

EDPL 701 (OM11)
Applied Research/ Data Based Decision Making

Fall 2004

Monday, 5:00- 8:00
Shady Grove Campus
Bldg. #1: Rm. 108 (Lecture)/ Rm. 214 (Lab)

Instructors:

Bob Croninger
Department Education Policy & Leadership
2110d Benjamin Building

Office Telephone: 301.405.2927
Office Fax: 301.405.3573
E-mail: croninge@umd.edu

John Larson
Department Education Policy & Leadership
2110e Benjamin Building

Office Telephone: 301.405.3570
Office Fax: 301.405.3573
E-mail: jclars123@aol.com

Class e-mail (reflector): mpel@umd.edu

Course Overview

Description

Educators increasingly find themselves inundated by quantitative data, including graphs, charts, and statistical tables that purport to say something of importance about the operation of schools, the quality of teaching, and the extent of student learning. This course focuses on the use of quantitative methods to identify education issues, consider the merits of administrative actions, and ultimately make “data-based” decisions to improve education outcomes. As part of the course, you will examine a range of statistical concepts (e.g., central tendency, variability) and statistical techniques (e.g., group-mean comparisons, correlation, and regression) frequently used in education research. You will consider alternative ways of displaying and organizing data

(e.g., tables and graphs), and you will practice interpreting, presenting, and answering questions about education data. Finally, you will examine and evaluate data-based claims about education policies and practices.

This is the second in a series of three required methodological courses in your field-based cohort program. While the first course provided an overview of both quantitative and qualitative research designs, this course focuses specifically on quantitative applications. If you wish to pursue additional training in quantitative methods, you will have the opportunity to do so in the spring semester, when you take the advanced methods seminar. The quantitative section of the advanced methods seminar (there will also be a qualitative section for those who are interested) will build on the knowledge and skills acquired in this course, focusing specifically on designing and interpreting analysis of covariance and regression analyses of education issues. Those interested in doing a quantitative dissertation study should enroll in the quantitative section next semester.

Pedagogical Approach

A basic premise of the course is that you will come to a deeper understanding (and hopefully appreciation) of quantitative methods through their application and investigation of relevant education problems and policies. Consequently, you will be required to not only perform relevant analyses of education data but also interpret results and discuss potential implications for practice. The basic datasets for the course are drawn from the Maryland State Department of Education and archival data from Montgomery County Public Schools. These data provide meaningful opportunities for you to address a wide range of education issues, ranging from school finance, staffing, student achievement, and student enrollment.

We have also placed a heavy emphasis on visual displays of data and quantitative analyses. This approach to analysis is typically associated with exploratory data analyses, a perspective on data analysis first promoted by John Tukey. Although compatible with a hypothesis-testing approach to data analysis (and also helpful in understanding the assumptions that underlie many statistical techniques), exploratory data analysis emphasizes a careful and open examination of the structure of individual variables, the relationship between pairs of variables, and possible relationships between groups of variables as a precursor to developing more complex statistical models. Such an approach requires “skepticism” and “openness,” Hartwig and Dearing argue (Exploratory data analysis, 1979), two habits of mind that we hope to encourage in your own approach to data based decision making.

Most classes will be a combination of lecture, demonstration, and application. Classes will typically begin with a warm-up exercise, in which we discuss a data display presented in a newspaper, magazine, education report, or similar media outlet. (We encourage you to bring in your own examples as part of the course.) We then introduce (or review) major statistical concepts and demonstrate the application of relevant statistical techniques using education data and graphical displays. Demonstrations will focus on relevant education issues and consider alternative ways of characterizing and understanding issues numerically and graphically. Most of the remainder of the class will be spent working on an analytic exercise that requires you to

work individually or in groups to apply the concepts and techniques demonstrated during the first half of the class.

Your Responsibilities

You should plan not only on attending all classes, but also on setting aside additional time to complete required readings, do analytic exercises, hone software skills and complete examinations. Because the course places a heavy emphasis on the actual application of statistical techniques, you will have to spend time outside of class exploring datasets, constructing measures, running statistical analyses, and writing up results. If for some reason you cannot attend class, please contact one of us to let us know and make arrangements to get notes and materials from one of your colleagues.

Generally speaking, you will have some homework to complete every week. You will be asked to complete six analytic exercises, a portfolio or notebook, and a final examination. Because most assignments are sequential, keeping up with assigned deadlines is critical. Late assignments may result in a lower grade. Incompletes will be granted only for exceptional circumstances (this is in your interest as well as ours).

- Graded analytic exercises – 30%
Analytic exercises involve completion of tasks associated with the analysis and use of quantitative data to examine education issues. They are meant to provide you with periodic feedback about your mastery of statistical concepts, techniques, and applications. Each exercise involves some use of SPSS and writing a 2-3 page memorandum that appropriately displays data and discusses the implications of findings. Each of the graded analytic exercises represents 5% of your grade.
- Portfolio/Notebook – 40%
We are asking that you assemble a portfolio or notebook as part of the class. The portfolio should include class handouts, notes, syntax files, corrected analytic exercises, and examples of different types of data displays. We will make six specific assignments in class to help you structure your portfolios (these will not be graded, though we will give you feedback on these assignments). We will also provide you with a recommended outline or set of sections to include in the portfolio/notebook. We will provide more information about the portfolios in class.
- Final examination – 30%
The final examination will assess your knowledge of material covered throughout the course. It will assess your ability to interpret various data displays, to consider possible implications of results for practice; and to apply basic standards in assessing the credibility of quantitative research. The final will be “open-book” or “open-materials” and will be administered the last day of class. We anticipate that your portfolios or notebooks will be useful in completing the examination.

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 alike. You should expect that we will:

- Be prepared for class, read and return your work in a timely manner, and be interested and engaged in your work;
- Remember that each of you brings a different research background and level of experience to this course, as well as help you develop your personal research interests whenever possible;
- Help you identify sources of additional substantive and methodological expertise, as needed; and
- Meet with you individually or in groups upon request and be available in person, by telephone, and by e-mail to answer questions.

General Instructional Policies

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 be reported to the Student Honor Council. If you have questions about the code, or your obligations under the code, contact the Office of Judicial Programs and Student Ethical Development. The full text of the code can be found at: www.inform.umd.edu/CampusInfo/Departments/jpo/code_acinteg.html.

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 the Office of Disability Support Services (310-314-7682).

It is the University policy that students should not be penalized because of their religious beliefs and observances. Whenever possible, students will be given reasonable time to make up any academic assignment that is missed due to participation in a religious observance. Students should inform the instructors of any conflicts between the course schedule and religious observances as soon as possible so that appropriate arrangements may be made.

Materials

Required Books

Two books are required for the course. All books can be purchased from an on-line or local bookstore, though if you took EDPL 673: Modes of Inquiry, you should own these books. Additional readings may also be made available to students during the course. We'll try to post these as documents on Dr. Croninger's faculty webpage (under courses):

<http://www.education.umd.edu/Depts/EDPA/faculty/croninger/EDPL701/index.htm>

Otherwise, we will hand these additional materials out in class.

McMillan, James H. (2004). Educational Research: Fundamental for the Consumer (4th edition). Boston: Pearson.

Gall, Meredith D., Gall, Joyce P., & Borg, Walter R. (2003). Educational Research: An Introduction (7th edition). Boston: Pearson.

Statistical Software

Statistical software is available at many University of Maryland computing locations, including the Shady Grove campus. Servers provide students with access to SPSS for Windows (what we will be using in class). We are requesting that you purchase your own copy of SPSS – specifically, the SPSS graduate pack. The graduate set of modules will provide you with software that is sufficient for doing all of the exercises and a dissertation, if you should choose to do a quantitative analysis. The student set of modules is cheaper but limited and not recommended if you intend to do a quantitative dissertation. Approximate cost of the graduate set of modules is \$200. You can purchase the software through the University Book Center or online (e.g., the campus e-store or journeyEd.com). More information about SPSS can be obtained from <http://www.spss.com/>. Please check system requirements and platform compatibility before purchasing any software. We'll talk more about access to statistical software and datasets during class (including why we think that it is important).

Schedule

The schedule is organized around statistical concepts and techniques associated with quantitative analyses of education data. We proceed generally, considering basic statistical concepts and procedures, along with the uses (and misuses) of data in education. We discuss various aspects of measurement and the use of basic statistics and visual displays to describe education phenomena. We then precede to more complex quantitative analysis, such as relationships between variables, strategies for presenting data, and standards for assessing the inferences that educators and policymakers draw from data. Unless stated otherwise, we will meet in room 108 for the first two hours of class (5-7) and in room 214, the computer lab, for the last hour of class

(7-8). Readings, analytic exercise, and portfolio assignments are due on the days that they are listed. Specific details about assignments will be given one week in advance of the due date.

Week 1, September 13, 2004

Getting started. Overview of the course. We'll begin with a brief overview of the course and syllabus. Then we'll discuss the nature of educational research and provide you with an exercise that we hope will serve as a benchmark for learning and be an example of what we are trying to accomplish this fall. In lab we'll introduce you to SPSS and do an exercise meant to convey the logic of an SPSS data matrix (essentially, a spread sheet).

Assignments, Exercises & Readings Due this Week.

- *Chapters 1, Educational Research: An Introduction by Gall, Gall, & Borg*
- *Chapter 1, Education Research: Fundamentals for the Consumer by McMillan*

Week 2, September 20, 2004

Introduction to Measurement. We'll spend roughly three weeks examining basic principles of measurement, including scales of measurement and characterizations of distributions of data. We'll discuss measures of central tendency (mean, median, mode) and variance (range, standard deviation). We'll consider the meanings of these statistics and how they may help us describe and understand educational phenomena. In lab we'll finish constructing a dataset and use this dataset to compute basic descriptive statistics. (You'll use the output as a basis for your 1st analytic exercise, due next week.)

Assignments, Exercises & Readings Due this Week.

- *1st Portfolio/notebook assignment*
- *Chapter 5, Educational Research: An Introduction by Gall, Gall, & Borg*
- *Chapters 2 & 6, Education Research: Fundamentals for the Consumer by McMillan*

Week 3, September 27, 2004

Exploratory analyses. Exploratory analyses rely on visual displays of data to examine the "shape" of the distribution of a single measure of some phenomenon of interest or to examine the relationship between two or more measures of different phenomena. These techniques are often used in conjunction with measures of central tendency and can provide important insights into statistical procedures. We'll consider some basic visual displays of data (e.g., box-and-whiskers) and discuss how these displays might be used to ask questions about education phenomena. In lab we'll apply this knowledge to education datasets.

Assignments, Exercises & Readings Due this Week.

- *1st Analytic exercise.*
- *Review chapter 5, Educational Research: An Introduction by Gall, Gall, & Borg*
- *Review chapters 2 & 6, Education Research: Fundamentals for the Consumer by McMillan*

Week 4, October 4, 2004

Scaling measures. The meaning of a measure can be adjusted by scaling it to some meaningful benchmark. We'll examine different scales (e.g. percentiles, z-scores) used in education research, and how they might be used with exploratory data analyses to inform education decisions. In lab, we'll use an education dataset to compute alternative scales for measures and apply them as part of an exercise.

Assignments, Exercises & Readings Due this Week.

- 2nd Portfolio/notebook assignment
- Chapter 7, *Educational Research: An Introduction* by Gall, Gall, & Borg
- Chapters 7, *Education Research: Fundamentals for the Consumer* by McMillan

Week 5, October 11, 2004

Confidence intervals. We'll consider the notions of sampling and confidence intervals. We'll discuss the logic of samples, ways in which education measures represent samples, and the types of questions typically asked about samples. A key question involves how much "confidence" can we have that sampled values fall within the plausible range of expected values in some population. (Sometimes also referred to as the external validity of a set of parameter estimates.) We'll explain these constructs and related statistics, and we'll demonstrate them in lab using an education dataset.

Assignments, Exercises & Readings Due this Week.

- 2nd Analytic exercise
- Chapter 6, *Educational Research: An Introduction* by Gall, Gall, & Borg
- Chapter 5, *Education Research: Fundamentals for the Consumer* by McMillan

Week 6, October 18, 2004

Comparison of two group means. We build on what we have learned about exploratory data analysis, sampling, and expected values to compare the distribution of measures drawn from one or more sample. We'll use these statistical concepts to consider the logic behind statistical tests of mean differences (specifically t-tests), as well as different standards that might be used to consider the "magnitude" of differences (e.g., effect sizes). In lab we'll use these statistical concepts and procedures to consider one of the more fundamental questions that educators confront with quantitative data— how do I know if scores are different across time or between populations?

Assignments, Exercises & Readings Due this Week.

- 3rd Portfolio/notebook assignment
- Chapter 10, *Educational Research: An Introduction* by Gall, Gall, & Borg
- Chapter 10, *Education Research: Fundamentals for the Consumer* by McMillan

Week 7, November 25, 2004

Comparison of multiple group means. We extend last week's lesson to consider how to compare means drawn from multiple samples (rather than just two samples). We'll use the same statistical concepts to consider the logic behind statistical tests of multiple mean comparisons (F-test and post hoc comparisons), and we'll discuss the confidence that we can have in various test results (internal validity). In lab we'll return to the dataset that we used last week to apply this knowledge and consider its uses in education research and decision making.

Assignments, Exercises & Readings Due this Week.

- 3rd Analytic exercise
- Review chapter 10, *Educational Research: An Introduction* by Gall, Gall, & Borg
- Review chapter 10, *Education Research: Fundamentals for the Consumer* by McMillan

Week 8, November 1, 2004

Cross-tabulations of data. Many questions about education phenomena involve systematic comparisons of different forms of categorical data. These data may be derived from continuous measures of phenomena (like test scores) or from nominal measures (like the race/ethnicity of students). We'll build on what we have learned so far about exploratory data analysis and expected values to examine different strategies for cross tabulating data. We apply these ideas in lab.

Assignments, Exercises & Readings Due this Week.

- 4th Portfolio/notebook assignment
- Review chapter 10, *Educational Research: An Introduction* by Gall, Gall, & Borg
- Review chapter 10, *Education Research: Fundamentals for the Consumer* by McMillan

Week 9, November 8, 2004

Cross-tabulations of data (continued). We continue with our examination of cross tabular displays of data, statistical tests of difference, and the uses (and misuses) of these procedures to make claims about education phenomenon. In doing so, we re-consider the idea of expected values, and we discuss cross tabular displays of categorical (or categorized) data, and statistical techniques (e.g., Chi-square statistics) for examining possible relationships between measures. We apply these ideas in lab.

Assignments, Exercises & Readings Due this Week.

- 4th Analytic exercise
- Review chapter 10, *Educational Research: An Introduction* by Gall, Gall, & Borg
- Review chapter 10, *Education Research: Fundamentals for the Consumer* by McMillan

Week 10, November 15, 2004

Logic of regression. In today's class we begin an examination of the logic of regression analysis. We use visual displays of multiple measures to examine possible relationships between variables, and we explain and use correlation coefficients and regression coefficients to describe these relationships. We apply these ideas in lab and consider how they might be used to answer questions about education phenomena.

Assignments, Exercises & Readings Due this Week.

- *5th Portfolio/notebook assignment*
- *Chapter 11, Educational Research: An Introduction by Gall, Gall, & Borg*
- *Chapter 8, Education Research: Fundamentals for the Consumer by McMillan*

Week 11, November 22, 2004

Logic of regression (continued). We extend what we have learned about the logic of regression to consider additional constructs related to regression analyses (e.g., residuals, variance explained, error bars). We use additional visual displays and these ideas to introduce the notion of value added analyses and discuss relevance of these analyses to data based decision making.

Assignments, Exercises & Readings Due this Week.

- *5th Analytic exercise*
- *Review chapter 11, Educational Research: An Introduction by Gall, Gall, & Borg*
- *Review chapter 8, Education Research: Fundamentals for the Consumer by McMillan*

Week 12, November 29, 2004

Logic of analysis of covariance (ANCOVA). Many educational questions fall into the category of did the program work? Did it work for everyone? Each of these questions is a variation and potential extension of value-added analyses. Using visual displays and examples drawn from education, we'll discuss the logic of ANCOVA and how it builds on what we have learned so far in class. We'll apply these ideas in lab.

Assignments, Exercises & Readings Due this Week.

- *6th Portfolio/notebook assignment*
- *Review chapter 10, Educational Research: An Introduction by Gall, Gall, & Borg*
- *Review chapter 10, , Education Research: Fundamentals for the Consumer by McMillan*

Week 13, December 6, 2004

Introduction to multilevel models. In this class we extend the notion of regression and analysis of covariance to introduce multilevel models and their relevance to education research. We use visual displays of group slopes to discuss the logic of these models and

how these techniques can be used to examine education policies and practices. We'll use lab time to review and answer questions related to the final examination. We'll also do course evaluations.

Assignments, Exercises & Readings Due this Week.

- 6th Analytic exercise
- Review chapter 11, *Educational Research: An Introduction* by Gall, Gall, & Borg

Week 14, December 13, 2004

Where do you go from here? We'll wrap up the class and discuss options that you have for deepening your understanding of quantitative applications and data based decision making. We'd also like to be able to gauge your interest in pursuing either quantitative or qualitative methods in the spring course. The majority of the class, however, will be dedicated to completing the final examination. The examination will be open-book, open-material. Bring a calculator, your portfolio/notebook, and pencils.

Assignments, Exercises & Readings Due this Week.

- Portfolio/notebooks (due end of class).