Shavelson Readings (Due prior to class)
1	1/11 1/13	▪ Course introduction and overview ▪ Validity: Internal & External	Ch. 1-2
2	1/18 1/20	▪ Validity: Internal & External (con't) ▪ Research Design	Ch. 1-2
3	1/25 1/27	▪ Statistical Inference: Probability and Distributions	Ch. 8-9
4	2/1 2/3	▪ Statistical Inference: Probability and Distributions	Ch. 10
5	2/8 2/10	▪ Statistical Inference: Decisions, Error, & Power	Ch. 11
6	2/15 2/17	▪ The General Linear Model: Multiple Regression	Ch. 18 (for review: Ch. 7)
7	2/22 2/24	▪ The General Linear Model: Multiple Regression (con't)	Ch. 18
8	3/1 3/3	▪ The General Linear Model: Multiple Regression (con't)	Ch. 18
9	3/8 3/10	▪ The General Linear Model: ANOVA	Ch. 13 (for review: Ch. 12)
10	3/15 3/17	▪ The General Linear Model: ANOVA	Ch. 13
11	3/22 3/24	**SPRING BREAK: NO CLASS**	
12	3/29 3/31	▪ The General Linear Model: Factorial ANOVA	Ch. 14
13	4/5 4/7	▪ The General Linear Model: Marrying Regression and ANOVA	Ch. 17
14	4/12 4/14	**AERA: NO CLASS**	
15	4/19 4/21	▪ The General Linear Model: Regression and ANOVA	Ch. 17
16	4/26 4/28	▪ TBD	
17	TBA	▪ SCHEDULED EXAM PERIOD	Eval. Conferences

A Note on Weekly Take-Home Assignments

A primary goal of this course is to help you build the metacognitive skills key to independent learning. Weekly take-home assignments are designed to do just this. Each Thursday I will assign a short task to be completed and submitted to me by the following Thursday. I will use these as a guide to how the class as a group understands the material; however, I will not formally grade each assignment. Rather, I will provide a solution set to each assignment; this solution should be used to compare your own work in order to help you gain a sense of your own understanding and to help you find places where you may need more work. Learning to learn independently is one of the key experiences of doctoral work; if needed, Jessica and I can help guide you through the process of comparing your work to solution sets for the initial take-home assignments.

A Note on Problem Sets

Problem sets are intended to provide hands-on experience with statistical analysis; they will require analysis via a basic statistical package. SPSS will serve as the supported statistical package in this class; CU can provide a personal copy for ~$50, and it is also available on most lab computers in the Education building. If you prefer to use some other package, please check with me before doing so.

Collaboration with classmates on problem set analyses is acceptable – and encouraged. Statistics is a discipline for which cooperative activity tends to improve the likelihood of mastery. That said, although you may collaborate on analysis, all writing must be generated independently. Although I do not plan to do so, students should note that their work may, at my discretion, be evaluated through TurnItIn.com, a plagiarism service provided to all faculty members at CU-Boulder; and that this service retains a copy of the submitted work for future comparisons.

Final Exam Period

In lieu of a comprehensive final exam, individual evaluation conferences will be held during the final exam period (TBA) or by appointment. Each student will prepare a short (single page) self-evaluation of their effort and learning in the course (guidelines for this evaluation will be provided later in the semester); these will be collected the last day of class along with the final research project. During each conference we will discuss the final project, the self-evaluation, and my evaluation of the student's performance throughout the semester. At the end of each meeting I will provide to each student his/her final grade. (IMPORTANT NOTE: Although we will discuss evaluation and grading together, I will have the final say regarding the final grade to be reported to the registrar.)

A Note on Activities and Participation in Class

My experience teaching statistics has demonstrated that material is mastered more readily not through absorption, but rather through articulation. As the poet W. H. Auden said, "How can I know what I think until I say it?" To facilitate mastery we will spend significant time in hands-on activities and discussions.

Typical (traditional) pedagogy in statistics has limited the comfort – and therefore participation and interaction – of many students. Classic work on diversity of learning

styles (see, for example, Gilligan's *A Different Voice*) has demonstrated great variation in the ways students respond to teaching approaches and construct new knowledge. As your instructor, my job is to create and foster the classroom environment most conducive for your learning. My view is that such an environment must provide a safe place to share knowledge, to give and receive feedback, and (especially) to make mistakes. This course will therefore be more collaborative and participatory in nature than may have been some of your previous statistics/methodology courses.

The success of an interactive, collaborative approach is a primary function of the degree of student participation. One factor in your evaluation (i.e., your grade) will be the nature of your participation during class. For summative purposes, I am less interested in whether your contributions during class are always "right" or "correct" – rather, success will be characterized by a willingness to take risks and share one's ideas even without certainty that those ideas are reflective of genius (or even just mastery).

Statistics is a discipline marked by a specialized vocabulary. Statistical knowledge is hierarchical – topics build on each other, requiring mastery of initial material prior to moving forward with new ideas. These issues make it quite easy to fall behind in statistics courses. I expect you to come to class regularly, keep up with the assigned readings and ask a lot of questions. If you find that you are falling behind, are not understanding the class material, or are feeling lost in any way, come to see me immediately. My goal is to help you attain mastery in what I believe is an important skill set that can be applied quite generally.

A Note on Commitment to Evidence and to Democracy, Diversity and Social Justice

A major component of the CU School of Education's mission is as follows:

> To promote the distinctive identity of the school by building on the already visible contributions of individual faculty members and by emphasizing our shared commitment to evidence-based policy and practice and to democracy, diversity and social justice (http://www.colorado.edu/education/mission.html)

To this end, this course will pay attention to how statistical methods have been used to advance, in the words of English Honors professor R.G. Billingsley, the "arbitrary nature of cultural and intellectual agendas". A recurring theme in this course will be that, while statistical methods can be useful and powerful, they are not absolutes in and of themselves, and should not be taken as such.

Reasonable Accommodation

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services (DS) early in the semester so that your needs may be addressed. DS determines accommodations based on documented disabilities. For additional information, call (303) 492-8671, visit Willard 322, or refer to http://www.colorado.edu/disabilityservices/

Religious Observances

I will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or other required attendance, provided advance notification of the conflict is given. Whenever possible, students should give at least two weeks advance notice to request special accommodation. For additional information on this policy, see http://www.colorado.edu/policies/fac_relig.html

A Note on Academic Honesty & Plagiarism

The development of the Internet has provided students with historically unparalleled opportunities for conducting research swiftly and comprehensively. The availability of these materials does not, however, release the student from appropriately citing sources where appropriate; or applying standard rules associated with avoiding plagiarism. Specifically, the instructor will be expecting to review papers written by students drawing ideas and information from various sources (cited appropriately), presented generally in the student's words after careful analysis, synthesis, and evaluation. An assembly of huge blocks of other individuals' existing material, even when cited, does not constitute an appropriate representation of this expectation. Uncited, plagiarized material shall be treated as academically dishonest, and the paper will be assigned a failing grade as a result. If the student is confused as to what constitutes plagiarism, he/she should review the CU Honor Code on this topic, or see the instructor.

Papers submitted by any student, written in part or in whole by someone other than that student, shall be considered to constitute fraud under the University Honor Code, and result in the assignment of an 'F' for the entire course.

See http://www.colorado.edu/academics/honorcode for more details.