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A project that is conducted in consultation with an advisor.

**Transfer Credit:**

For the Ed.M. degree, a maximum of 30 points of graduate credit may be transferred from other institutions. Only completed graduate courses with earned grades of B or higher will be considered for transfer credit. For more information, please speak with the Transfer Credit Coordinator in the Office of the Registrar.

**Satisfactory Progress:**

Students are expected to make satisfactory progress towards the completion of degree requirements. If satisfactory progress is not maintained, a student may be dismissed from the program. Where there are concerns about satisfactory progress, students will be informed by the program faculty.

## Doctor of Education - 90 points

**Measurement Core (15 points):**

- HUDM 5059            Psychological measurement (3)
- HUDM 5124            Multidimensional scaling and clustering (3)
- HUDM 6051            Psychometric theory I (3)
- HUDM 6052            Psychometric theory II (3)
- HUDM 6055            Latent structure analysis (3)

**Evaluation Core (12 points):**

- HUDM 5130            Meta-analysis (3)
- HUDM 5133            Causal inference for program evaluation (3)
- ORLJ 5040            Research methods in social psychology (3)

**with at least one Evaluation course selected from the following:**

- P8640                    Methods in program evaluation (3) (at Mailman School of Public Health)
- P8705                    Evaluation of health programs (3) (at Mailman School of Public Health)

**Quantitative Methods Core (18 points):**

- HUDM 4122\*           Probability and statistical inference (3)
- HUDM 5122\*           Applied regression analysis (3)
- HUDM 5123            Linear models and experimental design (3)
- HUDM 6026            Computational statistics (3)
- HUDM 6030            Multilevel and longitudinal data analysis (3)
- HUDM 6122            Multivariate analysis I (3)

\*HUDM 4125 may be substituted for HUDM 4122 and HUDM 5126 may be substituted for HUDM 5122.

**Measurement, Evaluation, and Statistics Electives (18 points):**

In consultation with an advisor, students can choose 18 points of courses from the below list, as well as from advanced courses offered at Columbia University Statistics Department, Mailman School of Public Health, and programs across Teachers College. The following are suggested but not required:

HUDM 5058	Choice and decision making (3)
P8120	Analysis of categorical data (3) (at Mailman School of Public Health)
P8121	Generalized linear models (3) (at Mailman School of Public Health)
W4640	Bayesian statistics (3) (at the Columbia Statistics Program)
HUDM 5250	Research practicum in measurement and evaluation (0-4)

**Psychology (18 points):**

In consultation with an advisor, a group of courses aimed at substantive preparation in the field of psychology.

**Related Courses (6 points):**

Selected from the areas of curriculum development, guidance, applied human development, supervision, and administration, and in consultation with an advisor.

**Dissertation Advisement and Seminar (minimum of 3 points):**

HUDM 7500*	Dissertation seminar (1-3 credits each for two semesters) required)
HUDM 8900	Dissertation advisement (0)

**Special Requirements:**

The first two years require full-time study. In addition to the above coursework, an approved certification paper, successful performance on the certification examination, and completion of an approved doctoral dissertation are also required.

**Transfer Credit**

Of a planned program of 90 points, at least 45 points must be taken through Teachers College registration. A maximum of 45 points may be transferred from another university for the Ed.D. degree. Only completed graduate courses with earned grades of B or higher that appear on the student's transcript from a regionally accredited institution may be considered for transfer credit.

The student files a "Request for an Allocation of Graduate Credit" with the Office of the Registrar. Once the Registrar's Office determines the eligibility of courses for transfer, final determination of transfer credit is awarded at the discretion of the faculty advisor after evaluation of the courses for content and relevance to program requirements. The Office of the Registrar notifies the student of the results.

## Satisfactory Progress

Students are expected to make satisfactory progress toward the completion of degree requirements. Program faculty annually review each student's progress. Where there are concerns about satisfactory progress, students will be informed by the program faculty. If a student is performing below expectations, remedial work within an appropriate timeline may be required. If satisfactory progress is not maintained, a student may be dismissed from the program.

## Doctor of Philosophy - 75 points

### Measurement Core (15 points):

- HUDM 5059 Psychological measurement (3)
- HUDM 5124 Multidimensional scaling and clustering (3)
- HUDM 6051 Psychometric theory I (3)
- HUDM 6052 Psychometric theory II (3)
- HUDM 6055 Latent structure analysis (3)

### Evaluation Core (9 points):

- HUDM 5130 Meta-analysis (3)
- HUDM 5133 Causal inference for program evaluation (3)
- ORLJ 5040 Research methods in social psychology (3)

### Quantitative Methods Core (21 points):

- MSTM 5030 Topics in probability theory (3)
- HUDM 4125 Statistical inference (3)
- HUDM 5123 Linear models and experimental design (3)
- HUDM 5126 Linear models and regression analysis (3)
- HUDM 6026 Computational Statistics (3)
- HUDM 6030 Multilevel and longitudinal data analysis (3)
- HUDM 6122 Multivariate analysis I (3)

### **Measurement, Evaluation, and Statistics Electives (18 points):**

In consultation with an advisor, students can select courses from the following list, as well as more generally from courses offered at other departments and schools at Columbia University:

- HUDM 5058                      Choice and decision making (3)
- P8120                              Analysis of categorical data (3) (at Mailman School of Public Health)
- P8121                              Generalized linear models (3) (at Mailman School of Public Health)
- W4640                              Bayesian statistics (3) (at the Columbia Statistics Program)
- HUDM 5250                      Research practicum in measurement and evaluation (0-4)

### **Psychology (minimum of 9 points):**

In consultation with an advisor, a group of courses aimed at substantive preparation in the field of psychology.

### **Dissertation Advisement and Seminar (minimum of 3 points):**

HUDM 7500\*                      Dissertation seminar (1-3 credits each for two semesters)

HUDM 8900                      Dissertation advisement (0)

### **Special Requirements:**

The first two years require full-time study. In addition to the above coursework, an approved empirical paper, an approved research paper, successful performance on the certification examination, and completion of an approved doctoral dissertation are required for the Ph.D.

### **M.Phil. Degree**

The M.Phil. is an *en passant* degree awarded to those nearing the completion of the Ph.D. degree. Students contact the Office of Doctoral Studies to file for award of the degree.

To receive the M.Phil., the student must satisfactorily complete the following requirements:

- 1). Register for courses through Teachers College and maintain continuous registration.
- 2). File in the Office of Doctoral Studies an approved Program Plan of Study, including transfer credit.
- 3). Complete not less than six courses with evaluative grades, under Teachers College registration, with a minimum composite grade decile of 6.
- 4). Pass the departmental Certification Examination (i.e., Research Methods Examination).
- 5). Complete an approved empirical research paper and an approved theoretical research paper.
- 6). Satisfactorily complete a minimum of 75 points of graduate credit, as indicated on the Program Plan (some programs exceed this minimum), and all program requirements for the Master of Philosophy degree.
- 7). Be recommended by the program advisor and department chair for the award of the M.Phil. degree, which signifies certification as a Ph.D. degree candidate who may continue the dissertation requirement under the auspices of the Teachers College faculty.

Candidates should provide copies of the program plan and both research papers to the Department of Human Development for inclusion in the student's records.

### **Transfer Credit**

Relevant courses completed in other recognized graduate schools to a maximum of 30 points, or 45 points if completed in another Faculty of Columbia University, may be accepted toward the minimum point requirement for the degree.

Only completed graduate courses with earned grades of B or higher that appear on the student's transcript from a regionally accredited institution may be considered for transfer credit.

The student files a "Request for an Allocation of Graduate Credit" with the Office of the Registrar. Once the Registrar's Office determines the eligibility of courses for transfer, final determination of transfer credit is awarded at the discretion of the faculty advisor after evaluation of the courses for content and relevance to program requirements. The Office of the Registrar notifies the student of the results.



## **Satisfactory Progress**

Students are expected to make satisfactory progress toward the completion of degree requirements. Program faculty annually review each student's progress. Where there are concerns about satisfactory progress, students will be informed by the program faculty. If a student is performing below expectations, remedial work within an appropriate timeline may be required. **If satisfactory progress is not maintained, a student may be dismissed from the program**

## Application Information

### Applied Statistics

GRE General Test is required for the M.S. in Applied Statistics. Background in calculus is also required. **Current doctoral students in other disciplines at Teachers College can also apply; if interested contact the program director.**

### Measurement and Evaluation

GRE General Test is required for all programs in Measurement and Evaluation. **For the Ph.D program, a background in calculus is also required. for the Ed.D, some preparation in college-level math or statistics is encouraged.**

### Faculty List

#### Faculty

JAMES E CORTER

Professor of Statistics and Education

YOUNG-SUN LEE

Associate Professor of Psychology and Education

LAWRENCE T DECARLO

Professor of Psychology and Education

BRYAN SEAN KELLER

Assistant Professor of Applied Statistics

#### Lecturers

DOBRIN A. MARCHEV

Full Time Lecturer

THANOS PATELIS

Full Time Lecturer

#### Adjunct

MICHAEL JEFFREY DEAN

Adjunct Assistant Professor

DORIS ZAHNER

Adjunct Associate Professor

KERRY M. MATLOSZ

Adjunct Assistant Professor

## Course List

### **HUD 4120 Methods of empirical research**

An introduction to the methods of scientific inquiry, research planning, and techniques of making observations and analyzing and presenting data.

### **HUDM 4050 Introduction to measurement**

An introduction to basic concepts and issues in measurement. Descriptive statistics, scales of measurement, norms, reliability, validity. Advantages and limitations of measurement techniques are discussed and illustrated.

### **HUDM 4120 Basic concepts in statistics**

Designed as a one-semester introduction to statistical concepts and methods. An overview of data analysis techniques, including organizing, graphing, analyzing, reporting, and interpreting data. Both descriptive and inferential techniques will be introduced. Use of statistical software is discussed.

### **HUDM 4122 Probability and statistical inference**

An introduction to statistical theory, including elementary probability theory; random variables and probability distributions; sampling distributions; estimation theory and hypothesis testing using binomial, normal, T, chi square, and F distributions. Calculus not required.

### **HUDM 4125 Statistical inference**

Prerequisite: Course in Calculus. Calculus-based introduction to mathematical statistics. Topics include an introduction to calculus-based probability; continuous and discrete distributions; point estimation; method of moments and maximum likelihood estimation; properties of estimators including bias and mean squared error; large sample properties of estimators; hypothesis testing including the likelihood ratio test; and interval estimation.

### **HUDM 4901 Research and independent study: Measurement and evaluation**

Permission required.

### **HUDM 4902 Research and independent study: Applied statistics**

Permission required.

### **HUDM 5000 HUDM Statistics Lab**

Students in this lab must also be enrolled in HUDM 5122 or HUDM 5123.

## **HUDM 5026 Intro to Data Analysis in R**

Prerequisite: HUDM 4122 or HUDM 4125. This course provides an introduction to the R language and environment for statistical computing with an emphasis on the application of fundamental graphical and statistical techniques. While some theory will be presented (for example, when discussing regression models), the focus will be on implementation and interpretation as opposed to study of the statistical properties of the methods.

## **HUDM 5058 Choice and decision making**

Prerequisite: HUDM 4122 or equivalent. Surveys quantitative models of individual decision making, from the introduction of the notion of "utility" by Daniel Bernoulli through current models such as Tversky and Kahneman's "Prospect Theory." The focus is on psychological or descriptive models of how people make decisions, although methods of rational decision analysis are briefly discussed.

## **HUDM 5059 Psychological measurement**

A previous course in statistics or measurement is recommended. An in-depth examination of measurement and associated techniques, norms, classical test theory, reliability, validity, item response theory, issues, and applications.

## **HUDM 5122 Applied regression analysis**

Least squares estimation theory. Traditional simple and multiple regression models and regression models, including use of categorical predictors. Logistic regression for dichotomous outcome variables is also covered. Lab meetings devoted to applications of SPSS regression program. Prerequisite: HUDM 4120 or HUDM 4122. Students may also contact Amina Abdelaziz (aa3195@tc.columbia.edu) to request a prerequisite override. Class time includes time for lab.

## **HUDM 5123 Linear models and experimental design**

Pre-requisite: HUDM 5122 or HUDM 5126. This course provides an overview of experimental design and analysis from the perspective of the general linear modeling framework. Topics include the incremental F test for model comparisons, dummy and effect coding, single and multiple factor ANOVA and ANCOVA, analysis of categorical outcome data via generalized linear models, and repeated measures. The course includes lab time devoted to computer applications.

## **HUDM 5124 Multidimensional scaling and clustering**

Prerequisites: HUDM 4122 and HUDM 5122 or equivalent. Familiarity with R recommended. Methods of analyzing proximity data (similarities, correlations, etc.), including multidimensional scaling, which represents similarities among items by plotting the items into a geometric space, and cluster analysis for grouping items. Graph and network models will also be discussed.

### **HUDM 5126 Linear models and regression analysis**

Introduction to the theory and application of linear regression using calculus and matrix algebra. Focus on multiple regression models including dummy variables and polynomial models, regression diagnostics, and advanced methods such as weighted least squares, multilevel models, and an introduction to the generalized linear model.

### **HUDM 5150 HUDM Statistical Careers, Communication, and Capstone**

Prerequisite: 24 points completed towards MS Applied Statistics degree. This is a capstone course to the M.S. in Applied Statistics degree. In it students will discuss best practices in statistical analyses, including the role of a consultant and ethical issues encountered in analyses. Students will also study best practices for effective communication of statistics, including verbal, written, and graphical. Students will produce a capstone paper integrating the methods and skills they have learned across the M.S. degree.

### **HUDM 5250 Research practicum in measurement and evaluation**

Permission required. Students enrolled are expected to spend a semester involved in a research project, either assisting a faculty member or in an applied setting. A formal report will be submitted.

### **HUDM 6026 Computational statistics**

Prerequisite: HUDM 4125 and either HUDM 5122 or HUDM 5126. Provides an introduction to computationally intense methods in applied statistics, taught in R. Topics include methods of evaluating statistical estimators; design, implementation, and reporting of Monte Carlo simulation studies; resampling and reordering methods; and nonparametric and data mining approaches to regression.

### **HUDM 6030 Multilevel longitudinal data analysis**

Prerequisite: HUDM 5122. Multilevel models include a broad range of models called by various names, such as random effects models, multi-level models, and growth curve models. This course introduces the background and computer skills needed to understand and utilize these models.

**HUDM 6051 Psychometric Theory I**

Permission required. Prerequisites: Both HUDM 5059 and HUDM 5122 or 5126. Classical test theory, and test/instrument development and validation.

**HUDM 6052 Psychometric theory II**

Permission required. Prerequisites: HUDM 6051 or equivalents. Item response theory & applications, and cognitive diagnostic models.

**HUDM 6055 Latent structure analysis**

Prerequisite: HUDM 5122. Recommended: HUDM 6122. Study of latent structure analysis, including measurement models for latent traits and latent classes, path analysis, factor analysis, structural equations, and categorical data analysis.

**HUDM 6122 Multivariate analysis I**

Prerequisite: HUDM 5122 or HUDM 5126; HUDM 5123 is recommended. An introduction to multivariate statistical analysis, including matrix algebra, general linear hypothesis and application, profile analysis, principal components analysis, discriminant analysis, and classification methods.

**HUDM 6900 Advanced research and independent study**

Permission required.

**HUDM 7500 Dissertation seminar**

Permission required. Development of doctoral dissertations and presentation of plans for approval. Registration limited to two terms. Ph.D & Ed.D students must complete 3 points over 2 semesters prior to proposing their dissertation.

**HUDM 8900 Dissertation advisement**

Individual advisement on doctoral dissertation. Fee to equal 3 points at current tuition rate for each term. See section in catalog on Continuous Registration for Ed.D./ Ph.D. degrees. Ed.D & Ph.D students must register for this every semester while completing their dissertation.