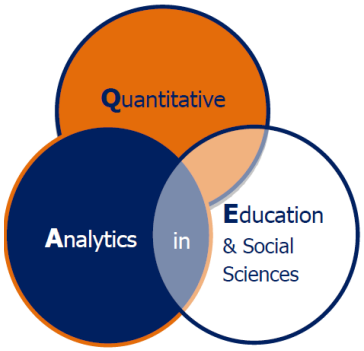


Quantitative Analytics in Education (QAE) and the Social Sciences

School of Education & Human Development

The Master of Education (M.Ed.) program in Quantitative Analytics in Education (QAE) and the Social Sciences prepares students to use rigorous data analytic techniques to inform and improve research, management, and policy decisions in education and the social sciences. The program prepares students for research roles as applied data scientists in settings that involve working with large data sets to address questions of substantive importance. Students in the program will gain proficiency in: (1) managing and analyzing data, (2) constructing and interpreting research reports, (3) developing an understanding of measurement, survey, and research design, and (4) communicating analytic results and interpretations to broad audiences. Students will gain proficiency in these areas through course-based applications of these tools to actual research problems in education and the social sciences.

The program is designed to prepare students for work in school systems, state education departments, assessment/testing companies, state and federal governments, private companies, and other organizations in which data analytics play a role. This program is also useful for existing professionals looking to complement their existing work, and to prepare students looking to pursue more advanced training through completion of a doctorate degree in research methodology. The program is offered on-grounds in Charlottesville, VA. Applications for fall enrollment are due April 15th.

Degree Requirements

The program of study requires a minimum of 30 credit hours of graduate coursework. To fulfill the credit-hour requirement the following conditions must be satisfied:

- no more than six credit-hours of relevant graduate study may be transferred from another institution unless a formal cooperative program arrangement exists between the Curry School and that institution,
- at least 18 credit-hours must be completed after admission to the program, and
- at least 24 credit-hours of graduate study must be taken from the University of Virginia and 18 of these hours must be taken on-grounds.

Students will be required to take four core foundational courses that cover a broad landscape of data analytics that include quantitative tools, developing and evaluating the quality of instruments (i.e., tests, measures, surveys) that are used to obtain data, creating and managing large data bases, and designing and evaluating the quality of education research designs. Students will extend this breadth of understanding through an additional two required courses that foster a more specialized understanding of advanced modeling procedures. Two additional course electives may be selected from the areas of: 1) advanced quantitative methods, 2) qualitative methods, and/or 3) other methodological areas of emphasis. These elective options are provided to allow program flexibility for more specific targeting of student career goals. A culminating experience is provided in the form of a capstone research project or a research internship. Students must work closely with their advisor to choose coursework that aligns with their academic requirements and career aspirations.

	Pre-Requisite (If Needed)	
EDLF 5330	Quantitative Methods and Data Analysis I[1]	3
	Foundational Skills (Required)	
EDLF 7420	Quantitative Methods II: GLM	3
EDLF 7403	Survey Design & Instrument Construction	3
EDLF 5310	Data Management for SS Research	3
EDLF 7402	Program Evaluation	
	or	3
EDLF 7300	Foundations of Educational Research	
	Advanced Modeling[2] (Choose 2-3)	
EDLF 8310	Generalized Linear Models	3
EDLF 8360	Multilevel Modeling in Education Research	3
EDLF 8361	Structural Equation Modeling	3
	Capstone Experience / Research Internship	
EDLF 5993	Independent Study	3
or 5985	Internship	
	Methodological Electives (Choose 2-3)[3]	
	Advanced Quantitative Program Evaluation	
EDLF 8311	Design and Analysis of Field Experiments	3
EDLF 8315	Causal Inference in Ed Policy Research	3
	Qualitative Methods	
EDLF 7404	Qualitative Analysis	3
EDLF 8440	Advanced Qualitative Analysis	3
	Additional Electives[3]	
EDLF 7330	Single-Subject Research	3
EDLF 6080	Education Policy	3
EDLF 7410	Mixed Methods Research Design	3
EDLF 8380	Case Study Research	3

1. This course does not count toward the 30 credits needed to complete the program.
2. EDLF 7420 (or similar experience) is a prerequisite for these courses.
3. Additional electives are also possible outside the School of Education. Examples of these include Data Visualization, Data Mining, Machine Learning, Bayesian Analysis, Impact Evaluation, R programming and data management, and Item Response Theory. These courses are typically offered in the Batten School, the Statistics Department, and/or the Psychology Department.

Capstone Experience / Research Internship (3 credit hours)

Option 1: The student will work closely with a research mentor on original research or comprehensive literature review. This option is similar to writing a thesis, but on a smaller scale. The final paper should be about the same length as a manuscript written for a scholarly journal. If conducting original research, the student must make a significant contribution to the work, as determined by their research mentor, though the student need not be the sole contributor (i.e., lead author).

Option 2: The student will obtain an internship with an organization in which they can obtain practical experience in data analytics. A written agreement between the student, the advisor, and the sponsoring organization must be in place prior to beginning the internship experience. This agreement will document the relevance of the experience to data analytics and must be approved by all parties.

Sample Plan of Study

Full-time students entering the program who have already taken the pre-requisite (EDLF 5330) or its equivalent, may complete the program in either two semesters and a trailing summer, or three semesters. A typical plan of study is shown below.

Semester 1 (fall)

EDLF 7420	Quantitative Methods II: GLM
EDLF 7403	Survey Design & Instrument Construction
EDLF 5310	Data Management for SS Research
EDLF 7402	Program Evaluation
EDLF 6080	Education Policy

Semester 2 (spring)

EDLF 8310	Generalized Linear Models
EDLF 8360	Multilevel Modeling in Education Research
EDLF 8361	Structural Equation Modeling
EDLF 8315	Causal Inference in Ed Policy Research

Semester 3 (summer)

EDLF 5993	Independent Study or
EDLF 5985	Internship

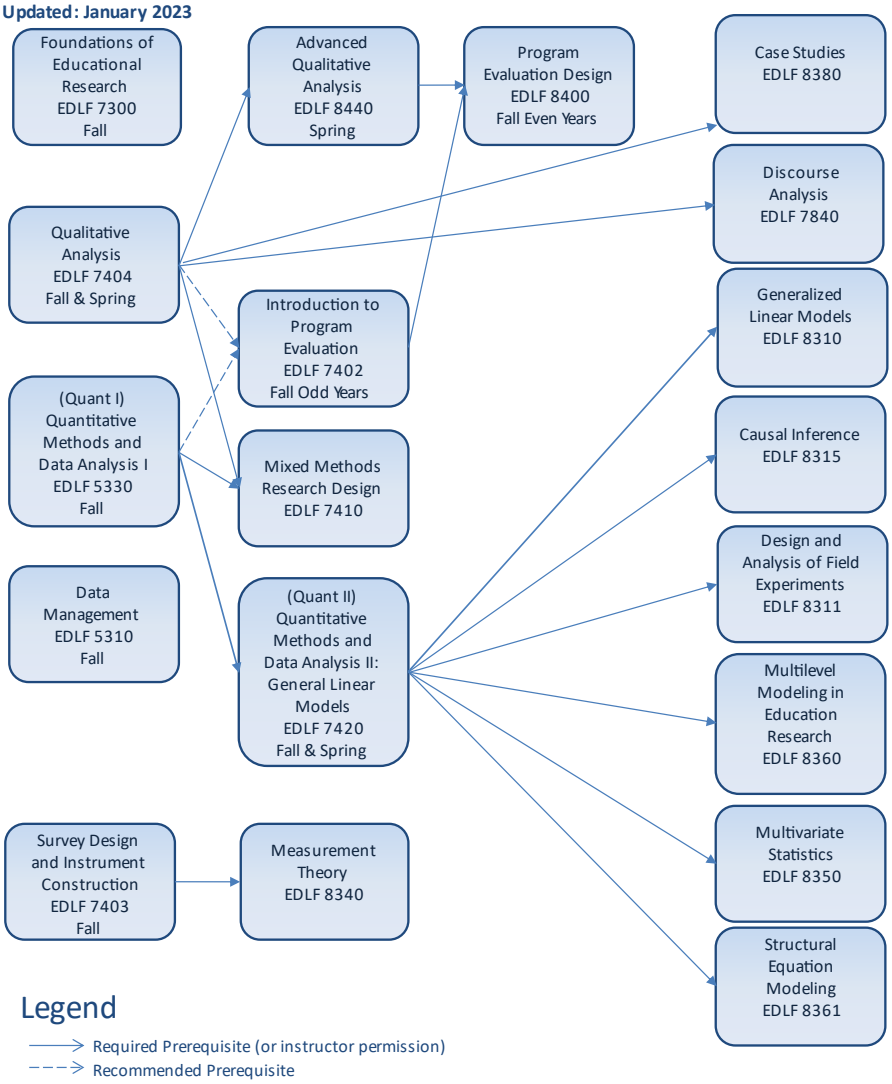
Learning Outcomes

General learning outcomes for the overall program include:

- Understand the philosophical underpinnings of various approaches to scientific research
- Identify and state educational questions in ways that facilitate answering them by quantitative and/or qualitative research methods
- Create efficient designs for collecting data appropriate to the questions posed
- Use powerful and appropriate procedures for collecting and analyzing data
- Bring existing knowledge to bear on research questions
- Communicate the findings effectively

M.Ed./Ph.D. Research Methods
Course Sequence Guide

Updated: January 2023



Course Descriptions

EDLF 5310 Data Management for Social Science Research
This course introduces strategies for effectively working with large-scale quantitative data for social science research. Topics covered include: data cleaning, recoding and checking; merging data from multiple sources; reshaping data; documenting processes; writing programs and macros to reduce errors; and presenting descriptive data through tables and graphs. Students will utilize Stata, a statistical software package. This course is usually offered in fall semester of every year.

EDLF 5330 Quantitative Methods and Data Analysis I
This introductory statistics course covers descriptive and inferential statistics. Students learn to identify the type of data, select appropriate statistic and graphical methods, analyze data, and interpret the results. Specific methods include the t-test, chi-square test, correlation, simple linear regression, one-way ANOVA, and repeated measures ANOVA. Calculations are done by hand and with statistical software.

EDLF 5500 Field Experiments
This course has three purposes. The first is to introduce students to recent methodological advances in the design and analysis of field experiments, particularly in school settings. The second is for students to read and discuss well-known field experiments that have important implications for policy, and/or our understanding of science. The third is to demonstrate that although the course is about field experiments, many of the issues that are addressed extend easily to the design and analysis of observational studies. Students will learn to use Stata for the analysis of field experiments. Prerequisite: EDLF 7420 or equivalent. This course is usually offered in spring semester of odd-numbered years.

EDLF 5985 Internship
Students apply academic experiences in professional and/or research settings; reflect and critically and constructively analyze experiences from multiple perspectives; and view the work as connecting course content authentic contexts. Students work as professionals with site supervisors and instructors to complete related assignments and relevant background research on the professional and academic resources available.

EDLF 5993 Independent Study

EDLF 6080 Education Policy
An introductory course in which principles of assessing educational policies are applied to the evidence currently available across a range of policies. Areas of education policy may include early childhood education, charter schools, accountability, teacher recruitment, retention and assessment, and bridging from K-12 to high education. Discussions focus on linking policies to outcomes for students.

EDLF 7060 Theoretical Perspectives on Educational Policy
This course introduces students to the use of theory in the educational research process by examining interpretive and critical theoretical approaches in educational policy research. It examines current theories including micro-macro theories, critical race theories, feminist and postmodern theories and their applications in research methods such as critical discourse analysis, critical ethnography, etc., as they pertain to policy research, policy analysis, and policy evaluation.

EDLF 7180 Tests and Measurements
This introductory course concentrates on the evaluation and interpretation of assessment tools. Topics include reliability and validity; social and ethical considerations of testing; summarizing and interpreting measurements; and the use of standardized tests, rating scales, and observational scales. This course is usually offered in fall semester of every year.

EDLF 7300 Foundations of Educational Research
Social and education science research encompasses a varied and challenging set of knowledge and skills to master. The nature of the research problems are complex and multifaceted; addressing these questions requires a diverse and strategic combination of research traditions, designs, and methods, so no single research design course exposes students to all that might be of relevance and interest. This course has two broad goals: (1) to build a foundation on which students can begin to development an understanding of social and education science research designs and methods; and (2) to develop students' basic competencies in specifying linkages among research questions, designs, methods, evidence, inference, and use. This course is offered every fall semester.

EDLF 7330 Single-Subject Research
Detailed examination of the design and interpretation of single-subject research. Foci for the course include rationale for single-subject research; methods for planning, implementing, and evaluating studies; and issues in the use of these methods.

EDLF 7402 Program Evaluation
An overview of current program evaluation approaches, this class is designed to provide an overview of the theories behind and approaches to evaluation as well as to begin to train students in evaluation design and methods. Theoretical, methodological, and empirical readings emphasize the terminology of educational evaluation and the variety of theoretical and design approaches to evaluation. Consideration is also given to the application of evaluation approaches and designs to non-educational settings. This course is usually offered in fall of odd-numbered years.

EDLF 7403 Survey Design and Instrument Construction
This course provides students with practical experience in survey research. Topics focus on survey design, administration, analysis, and reporting. Specific topics include item writing guidelines, cognitive interviews and pilot testing, survey implementation and planning, sampling methods, data analysis, and presentation of survey results. Particular attention is given to strategies for ensuring reliable survey responses and valid inferences.

EDLF 7404 Qualitative Analysis
This class serves as an introduction to the central concepts of qualitative methods in research and evaluation. Primary emphasis is on the development of skills required to conduct qualitative research, with a focus on research design, specific methods of inquiry, and approaches to analysis. The philosophy and epistemology of qualitative approaches are also discussed. Empirical readings provide examples of qualitative research within education and related fields. This course is usually offered fall and spring semester of every year.

EDLF 7410 Mixed Methods Research Design
This course provides an introduction to mixed methods in social science/educational research. We will consider the types of questions that mixed methods can answer and discuss the benefits/challenges of mixed methods research. We will cover research design, sampling, and analysis, including reading exemplars of mixed methods research. Students will apply the theoretical/methodological tenets

learned by designing their own mixed methods study. This course is usually offered in fall semester of even-numbered years.

EDLF 7420 Quantitative Methods II: General Linear Models
The focus of this course is on quantitative methods within a general linear modeling (GLM) framework. Topics include multiple regression with continuous outcomes and predictors that are continuous, dichotomous and multi-category (i.e., analysis of variance (ANOVA) in a regression framework), and combinations of these predictor types. Emphasis will also be placed on moderation and mediation, as well as assumptions underlying the appropriate use of these procedures. Students will develop both a theoretical and applied understanding of the general linear model in the context of continuous outcomes. Prerequisite: EDLF 5330 or equivalent.

EDLF 8310 Generalized Linear Models
This course provides students with advanced quantitative skills in applying ordinary least squares (OLS) methods, as well as introduces students to the generalized linear model (GLM) for cases when variables have specific non-normal conditional distributions. The course will address common data analytic challenges that arise in real world settings, such as when outcomes are not normally distributed, when the independent and dependent variables have nonlinear relationships, and when outliers or discrepant data are present. We also examine statistical methods for addressing missing covariate data and bootstrapping methods for inference tests. Prerequisite: EDLF 7420 or equivalent.

EDLF 8315 Causal Inference in Educational Policy Research
An advanced methods course on quasi-experimental statistical techniques for generating unbiased effect estimates when random assignment is not feasible. Underlying theories, identifying assumptions, and applications are presented for techniques drawn from a variety of disciplines including economics, sociology, and psychology including regression discontinuity, instrumental variables, difference-in-difference, matching, and fixed effects. This course is usually offered in spring semester of every year. Prerequisite: EDLF 7420 or equivalent.

EDLF 8340 Measurement Theory
Fundamentals of item response theory and generalizability theory. Topics include the Rasch, two-parameter logistic, and three parameter logistic models for binary items and the partial credit, rating scale, and generalized partial credit models for polytomous items. Additional topics include scale linking and score equating, and multidimensional item response theory. Generalizability theory topics include estimation of variance components for generalizability studies, and estimation of reliability coefficients for decision studies. Application of these methods to educational and psychological testing and the use of statistical software is emphasized. Students will learn to use statistical software such as R, jMetrik, and flexMIRT. Prerequisites: EDLF 7180 and EDLF 7420 or instructor permission. This course is usually offered in spring semester of every year.

EDLF 8350 Stat IV Multivariate Statistics
Presents the theory and rationale of selected multivariate statistical techniques. Topics include multivariate analysis of variance, canonical correlation, discriminant analysis, exploratory factor analysis, and confirmatory factor analysis. Emphasizes computer-assisted analysis and the application of appropriate statistical methods to research data. Prerequisite: EDLF 7420 or instructor permission. This course is usually offered in spring semester of every year.

EDLF 8400 Program Evaluation Design
Explores problems of designing, conducting, and reporting evaluation research studies. Time is spent examining philosophies of science that underlie evaluation studies; conceptualizing a total evaluation

study; planning for the use of time and resources in conducting an evaluation study; assembling the evidence for or against a particular proposition; analyzing costs; and learning how to avoid common pitfalls in working with clients and program participants to design and conduct an evaluation study. This course is usually offered in fall semester of odd-numbered years.

EDLF 8440 Advanced Qualitative Analysis
Advanced course in methods and practices of qualitative research. Students determine their own philosophy of inquiry and become increasingly proficient in the application of qualitative methods. Assumes an introductory course in qualitative methods. Focuses on research design and proposal development, data collection and analysis techniques, and presentation of findings. The course is field-based and guides students through the complete qualitative research cycle. This course is usually offered in spring semester of every year.

EDLF 8360 Multilevel Modeling in Education Research
This course is designed to familiarize students with the basics of multilevel modeling. Topics include random effects ANOVA models, means-as-outcomes models, random coefficients models, intercepts- and slopes-as-outcomes models, contextual models, random effects ANCOVA models, linear growth models, nonlinear growth models and cross-classified models. Prerequisite: EDLF 7420 or equivalent. This course is usually offered in fall semester of odd-numbered years.

EDLF 8361 Structural Equation Modeling
The major topics include exploratory/confirmatory factor analysis models, a variety of structural equation models, growth curve models, and multi-sample modeling analysis. The major focus of the course is both on the conceptual understanding of latent variable modeling and on practical application of these models in research and measurement. Students will work with data sets and computer programs to gain practical research experience.

EDLF 8380 Case Study Research
This course is intended for graduate students who have used or plan to use case study methods in their own research. The course will examine the foundations, logic, design, and ethics of case study research in education and the social sciences. The class will explore single-, multiple-, and mixed-methods case study designs and methods of data collection, interpretation, and analysis.