

CONTENT OF QUANTITATIVE RESEARCH METHODS COURSES

OFFERED BY PennGSE¹

Statistics Courses (A systematic sequence of four courses from introductory to advanced.)

Ed 667. Introductory Statistics for Educational Research: This is the introductory course in statistics that begins with descriptive statistics for univariate distributions, proceeds to bivariate regression and correlation, and then goes into concepts of statistical inference including sampling error and tests of statistical significance (t-test and chi square test). Effect size measures are also introduced. This course is prerequisite to most other quantitative methods courses, or can be taken as a co-requisite. Though there is no stated prerequisite, a working knowledge of basic algebra is essential.

Course Description: Scales of measurement; indices of central tendency and variability; product-moment correlation; introduction to the chi-squared; Z, T, and F distributions.
Prerequisite (or equivalent) to all other PREM courses.

Ed 767. Regression and Analysis of Variance: This is the second, or intermediate, course in statistics. Multiple regression and analysis of variance are the central components, as the title states.

Course Description: Analysis of survey data and controlled field experiments, including statistical models, hypothesis testing, experimental design, regression methods, and reporting.

Ed 880. Complex, Multilevel, and Longitudinal Research Models: This course addresses a number of advanced topics in statistical analysis, and follows Ed 767.

Course Description: Design, construction, sampling, internal and external validity principles; univariate and multivariate statistical treatment of experimental and quasi-experimental data; computer processing, interpretation, and reporting for simple and complex factorial, repeated measures, time series, growth trajectory, unbalanced, and multiple consistent and inconsistent covariates designs; error covariance structure modeling, hierarchical linear (and nonlinear) modeling, and multilevel individual growth-curve modeling. Prerequisite: Ed 767 or equivalent.

¹ See also separate list of similar quantitative research methods courses relevant to GSE students as offered by other departments at Penn

Ed 881. **Applied Multivariate Statistics:** This course addresses a number of additional advanced topics in statistical analysis, and follows Ed 880

Course Description: Multivariate strategies for hypothesis testing, prediction, and classification, including multiple regression, multivariate multiple regression, canonical regression, multiple logistic regression, multiple discriminant functions, factor analysis of scaled variables, hierarchical cluster analysis, and multivariate classification analysis; computer processing, interpretation, and reporting. Prerequisite: Ed 880 or equivalent.

Measurement Courses (A sequence of three courses from beginning to advanced.)

Ed 684. **Measurement and Assessment:** This is the introductory course in measurement that is prerequisite to more advanced courses. Though not required, completion of Ed 667 (Introductory Statistics), or its equivalent, will be helpful.

Course Description: Analysis of primary assessment concepts including basic theoretical principles, types and purposes of assessment devices, levels of measurement, standardization and norming, and methods to support reliability and validity; special focus on appropriate test interpretation, fairness, measurement of change, and incremental validity; application of standards for test development, usage, and critique in education, health care, public policy, and scientific inquiry. Prerequisite: None.

Ed 768. **Measurement Theory and Test Construction:** The focus of this course is on the domains of measurement that are central to education (especially achievement tests). This is an advanced course that goes into psychometric theory and principles underlying the construction of such tests and their properties. Completion of Ed 667 (Introductory Statistics), or its equivalent, is essential.

Course Description: Design of ability, achievement, and performance measures such as those applied for high-stakes decision making in large-scale assessment and for diagnosis and classification of individuals; advanced true-score and item response theory; item formatting, analysis, selection, calibration, linking, and scaling; analysis of reliability for continuous, ordinal, nominal, and composite scales; analysis of differential item functioning; model contrasting, test equating, and scaling for longitudinal assessment; standards and cut-point setting. Prerequisite: Ed 684 or equivalent.

Ed 771. **Factor Analysis and Scale Development:** This is an advanced course in psychometrics, including factor analysis. Completion of Ed 667 (Introductory Statistics), or its equivalent, is essential.

Course Description: Advanced measurement theory; exploratory and confirmatory item factoring and clustering for self-report, observational, rating, performance, and personality instruments; scaling procedures, hierarchical structure, invariance, generality, reliability, validity, interpretation, and scientific reporting. Prerequisite: Ed 684 or equivalent.

Evaluation Research Courses

Ed 591. **Program Evaluation and Policy Analysis:** The class is designed to provide students with the knowledge and tools to define questions for research and analysis that can be used to guide policy development, program design, and program operations.

Course Description: This course focuses on mapping questions to appropriate methods of research, judging the quality of research evidence and designing strong analysis and evaluation strategies for various purposes. The primary, but not exclusive, focus of the course is on education policy concerns.

Ed 680. **Evaluation of Policies, Programs, and Projects:** This course is an introduction the theory and methods of evaluation research.

Course Description: Evaluation of contemporary practice and policy through the generation of statistical and literal evidence, and the design and implementation of evaluation using the case study method. Ed 667 may be taken concurrently with Ed 680.

Survey Research Course

Ed 683. **Survey Methods and Design:** This course is an introduction to the theory and methods of survey research. Though not required, completion of Ed 667 (Introductory Statistics), or its equivalent, will be helpful.

Course Description: Design of field surveys in education, the social sciences, criminal justice research, and other areas; methods of household mail and telephone surveys, methods of assuring privacy, enhancing cooperation rates, and related matters; fundamentals of statistical sampling and sample design. Much of the course is based on contemporary surveys sponsored by the National Center for Education Statistics and other federal, state, and local agencies.

Research Design Course

Ed 871. **Randomized Trials and Experiments.** This course introduces students to the theory and methods of conducting randomized controlled field experiments. Though not required, completion of Ed 667 (Introductory Statistics), or its equivalent, will be helpful.

Course Description: Design and analysis of controlled experiments, including identifying and resolving scientific, managerial, ethical, political, institutional, legal, and statistical issues in the design, conduct and analysis of randomized trials for planning and evaluating programs, practices, and projects.

Data Processing Course

Ed 625. **Data Processing and Analysis:** The emphasis of this course is on developing skills with data management and statistical analyses using the SAS statistical package.

Course Description: Construction, management, and transformation of computerized data files; basic treatments with major statistical software; outlier detection, data mining, and imputation; graphic representation for experiments, cartographic modeling, and research reports. Prerequisite or co-requisite: Ed 667 or equivalent.