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Michigan State University
Department of Teacher Education
TE 934: Introduction to Quantitative Methods in Educational Research
Spring 2009

Course Instructors:

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Office hours are by appointment for both of us. **Email is the most efficient and reliable way to communicate with both of us.**

Seminar:

Mondays, 4:10 – 7:00 p.m. Room 133D Erickson Hall

Please do not be late. Also note that no food or drink (other than water) are permitted in the technology classroom.

Course Overview:

This course is a hands-on introductory course in quantitative research methods, data analysis, and conceptualization that focuses on non-experimental methods. As such, the course emphasizes the application of statistical concepts to practical questions in social science, policy, and evaluation, while also including instruction in appropriate statistical theory. The course has two parts: a consumer-based component and a producer-based component. You will learn to become a smart reader of quantitative studies and you will also develop skills for doing your own quantitative data analysis.

With regard to part 1, reading quantitative studies, we will discuss and analyze the types of quantitative studies educational researchers conduct. We will learn how they collect data or gain access to publicly available datasets, how they analyze the data, and how they draw conclusions based upon their analyses. We will learn to evaluate these studies along a variety of criteria – soundness of design, reliability, validity, ethics, and generalizability.

Regarding conducting your own data analysis, our study will start with descriptive statistics (means, standard deviations, normal distributions, correlation), and will then move to hypothesis testing using t-tests, contingency tables, ANOVA, and regression methods with a few variables. The course interweaves several concepts: framing

research questions, statistical theory, computing using quantitative methods, converting data into usable tables, learning to use a large-scale longitudinal database, designing empirical tests to examine policy issues by using appropriate statistical techniques, interpreting of results, and writing up research results.

Because the course emphasizes secondary analysis of existing data, rather than the collection of new data, we treat issues of research design in the context of large-scale educational studies. Students who complete this course will become competent in the use of SPSS statistical software, capable of relatively sophisticated secondary analysis with large datasets, familiar with one of the major and current Department of Education data sets, able to formulate and investigate their own educational problems, interpret findings in terms of their importance for policy, and able to write competently about research. Our focus is on the field settings and quasi-experimental designs commonly found in educational research.

This course is intended to help you develop your own knowledge, skills, and dispositions for the practice of quantitative research throughout your professional career, as you access and use the existing education knowledge base and as you add to that knowledge base by engaging in research. You will learn to locate, read, and evaluate quantitative research; you will learn to write summaries and reviews about research for a variety of audiences; and you will learn the basic elements of planning and conducting original research projects utilizing a range of different research designs and data collection and analysis strategies.

This course should be useful to you if you are planning to be a "scholar-practitioner" who incorporates inquiry of a quantitative nature into your regular professional practice, if you want to interpret research reports on different topics and, and if you want to be able to convey that knowledge effectively to others. It will also be foundational to those researchers who plan to take higher level quantitative methods courses.

Course Goals:

Students who successfully complete this course will be able to:

- Locate and obtain research reports, using databases and other tools and strategies;
- Understand the defining features of different kinds of empirical research (of a quantitative nature) and what can be learned from different kinds of studies;
- Read closely and extract useful information from a quantitative research reports and publications;
- Understand, critique, and synthesize material from the education knowledge base, producing summaries or reviews for use by oneself or by others, including educational practitioners, policy makers, and the public;
- Formulate new research questions, articulate relevant conceptual frameworks, and design appropriate methodological strategies for investigating the questions;

- Use the statistical software SPSS to conduct analyses including descriptive statistics, bivariate relationships (correlation, t-tests), contingency tables, ANOVA, and multiple regression
- Interpret computer output and write up research results in a form that academic journals typically expect them to be presented

Course Requirements

(1) Attendance and Participation (20%)

Because the course is a seminar, your attendance to class is imperative. If you need to miss a class, you must let both of us know in advance because your absence will affect our planning for the day's activities. Similarly, your participation in whole-group and small-group discussions is important not only for your learning but also the learning of others. Everyone's engagement in and contributions to discussions will influence your opportunities to learn in the course. Careful and critical reading accompanied by preparation of questions, insights and issues to discuss is a central part of making the course work as a learning community. A productive learning community can only be created when people come prepared, when people listen and are listened to, when participants offer evidence to support their claims and colleagues thoughtfully question them, and when community members value alternative perspectives and interpretations.

We will read texts very closely in this course. It will be essential that you complete the required readings before each class session and that you are prepared to raise questions and make comments about the readings during the class. We expect to hear many comments and questions in class that begin with "I don't understand why the author….." or "I disagree with the approach the author took because…" Those comments and questions represent your "zone of proximal development" and they will be the nodes around which we learn together.

NOTE: Please bring all of the assigned readings for the week to class. This is very important, as we will look at specific passages during our discussions.

(2) Four Short Analyses and Write-Ups (40%)

Because this is a "hands-on" course in learning to use appropriate statistical techniques, you will conduct four short analyses throughout the semester. These can be accomplished with a partner. Specifically, the topics will include:

(1) Descriptive Statistics
(2) Bivariate Relationships
(3) ANOVA
(4) Multiple Regression

These assignments will require you to conduct the analyses using SPSS and write a short analysis of them, to demonstrate your ability to interpret statistical output. We will assign you the specific research question to explore.

(3) Critical Analysis of an Empirical Study (20%)

Another goal of this course is learning to examine critically quantitative research. You will select a quantitative research study from your area of interest and summarize the work, and then write a critical analysis of it, specifically critiquing the research design and question, the data used, the analyses conducted, and the interpretations the author(s) draws. This is an individual assignment.

(4) Final Project (20%)

The final project allows you to pursue a research question of your choosing using the designated class dataset. This paper will resemble an authentic research article, with an introduction, a conceptual model representing your research design, a short literature review, methods section, results section, and discussion. This can be done in pairs.

Criteria for Assessment:
All of the assignments will be graded according to these criteria:

- ***Substance:*** Care and thoroughness in completing the assignment; evidence that you have worked hard, reflected carefully on what you are doing, and polished the final product; quality and integrity of the ideas, methods, and materials that are represented in the assignment; evidence that you have thought seriously about the activity, utilized what we have covered in class, and approached the assignment with a deep and broad range of thought.

- ***Style and Form:*** Quality of the writing and format of the assignment; evidence of a well-organized, well-written, and carefully proofread product.

Course Materials

1) The following articles are posted to ANGEL in the "Readings" folder:

Booth, W.C., Colomb, G.C., & Williams, J. M. (1995). "From topics to questions." In Booth, W.C., Colomb, G.C., & Williams, J. M. *The craft of research* (pp.35-45). Chicago: University of Chicago Press

Booth, W.C., Colomb, G.C., & Williams, J. M. (1995). "From questions to problems." In *The craft of research* (pp. 48-62). Chicago: University of Chicago Press.

Cohen, J., Cohen, P., West, S.G., and Aiken, L. S. (2003). "Multiple regression/

correlation with two or more independent variables." In *Applied multiples regression/correlation analysis for the behavioral sciences* (pp. 64-100). Mahweh, NJ: Lawrence Erlbaum Associates.

Couper, M.P. (Winter, 2000). Web surveys: A review of issues and approaches. *Public Opinion Quarterly* 64(4): 464-494.

Feuer, M., Towne, L, & Shavelson, R. (2002). Scientific culture and education research. *Educational Researcher, 31*(8): 4-14.

Lee, V. E., Burkam, D. T., Ready, D. D., Honigman, J., & Meisels, S. J. (2006). Full-day versus half-day kindergarten: In which program do children learn more? *American Journal of Education, 112*(2), 163-208.

Palincsar, A.S., & Brown, A.L. (1984). Reciprocal teaching of comprehension- fostering and monitoring activities. *Cognition and Instruction, 1*(2), 117-175.

Purcell-Gates, V., Duke, N. K., & Martineau, J. A. (2007). Learning to read and write genre-specific text: Roles of authentic experience and explicit teaching. *Reading Research Quarterly, 42*(1), 8-45.

Teddlie, C. and Tashakkori, A. (2003). "Major issues and controversies in the use of mixed methods in the social and behavioral sciences." In Tashakkori, A. and Teddlie, C. (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 3-50). Thousand Oaks, CA: Sage Publications.

*Other readings by Rebecca Jacobsen, Peter Youngs -- TBD

2) Books (to purchase)

Lee, V.E. and Burkam, D.T. (2002). *Inequality at the starting gate: Social background differences in achievement as children begin school.* Washington, D.C.: Economic Policy Institute.

Nardi, P.M. (2006). *Interpreting data: A guide to understanding research* (Boston: Pearson).

Schneider, B., Carnoy, M., Kilpatrick, J., Schmidt, W., and Shavelson, R.J. (2008). *Estimating causal effects: Using experimental and observational designs*. Washington, D.C.: American Educational Research Association. http://www.aera.net/publications/Default.aspx?menu_id=46&id=3360 (NOTE: this is available in pdf format on ANGEL, and from the above website, and you can also purchase this in book format)

Shadish, W.R., Cook, T.D. and Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton-

Mifflin.

3) Software

Note there are several ways for you to use the SPSS software for this course.

1) You can purchase software (note: you can use the graduate student version, which is considerably lower cost than the regular version; it only handles 1500 cases and 50 variables, and the dataset we created for the course is that size). http://www.spss.com/gradpack/ for $86.99. This can be installed on up to two computers.

2) You can lease software for 0-6 months for $45.99.

http://estore.e-academy.com/index.cfm?loc=estore/soft_browse/soft_display_product&parentID=3&ID_Product=603

3) You can use SPSS on campus computers.

You might also consider purchasing a guide to using SPSS.

Recommended:

American Psychological Association. (2002). *Publication manual*. Washington, D.C.: American Psychological Association

Weekly Schedule

Week 1 January 12, 2009 – Introduction to the Course

Key Questions:

1. What is quantitative research?
2. What is scientifically-based research?
3. Why are empirical studies (especially randomized) often privileged (in terms of funding)?
4. How do we define the concepts: cause, effect, and causal relationship?
5. What is the difference between correlation and causation?

Readings:

- Feuer, M., Towne, L, & Shavelson, R. (2002). Scientific culture and education research. *Educational Researcher* 31(8): 4-14. (on ANGEL)
- Shadish, W.R., Cook, T.D. and Campbell, D.T. Chapter 1: Experiments and Generalized Causal Inference
- Schneider, et.al. Chapter 1: Introduction

Assignment: None

Week 2 (January 19, 2009): No Class – Martin Luther King, Jr. Day

Readings:

- ECLS-K (on ANGEL) – read the following sections: Study Information, Instruments and Assessments (third grade year – fall parent interview, spring parent interview, spring teacher questionnaires), data collection and procedures, data analysis
- ECLS Codebook (on ANGEL)

Assignment:

- Become familiar with the class dataset (ECLS-K, third grade subsample)

Week 3 January 26, 2009 – Framing a Problem, a Research Question, and a Research Approach; Introduction to ECLS-K

Note: MEET in N12 Business College Complex **for the Lab**

Key Questions:

1. What kinds of research problems are appropriate for quantitative research?
2. How do researchers articulate the problem(s) they are studying?
3. How do they shift from a research topic to a particular research question?
4. Why do researchers choose different kinds of approaches?
5. What is a nationally representative dataset?
6. How can we determine whether the researcher's conclusions are warranted?

Readings:

- Booth, Colomb, Williams, Chapter 3: From Topics to Questions; Chapter 4: From Questions to Problems (ANGEL)
- Lee & Burkam, Executive Summary, Introduction; Chapter 1: Social and Academic Disadvantage as Children Enter Kindergarten; Chapter 2: Young Children's Social Disadvantage and Family Activities

Assignment:

- None

Week 4 February 2, 2009 -- Sampling; Descriptive Statistics; Guest Speaker – Dr. Peter Youngs (sampling, survey design and collection, analysis)

Key Questions:

1. How do researchers select and recruit participants?
2. Why is sampling important?
3. What is stratified sampling? Cluster sampling?
4. What do researchers do about attrition?
5. What are descriptive statistics and why are they important?
6. How are data represented through variables, and what kinds of variables exist?

Readings:

- Nardi, Introduction and Chapter 1: Describing Data
- Youngs, P. – TBD (ANGEL)

Assignment: None

Week 5 February 9, 2009 -- Quasi-Experimental Design; Funding Agencies; Guest Speaker – Dr. Rebecca Jacobsen (sampling, survey design and collection)

Key Questions:

1. What is the value of quasi-experimental design?
2. Why do researchers use quasi-experimental design?
3. What strategies can researchers use to improve the validity of their quasi-experimental designs?

4. How are quantitative researchers funded?
5. How do researchers deal with the following topics with regard to design and sampling?
    - Survey Modes
    - Internet Surveys vs. Phone Surveys
    - Survey construction
    - Three methods to assess preferences
    - Pretesting (cognitive interviews and a pilot)
    - Sampling
    - National Probability Sample Size
    - Oversampling sub populations
    - General Public
    - Working with Elite Samples

Readings:

- Schneider, et.al., Chapter 3: Estimating Causal Effects Using Observational Data
- Shadish, Cook, and Campbell. Chapter 4: Quasi-Experimental Designs that Either Lack a Control Group or Lack Pretest Observations of the Outcome
- Couper, M.P. (ANGEL)
- Jacobsen, R. – TBD (ANGEL)
- http://www.nsf.gov/funding/
- http://ies.ed.gov/funding/webinars/index.asp
- http://www.aera.net/grantsprogram/res_training/res_grants/RGindex.html

Assignment:

- **Short Analysis No. 1 – Descriptives and Frequencies.** Run descriptive statistics on five variables and frequencies on five variables. Create a table to display the information. Interpret the information in the tables. (See assignment description for more detail).

Week 6 February 16, 2009 -- Quasi-Experimental Design (continued); Bivariate Relationships; Guest Speaker – Dr. Annemarie Palincsar, University of Michigan School of Education

Key Questions:

1. What is the value of quasi-experimental design?
2. Why do researchers use quasi-experimental design?
3. What strategies can researchers use to improve the validity of their quasi-experimental designs?
4. What are experimental and control groups?
5. Why are pretests important?
6. What are bivarate relationships and what information can they give us?

Readings:

- Shadish, Cook, and Campbell, Chapter 5: Quasi-Experimental Designs that Use Both Control Groups and Pretests
- Nardi, Chapter 2: Understanding Tables; Chapter 3: Interpreting Relationships
- Schneider, et.al., Chapter 4: Analysis of Large-Scale Datasets Examples of NSF Supported Research
- Palincsar & Brown (ANGEL)

Assignment: None

Week 7 February 23, 2009 – Randomized Design; Critiquing Quantitative Studies; Guest Speakers – Dan Berebitsky and Seneca Rosenberg, University of Michigan School of Education

Key Questions:

1. What is random assignment?
2. Why does randomization "work"?
3. What are challenges to conducting randomized studies?
4. What constitutes a "good" quantitative study?
5. How do we evaluate quantitative studies?

Readings:

- Shadish, Cook, and Campbell (2002). Chapter 8: Randomized Experiments: Rationale, Designs, and Conditions Conducive to Doing Them
- Purcell-Gates, Duke, & Martineau (ANGEL)
- SSI Reading – TBD (ANGEL)

Assignment:

- **Short Analysis No. 2** – Bivariate Relationships – chi-square tables; correlations (See assignment description for more detail).

Week 8 March 2, 2009 – ANOVA; Studies using Nationally Representative Longitudinal Datasets

Note: MEET in N12 Business College Complex **for the Lab**

Key Questions:

1. When is ANOVA used instead of a t-test?
2. What are longitudinal studies, and what can we learn from analyzing them?
3. What are the benefits of using nationally representative longitudinal datasets?

Readings:

- Nardi, Chapter 4: Explaining Mean Differences

- Hong & Raudenbush (ANGEL)

Assignment: Critical Analysis

Week 9 March 9, 2009 – No Class – Spring Break

Readings: None

Assignment: None

Week 10 March 16, 2009 -- Causal Inference; Studies using Nationally Representative Longitudinal Datasets (cont'd)

Key Questions:

1. What's the difference between the cause of an effect and the effect of a cause?
2. What are the assumptions of temporal stability and causal transience?
3. What are problems associated with experiments with randomized assignments?
4. What is statistical power?

Readings:

- Schneider, et. al., Chapter 2: Causality: Forming an Evidential Base (ANGEL)
- Lee & Burkam, Chapter 3: Understanding how Social Disadvantage Relates to Academic Status; Chapter 4: Social Disadvantage and School Quality

Assignment:

- **Short Analysis No. 3** – ANOVA and t-tests (See assignment description for more detail).

Week 11 March 23, 2009 – Multiple Regression

Key Questions:

1. How does regression help explain the relationship between several independent or predictor variables and a dependent or criterion variable?
2. What is the regression equation?
3. What are confounding variables?
4. What are effect sizes?
5. What are the limits of regression?
6. How can we draw conclusions and policy recommendations from quantitative studies?

Readings:

- Nardi, Chapter 5: Reading Regressions

- Cohen, Cohen, West, and Aiken (ANGEL)

Assignment: None

Week 12 March 30, 2009 -- Multiple Regression (continued); Drawing Conclusions and Policy Recommendations from Quantitative Studies

Note: MEET in N12 Business College Complex **for the Lab**

Key Questions:

1. How does regression help explain the relationship between several independent or predictor variables and a dependent or criterion variable?
2. What is the regression equation?
3. What are confounding variables?
4. What are effect sizes?
5. What are the limits of regression?

Readings:

- Lee & Burkam, Chapter 5: Conclusions and Policy Recommendations

Assignment: **Final Project Prospectus**

Week 13 April 6, 2009 -- Issues of Validity and Ethics in Quantitative Research

Key Questions:

1. What is validity?
6. What's the difference between internal and external validity?
7. Why is validity important in quantitative research?
8. What are typical threats to validity?

Readings:

- Shadish, Cook, and Campbell (2002), Chapter 2: Statistical Conclusion Validity and Internal Validity; Chapter 3: Construct Validity and External Validity; and Chapter 9: Practical Problems 1: Ethics, Participant Recruitment, and Rand Assignment

Assignment:

- **Short Analysis No. 4 –** Multiple Regression (See assignment description for more detail).

Week 14 April 13, 2009 – AERA Week – Workshopping on Final Projects

Readings: None

Assignment: Work on final projects

Week 15 April 20, 2009 -- Mixed Methods Research

Key Questions:

1. Are qualitative and quantitative research methods incommensurate?
2. How can researchers design studies that use both qualitative and quantitative research?
3. What are the challenges of mixed-methods research?

Readings:

- Teddlie and Tashakkori, "Major issues and controversies in the use of mixed methods in the social and behavioral sciences." In *Handbook of mixed methods in social and behavioral research.*
- Halvorsen, A., Lee, V.E., and Andrade, F. (in press). Urban early elementary teachers' attitudes about teaching and their students: A mixed-method study. *Journal of Urban Education* (ANGEL)

Assignment: Continue working on final projects

Week 16 April 27, 2009 – Final Projects Presentations

Readings: None

Assignment: Final Projects & Presentations

Week 17 May 4, 2009 – 5:45 – 7:45 p.m.

Course Wrap-Up