



**Teachers College**  
COLUMBIA UNIVERSITY

# Academic Catalog 2025-2026

## Human Development

---

### Department Information:

- [Human Development ... 2](#)

### Programs:

- [Cognitive Science in Education ... 3](#)
- [Developmental Psychology ... 27](#)
- [Learning Analytics ... 38](#)
- [Measurement, Evaluation, and Statistics ... 44](#)
- [Data, Learning, and Society ... 59](#)

# 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.

In addition, each student registers for research practicum seminars during which they complete a substantive project as a culminating experience for the degree. Choice of advanced courses and research seminars should be shaped by the student's area of focus. Students whose interests do not fit one of these tracks may design their own area of focus, in consultation with their advisor.

# Degrees

## Master of Arts

### Cognitive Science in Education

Master of Arts

**Points/Credits:** 32

**Entry Terms:** Summer, Fall

---

### Degree Requirements

In the M.A. program students examine the cognitive mechanisms that underlie learning and thinking in school and non-school settings. Our program and coursework trains students in basic theories of human cognition, the practice and interpretation of empirical cognitive and developmental research.

The curriculum and program requirements are designed to prepare graduates for careers in several possible settings:

- 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.

### Program Requirements

Master of Arts: 32 points total

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)
- HUD 4120 Methods of Empirical Research (3)

Statistics/Research Design (3 points):

At least one of the following:

- 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 (3 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 (11 points):

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

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 Learning Analytics Practicum (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 4031 Data, testing, and meritocracy (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)

#### 15. Intelligent Technologies:

- HUDK 4011 Networked and online learning (3)
- 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)

Breadth Courses (6 points):

At least 2 Teachers College courses outside the program (non-HUDK) selected in consultation with an advisor.

Integrative Project: One of the following

1. Research Literature Review
2. Design (and perhaps Implementation) Project Paper
3. Empirical Research Design Paper

Program of Study

At least 20 points must be earned in Teachers College courses. The remaining coursework, through Teachers College registration, may be completed in Teachers College or other graduate divisions of Columbia University, but no more than 12 points of graduate credit from other faculties of the University will be credited toward the minimum point requirement. Graduate level courses in the University are numbered from 4000 and above. For the MA 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.

## Master of Education

### Educational Psychology: Cognitive, Behavioral, and Developmental Analysis

Master of Education

**Points/Credits:** 60

**Entry Terms:** 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.

## Doctor of Education

### Cognitive Science in Education

Doctor of Education

**Points/Credits:** 75

**Entry Terms:** Fall

---

### Degree Requirements

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 develops 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 program requirements are designed to prepare graduates for careers in several possible settings. 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.

In addition, each student registers for research practicum seminars during which they complete a substantive project as a culminating experience for that degree. Choice of advanced courses and research seminars should be shaped by the student's area of focus, as described below. Students whose interests do not fit one of these tracks may design their own area of focus, in consultation with their advisor.

#### Required Courses (9 points):

- HUDK 4029 Human cognition and learning (3)
- HUDK 4080 Educational psychology (3)
- HUDK 5023 Cognitive development (3)

#### Statistics (12 points):

Optional: HUDM 4120: Basic concepts in statistics (3) This course is not recommended for those who have taken undergraduate statistics.

#### Required:

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

#### Specialized Courses (minimum of 20 points):

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

#### 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)
- HUDK 5058 Choice and decision making (3)
- HBSK 5096 Psychology of memory (3)
- HUDK 5042 Motivation in education (3)
- HUDK 5053 Learning Analytics Practicum (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)

Research Apprenticeship (9 points):

Three or more semesters in a research practicum:

HUDK 6539 Research practicum in educational psychology, cognition, and learning (1-3), taken over multiple semesters for a total of 9 points. The first 3 point Research Practicum has to be taken in the Spring term of the first year. The student needs to submit a report of participation in a research study by the end of that Spring term.

#### Flexible Course (3 points)

In consultation with a faculty advisor the student can choose to take either another 3 points of Research Practicum (HUDK 6539) or another 3 points of Specialized Course.

#### Special Seminars (minimum of 5 points):

- HUD 6500 Doctoral Proseminar (3 points), taken during the Fall term of the first year
- HUDK 7502 Dissertation seminar (1-3), taken two semesters for minimum of 1 pt each
- HUDK 8901 Dissertation Advisement (0), taken after registration in HUDK 7502 or the approval of the dissertation proposal whichever comes first.
- TI 8900 PhD Dissertation defense

#### Breadth/Foundation Courses (9 Points):

3 points in measurement and 6 points in the following foundation courses:

##### 1. Biological Basis of Behavior:

- BBS 5068-5069 Brain and behavior I and II (combined for 3 points)
- BBSN 4000 Cognitive neuroscience
- BBSN 5033 Human clinical neuropsychology
- MSTC 5000 Neurocognitive models of information processing

##### 2. Cognitive Basis of Behavior:

- HBSK 5096 Psychology of memory
- HUDK 4015 Psychology of thinking
- HUDK 5025 Spatial thinking
- HUDK 5090 Psychology of language and reading

##### 3. Social Cultural Factors and Individual Differences:

- CCPX 5034 Child psychopathology
- HBSK 5031 Family as a context for child development
- HUDK 5029 Personality development and socialization across the lifespan
- HUDK 5040 Development and psychopathology: Atypical contexts and populations

- HUDK 5121 Personality development and socialization in childhood
- HUDK 5125 Cross-cultural psychology
- ORLJ 5017 Small group intervention: Theory and method
- ORLJ 5540 Pro-seminar in social and organizational psychology

#### 4. Measurement:

- HUDM 5059 Psychological measurement

Please note: Courses used to fill Breadth/Foundation course requirements may not be used to fulfill requirements in another area.

Non-departmental Courses (minimum of 8 points):

At least three courses outside the department selected in consultation with an advisor.

Additional Requirements:

- Two approved papers: an empirical study and an integrative research literature survey
- Successful performance on the Certification Examination
- Approved dissertation

Transfer Credit:

Relevant courses with earned grades of B or higher taken in other accredited graduate schools to a maximum of 30 points. 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.

## Doctor of Philosophy

### Cognitive Science in Education

Doctor of Philosophy

**Points/Credits:** 75

**Entry Terms:** Fall

---

## Degree Requirements

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 program requirements are designed to prepare graduates for careers in several possible settings. 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.

In addition, each student registers for research practicum seminars during which they complete a substantive project as a culminating experience for that degree. Choice of advanced courses and research seminars should be shaped by the student's area of focus, as described below. Students whose interests do not fit one of these tracks may design their own area of focus, in consultation with their advisor.

Doctor of Philosophy-75 points

Required Courses (9 points):

- HUDK 4029 Human cognition and learning (3)
- HUDK 4080 Educational psychology (3)
- HUDK 5023 Cognitive development (3)

Statistics (12 points):

Optional: HUDM 4120 Basic concepts in statistics (3) This course is not recommended for those who have taken undergraduate statistics.

Required:

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

Specialized Courses (minimum of 15 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 Learning Analytics Practicum (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 4031 Data, testing, and meritocracy (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)

#### 15. Intelligent Technologies:

- HUDK 4011 Networked and online learning (3)
- 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)

Research Apprenticeship (9 points):

Three or more semesters in a research practicum:

HUDK 6539 Research practicum in educational psychology, cognition, and learning (1-3), taken over multiple semesters for a total of 9 points. The first 3 point Research Practicum has to be taken in the spring term of the first year. The student needs to submit a report of participation in a research study by the end of that Spring term.

Flexible Course (3 points)

In consultation with a faculty advisor the student can choose to take either another 3 points of Research Practicum (HUDK 6539) or another 3 points of Specialized Course.

Special Seminars (minimum of 5 points):

- HUD 6500 Doctoral Proseminar (3 points), taken during the Fall term of the first year
- HUDK 7502 Dissertation seminar (1-3), taken two semesters for minimum of 1 pt each
- HUDK 8901 Dissertation Advisement (0), taken after registration in HUDK 7502 or approval of the dissertation proposal whichever comes first and until registration for TI 8900
- TI 8900 PhD Dissertation defense

Breadth/Foundation Courses (12 Points):

One course (minimum of 3 points) in each of the 4 following areas:

1. Biological Basis of Behavior:

- BBS 5068-5069 Brain and behavior I and II (combined for 3 points)
- BBSN 4000 Cognitive neuroscience
- BBSN 5033 Human clinical neuropsychology
- MSTC 5000 Neurocognitive models of information processing

2. Cognitive Basis of Behavior:

- HBSK 5096 Psychology of memory
- HUDK 4015 Psychology of thinking
- HUDK 5025 Spatial thinking
- HUDK 5090 Psychology of language and reading

3. Social Cultural Factors and Individual Differences:

- CCPX 5034 Child psychopathology

- HBSK 5031 Family as a context for child development
- HUDK 5029 Personality development and socialization across the lifespan
- HUDK 5040 Development and psychopathology: atypical contexts and populations
- HUDK 5121 Personality development and socialization in childhood
- HUDK 5125 Cross-cultural psychology
- ORLJ 5017 Small group intervention: theory and method
- ORLJ 5540 Pro-seminar in social and organizational psychology

#### 4. Measurement:

- HUDM 5059 Psychological measurement (3)

\*Please note: Courses used to fill Breadth/Foundation course requirements may not be used to fulfill requirements in another area.

#### Non-Departmental Courses (minimum of 8 points):

At least three courses outside the Department and selected in consultation with an advisor.

#### Additional Requirements:

- Two approved papers: an empirical study and an integrative research literature survey
- Successful performance on the Certification Examination
- Approved dissertation

#### 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

- James E **Cortez** Professor of Statistics and Education
- Peter **Gordon** Associate Professor of Neuroscience and Education
- Kay **James** Associate Professor of Neuroscience and Education
- Xiaodong D **Lin** Cleveland E. Dodge Professorship in 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

- John B **Black** Cleveland E. Dodge Professor Emeritus of Telecommunications & Ed.
- Deanna **Kuhn** Research Professor Emerita of Psychology and Education
- Barbara **Tversky** Professor Emerita of Psychology and Education

### Professors of Teaching

- Jie **Gao** Assistant Professor of Teaching

# 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 5042 - Motivation in Education**

Overview of student motivation in an academic context from a cognitive psychology perspective. Examines theories of academic motivation, their constructs, and linkages between constructs and student engagement and academic achievement.

### **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.

### **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 - Diss Sem:Human Cognit & Learn**

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 deviants 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.
- Electives in developmental psychology plus relevant electives offered by other Teachers College programs.
- A special project
  - HUDK5500 Capstone
  - One additional course in the Developmental Psychology Program (Research Practicum is recommended)

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-credit 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 credits 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 (Psychology - Developmental)

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
- 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 Capstone will be the course in which students are mentored on their special projects. 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 can 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 can 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.

### 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.

## 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  
OR HUDK 5121 OR HUDK 5029
- 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](mailto: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

#### 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 of their first year. The course is taken for 3 credits, and students only need a total of 3 credits to fulfill the requirement. 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 (Fall 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 email the HUD Staff at [hud1@tc.columbia.edu](mailto:hud1@tc.columbia.edu).

#### 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.

#### 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.

#### 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

- Kimberly G **Noble** Professor of Neuroscience and Education
- Emily Quinn **Rosenzweig** Associate Professor of Developmental Psychology
- Sonya Violet **Troller-Renfree** Assistant Professor, Developmental Psychology
- Tyler Wayne **Watts** Associate Professor of Psychology and Education

## Professors of Teaching

- Laura Mielcarek **DeRose** Assistant Professor of Teaching

# 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 Masters 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. Students in the Master of Science in 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. Students are encouraged to develop industry connections, which can result in internships and other experiential learning opportunities.

# Degrees

## Master of Science

### Learning Analytics

Master of Science

**Points/Credits:** 32

**Entry Terms:** Fall

### Degree Requirements

Degree Requirements (32 points)

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 Data, Testing, and Meritocracy
- HUDK 5053: Learning Analytics Practicum 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

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

- HUDM 5001 Programming for data science

(Note that the two courses in statistics (HUDM) also satisfy the college breadth requirement.)

Electives (minimum of 1 course for 2 points/credits)

- HUDK5100 (required for those doing an internship) or other courses at Teachers College that are related to the program.

Capstone Project:

Students will complete an integrative capstone project, involving analysis on real-world educational data to solve a real-world 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, you will need a "Reduced Course load" form approved 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

- James E **Cort**er 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

### Emeriti

- John B **Black** Cleveland E. Dodge Professor Emeritus of Telecommunications & Ed.
- Barbara **Tversky** Professor Emerita of Psychology and Education

## 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 4031 - Data, Testing, and Meritocracy

Individuals in modern societies live in a world in which evaluation is ubiquitous. More and more aspects of our performances are subject to informal and/or formal assessment. Everything from our health as infants, to our performance in schools as youngsters, our potential to benefit from higher education, and our capacity to contribute in the workplace is evaluated. This course examines the social dimensions of the development and operation of different kinds of evaluation systems in modern societies. Major topics include the social, political,

and intellectual contexts for evaluation, the institutional bases of evaluation activities, the social settings in which evaluation takes place, and the effects of evaluations on individuals and groups

### **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 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 5053 - Learning Analytics Practicum**

Learning Analytics Practicum is a core course of the M.S. in Learning Analytics Program and a gateway for students to transition from their education to a professional career. The course introduces principles and procedures in real-world educational data problems, provides support for students' capstone projects with external organizations, and helps students access resources and develop skills necessary for a career in education and data science.

### **HUDK 5324 - Research Practicum**

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

# 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 Ph.D. degree program in Measurement and Evaluation is 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 (Ph.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.

Students must also make satisfactory progress towards completion of the degree. A grade of C- or lower may result in dismissal from the program.

## Degrees

### Master of Science

#### Applied Statistics

Master of Science

**Points/Credits:** 32

**Entry Terms:** Fall

#### Degree Requirements

The master's degree in Applied Statistics offers preparation in applied statistics, data analysis and research methods, to prepare students for a number of research and applied positions in educational settings, testing bureaus, business, industry, and government.

The M.S. degree requires at least one year of study. In addition to the satisfactory completion of course work, a culminating project is required.

Statistics Requirements Applied Statistics Core Courses (27 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 5150 Statistical Careers, Communications and Capstone (3)\*\*
- HUDM 6026 Computational statistics (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.

\*\*This should be taken in the last Fall semester of study. This course includes completion of a culminating project.

Statistics Electives:

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 27-point requirement. Examples of candidate courses include: HUDM 5001, HUDM 5059, HUDM 5124, HUDM 5128, 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. (Non-HUDM)

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

Students must also make satisfactory progress towards completion of the degree. A grade of C- or lower may result in dismissal from the program.

## Master of Education

### Measurement and Evaluation

Master of Education

**Points/Credits:** 60

**Entry Terms:** Spring, Summer, Fall

### Degree Requirements

## Degree Requirements - 60 Points

### Measurement 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)

### Evaluation Core (6 points): :

- HUDM 5133 Causal inference for program evaluation (3) (recommended)
- 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
- EDPS 5646 Evaluation of Education and Social Programs (3)
- EDPA 6002 Quantitative Methods for Evaluating Educational Policies and Programs (3)

### 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 must also make satisfactory progress towards completion of the degree. A grade of C- or lower may result in dismissal from the program.

## Doctor of Education

### Measurement and Evaluation

Doctor of Education

**Points/Credits:** 75

**Entry Terms:** Fall

---

### 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 must also make satisfactory progress towards completion of the degree. A grade of C- or lower may result in dismissal from the program.

## Doctor of Philosophy

### Measurement and Evaluation

Doctor of Philosophy

**Points/Credits:** 75

**Entry Terms:** Fall

### Degree Requirements

Degree Requirements - 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)
- HBSS 6100 Measurement and Program Evaluation (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)
- HUDM 5128 Applied Categorical Data Analysis
- HUDM 5100 Programming for Data Science (3)
- HUDM 5250 Research practicum in measurement and evaluation (0-4)
- P8121 Generalized linear models (3) (at Mailman School of Public Health)
- GU4224 Bayesian Statistics (3) (at the Columbia Statistics Program)
- P8640 Methods in program evaluation (3) (at Mailman School of Public Health)
- P8705 Evaluation of health programs (3) (at Mailman School of Public Health)

- EDPS 5646 Evaluation of Educational and Social Programs (3) Quantitative
- EDPA 6002 Methods for Evaluating Educational Policies and Programs (3)

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. Complete at least six courses with evaluative grades under Teachers College registration
2. Pass the Certification Examination (i.e., Research Methods Examination)
3. Complete an approved empirical research paper
4. Complete an approved theoretical research paper
5. Complete all 75 points of coursework required for the degree
6. 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 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 must also make satisfactory progress towards completion of the degree. A grade of C- or lower may result in dismissal from the program.

## Faculty

### Faculty

- Chia-Yi **Chiu** Associate Professor Applied Statistics
- James E **Cortner** 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

### Professors of Teaching

- Jie **Gao** Assistant Professor of Teaching

## 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 5001 - Programming for Data Science**

This course is an introduction to essential programming concepts, structures, and techniques for data science. Topics covered include data types, data structures, control statements, and functions, using the NumPy and Pandas libraries in the programming language Python. The course also covers version control using Git and GitHub and database management using SQLite. Additionally, content on the development of interactive plots and dashboards using Plotly and Dash libraries will be included.

## **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.

## **HUDM 5123 - Linear Models Experimentl Dsgn**

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**

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 5128 - Applied Categorical Data Analysis**

This course provides an introduction to basic concepts and common statistical models and analyses for categorical data. It includes enough theory, examples of applications, and practice using categorical techniques so that students can use these methods in their own research, as well as critically read research papers that use such methods. Topics include description and inference for binomial and multinomial; analysis of contingency tables; generalized linear models for discrete data; logistic regression; multcategory logit models; inference for matched pairs and correlated clustered data; and loglinear models.

### **HUDM 5133 - Causal inference for program evaluation**

This course will prepare students to start research in causal inference. It will provide an introduction to the theoretical and practical aspects of causal inference methods, along with real-world applications in education. Topics include: the Neyman-Rubin potential outcomes framework, Pearl's directed acyclic graphical models, single-world intervention graphs, non-equivalent control group designs using both traditional methods (e.g., matching, weighting, regression) and machine learning methods, optimal treatment regimes, regression discontinuity designs, and sensitivity analysis.

### **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**

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**

Item response theory & applications, and cognitive diagnostic models.

## **HUDM 6053 - Cognitive Diagnosis in Psychometrics**

To equip our students with the cutting-edge methods for analyzing educational data, the course provides an in-depth introduction to cognitive diagnosis models and methods, a novel psychometric framework for developing educational and psychological tests and analyzing item-response data. This course covers the rationale, bases and frameworks for analyzing cognitive diagnosis data, as well as the most recent developments in the area. Specific topics include parametric and nonparametric methods for cognitive diagnosis, algorithms for model estimation and procedures for model comparison, theories on skill and item associations and their validations, and computerized adaptive testing. These topics are taught through lectures, discussions, inquiry-based strategies, and hands-on data analysis.

## **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**

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.

# Data, Learning, and Society

Department of Human Development

## Program Description

The online Masters of Science in Data, Learning, and Society Program offers students an opportunity to acquire basic techniques in statistics and data science as they apply to the study of learning in the context of the growing reliance on data as a foundation for the operation of the learning sector.

The program aims to equip students with the skills, techniques, and perspectives for the socially responsible application of data to understand and support learning in contemporary society. The program prepares students for positions as analysts of learning programs and activities in public and private institutions. Graduates will be able to approach their work with a solid grounding in contemporary data techniques, an understanding of the unique aspects of empirical work on learning, and an appreciation of the social and ethical issues presented by the growing availability of data on learners and learning.

The program: 1) introduces students to statistical and data science fundamentals, 2) provides a solid understanding of the study of learning in its various forms, and 3) allows students to consider both the possibilities and the problems attendant to the growing use of learning data.

The program is particularly attractive to students who are recent college graduates, early career professionals, and established educators who wish to develop a more sophisticated understanding of the potential of the growing availability of data on learning.

## Degrees

### Master of Science

#### Data, Learning, and Society (Online)

Master of Science

**Points/Credits:** 32

**Entry Terms:** Fall

## Degree Requirements

Program Requirements Master of Science: 32 Points Total

Core Requirements (12 credits):

- HUD 4120 - Methods of Empirical Research (3 credits)
- HUDM 4122 - Probability and Statistical Inference (3 credits)
- HUDK 4029 - Human Cognition and Learning (3 credits)
- HUDK 4052 - Data, Learning, and Society (3 credits)

Two Additional Courses in Data (6 credits):

- HUDK 4050 - Core Methods in Educational Data Mining (3 credits)
- HUDK 4053 - Managing Educational Data (3 credits)
- HUDM 5026 - Intro to Data Analysis in R (3 credits)
- HUDM 5059 - Psychological Measurement (3 credits)
- HUDM 5122 - Applied Regression Analysis (3 credits)

One Additional Course in Learning (3 credits):

- HUDK 4011 - Networked and Online Learning (3 credits)
- HUDK 5053 - Cognitive Development (3 credits)
- HUDK 5037 - The Psychology of E-Learning in Business and Industry (3 credits)

One Additional Course in Social Impact (3 credits):

- HUDK 4031 - Data, Testing, and Meritocracy (3 credits)
- HUDK 5025 - Cross-Cultural Psychology (3 credits)
- HUDK 5035 - Poverty, Inequality, and Child Development (3 credits)
- HUDK 5040 - Development and Psychopathology: Atypical Contexts and Populations

Breadth Requirement (6 credits):

Two courses approved by your program advisor draw from other online courses across the College.

### Masters Culminating Requirement: Integrated Project

- HUDK 5324 - Research Practicum (2 credits)
- Students will complete a capstone project drawing on their studies in the program.

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/>.

## Faculty

### Faculty

- James E **Cortez** 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

### Emeriti

- John B **Black** Cleveland E. Dodge Professor Emeritus of Telecommunications & Ed.

## 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 4029 - Human cognition and learning**

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

### **HUDK 4031 - Data, Testing, and Meritocracy**

Individuals in modern societies live in a world in which evaluation is ubiquitous. More and more aspects of our performances are subject to informal and/or formal assessment. Everything from our health as infants, to our performance in schools as youngsters, our potential to benefit from higher education, and our capacity to contribute in the workplace is evaluated. This course examines the social dimensions of the development and operation of different kinds of evaluation systems in modern societies. Major topics include the social, political, and intellectual contexts for evaluation, the institutional bases of evaluation activities, the social settings in which evaluation takes place, and the effects of evaluations on individuals and groups

### **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 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 5324 - Research Practicum**

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