Teachers College
COLUMBIA UNIVERSITY

Academic Catalog 2023-2024

Human Development

Department Information:

Programs:

The Department of Human Development

Our Mission

The Department of Human Development is devoted to promoting an understanding of human development in families, schools, and institutions across the lifespan. The department provides social scientists and educators with theories, empirical methods, and analytical tools for understanding and conducting research in human development and cognition and for helping solve educational and psychological problems.

Cognitive Science in Education

Department of Human Development

Program Description

In the Cognitive Science in Education Program, students examine the cognitive mechanisms that underlie learning and thinking in school and non-school settings. The program trains students in basic theories of human cognition, the practice and interpretation of empirical cognitive and developmental research, as well as how to use research to improve educational practices and develop innovative methods built around new technologies. Studies in cognitive, developmental and educational psychology, and computer science provide students with a valuable perspective on cognition and learning.

The curriculum and degree program requirements are designed to prepare graduates for careers in several possible settings. For the master's degree programs, these settings include

- school systems seeking instructional technology coordinators and teachers who are knowledgeable about cognitive and developmental theories and research.
- publishers and software companies looking for people with knowledge of cognition and development, and experience in instructional design.
- research organizations seeking people to conduct basic research and work on instructional applications of computers and related technologies.

For the doctoral programs, work settings after graduation might include research organizations or universities seeking faculty in cognitive psychology, educational psychology, educational technology, reading, and learning analytics.

Students in the Cognitive Science in Education Program begin by taking a set of core background courses, then pursue one of three areas of focus: Foundations of Cognition and Learning, Applications, and Intelligent Technologies.

Degrees

Master of Education

Educational Psychology: Cognitive, Behavioral, and Developmental Analysis

Master of Education

Points/Credits: 60

Entry Terms: Spring/Summer/Fall

Degree Requirements

Core Courses (9 points):

Three courses selected from the following:

- HUDK 4015 Psychology of thinking (3)
- HUDK 4029 Human cognition and learning (3)
- HUDK 4080 Educational psychology (3)
- HUDK 5023 Cognitive development (3)
- HUDK 5042 Motivation in education (3)
- HUDK 5125 Cross-Cultural psychology (3)

Statistics/Research Design (12 points):

- HUDM 4120 Basic concepts in statistics (3)
- HUDM 4122 Probability and statistical inference (3)
- HUDM 5122 Applied regression analysis (3)
- HUDM 5123 Linear models and experimental design (3)

Research Practicum (6 points):

- HUDK 5324 Research work practicum (3) by permission,
- HUD 6500 Proseminar in Human Development (1), and
- HUDK 5324 Research work practicum (2) by permission

(The Integrative Project is done in conjunction with these courses)

Specialized Courses (24-27 points):

Selected in consultation with an advisor and focusing on one of the following areas of focus:

1. Foundations of Cognition and Learning
    - HUDK 4015 Psychology of thinking (3)
    - HUDK 4027 Development of mathematical thinking (3)
    - HUDK 4050 Core methods in educational data mining (3)
    - HUDK 4051 Learning analytics: process and theory (3)

- HUDK 4052 Data, Learning, and Society (3)
- HUDK 4054 Managing education data (3)
- HUDK 5020 Development of creativity (3)
- HUDK 5024 Language development (2-3)
- HUDK 5025 Spatial thinking (3)
- HUDK 5029 Personality development and socialization across the lifespan (3)
- HUDK 5030 Visual explanations (3)
- HUDM 5058 Choice and decision making (3)
- HBSK 5096 Psychology of memory (3)
- HUDK 5042 Motivation in education (3)
- HUDK 5053 Feature engineering studio (3)
- HUDK 5063 Cognitive development beyond childhood (3)
- HUDK 5120 Development of creativity: the case study method (3)
- HUDK 5125 Cross-cultural psychology (3)

19. Applications
    - HUDK 4015 Psychology of thinking (3)
    - HUDK 4027 Development of mathematical thinking (3)
    - HUDK 4035 Technology and human development (3)
    - HUDK 5024 Language development (3)
    - HUDK 5035 Psychology of media (3)
    - HUDK 5042 Motivation in education (3)
    - HUDK 5063 Cognitive development beyond childhood (3)
    - HUDK 5090 Psychology of language and reading (3)
    - HUDK 5100 Supervised research and practice (1-6)
    - HBSK 4074 Development of reading comprehension strategies and study skills (3)
    - EDPS 4021 Sociology of education (3)
    - HBSK 4074 Reading comprehension strategies and study skills (3)
    - ORL 5522 Evaluation methods I (3)

14. Intelligent Technologies:
    - HUDK 4015 Psychology of thinking (3)
    - HUDK 4021 Developmental psychology – infancy (2-3)
    - HUDK 4022 Developmental psychology – childhood (2-3)
    - HUDK 4023 Developmental psychology – adolescence (2-3)
    - HUDK 4025 Cognition of handheld devices (3)
    - HUDK 4029 Cognition and learning (3)
    - HUDK 4035 Technology and human development (3)
    - HUDK 4040 Social media and users (3)
    - HUDK 4050 Core methods in educational data mining (3)
    - HUDK 4051 Learning analytics: Process and theory (3)
    - HUDK 5025 Spatial thinking (3)
    - HUDK 5030 Visual explanations (3)
    - HUDK 5035 Psychology of media (3)
    - HUDK 5036 Psychology of children's television (3)
    - HUDK 5063 Cognitive development beyond childhood (3)
    - HUDK 5120 Development of creativity: the case study method (3)
    - HUDK 5197 Psychology of eLearning in business and industry (3)
    - HUDK 5037 Psychology of children's television (3)
    - HUDK 5063 Cognitive development beyond childhood (3)
    - MSTU 4039 Video games in education (3)

- MSTU 5000 Possibility of virtual worlds (3)
- ORLD 4015 How adults learn (3)
- ORLJ 4005 Organizational psychology (3)

Non-departmental Courses (minimum of 6 points):

At least 2 Teachers College courses outside the Department selected in consultation with an advisor.

Integrative Project:

One of the following

- Empirical Research Paper
- Design (and perhaps Implementation) Project Paper
- Research Literature Review Paper

Program of Study

Thirty points must be completed under the auspices of Teachers College, including 18 points in Teachers College courses. A maximum of 30 points of graduate credit may be transferred from other accredited institutions. Candidates who have completed an M.A. or M.S. degree through Teachers College must register for a minimum of 45 points of the required 60 through Teachers College.

Satisfactory Progress

Students are expected to make satisfactory progress toward the completion of degree requirements. If satisfactory progress is not maintained, a student may be dismissed from the program. 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.

Faculty

Faculty

- John B **Black** Cleveland E. Dodge Professor of Telecommunications & Ed.
- James E **Corter** Professor of Statistics and Education
- Karen **Froud** Associate Professor of Neuroscience and Education
- Peter **Gordon** Associate Professor of Neuroscience and Education
- Xiaodong D **Lin** Professor of Cognitive Studies
- Gary J **Natriello** Ruth L. Gottesman Professor in Educational Research
- Robert Stuart **Siegler** Jacob H. Schiff Foundations Professor of Psychology and Education
- Renzhe **Yu** Assistant Professor, Learning Analytics / Educational Data Mining

Emeriti

- Deanna **Kuhn** Research Professor Emerita of Psychology and Education

Adjunct Faculty

- Jie **Gao** Adjunct Assistant Professor

Courses

HUDK 4011 - Networked and Online Learning

The course explores the social dimensions of online learning. The course begins by reviewing the uniquely social dimensions of learning in general and then turns to an examination of the transition to the information age that has made online or networked learning possible. The course next covers how traditional social forms such as classrooms, schools, professions, and libraries have been represented in online learning venues followed by consideration of new and emerging social forms such as digital publishing, social networks and social media, adaptive learning technologies, and immersive and interactive environments. The course concludes by examining macro-level factors that shape the opportunities for online learning.

HUDK 4015 - Psychology of thinking

Examines cognitive psychology theories and research about various kinds of thinking, what each kind is best suited for, and problems people have with it. Also examines the best ways of learning from each kind of thinking. Critically examines the various thinking skills curricula that have been proposed.

HUDK 4027 - How Children Learn Math

The development of informal and formal mathematical thinking from infancy through childhood with implications for education.

HUDK 4029 - Human cognition and learning

Cognitive and information-processing approaches to attention, learning, language, memory, and reasoning.

HUDK 4035 - Technology and human development

Examines the use and design of various educational technologies (computer software, multimedia shareware, TV, World Wide Web sites, etc.) from the perspective of basic research and theory in human cognitive and social

development. Provides a framework for reasoning about the most developmentally appropriate uses of technology for people at different ages.

HUDK 4080 - Educational psychology

Examines landmark issues in educational psychology, highlighting philosophical underpinnings and empirical evidence, tracing each issue from its roots to contemporary debates and evaluating current educational practice.

HUDK 4902 - Research and independent study

Permission required.

HUDK 5020 - The development of creativity

Major theories and contemporary research in creative work, emphasizing case studies of exceptional and historically influential individuals.

HUDK 5023 - Cognitive development

Theory and research on the development of cognitive processes across the lifespan.

HUDK 5025 - Spatial thinking

Analyzes research on how people learn, mentally represent, mentally transform, describe, and act on the spaces they encounter. Mental models of and transformations of space underlie the way people think about abstract domains, so thought about space has implications for thought in general. Implications for education and HCI are considered.

HUDK 5030 - Visual explanations

Surveys production and comprehension of visualizations ranging from ancient cave paintings and petroglyphs to diagrams, charts, graphs, comics, picture books, photographs, gesture, and film to extract and apply techniques for conveying objects, actions, forces relations, and emotions, meanings that are both inherently visible and non-visible. Implications for education, art, media, and HCI are drawn.

HUDK 5035 - Psychology of media

Covers psychological theories and research that relate to various media and what people learn directly and indirectly from them.

HUDK 5063 - Cognitive development beyond childhood

Examination of all aspects of cognitive functioning over the major portion of the life cycle that occurs beyond childhood, addressing both common patterns and individual and cultural variations. A particular focus will be critical examination of the research methods by which such knowledge is gained.

HUDK 5090 - Psychology of language and reading

Basic theories, empirical findings, and educational applications in the psychology of language and reading: the cognitive processes involved in the perception and production of oral and written language.

HUDK 5197 - The Psychology of E-learning in Business and Industry

This course will focus on the design of online learning experiences in workplace environments, from a perspective that looks to put academic research into practice. Real-world cases, including numerous demonstrations of real-life courses and systems, will be used to explore uses of online learning in the workplace for both training and "just-in-time" performance support purposes. This course will cover a variety of online learning methods, including simulations, games, mobile learning, social learning, uses of artificial intelligence, and learning in virtual reality environments. The methods and case studies will be examined with an eye toward relevant research in the areas of education, software usability, and cognitive psychology. Potential career paths for someone interested in the field of workplace e-learning will also be discussed. This course does not have a pre-requisite.

HUDK 5324 - Research Practicum

Students learn research skills by participating actively in an ongoing faculty research project.

HUDK 6523 - Seminar in cognitive development

Permission required. Advanced topics in research and theory in cognitive development.

HUDK 6539 - Research practicum in educational psychology, cognition, and learning

Permission required. Limited to doctoral candidates in psychology.

HUDK 6902 - Advanced research and independent study

Permission required.

HUDK 7502 - Dissertation seminar

Permission required. Development of doctoral dissertation and presentation of plans for approval. Registration limited to two terms.

HUDK 8901 - Dissertation Advisement - Human Cognition/Learning

Individual advisement on doctoral dissertation. Fee to equal 3 points at current tuition rate for each term. See catalog section on Continuous Registration for Ed.D./Ph.D. degrees.

Developmental Psychology

Department of Human Development

Program Description

The Program in Developmental Psychology focuses on the development of individuals across their lifespan; at Teachers College, our focus is on the infant, preschool, school, and early adulthood life phases/years. Development occurs within contexts; at Teachers College, our focus is on the family, the preschool and school, the neighborhood, and the media. We are interested in both how development unfolds and how trajectories may be altered by interventions and programs. Development involves interactions between the individual and environments; at Teachers College, our focus is on how biological characteristics and vulnerabilities are expressed in various contexts and on how genes by environmental interactions are expressed (and may be altered).

Master of Arts (M.A.)

The Master of Arts degree in Developmental Psychology minimally requires completion of 32 points. In accordance with individual interests and objectives, students acquire familiarity with basic theoretical and research orientations as well as exposure to substantive knowledge in the areas of cognitive, language, personality, and social functioning and development. Opportunity exists for the study of deviant as well as normal psychological functioning within a developmental framework.

Students may pursue independent study in order to undertake theoretical or empirical research projects or fieldwork. Students whose goal is to acquire professional skills in clinical or counseling psychology may enroll in introductory course offerings, which in many cases may be applicable if the student is later admitted to one of the more advanced master's or doctoral programs in those areas.

In order to accommodate the diverse aims of individual students, a considerable degree of flexibility has been built into the course of study leading to the M.A. degree. An attempt has been made to minimize specific course requirements, and the student will find that there is a good deal of freedom to choose from among the many offerings provided by Teachers College.

The course of study has these main components:

- A basic course in methods of research.

- Required courses in cognitive development, personality development in atypical populations, and social and personality development.
- A basic course in statistics.
- Research capstone.
- Electives in developmental psychology plus relevant electives offered by other Teachers College programs.
- A special project.

Students completing the M.A. degree accept positions in research laboratories or field settings, biomedical institutions, educational and child care agencies, foundations, public policy settings, state and local governments, community programs, and as instructors in community colleges; or they go on to pursue more advanced degrees in particular areas of specialization.

Doctor of Philosophy (Ph.D.)

The 75-point doctoral degree prepares students for faculty positions in colleges, graduate schools of education, and universities, and for positions as research associates in research laboratories, biomedical schools, foundations, public policy, and arts and sciences, as well as policy research firms, governmental agencies, and nons-profit organizations. Throughout their program, doctoral candidates work in a close apprentice relationship with a faculty advisor of their choice. The Ph.D. degree requires completion of 75 points with an empirical research dissertation.

The aim of instruction at the doctoral level is to produce a psychologist who can make a sound and innovative research contribution to the study of human development, who is concerned with the relationship between development and education, and who is equipped to teach about such matters. Students acquire the conceptual background and methodological skills necessary for faculty positions in colleges and universities or for positions as associates and consultants in research laboratories, biomedical schools, and other applied settings.

While consultation between student and faculty advisor is considered to be the best way to decide which steps should be taken towards these goals, there are specific requirements for all students in Developmental Psychology that serve to define the character of the Program and to ensure that all students have a common experience and acquire a common level of expertise in dealing with the core issues in the field.

The courses offered through the Program provide content in the research and theoretical literature relating to all phases of the psychology of human development. All age groups are covered, from infancy through childhood, adolescence to adulthood, and later life. Coursework in developmental psychology can be supplemented by courses in the other psychology programs at Teachers College as well as by courses in the social sciences, linguistics, and other fields offered at Teachers College and the graduate faculty of Columbia University (including the Columbia University College of Physicians and Surgeons). The doctoral program is focused primarily on

training in the conduct of empirical (e.g., experimental, observational, and interview) research. Other types of research (theoretical, descriptive, and historical) may be undertaken in special circumstances of student and advisor competence.

Degrees

Master of Arts

Developmental Psychology

Master of Arts

Points/Credits: 32

Entry Terms: Summer/Fall

Degree Requirements

1. Five CORE courses taken for 3 points each.
    - The following three courses:
        - HUD 4120 Methods of Empirical Research
        - HUDK 5023 Cognitive Development
        - HUDK 5040 Development and Psychopathology: Atypical Contexts and Populations
    - One of the following two courses on Social-Emotional Development:
        - HUDK 5029 Personality Development and Socialization across the Lifespan
        - HUDK 5121 Children's Social and Emotional Development in Context
    - A fifth course selected from among the following options:
        - BBS 5068 - 5069 Brain and Behavior I and II (taken for a total of 3 points)
        - BBSN 5193 - Neuroscience of Adversity
        - HUDK 4027 Development of Mathematical Thinking
        - HUDK 4029 Human Cognition and Learning
        - HUDK 4080 Educational Psychology
        - HUDK 5024 Language Development
        - HUDK 5025 Spatial Thinking
        - HUDK 5030 Visual Explanations
        - BBSN 5007 Neuroscience Applications to Education
2. One of the following three STATISTICS courses taken for 3 points:
    - HUDM 4120 Basic Concepts in Statistics (if no undergraduate statistics)
    - HUDM 4122 Probability/Statistical Inference
    - HUDM 5122 Applied Regression Analysis
4. Two SPECIALIZED Courses in the Developmental Psychology Program taken for 3 points each.
    - HUDK 5500 Capstone

- One additional course in the Developmental Psychology Program
- Each student shall complete a Departmental Special Project.
- The practicum will be the course in which students are mentored on this special project. The special project is intended to be a "culminating experience" that allows the student to integrate in one paper various aspects of what has been learned at Teachers College. The project does not have to be an empirical study, it may be a literature review or theoretical paper. If the special project involves an empirical study, it does not have to be a complete investigation; it may be a report of a pilot study. Students should aim to generate an organized, scholarly document, reporting thoughtful, careful and rigorous work

5. Additional COURSES OUTSIDE the Developmental Psychology Program taken for 1-3 points each. (To meet the College breadth requirement, students must take a total of six points in Teachers College courses outside the Program, by any combination of courses).
6. One ELECTIVE COURSE selected in consultation with an advisor. Note: Students doing a field-based internship should enroll in HUDK5100.
7. In consultation with an advisor and with permission of the supervising faculty member, a relevant independent study may be taken, but is not required.
8. Special Project (completed as part of the HUDK 5500 course): The special project is intended to be a "culminating experience" that allows students to integrate in one paper various aspects of what has been learned at Teachers College. The project does not have to be an empirical study; it may be a literature review, theoretical paper, evaluation of an educational program, or a research proposal. If the special project involves an empirical study, it does not have to be a complete investigation; it may be a report of a pilot study. Students should aim to generate an organized, scholarly document, reporting thoughtful, careful, and rigorous work.

Transfer Credit

For the M.A. degree, no transfer credit is granted for work completed at other universities.

Satisfactory Progress

Students are expected to make satisfactory progress toward 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. If a student is performing below expectations, remedial work within an appropriate timeline may be required.

FOR MORE INFORMATION PLEASE CONTACT:

HUD Staff

P: 212-678-4190

Doctor of Philosophy

Developmental Psychology

Doctor of Philosophy

Points/Credits: 75

Entry Terms: Summer/Fall

Degree Requirements

Courses and Requirements

Core Courses:

Students are generally advised to take the following four courses in developmental psychology in their first year of doctoral studies.

- HUDK 5040 Developmental and psychopathology: Atypical contexts
- HUDK 6520 Seminar on lifespan development
- HUDK 5023 Cognitive Development
- HUD 4120 Methods of Empirical Research
  OR
  ORLJ 5040 Research methods in social psychology I

Statistics Sequence:

The following four statistics courses are required, and students are advised to begin enrollment during the first semester of study. HUDM 4122 may be waived for students who have taken appropriate coursework in statistics at the undergraduate/graduate level or who have passed an equivalency examination. Please contact HUD Staff at hud1@tc.columbia.edu for more information.

- HUDM 4122 Probability and statistical inference
- HUDM 5122 Applied regression analysis
  OR
  EDPA5002 - Data Analysis for Policy Decision Making
- HUDM 5123 Linear models and experimental Design
  OR
  EDPE6023 - Advanced Causal Methods
- HUDM 6122 Multivariate analysis

Once this sequence is finished, students may find it helpful to take one or more of the following courses, which provide instruction on more advanced topics:

- HUDM 6030 Multilevel and longitudinal data analysis
- HUDM 6055 Latent structure analysis
- HUDM 5133 Casual Inference Program Evaluation

Breadth Requirement:

All doctoral students must take at least one course for a minimum of 3 points in each of the following four areas listed below. The courses must be other than courses required as part of the degree program core. Students should consult with their advisors about whether specific courses meet program requirements. Examples of suitable courses are included below.Students may also consult the TC course catalog for other examples. Note that courses used to fill the Breadth/Foundation course requirements may not be used to fulfill requirements in another area.

Biological Basis of Behavior:

- BBS 5068 Brain & behavior I and BBS 5069 Brain and behavior II (total 3 points)
- MSTC 5000 Neurocognitive Models of Information Processing
- BBSN 5007 Neuroscience Applications to Education

Cognitive Basis of Behavior:

- CCPX 5020 Cognition, emotion, and culture
- HBSK 5096 Psychology of memory
- HUDK 4015 Psychology of thinking
- HUDK 4029 Human cognition and learning
- HUDK 5024 Language development
- HUDK 5025 Spatial thinking
- HUDK 5030 Visual explanations
- HUDK 5090 Psychology of language and reading

Social Cultural Factors & Individual Differences:

- BBSN 5152 Neuroscience, Ethics and the Law
- BBSN 5193 Neuroscience of Adversity
- HBSK 5031 Family as context for child development
- HUDK 5029 Personality development and socialization across the lifespan
- HUDK 5121 Children's social and emotional development in context
- HUDK 5125 Cross cultural psychology
- HUDK 6036 Child and family policy I
- ORLJ 5017 Small group intervention: Theory and method
- ORLJ 5106 Psychological aspects of organizations
- ORLJ 5540 Proseminar in social and organizational psychology

Measurement:

- HUDM 5059 Psychological measurement
- HUDM 6051 Psychometric theory
- HUDM 6055 Latent structure analysis

Proseminar Requirement:

Doctoral Students are required to enroll in proseminar during the fall and spring of their first year. The course is taken for 3 credits per semester, totaling 6 credits for the year. This course covers various topics integral to the doctoral experience and is a great way for students to present their work amongst peers and gain feedback.

HUD 6500 Doctoral Proseminar (2 semesters)

Out-of-Department Requirement:

Doctoral students must take at least three courses outside the Department.

Course Assistantship Requirement:

Doctoral students must be a course assistant for two master's-level courses, which may include HUDK 5324, the Master's Practica. For more information, please visit the Department of Human Development located in Grace Dodge Hall, room 453.

Certification Papers:

The two advanced requirements that are met prior to presenting a dissertation proposal are an original theoretical paper and an original empirical research paper in the student's area of specialization. For more information, please visit the Department of Human Development located in Grace Dodge Hall, room 453.

Certification Examination:

As part of their certification requirements, all students must take a three-hour examination in research methods.

Post-Certification Requirement:

Ph.D. candidates must take a minimum of 15 additional points after meeting certification requirements, including the points enrolled during the semester in which certification occurs.

Dissertation Seminar:

For a dissertation proposal to be approved, the student must enroll in Dissertation Seminar (HUDK 7501). Dissertation Seminar is typically taken for one semester--the semester in which the student wishes to finish the dissertation proposal and have it approved. It can be taken for a maximum of two semesters. If the proposal is not approved in the first semester, the student must register for a second semester. After the approval of the proposal or the completion of the second semester, whichever comes first, the student proceeds automatically into registration for Dissertation Advisement.

Dissertation Proposal Hearing:

When the student and the advisor have agreed on a proposal for dissertation research, a proposal hearing will be scheduled.

Advanced Seminar:

After completing the collection of data, the student will request that an Advanced Seminar be scheduled. The purpose of the Advanced Seminar is for the committee to review data and their analysis before the final Dissertation Defense.

Dissertation Defense:

Requirements for the scheduling of the dissertation defense and composition of the dissertation committee can be found in the requirements bulletin for the Degree of Doctor of Philosophy (obtainable from the Office of Doctoral Studies).

M.Phil. Degree:

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

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

1. File an approved "Program Plan of Study" with the Office of Doctoral Studies
2. Complete at least six courses with evaluative grades under Teachers College registration
3. Pass the Certification Examination
4. Complete an approved empirical research paper
5. Complete an approved theoretical research paper
6. Complete all 75 points of coursework required for the degree.

Please note: Students must submit a copy of their Program Plan of Study and both research papers to the Department of Human Development for record keeping purposes.

Transfer Credit:

Relevant graduate courses with earned grades of B or higher taken in other accredited 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 Ph.D. degree. For more information, please contact the Transfer Credit Coordinator in the Registrar's Office.

Satisfactory Progress:

Students are expected to make satisfactory progress toward 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.

Faculty

Faculty

- Jeanne **Brooks-Gunn** Virginia and Leonard Marx Professor of Child and Parent Development and Education
- Kimberly G **Noble** Professor of Neuroscience and Education
- Tyler Wayne **Watts** Assistant Professor in Developmental Psychology

Lecturers

- Laura Mielcarek **DeRose** Lecturer

Courses

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.

HUDK 4021 - Developmental psychology: Infancy

Review of research and theory in early perceptual, cognitive, and social/emotional development, with particular attention to the interaction of biological and environmental factors in early life.

HUDK 4022 - Developmental psychology: Childhood

Children's cognition, perception, representation, language, affect, personality, and sexuality. Family structure and school as they influence these aspects of childhood.

HUDK 4023 - Developmental psychology: Adolescence

Theoretical and empirical studies of classic and current theories of how adolescents construct their identity and develop physically, cognitively, morally, emotionally, and socially.

HUDK 4027 - How Children Learn Math

The development of informal and formal mathematical thinking from infancy through childhood with implications for education.

HUDK 4901 - Research and independent study

Permission required.

HUDK 5020 - The development of creativity

Major theories and contemporary research in creative work, emphasizing case studies of exceptional and historically influential individuals.

HUDK 5023 - Cognitive development

Theory and research on the development of cognitive processes across the lifespan.

HUDK 5024 - Language Development

Survey of research and theory in the development of language, beginning with communication and the origins of language in infancy and emphasizing acquisition of the forms of language in relation to their content and use.

HUDK 5029 - Development and socialization across the lifespan

Theory and research regarding the interaction between naturally developing personality structures and socialization processes throughout life.

HUDK 5040 - Development and psychopathology: Atypical contexts and populations

Using contemporary research as the basis, the focus is on the interface between classical developmental psychology theories and patterns of development identified in atypical contexts (e.g., poverty) and among atypical populations (e.g., resilient youth). Implications for interventions and policy are also discussed.

HUDK 5121 - Children's Social and Emotional Development in Context

Contemporary theory and research on children adaptation to developmental tasks of childhood. Comparison of typical and atypical pathways in social-personality development. Analysis of the logic and method of empirical studies of development.

HUDK 5125 - Cross-cultural psychology

Survey of psychological studies of development in different cultures, with emphasis on perceptual and cognitive issues and methodological problems specific to cross-cultural research.

HUDK 5324 - Research Practicum

Students learn research skills by participating actively in an ongoing faculty research project.

HUDK 6036 - Child and Family Policy I

Provides a multi-disciplinary perspective on child and family policy. Also provides a foundation of knowledge concerning the role of child and family perspectives in informing policy.

HUDK 6520 - Development Over the Lifespan: Doctoral Seminar

Permission required. How people become socialized and how psychology deals with the process in terms of developmental concepts.

HUDK 6901 - Advanced research and independent study

Permission required.

HUDK 7501 - Dissertation seminar

Permission required. Development of doctoral dissertations and presentation of plans for approval. Registration limited to two terms.

HUDK 8900 - Dissertation advisement - Developmental Psychology

Individual advisement on doctoral dissertation. Fee to equal 3 points at current tuition rate for each term. See the section on Continuous Registration for Ed.D./Ph.D. degrees for details.

Learning Analytics

Department of Human Development

Program Description

The Program in Learning Analytics prepares students to understand and use emerging quantitative methods, drawn from computer science, statistics, and cognitive science, for handling the vast amounts of data generated by online and digital learning environments.

Students complete coursework in learning analytics and educational data mining methods, tools, and theory over the course of a year of full-time study beginning in the fall semester and concluding in the summer. Part-time study for those working in related fields is also available.

In addition to learning about relevant policy, legal, and ethical issues involved in conducting analytics on educational data, students will be challenged to use learning analytics methods to improve learning opportunities for a range of student populations.

Studying with a faculty of internationally recognized experts, students in the Learning Analytics Program work with real-world data collected from online and digital learning environments in the K-12 and post-secondary sectors.

The Program includes face-to-face and online components and opportunities for individual instruction and advice. The Program has strong industry connections, which can result in internship opportunities and other experiential learning opportunities.

Degrees

Master of Science
Learning Analytics

Master of Science

Points/Credits: 32

Entry Terms: Fall Only

Degree Requirements

Required Program Core Courses: (minimum of 5 courses for 15 points/credits)

- HUDK 4050: Core Methods in Educational Data Mining
- HUDK 4051: Learning Analytics: Process and Theory
- HUDK 4052: Data, Learning, and Society OR HUDK 4011 Networked and Online Learning
- HUDK 4054: Managing Educational Data OR HUDK 4031 Evaluation: Individuals, Groups, Institutions
- HUDK 5053: Feature Engineering Studio OR HUDK 5324 Research Work Practicum

Additional Courses in Learning (HUDK): (minimum of 3 courses for 9 points/credits)

Three courses with the HUDK prefix selected in consultation with your advisor:

- HUDK 4015 Psychology of thinking (3)
- HUDK 4029 Human Cognition and Learning (3)
- HUDK 4080 Educational psychology (3)
- HUDK 5023 Cognitive development (3)
- HUDK 5042 Motivation in education (3)
- HUDK 5125 Cross-Cultural psychology (3)
- HUDK 5100 Supervised Research and Practice (1-6)

Courses in Statistics (minimum of 2 courses for 6 points/credits) Also satisfies the College Breadth Requirement

- HUDM 4122 Probability and statistical inference OR HUDM 4125 Statistical inference
- HUDM 5122 Applied regression analysis

Students with prior coursework in statistics may place out of one or more statistics courses and consider these additional options:

- HUDM 5026 Introduction to data analysis in R
- HUDM 5123 Linear models and experimental design
- HUDM 5124 Multidimensional scaling and clustering
- HUDM 5133 Causal inference for program evaluation

Capstone Project:

Students will complete an integrative capstone project, involving analysis with educational data to address a real-world problem or question.

For the M.S. degree, no transfer credit is granted for work completed at other universities.

Satisfactory Progress

Students are expected to make satisfactory progress toward the completion of degree requirements. If satisfactory progress is not maintained, a student may be dismissed from the program. 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. Further policy details can be found in the Teachers College Student Handbook: https://www.tc.columbia.edu/student-handbook/

Full-time Program

Students can apply for and be admitted to the full-time program in the fall semester only. This program takes up to 3 semesters of study.

For International Students on Visas: Each semester international students must maintain 9 points for full time status. In the last semester, they will need a "Reduced Course load" form signed by the Program Director.

For all students: In their last semester, students will need to submit an "Intent to Graduate" form early in the semester.

Faculty

Faculty

- John B **Black** Cleveland E. Dodge Professor of Telecommunications & Ed.
- James E **Corter** Professor of Statistics and Education
- Bryan Sean **Keller** Associate Professor of Practice in Applied Statistics
- Gary J **Natriello** Ruth L. Gottesman Professor in Educational Research
- Renzhe **Yu** Assistant Professor, Learning Analytics / Educational Data Mining

Visiting Faculty

- Yasemin **Gulbahar Guven** Visiting Assistant or Associate Professor - Learning Analytics Program

Courses

HUDK 4011 - Networked and Online Learning

The course explores the social dimensions of online learning. The course begins by reviewing the uniquely social dimensions of learning in general and then turns to an examination of the transition to the information age that has made online or networked learning possible. The course next covers how traditional social forms such as classrooms, schools, professions, and libraries have been represented in online learning venues followed by consideration of new and emerging social forms such as digital publishing, social networks and social media,

adaptive learning technologies, and immersive and interactive environments. The course concludes by examining macro-level factors that shape the opportunities for online learning.

HUDK 4029 - Human cognition and learning

Cognitive and information-processing approaches to attention, learning, language, memory, and reasoning.

HUDK 4050 - Core methods in Educational Data Mining

The Internet and mobile computing are changing our relationship to data. Data can be collected from more people, across longer periods of time, and a greater number of variables, at a lower cost and with less effort than ever before. This has brought opportunities and challenges to many domains, but the full impact on education is only beginning to be felt. Core Methods in Educational Data Mining provides an overview of the use of new data sources in education with the aim of developing students' ability to perform analyses and critically evaluate their application in this emerging field. It covers methods and technologies associated with Data Science, Educational Data Mining and Learning Analytics, as well as discusses the opportunities for education that these methods present and the problems that they may create. The overarching goal of this course is for students to acquire the knowledge and skills to be intelligent producers and consumers of data mining in education. By the end of the course students should be able to systematically develop a line of inquiry utilizing data to make an argument about learning and be able to evaluate the implications of data science for educational research, policy, and practice.

HUDK 4051 - Learning Analytics: Process and theory

Learning Analytics, Theory & Practice builds on HUDK 4050 Core Methods in Educational Data Mining to provide advanced techniques in the use of new data sources in education with the aim of developing students' ability to perform analyses and critically evaluate their application in this emerging field. It covers methods and technologies associated with data science, machine learning and learning analytics, as well as discusses the opportunities for education that these methods present and the problems that they may create.

HUDK 4052 - Data, Learning, and Society

Introduction to multiple perspectives on activities connected to progress in our capacity to examine learning and learners, represented by the rise of learning analytics. Students develop strategies for framing and responding to the ranges of values-laden opportunities and dilemmas presented to research, policy, and practice communities as a result of the increasing capacity to monitor learning and learners.

HUDK 4054 - Managing education data

Attaining, compiling, analyzing, and reporting data for academic research. Includes data definitions, forms, and descriptions; data and the research lifecycle; data and public policies; and data preservation practices, policies, and costs.

HUDK 5030 - Visual explanations

Surveys production and comprehension of visualizations ranging from ancient cave paintings and petroglyphs to diagrams, charts, graphs, comics, picture books, photographs, gesture, and film to extract and apply techniques for conveying objects, actions, forces relations, and emotions, meanings that are both inherently visible and non-visible. Implications for education, art, media, and HCI are drawn.

HUDK 5053 - Feature engineering studio

Feature Engineering Studio is a core course of the Learning Analytics Program and preference is given to students within this course of study. FES is a design studio style course that tackles real world data problems associated with technology use in education. Students will work in groups with outside organizations on data projects pertinent to educational problems. They will be required to respond to briefs supplied by the organizations and perform all parts of the workflow to generate data solutions for those organizations including, data cleaning and access, feature engineering and distillation, visualization, and final deliverables.

Measurement, Evaluation, and Statistics

Department of Human Development

Program Description

The Measurement, Evaluation and Statistics Program includes degree programs in Applied Statistics; and Measurement and Evaluation.

The **M.S. in Applied Statistics** (32 points) requires three semesters of full-time study, and students may complete the program in 3 semesters (fall/spring/summer). This master's degree program provides training for a number of positions in applied research settings, testing organizations, and business organizations. In addition to the satisfactory completion of coursework, an integrative project is required.

The **Ed.M. in Measurement and Evaluation** (60 points) is a two-year master's degree program. It provides training for a number of positions in educational research bureaus and testing organizations. In addition to the satisfactory completion of coursework, an integrative project is required for the master's degree.

The **Ed.D. and Ph.D. degree programs in Measurement and Evaluation** are designed to prepare graduates for careers in a wide range of educational settings. Graduates acquire specialized knowledge and skills in test theory, test and instrument development and validation, program evaluation, and quantitative analysis of educational and psychological data. Some graduates pursue careers as university/college professors teaching measurement, evaluation, and statistics. Some are employed in city or state departments of education in the planning and supervision of testing programs and research and evaluation projects. Others work for test publishers, licensure and certification boards, and government agencies in the construction of tests or in the management of large-scale testing programs. Still others work in evaluation, research design, and statistics in contrast research firms, as well as health care and business settings.

A **Doctor of Philosophy (Pd.D.)** degree is required for most college teaching positions and for positions of professional responsibility in testing organizations, departments of education, and licensure and certification boards. The Ph.D. (75 points) is appropriate for individuals with strong quantitative and technical skills who wish to focus on theoretical issues in measurement and evaluation or who have a strong background in a substantive area of psychology in which they wish to further the development and application of measurement techniques.

The **Ed.D.** (90 points) is appropriate for individuals who wish to focus on the application of measurement and evaluation techniques in education, psychology, and business and industry. Both doctoral degrees are accepted as qualification for faculty positions in schools of education in the United States.

Degrees

Master of Science

Applied Statistics

Master of Science

Points/Credits: 32

Entry Terms: Fall Only

Degree Requirements

Applied Statistics Core Courses (18 points):

The following courses are required (in special circumstances, substitute courses may be approved by an advisor.):

- HUDM 4125 Statistical inference (3)
- HUDM 5126 Linear models and regression analysis (3)*
- HUDM 6026 Computational statistics (3)
- HUDM 5150 Statistical Careers, Communications and Capstone (3)

and at least one of:

- HUDM 5123 Linear models and experimental design (3)
- HUDM 6030 Multilevel and longitudinal data analysis (3)

and at least one of:

- HUDM 6055 Latent structure analysis (3)
- HUDM 6122 Multivariate analysis (3)

*Under special circumstances HUDM 5122 may be substituted for HUDM 5126; advisor approval is required.

Statistics Electives (8 points):

Other advanced statistics courses offered by the Program or by other Departments/ Schools of Columbia University may be selected, in consultation with an advisor, to complete the 18-point requirement. Examples of candidate courses include: HUDM 5059, HUDM 5124, HUDM 5130, and HUDM 5133.

Breadth Requirement (6 points):

At least 6 points must be taken at Teachers College from outside the Program in Measurement, Evaluation, and Applied Statistics.

Culminating Experience:

A special project that is conducted in consultation with an advisor.

Transfer Credit:

For the M.S. degree program, no transfer credit is granted for work completed at other universities.

Satisfactory Progress in MSAS Program Policy

Under College policy, no more than 3 points of C- may be credited toward any degree, certificate or diploma. Students who accumulate 8 points or more with grades of C- or lower may not continue study at the College and will not receive a degree or diploma.

The College also has a policy on Satisfactory Academic Progress (SAP), available at https://www.tc.columbia.edu/admission/financial-aid/resources/sap-policy/, which spells out the academic standards necessary to maintain eligibility for federal financial aid. In addition to College policies, the MSAS program requires that students pass (with grades of A through C) all 6 required courses (i.e., HUDM 4125, 5126, 6026, 6122/6055, 6030/5123, 5150). A grade of C- or below in any of these core courses results in dismissal from the program. For statistics elective courses and breadth courses the College policy applies.

Satisfactory Progress for the M.S. degree program is a B or above.

Master of Education

Measurement and Evaluation

Master of Education

Points/Credits: 60

Entry Terms: Spring/Summer/Fall

Degree Requirements

Measurement and Evaluation Core Courses (12 points):

- HUDM 5059 Psychological measurement (3)
- HUDM 6051-6052 Psychometric theory I and II (3 each)
- HUDM 6055 Latent structure analysis (3)

And at least 6 points selected from the following:

- T6416 Program evaluation in social services (3) at School of Social Work
- P8582 Program evaluation design for health policy and management (3) at Mailman School of Public Health
- 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 (15 points):

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

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

Psychology (12 points):

Courses are taken in one or more of the following areas: developmental psychology, cognitive studies, counseling psychology, organizational psychology, or social psychology.

Research Methods (6 points):

- HUD 4120 Methods of empirical research (3)
- HUDM 5250 Research practicum in measurement and evaluation (0-4)

Other Aspects in Education (6 - 9 points):

One course in foundations of education and two courses in curriculum and teaching and/or educational leadership, chosen in consultation with an advisor.

Electives:

Chosen in consultation with an advisor and designed to strengthen and broaden the student's professional preparation.

Culminating Experience:

A project that is conducted in consultation with an advisor.

Transfer Credit:

For the Ed.M. degree, 30 points must be completed under the auspices of Teachers College, including 18 points in Teachers College courses. A maximum of 30 points of graduate credit may be transferred from other accredited 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.

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 Program Director 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 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.

Satisfactory progress in the Ed.M. degree program is a B or above.

Doctor of Education

Measurement and Evaluation

Doctor of Education

Points/Credits: 90

Entry Terms: Fall Only

Degree Requirements

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:

- HP8640 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 choose 18 points of courses from the below list, or 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:

1. HUDM 5058 Choice and decision making (3)
2. P8120 Analysis of categorical data (3) (at Mailman School of Public Health)
3. P8121 Generalized linear models (3) (at Mailman School of Public Health)
4. W4640 Bayesian statistics (3) (at the Columbia Statistics Program)
5. 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.

Satisfactory Progress for the Ed.D. degree is a B+ or above.

Satisfactory progress for a doctoral research fellow scholarship is a B+ or above.

Doctor of Philosophy

Measurement and Evaluation

Doctor of Philosophy

Points/Credits: 75

Entry Terms: Fall Only

Degree Requirements

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 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 theoretical research paper, successful performance on the certification examination, and completion of an approved doctoral dissertation are required for the Ph.D degree.

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 (ODS) to file for the 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, 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 accredited 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.

Satisfactory Progress for the Ph.D. degree is a B+ or above.

Satisfactory progress for a doctoral research fellow scholarship is a B+ or above.

Faculty

Faculty

- James E **Corter** Professor of Statistics and Education
- Lawrence T **DeCarlo** Professor of Psychology and Education
- Bryan Sean **Keller** Associate Professor of Practice in Applied Statistics
- Young-Sun **Lee** Associate Professor of Psychology and Education
- Youmi **Suk** Assistant Professor of Applied Statistics
- Renzhe **Yu** Assistant Professor, Learning Analytics / Educational Data Mining

Lecturers

- Giovanni **Motta** Full Time Lecturer - Applied Statistics

Adjunct Faculty

- Jie **Gao** Adjunct Assistant Professor

Courses

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 - 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 research on psychological judgment and decision making, including historical and modern versions of utility theory, Tversky and Kahneman's influential Prospect Theory, emotion and decision making, decisions from experience, and decisions in a social context. The focus is on psychological or descriptive models of how people make decisions, although methods for 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 polynomial regression models, including use of categorical predictors. Logistic regression for dichotomous outcome variables is also covered. Class time includes lab time devoted to applications with IBM SPSS. Prerequisite: HUDM 4120 or HUDM 4122 or HUDM 4125.

HUDM 5123 - Linear models and experimental design

Prerequisite: 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 - 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.