

TE 934: Introduction to Quantitative Methods in Educational Research
Spring, 2016
Michigan State University
Department of Teacher Education

Course Instructor:

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Office hours are by appointment. **Email is the most efficient and reliable way to communicate with me.**

Seminar & Lab:

Mondays 12:40-3:30 p.m. Room 109 Erickson Hall

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 (10%)

Because the course is a seminar, your attendance to class is imperative. If you need to miss a class, you must let me know in advance because your absence will affect the 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 Analyses and Write-Ups (50%)

Because this is a "hands-on" course in learning to use appropriate statistical techniques, you will conduct four short analyses throughout the semester. All assignments can be accomplished with a partner or in groups of three. 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. I will assign you the specific research question to explore.

(4) Final Project (25%)

The final project allows you to pursue a research question of your choosing using the designated class dataset or your own 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 or groups of three.

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.

Overall Grading Scale

4.0	93 – 100%	2.5	71 – 78%	1.0	51 – 56%
3.5	86 – 92%	2.0	64 – 70%	0.0	0 – 50%
3.0	79 – 85%	1.5	57 – 63%		

Writing Support

If you need more help in meeting the writing expectations for this or other courses than you can get from your instructors, you should contact the University's Writing Center, at 300 Bessey Hall, 432-3610. Grammar Hotline: 432-1370. Website:

<http://writing.msu.edu/>.

Academic Honesty and Integrity

In all classes, we assume that the student is honest and that all course work and examinations represent the student's own work. Violations of the academic integrity policy such as cheating, plagiarism, selling course assignments or academic fraud are grounds for academic action and/or disciplinary sanction as described in the university's student conduct code. **Incidents of plagiarism are taken very seriously and will be pursued.** Students are strongly cautioned not to copy any text verbatim on class quizzes, tests, reports, projects, or other class assignments without using appropriate quotations and source citations.

For University regulations on academic dishonesty and plagiarism, refer to

<http://www.vps.msu.edu/SpLife/rule32.htm>

<http://www.msu.edu/unit/ombud/plagiarism.html>

Course Materials

1) Books (to purchase)

American Psychological Association. (2009). *Publication manual of the American Psychological Association. Sixth Edition*. Washington, DC: American Psychological Association. [REQUIRED]

Hoy, W.K. & Adams, C.M. (2016). *Quantitative research in education: A primer*. (2nd Edition) Thousand Oaks, CA: Sage Publications. [REQUIRED]

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

- Lee, V. E. & Burkham, D.T. (2002). *Inequality at the starting gate: Social background differences in achievement as children begin school*. Washington, D.C.: Economic Policy Institute. [REQUIRED]
- Field, A. (2013). *Discovering statistics using IBM SPSS Statistics: And sex and drugs and rock 'n' roll*. Thousand Oaks, CA: Sage Publications. [SUPPLEMENTAL]
- Norusis, M. (2009). *SPSS 17.0 guide to data analysis*. Upper Saddle, NJ: Prentice Hall [SUPPLEMENTAL]
- Shadish, W.R., Cook, T.D. and Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton-Mifflin. [SUPPLEMENTAL]

2) Software

Note there are several ways for you to use the SPSS software (version 19.0 or higher) for this course. As you explore these options, it would be helpful to share with your classmates about where you find the software and for what cost.

- You can purchase the regular version SPSS. In the past, some students who purchased the student version expressed regret they did not purchase the regular version, since it can accommodate so many more cases and variables.
- You can purchase the student version of SPSS, which is considerably lower cost than the regular version. Note: it only handles 1500 cases and 50 variables, and the dataset we created for the course is that size
- You can lease software for 0-6 months or 6-12 months.
- You can use SPSS on some campus computers (and not buy it). However, that will require you to complete all assignments while the campus computers are available. Last time, students expressed how helpful it was to have their own version of the software on their computers.

SPSS is available at the following sites:

- <https://cstore.msu.edu/search-software>
- <http://creationengine.com/html/pl.lasso?s=SPSS&reset.x=0&reset.y=0&reset=reset>
- https://estore.onthehub.com/WebStore/ProductsByMajorVersionList.aspx?cmi_mnuMain=2ff73789-74c7-e011-ae14-f04da23e67f6&pc=ddc848d8-b4fe-e111-bd05-f04da23e67f6
- <http://studentdiscounts.com/spss.aspx>

Tentative Weekly Schedule

Week 1: January 11 – Introduction to the Course
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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.

Assignment: None

NO CLASS January, 18 (but there is reading for this week)

Readings:

- Lee & Burkam, Executive Summary; Introduction; Chapter 1: Social and Academic Disadvantage as Children Enter Kindergarten

Assignment: None

Week 2: January 25 Framing a Problem, a Research Question, and a Research Approach; LAB/Introduction to ECLS-K

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:

- ECLS-K User Manual Third Grade – read only the Introduction, Sections 1.1, 1.2, 1.3; and Description of Data Collection Instruments, Sections 2.1, 2.2, 2.3
- ECLS Codebook
- Hoy & Adams, Chapter 1: The Nature of Research and Science
- Nardi, Introduction and Chapter 1: Describing Data
- For extra help with SPSS, use Fields Chapter 3

Assignment:

- Become familiar with the class dataset (ECLS-K, third grade subsample) in preparation for lab

Week 3: February 1 -- Sampling; Descriptive Statistics; (sampling, survey design and collection, analysis)/ Continued Lab 1

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:

- Lee & Burkam, Chapter 2: Young Children's Social Disadvantage and Family Activities
- Hoy & Adams, Chapter 2: Concepts, Variables, and Research Problems,
- SUPPLEMENTAL: Fields, p. 7-10 (sections 1.5.1-1.5.2) and p.19-34 (all of section 1.6)

Assignment: None

Week 4: February 8 -- Value of Tests/Funding Agencies (sampling, survey design and collection)

Key Questions:

1. What is a test?
2. What we measure: Just how good is the sample?
3. How do researchers select their samples?

Readings:

- Hoy & Adam, Chapter 3: Conceptual Foundations of Statistics
- <http://unesdoc.unesco.org/images/0021/002145/214550E.pdf> (Chapter 1, p 1-26)
- Tatto, M.T. & Senk, S. (2011). The mathematics education of future primary and secondary teachers: Methods and findings from the Teacher Education and Development Study in Mathematics. *Journal of Teacher Education* 62(2) 121-137.

Assignment: Analysis No. 1 – Descriptives and Frequencies. Run descriptive statistics on five variables and frequencies on key variables. Create a table to display the information. Interpret the information in the tables. (See assignment description for detail). ** Due by class time.

Week 5: February 15 -- Quasi-Experimental Design; Bivariate Relationships/ LAB

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 bivariate relationships and what information can they give us?

Readings:

- Nardi, Chapter 2: Understanding Tables; Chapter 3: Interpreting Relationships
- Hoy & Adams, Chapter 3: Conceptual Foundations of Statistics
- SUPPLEMENTAL: Fields, Chapter 7 (read only p. 262-278)

Assignment: None

Week 6: February 22 – Randomized Design; Bivariate Relationships Cont'd

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:

- Cook, T. D. (2001). Science phobia: Why education researchers reject randomized experiments. *Education Next*, 63-68
(http://www.indiana.edu/~educy520/readings/cook01_ed_research.pdf).

Assignment:

Week 7: Feb 29 – ANOVA; Studies using Nationally Representative Longitudinal Datasets/LAB

Key Questions:

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

Readings:

- Nardi, Chapter 4: Explaining Mean Differences
- Fields, Chapter 11 (Supplemental)
- *Assignment: Analysis No. 2* – Bivariate Relationships – chi-square tables; correlations (see assignment description for more detail). ** Due by class time

Week 8: March 14 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?
5. How do researchers select and recruit participants?
6. How do researchers collect and analyze their own data?
7. How do researchers determine which statistical analyses to use to answer their research questions?

Readings:

- Lee & Burkam, Chapter 3: Understanding how Social Disadvantage Relates to Academic Status; Chapter 4: Social Disadvantage and School Quality

Assignment:

- NONE

Week 9: March 21—Continuation of ANOVA; Lab 4; Interpreting quantitative studies

Key Questions:

1. How do we find where the differences are in ANOVA?
2. How do we write about ANOVA results?
3. How do we read and critique a quantitative paper?

Readings:

- Re-read ANOVA readings in Hoy & Adams AND Nardi
- Palmer Reading
- Fields, Chapter 8 (Supplemental)

Assignment: None

Week 10: March 28-- Introduction to Regression/Recoding LAB

Key Questions:

1. How does regression help explain the relationship between several independent or predictor variables and a dependent or criterion variable?
2. How can the statistical procedure of regression show (1) how much of the variance in the outcome we can explain; (2) the influence of an IV on a DV; (3) how to compare relative sizes of IVs; (3) how to “explain away” the effects of certain IVs when other IVs are introduced in a hierarchical regression?

Readings:

- Nardi, Chapter 5: Reading Regressions
- Recess Reading
- Fields, Chapter 8 (Supplemental)

Assignment: Analysis No. 3 – Statistical significance (see assignment description for detail). ** Due by class time.

Week 11: April 4 -- Multiple Regression (continued); Drawing Conclusions and Policy Recommendations from Quantitative Studies/ LAB

Key Questions:

1. What is the regression equation?
2. What are confounding variables?
3. What are effect sizes?
4. What are the limits of regression?

Readings:

- Lee & Burkam, Chapter 5: Conclusions and Policy Recommendations
- Hoy, Chapter 3: Conceptual Foundations of Statistics, read ONLY pp. 59-66

Week 12: April 11 -- Multiple Regression/Transforming Variables/LAB
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Key Questions:

1. How do we prepare variables for use in regression?
2. What is the regression equation?
3. What are confounding variables?
4. What are effect sizes?
5. What are the limits of regression?

Readings:

- 9 Things to Know about Reading Regression Tables: <http://egap.org/methods-guides/9-things-know-about-reading-regression-table>

Assignment: Final Project Prospectus ** Due by class time.

Week 13: April 18- Issues of Ethics and Validity in Quantitative Research
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Key Questions:

1. Why should ethics be considered when designing and conducting quantitative research?
2. What is validity?

3. What's the difference between internal and external validity?
4. Why is validity important in quantitative research?
5. What are typical threats to validity?

Readings:

- AERA Code of Ethics (2011)
- Ohlund, B. & Yu, C. Threats to validity of research design (<http://web.pdx.edu/~stipakb/download/PA555/ResearchDesign.html>).
- Choose an ECLS Article to read and discuss in class (see options on D2L)

Assignment:

- **Analysis No. 4** – Multiple Regression (see assignment description for detail). **
Due by class time.

Week 14 April 25 Mixed Methods and Final Preparations
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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:

- Johnson, R.B. & Onwuegbuzie, A.J. (2004). Mixed Methods Research: A research paradigm whose time has come. *Educational Researcher*. 33(7) 14-26.
- Wright, T.S. & Gotwals, A.W. (in press). Supporting kindergartners' science talk in the context of an integrated science and disciplinary literacy curriculum. *Elementary School Journal*.
- Halvorsen, A-L, Duke, N., Brugar, K.A., Block, M.K., Strachan, S.L., Berka, M.B. & Brown, J.M. (2012): Narrowing the Achievement Gap in Second-Grade Social Studies and Content Area Literacy: The Promise of a Project-Based Approach, *Theory & Research in Social Education*, 40:3 198-229

Finals Week: Final exam: Thursday May 5, 12:45-2:45
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Assignment: Final Project and Presentations