TEACHERS COLLEGE
COLUMBIA UNIVERSITY
A Graduate School of Education, Health & Psychology

Academic Catalog 2019-2020

Mathematics, Science & Technology

Department Information:

Programs:

Mathematics, Science & Technology

Contact Information

Department Chair: Professor Erica Walker

Contact: Dr. Kristin Gorski

Email: tcmst@tc.columbia.edu

Phone: (212) 678-4095

Fax: (212) 678-8129

Address: 321 Thompson Hall

Box: 19

Mission

Programs in the *Department of Mathematics, Science & Technology* focus on issues in educational practice and related professions in mathematics, science and technology, including the relationships between these disciplines.

The world has been transformed by the achievements in the pure and applied disciplines grounded in mathematics, science and technology. Current reforms in education place increasing significance on wide public understanding of these three fields of human endeavor. Presently, a focus on STEM and STEAM in education shows the recognized importance of an interdisciplinary approach to help make these fields engaging and meaningful to students of all ages. The study of communication and technology in education is broadly based and enriched by cultural and historical wisdom that provides a scholarly perspective on the role of media and technology in society, particularly in educational subject areas. Within this unifying view, the Department of Mathematics, Science & Technology includes specialized programs to address the needs of professional practitioners in each area.

The Department incorporates programs in three areas: Mathematics Education; Science Education; and Communication, Media, and Learning Technologies Design (CMLTD).

The Mathematics Education and Science Education programs include scholars who address the preparation of mathematics and science teachers and teacher educators. They focus particularly on supporting students in acquiring scientific and mathematical literacy to foster the future development of science and technology; understanding environmental sciences, improved global stewardship of the environment, and the link between science and society; and using computers, computer modeling, and instrumentation in mathematics and science instruction. These scholars have extensive experience, both international and U.S.-based, in their subject matter disciplines and in educational theory and practice. In addition, the Science Education Program offers a joint degree (DDS/MA) in collaboration with the College of Dental Medicine at Columbia University for medical practitioners who are planning to become professors of medical education.

The Program in Communication, Media, and Learning Technologies Design (CMLTD) provides a cluster of degree programs for students who seek to develop leadership capacities for the use of information and communication technologies in education across subject domains. The programs prepare candidates for leadership roles in integrating digital technologies into education and society and for entry into creative work in the educational uses of new media. CMLTD doctoral programs develop scholars who use the social and human sciences to study how applications of advanced technologies in education act as social and historical forces, empowering educators to seek new solutions to established problems. Graduate study in CMLTD is tightly integrated with design and implementation projects situated in several externally funded centers and institutes at Teachers College and Columbia University. This program is led by faculty with extensive international and U.S.-based experience and also links the College to ongoing university initiatives in communication and information technologies worldwide. Faculty and students of this program examine technology, as well as the role of computers and various media, in influencing communication in education and the assessment of educational performance in a wide variety of institutional settings. The program includes areas such as literacy, teacher education, educational technology, the development of digital games, online learning, media and culture, instructional technology and media, and maker education.

While each program has a unique focus and set of perspectives, the faculty members in the Department of Mathematics, Science & Technology share common scholarly perspectives, educational ideals, and a strong commitment to the improvement of society through excellence in the scholarly practice of the educating professions and the enhancement of human potential.

Communication, Media and Learning Technologies Design

Department of - Mathematics, Science & Technology

Contact Information

Phone: (212) 678-3344

Fax: (212) 678-8227

Email: tccmltd@tc.edu

Director: Professor Sandra Okita

Program Description

Communication, Media and Learning Technologies Design (CMLTD) provides a cluster of degree programs for students who seek to develop leadership capacities in the use of information and communication technologies in education and society. The program applies to all subject areas and serves students, staff, and faculty members who share a commitment as educators to use digital technologies to improve education and society at all levels. Work through CMLTD should move simultaneously toward two poles of understanding and practice: toward a comprehensive understanding of the cultural and historical implications of new technologies for education and life and toward purposefully selecting and shaping the uses of new media in educational practice across and subject areas.

CMLTD aims to prepare students to deal with both present and future implications of new media and to play a constructive role in shaping the educational response to innovations in information and communication technologies. The CMLTD Program encompasses the use of new media broadly in modern educational and public service arenas, including video, computer-based media, digital and non-digital game-based learning, and the role of communication and media in society from an historical and modern perspective.

CMLTD's programs deal with the many ways in which material culture changes and shapes educational practice. Listed are current assumptions about the long-term effects that innovations in information, communication, and game technologies are having on education and culture. Work through CMLTD should lead faculty and students to study, criticize, develop, and extend propositions such as these:

- With emerging intellectual demands and conditions, activities contributing to the creation of knowledge will increase in relative value, while those devoted solely to its dissemination will decrease.
- When changes in information and communication technologies transform the ways people create, disseminate, and apply knowledge, deep changes in educational practices occur.
- Educational institutions, including schools of education, will undergo prolonged change and significant transformation, occasioned by changes in the media of intellectual production.
- Literacy practices will become more central to active participation in information networks and modern life.
- Preservice education will need to focus more on the active integration of Information Communication Technologies, or ICTs, into pedagogy and research.
- As digital information and communication technologies become more accessible, the separation of schools and higher education into two, largely distinct, educational cultures will markedly diminish.
- Campuses will remain important foci of intellectual activity, while participation in them will become more flexible via networks supporting asynchronous, distributed involvement.
- Specialists in education will need to work closely with scholars, scientists, and professionals to embed powerful learning experiences in digital technology for advancing knowledge.
- Increasingly, educators will de-emphasize imparting a static stock of information and ideas and will instead seek to enable all people to contribute to the advancement of knowledge.
- Demand for highly skilled educators will increase and preparing them will largely be a field-based engagement in situations where students interact with new knowledge resources.
- Educational institutions, redefined, will increase in public importance and the educating professions will increasingly become high-tech and high-prestige professions.

- Changes in information, games, and communication technologies will resuscitate the progressive movement in education, enabling it to be both broadly egalitarian and intellectually rigorous.

Communication, Media and Learning Technologies Design aims to prepare students to deal with both present and future implications of new media and to play a constructive role in shaping the educational response to innovations in information and communication technologies, including mobile devices and augmented reality and cloud computing. Although these concerns are common to all program strands, each has distinct nuances with respect to methods and purpose:

- Communication and Education relies primarily on social science inquiry to understand, interpret, and shape how information and communication technologies influence culture and education, including areas such as literacy and teacher education.
- Computing in Education works with computer information systems to facilitate the effective extension of digital technologies into educational practice. This strand includes within it an online master's program that can be completed by students who live too far away to attend classes during the regular academic year.
- Design & Development of Digital Games prepares students to design, develop, implement and evaluate digital games for learning and behavior in both formal and informal educational settings.
- Instructional Technology and Media concentrates on the creation and application of innovative technologies, guided by a research tradition grounded in pedagogy and cognitive science, in order to make new media work as powerful tools for study and teaching.

Across the program strands, students and faculty members engage in research, development, theory, and application. All put a high priority on group work; fieldwork and internships; and planning, implementing, and completing innovative projects. Schools, computer companies, businesses, and other agencies are normally partners in projects, providing environments, materials, personnel, or opportunities for carrying them out. Based in CMLTD and with program affiliates, there is a wide range of internship and fieldwork opportunities for students. The CMLTD Program's multiple faculty-directed labs offer additional learning and research opportunities for students.

Communication and Education

The program in Communication and Education prepares students for various roles:

- Teaching and research positions in higher education;

- Working in schools using information and communication technologies to improve educational practice;
- Conducting formative and evaluative research in the areas of educational media and information technologies, in and out of school settings and across subject areas;
- Designing innovations in the use of new media for educational purposes; and
- Working in business and government settings to design and implement corporate communication programs.

The program uses methods of the social sciences, encompassing both qualitative and quantitative approaches to the study of communication and education. It asks in particular how education and other social systems change under the impact of new media. Faculty members and students pursue three broad areas of inquiry, enabling them to:

- Reflect on the historical effects of media and on the cultural uses of developments such as face-to-face speech, writing, printing, photography, film, radio, television, computers, and networked multimedia;
- Use anthropological, linguistic, and other methods to study how the diverse forms of communication, literacy, information processing, and cognition condition educational practice;
- Explore the effects of media, including games, MOOCs, and mobile platforms, on social relations, and develop strategies for using information and communications technologies to improve conditions of education and life.

In the course of completing a degree, students should expect to attend closely to both technical artifacts and human activity: that is, both to material systems of communication in which technologies are the primary interest and to interpersonal, direct communication dynamics in which unmediated face-to-face exchanges are the subject of inquiry. A major theme for continuous reflection should be the diverse ways in which the modes of communication condition meanings that are actually and potentially communicated—whether in face-to-face conversation, through distance learning technologies, or through societies and communities that are created in virtual worlds and on social media.

Computing in Education - Online

Students who complete the online master's program in Computing in Education take positions in:

- Schools, as computer coordinators or teachers using advanced technologies in the classroom;
- New media companies, developing software and multimedia applications for education, training, and gaming environments; and
- Academic computer centers, corporate information services, and in education departments at the federal, state, and local levels, managing the integration of information and communication technologies into schools.

Design and Development of Digital Games

The M.A. program in Design and Development of Digital Games prepares students to design, develop, implement and evaluate digital games for learning and behavior in both formal and informal educational settings. This program is unique in that the curriculum is structured to examine game design from a combination of social, cultural, cognitive, and affective perspectives. Students who are studying the design and development of games for education as a concentration need the degree to reflect this area of study, which is not only optimal but necessary for their intended goals.

Digital games are fast becoming an integral part of professional education and training in education, medicine, business, and entertainment. A program on gaming with a focus specifically on learning meets the demands and interests of many students in the educational technology field. In the field of educational game design, the rapid changes in technologies are reshaping the ways we create, evaluate, reflect, reason, and learn, and the interdisciplinary nature of game design has led to greater creativity in teaching and learning, and opportunities to collaborate with industry.

Some of the required and suggested courses relate to the design of educational technology (of which games are a part), which are very relevant to design of games that target learning—what are often called educational games. Similarly, the development of educational (or other) games depends upon the ability to program such games, or, at very least, to have enough programming knowledge to be able to communicate appropriately with programmers who will develop games based on design specifications. Therefore, courses on game development, for example, complement the required programming course sequences that teach programming skills that can be applied to games.

Instructional Technology and Media

Students who have earned degrees in Instructional Technology and Media find positions in education, government, and industry. Some continue to work within formal education, as teachers, researchers, or administrators on the elementary, secondary, or college level. Others work in training and development departments in business or government agencies. An increasing number work as independent professionals in a variety of settings such as educational service, production consulting, and publishing. Still others have established themselves as researchers, designers, and producers for innovative multimedia projects.

The World Wide Web and related technologies have lowered the costs of distance learning programs greatly while increasing their flexibility. Through Instructional Technology and Media, faculty members and students join to develop the skills needed to make full use of the new opportunities in distance and distributed learning.

In recent years, students in the program have made four questions paramount:

- Which emerging technologies hold greatest promise for enriching learning experiences throughout the educational enterprise?
- What pedagogical strategies should designers embody in instructional materials, including those based on multimedia and those reflected in gaming environments?
- How should educators deploy, manage, and evaluate information and communication technologies in classrooms for optimal educational effect?
- What principles of design and practice should educators incorporate into distributed educational courses and programs?

Participants in all CMLTD program areas share a basic conviction that good design in educative matters starts with careful attention to the needs and characteristics of the individuals that the design will serve. For example, the ability to understand the individual through empirical research and empathic engagement will make the design of instructional technology not only technically proficient but educationally valuable as well. In all, this attention to the individual in society and culture defines the technological humanism we seek through all components of the programs in CMLTD—a humanism that combines the use of sophisticated technology with humane commitments for guiding purposes.

Special Degree Cohorts:

Online Master's Program in Computing in Education

The program in Computing in Education features coursework that is conducted online. The online program is designed to be available completely online, without an on-campus, face-to-face class experience. Participants take about ten courses online, which use video conferencing, discussion boards, and other means of online communication. Besides these courses, students have the opportunity to work on an independent project and possibly to attend three-day workshops at Teachers College in the summers. Students concentrate in Teaching and Learning with Technology or Technology Leadership. For more information, contact Dr. Jin Kuwata at kuwata@tc.columbia.edu or (212) 678-3344.

Technology Specialist

This is a Master of Arts degree program leading to a New York State teaching license for "Technology Specialist K-12" candidates to become technology coordinators in schools. Student teaching and fieldwork are required. The program is available to those with or without initial teaching licenses who have some knowledge and experience in using technology in teaching. For further information, contact Dr. Ellen Meier at (212) 678-3829 or ebm15@columbia.edu.

Technology Specialist - Track II

This is a Master of Arts degree program leading to an initial teaching certificate as a Technology Specialist K-12. It is intended for those already holding New York State certification in another content area. Program goals include preparing individuals to use technology as a set of tools with students, to work effectively with teachers to help them learn to use technology and design, and to implement curriculum where technology is well integrated. Completing the program requires 38 Teachers College credits, as well as 100 hours of fieldwork and 40 days of student teaching.

Degree Summary

The Communication, Media and Learning Technologies Design area of study includes the following programs: Communication and Education; Computing in Education; Design and Development of Digital Games; Instructional Technology and Media; and Technology Specialist.

COMMUNICATION AND EDUCATION (TECM)

Degrees offered:

- Master of Arts (M.A.)
- Master of Education (Ed.M.)

- Doctor of Education (Ed.D.)

COMPUTING IN EDUCATION-ONLINE (TECD)

Degree offered:

- Master of Arts (M.A.)

DESIGN AND DEVELOPMENT OF DIGITAL GAMES (TEDG)

Degree offered:

- Master of Arts (M.A.)

INSTRUCTIONAL TECHNOLOGY AND MEDIA (TEIT)

Degrees offered:

- Master of Arts (M.A.)
- Master of Education (Ed.M.)
- Doctor of Education (Ed.D.)

TECHNOLOGY SPECIALIST

Degrees offered:

TECHNOLOGY SPECIALIST- K-12 Initial Certification (TETS-INIT)

- Master of Arts (M.A.)

TECHNOLOGY SPECIALIST- Track II: K-12 Initial Certification (TETT-INIT)

- Master of Arts (M.A.)

For a complete listing of degree requirements, please continue on to this program's "Degrees" section in this document

Degree Requirements

General Information

The college-wide degree requirements are stated in the Degree Requirements section of this bulletin. The following steps specific to Communication, Media, and Learning Technologies Design amplify the college-wide requirements and should serve as an aid for structuring an individualized program of study based on previous experience, professional goals, and interests. Enrolled students can obtain further information about requirements and the academic calendar from the CMLTD Program office at (212) 678-3344. Degrees represent advanced levels of mastery in rigorous scholarship and disciplined practice. In developing a program, students should find ways to meet the intrinsic demands of the field.

Master of Arts in Communications and Education

Communication and Education (TECM)

The Communication and Education degree program relies primarily on social science inquiry to understand, interpret, and shape how information, communication technologies and new media influence culture and education, including areas such as literacy, social justice, youth development, and teacher education.

This program uses a broad range of methods -- including both qualitative and quantitative approaches -- to study the intersections of communication and learning. It asks, in particular, how education and other social systems change under the impact of emerging media. The program encourages students to:

- Reflect on the historical, cultural and social impact of a wide range of media
- Leverage relevant research methods and modes of inquiry to better understand how communication and media use shape learning practices

- Attend closely to both technological artifacts and human activity, reflecting on the diverse ways in which modes of communication condition the meanings actually, and potentially, communicated—particularly through the wide variety of digital means available to us.

Students graduating from the program in Communication and Education have pursued a wide variety of career paths, in accordance with their goals and interests. Some of these include:

- Teaching and research positions in higher education;
- Working in schools, museums or other educational institutions to leverage new media technologies in effective and empowering ways;
- Conducting formative and evaluative research on the use of media in/for learning, both within classrooms and beyond;
- Designing and implementing innovations in the use of new media for educational, social or civic purposes; or
- Working in government or nonprofit settings to shape the conversation around new media and learning through research and policy work.

Master of Arts (32 points required)

To earn the Master of Arts (M.A.), students must satisfactorily complete 32 points of coursework and an integrative project. In CMLTD programs, the M.A. degree serves two main functions: a mark of entry-level professional qualifications in the fields covered and a grounding for further, more advanced specialization in the field.

Students must take coursework totaling at least 32 points. The following are required:

Core Requirement: (1 point)

- MSTU 4000 Core Seminar in Communication, Computing, and Technology (1 point)

Foundational Knowledge: At least three areas must be represented. (9 points)

- Cognitive Issues and Technology
    - MSTU 4133 Cognition and Computers

    - MSTU 4088 Introduction to Learning Sciences and Educational Technology
- Social Issues and Technology
    - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
    - MSTU 4020 Social and Communicative Aspects of the Internet
- Cultural Issues and Technology
    - MSTU 4028 Technology and Culture
    - MSTU 5002 Culture, Media, and Education
- Educational Practice and Design
    - MSTU 4001 Technology and School Change
    - MSTU 4050 Online Schools and Online Schooling K-12
    - MSTU 4083 Instructional Design of Educational Technology

Breadth Requirement: (6 points)

All students (at both master's and doctoral levels) must complete 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU).

Additional Requirements: for M.A. students in Communication and Education (TECM)

- MSTU 4016 The History of Communication
- 13 points additional MSTU courses
- Other courses chosen in consultation with an advisor

Integrative M.A. Project

Candidates for the M.A. degree are expected to culminate their work with an integrative project. Projects vary but share the common following features:

- Empirically based and grounded in the research literature
- Address a problem or phenomenon of the student's interest and area of study
- Provide a solution to the problem

Some examples include:

- Design of new learning technologies and media-driven experiences

- Development of new models, curriculum, and/or lessons integrating technology
- A thesis or case study analysis of a trend in the field of learning technology

Specifics of the integrative project are determined through discussions with the students' advisors. In addition, because experientially-grounded learning is invaluable preparation for professional practice, students are strongly advised to take fieldwork or internships as an integral part of their master's program.

For students completing only the M.A. degree, this project should be related to their career goals and should provide tangible evidence of their skills and strengths.

Master of Arts in Computing in Education (Online)

Computing in Education - Online (TECD)

The M.A. program in Computing in Education: Online, is a 32-point program where all courses needed to complete the degree are offered online. The program represents the wide range of goals presented by its parent program of Communication, Media, and Learning Technologies Design (CMLTD). It provides a broad foundational view of technology as it relates to learning from cognitive, social, cultural, and applied perspectives. It also provides a deeper view of specific issues around different genres of technology, theories, and practice.

Students in this program come from a variety of different backgrounds crossing international and cultural borders. Students represent an array of professions, including educational institutions, industry, and non-traditional histories. Many students in this program work full-time and take 1-2 courses a term (part-time) enjoying the flexibility available to complete the requirements. Students of the program have successfully gone on to a variety of roles upon graduation including (but not limited to) working in and with K-12 institutions as teachers, specialists, and leaders, as well as industry positions such as designing instructional and learning experiences. Whether you enter with formal, informal, or non-traditional

education/learning related expertise, this program hones one's understanding of how to approach learning with technology, to solve some of the most pressing issues of today.

The experiences of online coursework in the Computing in Education program are as diverse as the issues explored. Courses are designed by each professor with learning as the driving objective. Students will experience coursework in a variety of formats (e.g. discussion forums, video conferences, real-time chats, blended experiences, etc.). Many courses are project-based, collaborative, with rich and intimate opportunities to interact and engage both with one's peers and professors. Online students participate in the same courses as their face-to-face CMLTD counterparts/peers and are welcome to enroll in traditional on-site, face-to-face classes if opportunities permit.

Master of Arts (32 points required)

To earn the Master of Arts (M.A.), students must satisfactorily complete 32 points of coursework and an integrative project. In CMLTD programs, the M.A. degree serves two main functions: a mark of entry-level professional qualifications in the fields covered and a grounding for further, more advanced specialization in the field.

Students must take coursework totaling at least 32 points. The following are required:

Core Requirement: One programming course must be taken. (3 points)

- Programming Course
  - MSTU 4031 Object-Oriented Theory and Programming I
  - MSTU 5003 Theory and Programming of Interactive Media I

Foundational Knowledge: At least three areas must be represented. (9 points, minimum)

- Cognitive Issues and Technology
  - MSTU 4133 Cognition and Computers
  - MSTU 4088 Introduction to Learning Sciences and Educational Technology

- Social Issues and Technology
    - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
    - MSTU 4020 Social and Communicative Aspects of the Internet
- Cultural Issues and Technology
    - MSTU 4028 Technology and Culture
    - MSTU 5002 Culture, Media, and Education
- Educational Practice and Design
    - MSTU 4001 Technology and School Change
    - MSTU 4050 Online Schools and Online Schooling K-12
    - MSTU 4083 Instructional Design of Educational Technology

Breadth Requirement: (6-9 points)

All students must complete a minimum of 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU).

Additional Requirements: for M.A. students in Computing in Education (TECD)

- At least 11-14 points of MSTU courses or other courses with the faculty advisor's approval. In particular, M.A. students in the Computing in Education degree through the completely online option have a slightly more constrained set of courses available to meet program requirements and should work closely with their respective advisor.

Integrative M.A. Project

Candidates for the M.A. degree are expected to culminate their work with an integrative project. Projects vary but share the common following features:

- Empirically based and grounded in the research literature
- Address a problem or phenomenon of the student's interest and area of study
- Provide a solution to the problem

Some examples include:

- A literature review or case study analysis of a trend in the field of learning technology
- Design of new learning technologies and media-driven experiences

- Development of new models, curriculum, and/or lessons integrating technology
- On-site field study and recommendations for teachers

Specifics of the integrative project are determined through discussions with the students' advisors. In addition, because experientially-grounded learning is invaluable preparation for professional practice, students are strongly advised to take fieldwork or internships as an integral part of their master's program.

For students completing only the M.A. degree, this project should be related to their career goals and should provide tangible evidence of their skills and strengths.

Master of Arts in Design and Development of Digital Games

Design and Development of Digital Games (TEDG)

The M.A. program in **Design and Development of Digital Games** is a 32-33 point program that prepares students to design, develop, implement and evaluate digital games and closely related technologies (such as mobile apps, interactive media, virtual and augmented reality) for learning and social impact in both formal and informal educational settings. This program is unique in that the curriculum is structured to examine game design from a combination of social, cultural, cognitive, and affective perspectives. Students who are studying the design and development of games for education as a concentration need the degree to reflect this area of study, which is not only optimal but necessary for their intended goals.

Games and closely related technologies are increasingly important for learning and for professional education and training in schools, medicine, business, entertainment, and other domains. Rapid changes in these technologies are reshaping the ways we create, evaluate, reflect, reason, and learn. The interdisciplinary nature of game design has led to more creative approaches in teaching and learning in both informal learning contexts (such as museums and homes) and formal learning contexts (classrooms, schools, and workplaces).

The skills involved in designing, developing and studying games are relevant to a wide variety of careers, for instance: instructional design, coding, web and app development, project management, user experience (UX) design, illustration, and 3D modeling, and so on. Whether you wish to pursue a career specifically in games (commercial or educational game design) or want to use games as a means to other endeavors, this program is an exciting and modern platform for your career journey.

Courses in the M.A. degree program provide a solid foundation in both theoretical and practical aspects to the design of educational technology (of which games are a part), which are very relevant to the design of games that target learning—what are often called educational games. Similarly, the **development** of educational (or other) games depends upon the ability to program such games, or, at very least, to have enough programming knowledge to be able to communicate appropriately with programmers who will develop games based on design specifications. Therefore, courses on game development, for example, complement the required programming course sequences that teach programming skills that can be applied to games.

Minimum Point Requirement

A minimum of 32 points of coursework is required for completion of the degree. Course credits from previous, non-Teachers College work cannot be transferred in to count toward the 32 points required for the M.A. degree.

Required Core Courses (10 points)

- Required courses:
  - MSTU 4000: Core Seminar (1 point)
  - MSTU 4088 Introduction to Learning Sciences and Educational Technology (3 points)
  - MSTU 4083: Instructional Design of Educational Technology (3 points)
- For the remaining points, choose between:
  - MSTU 4020: Social and Communicative Aspects of ICTs (3 points)
  - MSTU 4005: Equity, Ethics and Social Issues (3 points)

    OR

    MSTU 4504: Ethical Issues in Technology Design (3 points)

Requirements in the Major Area (15 points)

- 6 points of a programming course sequence:
  - MSTU 4031: Object-Oriented Theory and Programming I (3 points) **AND** MSTU 5031: Object-Oriented Theory and Programming II (3 points)
    OR
    MSTU 5003: Theory and Programming of Interactive Media I (3 points) **AND** MSTU 5013: Theory and Programming of Interactive Media II (3 points)
  - Other programming courses approved by academic adviser
- For the remaining 9 points, choose any combination of the following courses:
  - MSTU 4039: Game Design Fundamentals: Theory and Practice of Game Design (3 points)
  - MSTU 4040: Mobile Learning (3 points)
  - MSTU 5000: Virtual, Augmented, Mixed Reality and Games as Learning Tools (3 points)
  - MSTU 5015: Research/Programming in Serious Games (3 points)
  - MSTU 6000: Advanced Design of Educational Games (3 points)

Elective Courses (1-3 points)

1-3 points of additional MSTU courses.

Breadth Requirement: (6-9 points)

All students must complete a minimum of 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU).

Integrative M.A. Project

Candidates for the M.A. degree are expected to culminate their work with an integrative project. Projects vary but share the common following features:

- Empirically based and grounded in the research literature
- Address a problem or phenomenon of the student's interest and area of study
- Provide a solution to the problem

Some examples include:

- Design of a new game, app, virtual reality experience or other form of interactive media
- Case study analysis of a trend in the field of game-based learning
- Development of new models, curriculum, and/or lessons integrating technology
- On-site field study and recommendations for teachers

Specifics of the integrative project are determined through discussions with the students' advisors.

For students completing only the M.A. degree, this project should be related to their career goals and should provide tangible evidence of their skills and strengths.

Master of Arts in Educational Technology Specialist: For Certified Teachers

Educational Technology Specialist K-12 Certification: For Certified Teachers (TETT-INIT)

The M.A. program for Educational Technology Specialist K-12 Certification: TETT Track, is a 38-point program. There are two tracks for the overall program: one for students who hold an existing teaching certification and one for students who do not. The TETT track is designed for certified teachers and places more emphasis on leadership and research as it relates to the use of technology in schools. Candidates are prepared to take on a variety of roles in schools, including but not limited to: individuals who want to work with technology in the classroom, technology coaches who support K-12 teachers in the design and implementation of technology-related curriculum and projects, technology directors, and professional developers. Some candidates also return to teaching positions where they work directly with students in STEM or STEAM Labs, and also support schools in developing and implementing classes related to coding and computational thinking. Completing the program requires 38 points, as well as 50 hours of fieldwork/observation and 100 hours (or 20 days) of student teaching.

Master of Arts (38 points required)

The M.A. program for Educational Technology Specialist K-12 Certification: TETT Track for certified teachers is a 38-point program. There are two tracks for this program, depending upon if the student holds an existing teaching certification. This specific track (TETT) is designed for individuals who hold a current teaching certification. Students in this track enter at various points in their teaching career. Some hold initial certification in a different content area (such as mathematics or history) and complete the program to obtain professional certification in their first content area while also adding an initial certificate as an Educational Technology Specialist. Others are veteran teachers holding professional certification in a different content area and are seeking to teach courses related to technology or eventually become technology leaders. This M.A. program requires students to complete one semester of practica, with at least 50 hours of observation and at least 100 hours of student teaching. Credit for student teaching can be earned while teaching in one's current position under certain circumstances and can be discussed with the program advisor.

The program follows the International Society for Technology Education (ISTE) Standards for Coaches and offers courses related to teaching and learning with technology through different perspectives: cognitive, social, cultural and applied practice. Each student's program is different, depending upon students' professional goal and interests. Students are encouraged to take courses related to the learning sciences, leadership and educational policy, staff development, and the use of assistive technologies. Students attend most courses face-to-face, but some of the courses are offered online.

Students can complete the program full-time in two years but have the option to go part-time, as many of the students teach full-time during the day. Students register for practica during both the Fall and Spring semesters in the second year of the program. Over the course of the second year, students complete 50 hours of observation in schools, in addition to a minimum of 20 days (or 100 hours) of student teaching. Students in this track typically complete student teaching on a part-time schedule. Additional information regarding student teaching requirements are below.

Students must take coursework totaling 38 points. The following are required:

Required Courses (18 points)

- Social Issues and Technology
  - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
- Cultural Issues and Technology
  - MSTU 4052 Computers, Problem Solving, and Cooperative Learning
- Educational Practice and Design
  - MSTU 4001 Technology and School Change
  - MSTU 4029 Managing Educational Technology Resources
- Policy and Leadership (choose one for 3 points)
  - MSTU 5033 Educational Technology Policy: Challenges & Opportunities
  - MSTU 5029 Technology Leadership and Schools
- Research (choose one for 3 points)
  - MSTU 5001 Assessing the Impact of Technology
  - MSTU 5025 Researching Technology in Educational Environments

Additional Core Courses (choose two courses for 6 points)

- MSTU 4020 Social Aspects of the Internet and ICTs
- MSTU 4049 Technologies and Literacies
- MSTU 4050 Online Schools and Online Schooling K-12
- MSTU 4083 Instructional Design of Educational Technology
- MSTU 4133 Cognition and Computers
- MSTU 5002 Culture, Media, and Education
- MSTU 5005 Case-Based Teaching in Electronic Environments

Required Courses Outside of Department (8 points)

- Adult Learning
  - C&T 5053 Staff development Processes and Procedures
- Leadership
  - ORLA 4044 Transforming Schools and Transforming Education
- Curriculum Design
  - C&T 4052 Designing Curriculum and Instruction
- Special Education (choose one)
  - HBSE 4000 Introduction to Special Education
  - HBSE 4005- Computer Applications in Special Education

- Human Development (choose one for 3 points)
    - HUDK 4022 Developmental Psychology: Childhood
    - HUDK 4029 Cognition and Learning

Required Practica (6 points)

- MSTU 4700 Student Teaching Practicum in Educational Technology (Elementary)
- MSTU 4700 Student Teaching Practicum in Educational Technology (Secondary)

Breadth Requirement: (6 points, minimum)

All students must complete a minimum of 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU). This requirement is typically already met when taking required courses outside of the department (see above).

Student Teaching and Fieldwork Requirements:

Students are required to complete two semesters of practicum (MSTU 4700). Practicum in the Fall semesters focus on elementary grades (grades K-6), and practicum in the Spring semesters focus on secondary grades (grades 7-12). The program requires at least 50 hours of observation and at least 100 hours (or 20 days) of student teaching across two semesters. The grade level of the student's current teaching certification will determine which grade the student will be placed in for student teaching. For example, if the student currently holds an initial teaching certificate for a secondary content area, the student will be placed in an elementary setting for student teaching as the Educational Technology Specialist certificate covers K-12.

Fieldwork consists of observing a variety of activities relating to the role of an Educational Technology Specialist: observing technology coordinators and directors provide support to teachers, observing students at work using technology, and observing technology-related professional development workshops. Students may also observe technology integrators planning with teachers, facilitating the use of a makerspace or teaching coding and computational thinking.

Student teaching placements will, for the most part, occur in local schools that are our program's partners. Cooperating teachers may be technology coaches, technology integrators, directors of technology, or tech-savvy classroom teachers. Students already working full-time in the role of an Educational Technology Specialist, who would like to use their employment to fulfill student teaching requirements, must receive approval under guidelines set forth by the College and Office of Teacher Education. Depending upon availability, summer student teaching placements may also be arranged in consultation with the program advisor.

Additional Requirements for Certification:

Students may obtain the Educational Technology Specialist K-12 Certification by fulfilling New York State Education Department (NYSED) teacher certification requirements, many of which may already be fulfilled from holding an existing teacher certification:

- Successful completion of MA degree for Educational Technology Specialist K-12 Certification
- Pass the NYSTCE Educating All Students Test (EAS)
- Pass the NYSTCE Content Speciality Test (CST - Educational Technology Specialist)
- Complete three workshops: 1) child abuse and identification reporting; 2) school violence prevention and intervention; and 3) Dignity for All Students Act (DASA)
- Fulfilling Liberal Arts and Sciences Requirement (required for graduation and NYS certification)
  Transcripts will be reviewed as part of the admissions process. Students will be notified by Office of Teacher Education if any courses are required to meet this requirement.
- When the M.A. degree is awarded; file an Institutional Recommendation Data Form with the Office of Teacher Education.

Requirements for NYS certification are subject to change, please check the Office of Teacher Education and NYSED website for additional information.

Special Requirements for Professional Education Programs Under CAEP Review

1. *State licensure test* of content knowledge will be measured by the NYSTCE Content Specialty Test for Educational Technology Specialist.

2. *Assessment of content knowledge in the field of Educational Technology.* Candidates will be assessed through their classroom observation projects. This work will be completed as part of MSTU 4700: Student Teaching Practicum in Educational Technology.

3. *Assessment that demonstrates candidates ability to plan appropriate teaching and learning experiences.* This is measured through assessment of a curriculum unit designed by the candidate that integrates technology. The unit is grounded in the approach taken by *Understanding by Design* (Wiggins & McTighe, 2005) and focuses on how technology tools may be used for problem-solving and student collaboration and how student learning will be assessed. This work will be completed as part of MSTU 4052: Computers, Problem Solving, and Cooperative Learning or C&T 4052: Designing Curriculum and Instruction.

4. *Assessment of candidates practicum, field or clinical experiences.* Candidates will be observed during student teaching and assessed by one of the program supervisors using a rubric for teaching practice.

5. *Assessment that demonstrates candidates ability to model, design, and disseminate methods and strategies in technology to support student learning.* Candidates will be observed during student teaching and assessed by one of the program supervisors using a rubric for teaching practice.

6. *Assessment that demonstrates the candidate understands and can develop programs that address the social, legal and ethical issues related to technology within the district/region/state.* Candidates will use data from a needs assessment to create a technology plan for a real or fictitious school. If the plan is for an existing school, it should have details that fit the needs of that school. If not for an actual school, the plan should discuss options in appropriate planning areas. A rubric will be used to assess key factors for a technology plan. This work will be completed as part of MSTU 4052, 4005 and/or 4029.

7. *Assessment of candidates reflection on use of technology for teaching and learning in K-12 schools.* Candidates will keep student teaching journals as a way to reflect upon their student teaching experiences and practice. This work will be completed as part of the course work in practicum, MSTU 4700.

8. *Assessment that addresses facilitation of a shared vision for integration of technology and how to foster an environment and culture conducive to the realization of the vision.* Please see the description of the integrative project in the next section.

Integrative M.A. Project

Candidates for the M.A. degree will prepare a final integrative project. The project may vary considerably from candidate to candidate, depending on her or his particular interests. In general, all projects will share these characteristics:

- They will be deeply informed by readings and research done throughout the program.
- They will be informed by candidates' reflections on their experiences during the program, and what they have learned about students' use of and learning with technologies.
- They will focus on some aspect of planning for the future, and in this way advance the field by contributing candidates' ideas on how the use of technology in schools may be improved.
- They will address the problems and issues involved in using technology fairly and equitably to advance the learning of all children.

Master of Arts in Educational Technology Specialist: For Non-certified Teachers

Educational Technology Specialist K-12 Certification: For Non-Certified Teachers (TETS-INIT)

This Master of Arts degree program leads to an initial K-12 teaching certificate in New York State as an Educational Technology Specialist. This program is designed for individuals who do not hold any current teaching certifications. Candidates are

prepared to take on a variety of roles in schools, including but not limited to: coaching and supporting K-12 teachers in the design and implementation of technology-related curriculum and projects, designing and leading professional development sessions, working directly with students in STEM or STEAM Labs, as well as supporting schools in developing and implementing classes related to coding and computational thinking. Completing the program requires 38 points, and involves two semesters fieldwork/observation (a year-long total of 100 hours) and student teaching (a year-long total of 200 hours or 40 days of student teaching.

Master of Arts (38 points required)

The M.A. program for Educational Technology Specialist K-12 Certification: TETS Track, is a 38-point program. There are two tracks for the overall program: one for students who hold an existing teaching certification and one for students who do not. The TETS track is for those who do not hold any current teaching certifications. Students in this track come from a variety of backgrounds. Some may be career changers seeking to work with technology in schools and others may have teaching experience but no certification. This M.A. program provides classroom experience: students complete two semesters of "practica," one spent in elementary classrooms (K-6) and the other spent in secondary grades (7-12).

The program follows the International Standards for Technology Education (ISTE) Standards for Coaches and offers courses related to teaching and learning with technology through different perspectives: cognitive, social, cultural, and applied practice. Students are also encouraged to take courses related to the learning sciences, educational policy, and use of assistive technologies in special education. Each student's program is different, depending upon students' professional goals and interests. Students attend most courses face-to-face, but some of the courses are offered online.

Students can complete the program full-time in two years but have the option to go part-time, as many of the students work during the day. In the second year students register for "practica" during both the Fall and Spring semesters in the of the program. Completing the program requires 38 points, and involves two semesters fieldwork/observation (a year-long total of 100 hours) and student teaching (a year-long total of 200 hours or 40 days of student teaching. Students are

strongly encouraged to make themselves available full-time for student teaching, but it is possible to complete student teaching part-time. Additional information regarding student teaching requirements are below.

Students must take coursework totaling 38 points. The following are required:

Required Courses (18 points)

- Cognitive Issues and Technology
  - MSTU 4133 Cognition and Computers
- Social Issues and Technology
  - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
- Cultural Issues and Technology
  - MSTU 4052 Computers, Problem Solving, and Cooperative Learning
- Educational Practice and Design
  - MSTU 4001 Technology and School Change
  - MSTU 4029 Managing Educational Technology Resources
- Programming Course (choose one for 3 points)
  - MSTU 4031 Object-Oriented Theory and Programming
  - MSTU 5003 Theory and Programming of Interactive Media I

Required Courses Outside of Department (9 points)

- Curriculum Design
  - C&T 4052 Designing Curriculum and Instruction
- Special Education (choose one for 3 points)
  - HBSE 4000 Introduction to Special Education
  - HBSE 4005 Computer Applications in Special Education
- Human Development (choose one for 3 points)
  - HUDK 4022 Developmental Psychology: Childhood
  - HUDK 4029 Cognition and Learning

Required Practica (6 points)

- MSTU 4700 Student Teaching Practicum in Educational Technology (Elementary)

- MSTU 4700 Student Teaching Practicum in Educational Technology (Secondary)

Electives (5 points)

All elective courses must be approved in consultation with the faculty program advisor. Weekend workshops and skills courses do not meet this requirement.

Breadth Requirement: (6 points, minimum)

All students must complete a minimum of 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU). Typically, this requirement is already met when taking required courses outside of the department (see above).

Student Teaching and Fieldwork Requirements:

Students are required to complete two semesters of practicum (MSTU 4700) which includes fieldwork and student teaching. Practicum in the Fall semesters focus on elementary student teaching (grades K-6), and practicum in the Spring semesters focus on secondary student teaching (grades 7-12). Each practicum consists of at least 50 hours of observation and at least 100 hours (or 20 days) of student teaching, for a year-long total of at least 100 hours of fieldwork and at least 200 hours (or 40 days) of observation across the two semesters.

Fieldwork consists of observing a variety of activities relating to the role of an Educational Technology Specialist: observing students at work using technology, observing technology coordinators providing support to teachers, and observing technology-related professional development sessions. Students may also observe technology integrators planning with teachers, facilitating the use of a makerspace or teaching coding and computational thinking.

Student Teaching placements will, for the most part, occur in local schools that partner with our program. Cooperating teachers may be technology coaches, technology integrators, directors of technology, or tech-savvy classroom teachers. Students already working full-time in the role of an Educational Technology Specialist, who would like to use their employment to fulfill student teaching

requirements, must receive approval under guidelines set forth by the College and Office of Teacher Education.

Additional Requirements for Certification:

Students may obtain the Educational Technology Specialist K-12 Certification by fulfilling New York State Education Department (NYSED) teacher certification requirements:

- Successful completion of MA degree for Educational Technology Specialist K-12 Certification
- Pass the NYSTCE Educating All Students Test (EAS)
- Pass the NYSTCE Content Speciality Test (CST - Educational Technology Specialist)
- Complete three workshops: 1) child abuse and identification reporting; 2) school violence prevention and intervention; and 3) Dignity for All Students Act (DASA)
- Fulfilling Liberal Arts and Sciences Requirement (required for graduation and NYS certification)
  Transcripts will be reviewed as part of the admissions process. Students will be notified by Office of Teacher Education if any courses are required to meet this requirement.
- When the M.A. degree is awarded; file an Institutional Recommendation Data Form with the Office of Teacher Education.

Requirements for NYS certification are subject to change. Please check the Office of Teacher Education and NYSED website for additional information.

Special Requirements for Professional Education Programs Under CAEP Review

1. *State licensure test* of content knowledge will be measured by the NYSTCE Content Specialty Test for Educational Technology Specialist.

2. *Assessment of content knowledge in the field of Educational Technology.*
   Candidates will be assessed through their classroom observation projects. This work will be completed as part of MSTU 4700: Student Teaching Practicum in Educational Technology.

3. *Assessment that demonstrates candidates ability to plan appropriate teaching and learning experiences.* This is measured through assessment of a curriculum unit designed by the candidate that integrates technology. The unit is grounded in Wiggins' and McTighes' (2005) *Understanding by Design* (UbD) approach and focuses on how technology tools may be used for problem-solving and student collaboration and how student learning will be assessed. This work will be completed as part of MSTU 4052: Computers, Problem Solving, and Cooperative Learning or C&T 4052: Designing Curriculum and Instruction.

4. *Assessment of candidates practicum, field or clinical experiences.* Candidates will be observed during student teaching and assessed by one of the program supervisors using a rubric for teaching practice.

5. *Assessment that demonstrates candidates ability to model, design, and disseminate methods and strategies in technology to support student learning*. Candidates will be observed during student teaching and assessed by one of the program supervisors using a rubric for teaching practice.

6. *Assessment that demonstrates the candidate understands and can develop programs that address the social, legal and ethical issues related to technology within the district/region/state.* Candidates will use data from a needs assessment to create a technology plan for a real or fictitious school. If the plan is for an existing school, it should have details that fit the needs of that school. If not for an actual school, the plan should discuss options in appropriate planning areas. A rubric will be used to assess key factors for a technology plan. This work will be completed as part of MSTU 4052, 4005 and/or 4029.

7. *Assessment of candidates reflection on use of technology for teaching and learning in K-12 schools.* Candidates will keep student teaching journals as a way to reflect upon their student teaching experiences and practice. This work will be completed as part of the course work in practicum, MSTU 4700.

8. *Assessment that addresses facilitation of a shared vision for integration of technology and how to foster an environment and culture conducive to the realization of the vision.* Please see the description of the integrative project in the next section.

Integrative M.A. Project

Candidates for the M.A. degree will prepare a final integrative project. The project may vary considerably from candidate to candidate, depending on her or his particular interests. In general, all projects will share these characteristics:

- They will be deeply informed by readings and research done throughout the program.
- They will be informed by candidates' reflections on their experiences during the program, and what they have learned about students' use of and learning with technologies.
- They will focus on some aspect of planning for the future, and in this way advance the field by contributing candidates' ideas on how the use of technology in schools may be improved.
- They will address the problems and issues involved in using technology fairly and equitably to advance the learning of all children.

Master of Arts in Instructional Technology and Media

Instructional Technology and Media (TEIT)

The Instructional Technology and Media degree programs examine the relationship between the design of technology, digital media, cultural context, social interaction, and learning. Courses provide extensive exposure to theories of cognition and design, as well as deep dives into applications of these theories in practice. Consequently, while students will encounter a wide range of cognitive, social, and design theories, students are encouraged to consider the power, equity, and ethical implications of context and culture in their application across learning spaces and environments. Faculty and students' current areas of exploration include state of the art technologies such as virtual and augmented reality, the design of toys and digital games, maker education and digital fabrication, robotics and social pedagogical agents, artificial intelligence and computational literacy.

Students graduating from the program in Instructional Technology and Media have pursued a wide variety of career paths, in accordance with their goals and interests. Some of these include:

- Teaching, and research positions in higher education;
- Administrative and teaching positions in elementary, middle, and high schools;
- Creating educational technology startups and joining established industry leaders such as PBS, Nickelodeon, Google, Amazon, Sesame Workshop;
- Research and design positions in informal learning contexts such as museums and non-profit organizations to leverage new media technologies in effective and empowering ways;
- Research positions and design of technology-based training in corporations;
- Conducting formative and evaluative research on the use of media in/for learning, both within classrooms and beyond;
- Designing and implementing innovations in the use of new media for educational, social or civic purposes; or
- Working in government or nonprofit settings to shape the conversation and policy around new media and learning through research and policy work.

Participants in all CMLTD program areas share a basic conviction that good design in educative matters starts with careful attention to the needs and characteristics of the individuals that the design will serve. For example, the ability to understand the individual through empirical research and empathic engagement will make the design of instructional technology not only technically proficient but educationally valuable as well. In all, this attention to the individual in society and culture defines the technological humanism we seek through all components of the programs in CMLTD—a humanism that combines the use of sophisticated technology with humane commitments for guiding purposes.

Master of Arts (32 points required)

To earn the Master of Arts (M.A.), students must satisfactorily complete 32 points of coursework and an integrative project. In CMLTD programs, the M.A. degree serves two main functions: a mark of entry-level professional qualifications in the fields covered and a grounding for further, more advanced specialization in the field.

Students must take coursework totaling at least 32 points. The following are required:

Core Requirement: (1 point)

- MSTU 4000 Core Seminar in Communication, Computing, and Technology (1 point)

Foundational Knowledge: At least three areas must be represented. (9 points, minimum)

- Cognitive Issues and Technology
  - MSTU 4133 Cognition and Computers
  - MSTU 4088 Introduction to Learning Sciences and Educational Technology
- Social Issues and Technology
  - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
  - MSTU 4020 Social and Communicative Aspects of the Internet
- Cultural Issues and Technology
  - MSTU 4028 Technology and Culture
  - MSTU 5002 Culture, Media, and Education
- Educational Practice and Design
  - MSTU 4001 Technology and School Change
  - MSTU 4050 Online Schools and Online Schooling K-12
  - MSTU 4083 Instructional Design of Educational Technology

Breadth Requirement: (6 points)

All students (at both master's and doctoral levels) must complete a minimum of 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU).

Additional Requirements: for M.A. students in Instructional Technology and Media (TEIT)

- MSTU 4083 Instructional Design of Educational Technology
  - Counts toward the Foundational Knowledge area

- Two programming courses must be taken. This requirement can be met by taking the two-course Object-Oriented or Interactive Media programming sequence.
    - MSTU 4031 and 5031 Object-Oriented Programming and Theory I & II
    - MSTU 5003 and 5013 Theory and Programming of Interactive Media I & II
- 10 points of additional MSTU courses
- Other courses chosen in consultation with an advisor

Integrative M.A. Project

Candidates for the M.A. degree are expected to culminate their work with an integrative project. Projects vary but share the common following features:

- Empirically based and grounded in the research literature
- Address a problem or phenomenon of the student's interest and area of study
- Provide a solution to the problem

Some examples include:

- Design of new learning technologies and media-driven experiences
- Development of new models, curriculum, and/or lessons integrating technology
- A thesis or case study analysis of a trend in the field of learning technology

Specifics of the integrative project are determined through discussions with the students' advisors. In addition, because experientially-grounded learning is invaluable preparation for professional practice, students are strongly advised to take fieldwork or internships as an integral part of their master's program.

For students completing only the M.A. degree, this project should be related to their career goals and should provide tangible evidence of their skills and strengths.

Master of Education (60 points)

Communication and Education (TECM)

The Communication and Education degree program relies primarily on social science inquiry to understand, interpret, and shape how information, communication technologies and new media influence culture and education, including areas such as literacy, social justice, youth development, and teacher education.

This program uses a broad range of methods -- including both qualitative and quantitative approaches -- to study the intersections of communication and learning. It asks, in particular, how education and other social systems change under the impact of emerging media. The program encourages students to:

- Reflect on the historical, cultural and social impact of a wide range of media
- Leverage relevant research methods and modes of inquiry to better understand how communication and media use shape learning practices
- Attend closely to both technological artifacts and human activity, reflecting on the diverse ways in which modes of communication condition the meanings actually, and potentially, communicated—particularly through the wide variety of digital means available to us.

Students graduating from the program in Communication and Education have pursued a wide variety of career paths, in accordance with their goals and interests. Some of these include:

- Teaching and research positions in higher education;
- Working in schools, museums or other educational institutions to leverage new media technologies in effective and empowering ways;
- Conducting formative and evaluative research on the use of media in/for learning, both within classrooms and beyond;
- Designing and implementing innovations in the use of new media for educational, social or civic purposes; or
- Working in government or nonprofit settings to shape the conversation around new media and learning through research and policy work.

Master of Education (60 points required)

An Ed.M. degree represents roughly the equivalent of two years of full-time study. It serves for some to mark progress toward a doctorate and for others to initiate intermediate professional qualifications for students who have previously completed a master's degree at Teachers College or another institution. Up to 30 points of graduate credit earned elsewhere may be counted toward the minimum

60-point requirement. Ed.M. candidates who have completed an M.A. in CMLTD or an equivalent program should select further courses to broaden and deepen their mastery of the field. Those who are transferring a significant number of points from a different specialty toward the Ed.M. should include a selection of CMLTD core program courses in their remaining coursework. In addition to completing the minimum course requirements and developing a skill specialization, candidates for the Ed.M. degree culminate their work through a research or development project submitted to the faculty.

Master of Education (Ed.M.) programs are offered in Communication and Instructional Technology and Media. In each of these Ed.M. programs, students must take coursework totaling at least 60 points. The following are required of all Ed.M. students:

Core Requirement: (1 point)

- MSTU 4000 Core Seminar in Communication, Computing, and Technology (1 point)

Foundational Knowledge: At least three areas must be represented. (9 points)

- Cognitive Issues and Technology
  - MSTU 4133 Cognition and Computers
  - MSTU 4088 Introduction to Learning Sciences and Educational Technology
- Social Issues and Technology
  - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
  - MSTU 4020 Social and Communicative Aspects of the Internet
- Cultural Issues and Technology
  - MSTU 4028 Technology and Culture
  - MSTU 5002 Culture, Media, and Education
- Educational Practice and Design
  - MSTU 4001 Technology and School Change
  - MSTU 4050 Online Schools and Online Schooling K-12
  - MSTU 4083 Instructional Design of Educational Technology

Research Methods and Design: (3 points)

Students must complete one research method or research design course offered either in or outside the CMLTD program. Suggested courses include the following:

- HUDM 4122 Probability and Statistical Inference
- ITSF 5000 Methods of inquiry: Ethnography and Participant Observation
- MSTU 5025 Researching Technology in Educational Environments
- MSTU 5001 Assessing the Impact of Technology In Schools

Breadth Requirement: (6 points)

All students must complete 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU). Suggested: HUDM 4120 Basic concepts in statistics; ITSF 5000 Methods of inquiry-Ethnography and participant observation; and/or other basic research/inquiry courses without an MSTU prefix.

Additional Requirements: for Ed.M. students in Communication and Education (TECM)

- MSTU 4016 The History of Communication
- MSTU 5606 Readings in Communication Theory and Social Thought I
- 35 points of additional MSTU courses
- Other courses chosen in consultation with an advisor

Integrative Ed.M. Project

The Integrative Ed.M. Project is a research or development project that should result from independent effort equivalent to that of a 3-point course. Like the M.A. integrative project, it should provide tangible evidence of a student's skills and strengths and should represent the student's interests, as well as display the specialized skills developed for the degree.

Students accepted for a doctoral program should earn the Ed.M. as an integral part of their doctoral work. However, the Ed.M. can be far more than a stepping stone to a doctorate. It allows for great flexibility, and students can use it to lay a strong foundation for significant positions of leadership that demand high levels of skill but do not require doctoral-level academic certification. For instance, students can put together a very effective 60-point program dealing with "school media for curriculum innovation." In a similar way, one can develop a very strong grounding

in educational software development through the Ed.M. degree. It can serve many purposes. One needs to think through one's aspirations and use the scope of the Ed.M. program to build academic and experiential foundations in accordance with one's achievement goals.

Master of Education in Instructional Technology and Media

Instructional Technology and Media (TEIT)

The Instructional Technology and Media degree programs examine the relationship between the design of technology, digital media, cultural context, social interaction, and learning. Courses provide extensive exposure to theories of cognition and design, as well deep dives into applications of these theories in practice. Consequently, while students will encounter a wide range of cognitive, social, and design theories, students are encouraged to consider the power, equity, and ethical implications of context and culture in their application across learning spaces and environments. Faculty and students' current areas of exploration include state of the art technologies such as virtual and augmented reality, the design of toys and digital games, maker education and digital fabrication, robotics and social pedagogical agents, artificial intelligence and computational literacy.

Students graduating from the program in Instructional Technology and Media have pursued a wide variety of career paths, in accordance with their goals and interests. Some of these include:

- Teaching, and research positions in higher education;
- Administrative and teaching positions in elementary, middle, and high schools;
- Creating educational technology startups and joining established industry leaders such as PBS, Nickelodeon, Google, Amazon, Sesame Workshop;
- Research and design positions in informal learning contexts such as museums and non-profit organizations to leverage new media technologies in effective and empowering ways;
- Research positions and design of technology-based training in corporations;
- Conducting formative and evaluative research on the use of media in/for learning, both within classrooms and beyond;

- Designing and implementing innovations in the use of new media for educational, social or civic purposes; or
- Working in government or nonprofit settings to shape the conversation and policy around new media and learning through research and policy work.

Participants in all CMLTD program areas share a basic conviction that good design in educative matters starts with careful attention to the needs and characteristics of the individuals that the design will serve. For example, the ability to understand the individual through empirical research and empathic engagement will make the design of instructional technology not only technically proficient but educationally valuable as well. In all, this attention to the individual in society and culture defines the technological humanism we seek through all components of the programs in CMLTD—a humanism that combines the use of sophisticated technology with humane commitments for guiding purposes.

Master of Education (60 points required)

An Ed.M. degree represents roughly the equivalent of two years of full-time study. It serves for some to mark progress toward a doctorate and for others to initiate intermediate professional qualifications for students who have previously completed a master's degree at Teachers College or another institution. Up to 30 points of graduate credit earned elsewhere may be counted toward the minimum 60-point requirement. Ed.M. candidates who have completed an M.A. in CMLTD or an equivalent program should select further courses to broaden and deepen their mastery of the field. Those who are transferring a significant number of points from a different specialty toward the Ed.M. should include a selection of CMLTD core program courses in their remaining coursework. In addition to completing the minimum course requirements and developing a skill specialization, candidates for the Ed.M. degree culminate their work through a research or development project submitted to the faculty.

Master of Education (Ed.M.) programs are offered in Communication and Instructional Technology and Media. In each of these Ed.M. programs, students must take coursework totaling at least 60 points. The following are required of all Ed.M. students:

Core Requirement: (1 point)

- MSTU 4000 Core Seminar in Communication, Computing, and Technology (1 point)

Foundational Knowledge: At least three areas must be represented. (9 points)

- Cognitive Issues and Technology
  - MSTU 4133 Cognition and Computers
  - MSTU 4088 Introduction to Learning Sciences and Educational Technology
- Social Issues and Technology
  - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
  - MSTU 4020 Social and Communicative Aspects of the Internet
- Cultural Issues and Technology
  - MSTU 4028 Technology and Culture
  - MSTU 5002 Culture, Media, and Education
- Educational Practice and Design
  - MSTU 4001 Technology and School Change
  - MSTU 4050 Online Schools and Online Schooling K-12
  - MSTU 4083 Instructional Design of Educational Technology

Research Methods and Design: (3 points)

Students must complete one research method or research design course offered either in or outside the CMLTD program. Suggested courses include the following:

- HUDM 4122 Probability and Statistical Inference
- ITSF 5000 Methods of inquiry: Ethnography and Participant Observation
- MSTU 5025 Researching Technology in Educational Environments
- MSTU 5001 Assessing the Impact of Technology In Schools

Breadth Requirement: (6 points)

All students must complete 6 points at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU). Suggested: HUDM 4120 Basic concepts in

statistics; ITSF 5000 Methods of inquiry-Ethnography and participant observation; and/or other basic research/inquiry courses without an MSTU prefix.

Additional Requirements: for Ed.M. students in Instructional Technology and Media (TEIT)

- MSTU 4083 Instructional Design of Educational Technology
    - Counts toward the Foundational Knowledge area
- Two programming courses must be taken. This requirement can be met by taking the two-course Object-Oriented or Interactive Media programming sequence.
    - MSTU 4031 and 5031 Object-Oriented Programming and Theory I & II
    - MSTU 5003 and 5013 Theory and Programming of Interactive Media I & II
- 5 points of additional MSTU courses
- Other courses chosen in consultation with an advisor

Integrative Ed.M. Project

The Integrative Ed.M. Project is a research or development project that should result from independent effort equivalent to that of a 3-point course. Like the M.A. integrative project, it should provide tangible evidence of a student's skills and strengths and should represent the student's interests, as well as display the specialized skills developed for the degree.

Students accepted for a doctoral program should earn the Ed.M. as an integral part of their doctoral work. However, the Ed.M. can be far more than a stepping stone to a doctorate. It allows for great flexibility, and students can use it to lay a strong foundation for significant positions of leadership that demand high levels of skill but do not require doctoral-level academic certification. For instance, students can put together a very effective 60-point program dealing with "school media for curriculum innovation." In a similar way, one can develop a very strong grounding in educational software development through the Ed.M. degree. It can serve many purposes. One needs to think through one's aspirations and use the scope of the Ed.M. program to build academic and experiential foundations in accordance with one's achievement goals.

Doctor of Education in Communication and Education

Communication and Education (TECM)

Communication, as a field, has changed dramatically over the past few decades. These shifts have been brought on by evolution in communication technologies, increased portability of digital devices, and new modes of communication and representation that include rapidly changing interactive platforms and increased capacity for the consumption, production, and circulation of media.

The Communication and Education degree programs provide students with a strong foundation in the interdisciplinary theories and pedagogical approaches that reflect these unfolding changes in the field, particularly as they impact education in all forms. Our program relies primarily on social science inquiry to understand, interpret, and shape how information, communication technologies and new media influence culture and education, including areas such as literacy, social justice, youth development, and teacher education.

This program encourages the use of a broad range of methods -- including both qualitative and quantitative approaches -- to study the intersections of communication and education across a variety of contexts. It asks, in particular, how education -- including schooling and other social systems -- change under the impact of emerging media. The program encourages students to:

- Reflect on the historical, cultural and social impact of a wide range of media
- Leverage relevant research methods and modes of inquiry to better understand how communication and media use shape learning practices
- Attend closely to both technological artifacts and human activity, reflecting on the diverse ways in which modes of communication condition the meanings actually, and potentially, communicated—particularly through the wide variety of digital means available to us.

Students graduating from the program in Communication and Education have pursued a wide variety of career paths, in accordance with their goals and interests. Some of these include:

- Teaching and research positions in higher education;

- Working in schools, museums or other educational institutions to leverage new media technologies in effective and empowering ways;
- Conducting formative and evaluative research on the use of media in/for learning, both within classrooms and beyond;
- Designing and implementing innovations in the use of new media for educational, social or civic purposes; or
- Working in government or nonprofit settings to shape the conversation around new media, communication, and learning through research and policy work.

Doctor of Education

Doctor of Education (Ed.D.) degree candidates should read Requirements for the Degree of Doctor of Education, which can be obtained from the Teachers College Office of Doctoral Studies. It states the formal requirements for the degree and lays out the steps leading to it.

The Communication, Media, and Learning Technologies Design (CMLTD) program follows these requirements, while providing doctoral students with a customizable experience based on core and specialized courses, skill concentrations, and independent research. These experiences have been designed to ensure that students master different modes of inquiry; contribute professionally to the field through conference presentations and publications; and participate actively in CMLTD research centers, events and initiatives.

Doctor of Education (Ed.D.) programs are offered in both Communication and in Instructional Technology and Media. In each of these Ed.D. programs, students must take coursework totaling at least 90 points. Programs are planned individually in consultation with the student's faculty advisor. Doctoral candidates should develop a systematic plan for study early in their program, encouraging sustained consideration of a dissertation topic and tailoring course selection to support dissertation work.

The following are required of all Ed.D. students:

Core Seminar: MSTU 4000 and Doctoral Colloquium: MSTU 6600 (3 points total)

- One-point registration for MSTU 4000. After MSTU 4000, Ed.D. students must take MSTU 6600 for a total of two points, and then continue to register

for MSTU 6600 for zero points each semester until graduation.

Foundational Knowledge: All four areas must be represented. (12 points, minimum)

- 1. Cognitive Issues and Technology
  - MSTU 4133 Cognition and Computers
  - MSTU 4088 Introduction to Learning Sciences and Educational Technology

- 2. Social Issues and Technology
  - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
  - MSTU 4020 Social and Communicative Aspects of the Internet

- 3. Cultural Issues and Technology
  - MSTU 4028 Technology and Culture
  - MSTU 5002 Culture, Media, and Education

- 4. Educational Practice and Design
  - MSTU 4001 Technology and School Change
  - MSTU 4050 Online Schools and Online Schooling K-12
  - MSTU 4083 Instructional Design of Educational Technology

Research Methods and Design: (12 points, minimum)

The following are examples of available courses. Students should familiarize themselves with the full range of courses that are offered and choose a class that is relevant to their dissertation work, in consultation with their faculty advisor.

- Introductory Quantitative Methods Course (3 points)
  - HUDM 4122 Probability and Statistical Inference
  - Note: HUDM 4120 Basic Concepts in Statistics, *does not* meet this requirement.

- Introductory Qualitative Methods Course: taken from the following or similar (3 points)
  - C&T 5502 Introduction to Qualitative Research in Curriculum and Teaching

- ITSF 5000 Methods of Inquiry: Ethnography and Participant Observation
- ITSF 5001 Ethnography and Participant Observation: Fieldwork, Analysis, Reporting

- Specialized Research Design (3 points)
  - MSTU 5001 Assessing the Impact of Technology in Schools
  - MSTU 5025 Research Technology in Educational Environment

- Additional non-introductory research methodology class (3 points)
  The following are examples of available courses. Students should familiarize themselves with the full range of courses that are offered and choose a class that is relevant to their dissertation work, in consultation with their faculty advisor.
  - A&HE 6151 Narrative Research in English Education
  - A&HL 4104 Discourse Analysis
  - HUDM 5122 Applied Regression Analysis
  - HUDM 5123 Linear Models and Experimental Design
  - ORL 6500 Qualitative Research Methods in Organizations: Design and data collection
  - ORL 6501 Qualitative Research Methods in Organizations: Data analysis and reporting

Breadth Requirement: (6 points, minimum)

Students must complete a minimum of three Teachers College courses, each for at least 2 credits, outside of the Communication, Media and Learning Technologies Design Program (i.e., courses with a prefix other than MSTU).

Complete the doctoral certification process (see explanation later in this section).

Successfully propose, complete, and defend the doctoral dissertation.

- Register for the Dissertation Seminar (MSTU 7501 or 7503, 1 point) when presenting the Dissertation Proposal. See also the regulations for MSTU 8900 and the section in the Academic Catalog on continuous registration.

Additional Requirements for Ed.D. students in Communication and Education (TECM)

- MSTU 4016 The History of Communication
- MSTU 5606 Readings in Communication Theory and Social Thought
- One programming course
    - MSTU 4031 Object-Oriented Theory and Programming I
    - MSTU 5003 Theory and Programming of Interactive Media I
- At least 15 points of MSTU courses
- Other courses chosen in consultation with an advisor

Doctoral Certification Process

The CMLTD program has designed its certification requirements to help prepare students for dissertation work and document that preparedness. The Doctoral Certification Process for CMLTD students has three steps. (Students' names are not sent forward to the Office of Doctoral Studies to be certified until all three of the following requirements have been successfully completed.)

1. An Integrative Question that the student answers in writing during the regular certification examination session that the Office of Doctoral Studies schedules each semester.

   This question is about some currently prominent educational technology topic that students answer by pulling material from CMLTD courses and course-related as well as independent readings. The best way to prepare for this question is to think of currently important educational technology topics related to your area of interest and try to think of how you would integrate content covered in different courses to address these topics. Please note: The CMLTD certification written examination will be a take-home exam (exam question will be distributed on Friday, written exam collected the following Monday). The written integrative question part of the certification process is not available during the summer.

2. A Literature Review or critical assessment of scholarship (a paper of around 30 pages, double-spaced) related to the student's dissertation plans. This represents a head start on the literature review chapter of the dissertation.

This paper is approved by the faculty advisor. Approved papers may be posted and generally available to others for future reference.

3. A Certification Pilot Project that would be a smaller scale version of what might be done in the dissertation or a project or pilot study that leads to the dissertation project. Generally, this certification project has three steps, but students should consult with their advisor for specific instructions:
    1. Write a short project proposal, which the faculty advisor must approve.
    2. Complete the project;
    3. Write a project report (around 30 pages), which is approved by the advisor.

When the faculty advisor verifies that the student has completed the Integrative Question portion, the Literature Review paper, and the Certification Pilot Project, the student is recommended for certification. To receive full certification for doctoral work, students must also meet certain college-wide requirements, as explained in the Degree Requirements section of this bulletin.

Policies on the Written Examination Portion of the CMLTD Certification Process

The exam question is constructed broadly so that it can be addressed by people from different perspectives and program strands within CMLTD. CMLTD students may refer to resources (books, journal articles, notes, etc.) while responding to the take-home exam question. References to people and articles are expected in the body of the response and work must not be mischaracterized. Please include a formal reference list at the end of the response. Past questions are available for students upon request. Please contact the program secretary to see the past exams on file.

Students can attempt to successfully complete the written response portion of the certification process no more than two times.

Evaluation Procedures

Each response is evaluated by the CMLTD faculty, who meet as a group to read students' examinations. Students' names are removed from their examinations and the examinations are then circulated during the meeting of the faculty. The examination is read and discussed and a decision is made about its grade.

Basic Evaluation Criteria

All responses are evaluated with regard to the following four questions:

1. Does the response address the question asked?
2. Does the response integrate material (using several references and sources) from each of three different core courses or from various perspectives or theories?
3. Does the response present a coherent and meaningful discussion?
4. Is the response substantive enough to convince the reader that the student has an advanced, graduate-level grasp of the field?

Doctor of Education in Instructional Technology and Media

Instructional Technology and Media (TEIT)

The Instructional Technology and Media degree programs examine the relationship between the design of technology, digital media, cultural context, social interaction, and learning. Courses provide extensive exposure to theories of cognition and design, as well deep dives into applications of these theories in practice. Consequently, while students will encounter a wide range of cognitive, social, and design theories, students are encouraged to consider the power, equity, and ethical implications of context and culture in their application across learning spaces and environments. Faculty and students' current areas of exploration include state of the art technologies such as virtual and augmented reality, the design of toys and digital games, maker education and digital fabrication, robotics and social pedagogical agents, artificial intelligence and computational literacy.

Students graduating from the program in Instructional Technology and Media have pursued a wide variety of career paths, in accordance with their goals and interests. Some of these include:

- Faculty, teaching, and research positions in higher education;
- Administrative and teaching positions in elementary, middle, and high schools;

- Creating educational technology startups and joining established industry leaders such as PBS, Nickelodeon, Google, Amazon, Sesame Workshop;
- Research and design positions in informal learning contexts such as museums and non-profit organizations to leverage new media technologies in effective and empowering ways;
- Research positions and design of technology-based training in corporations;
- Conducting formative and evaluative research on the use of media in/for learning, both within classrooms and beyond;
- Designing and implementing innovations in the use of new media for educational, social or civic purposes; or
- Working in government or nonprofit settings to shape the conversation and policy around new media and learning through research and policy work.

Participants in all CMLTD program areas share a basic conviction that good design in educative matters starts with careful attention to the needs and characteristics of the individuals that the design will serve. For example, the ability to understand the individual through empirical research and empathic engagement will make the design of instructional technology not only technically proficient but educationally valuable as well. In all, this attention to the individual in society and culture defines the technological humanism we seek through all components of the programs in CMLTD—a humanism that combines the use of sophisticated technology with humane commitments for guiding purposes.

Doctor of Education

Doctor of Education (Ed.D.) degree candidates should read Requirements for the Degree of Doctor of Education, which can be obtained from the Teachers College Office of Doctoral Studies. It states the formal requirements for the degree and lays out the steps leading to it. Communication, Media and Learning Technologies Design requirements provide experiences through basic courses, skill concentrations, and independent projects, all leading to the certification examination and the dissertation. These experiences have been designed to ensure that students develop skills in one or more modes of inquiry; contribute professionally to the field through conferences, presentations, or publications; and participate actively in CMLTD functions outside of class work.

Programs are planned individually in consultation with a faculty advisor. Doctoral candidates should develop a systematic plan for study early in their program, encouraging sustained consideration of a dissertation area and tailoring course selection to support dissertation work. The doctorate represents the highest level of educational preparation achievable in the field. To complete it well, students should meet all requirements in an intellectual spirit consonant with this status. Doctor of Education (Ed.D.) programs are offered in both Communication and in Instructional Technology and Media. In each of these Ed.D. programs, students must take coursework totaling at least 90 points. The following are required of all Ed.D. students:

Core Seminar: MSTU 4000 and Doctoral Colloquium: MSTU 6600 (3 points total)

- One-point registration for MSTU 4000. After MSTU 4000, Ed.D. students must take MSTU 6600 for a total of two points, and then continue to register for MSTU 6600 for zero points each semester until graduation.

Foundational Knowledge: All four areas must be represented. (12 points, minimum)

- Cognitive Issues and Technology
  - MSTU 4133 Cognition and Computers
  - MSTU 4088 Introduction to Learning Sciences and Educational Technology
- Social Issues and Technology
  - MSTU 4005 Equity, Ethical, and Social Issues in Educational Technology
  - MSTU 4020 Social and Communicative Aspects of the Internet
- Cultural Issues and Technology
  - MSTU 4028 Technology and Culture
  - MSTU 5002 Culture, Media, and Education
- Educational Practice and Design
  - MSTU 4001 Technology and School Change
  - MSTU 4050 Online Schools and Online Schooling K-12
  - MSTU 4083 Instructional Design of Educational Technology

Research Methods and Design: (12 points, minimum)

- Introductory Quantitative Methods Course (3 points)
  - HUDM 4122 Probability and Statistical Inference
  - Note: HUDM 4120 Basic Concepts in Statistics, *does not* meet this requirement.
- Introductory Qualitative Methods Course: taken from the following or similar (3 points)
  - C&T 5502 Introduction to Qualitative Research in Curriculum and Teaching
  - ITSF 5000 Methods of Inquiry: Ethnography and Participant Observation
  - ITSF 5001 Ethnography and Participant Observation: Fieldwork, Analysis, Reporting
- Research/Research Design Applied to Technology (3 points)
  - MSTU 5001 Assessing the Impact of Technology in Schools
  - MSTU 5025 Research Technology in Educational Environment
- Additional, non-introductory quantitative, qualitative, or other non-introductory research methodology class (3 points)
  The following are examples of what is available. Students should familiarize themselves with the full range of courses that are offered and choose a class that is relevant to their dissertation work, in consultation with their faculty advisor.
  - A&HE 6151 Narrative Research in English Education
  - A&HL 4104 Discourse Analysis
  - HUDM 5122 Applied Regression Analysis
  - HUDM 5123 Linear Models and Experimental Design
  - ORL 6500 Qualitative Research Methods in Organizations: Design and data collection
  - ORL 6501 Qualitative Research Methods in Organizations: Data analysis and reporting

Breadth Requirement: (6 points, minimum)

All students (at both master's and doctoral levels) must complete a minimum of three courses, each for at least 2 credits, at Teachers College outside of the Communication, Media and Learning Technologies Design Program (that is, courses with a prefix other than MSTU).

Complete the doctoral certification process (see explanation later in this section).

Successfully propose, complete, and defend the doctoral dissertation.

- Register for the Dissertation Seminar (MSTU 7501 or 7503, 1 point) when presenting the Dissertation Proposal. See also the regulations for MSTU 8900 and the section in the Academic Catalog on continuous registration.

Additional Requirements: for Ed.D. students in Instructional Technology and Media (TEIT)

- MSTU 4083 Instructional Design of Educational Technology
    - Counts toward the Foundational Knowledge area
- Two programming courses must be taken. This requirement can be met by taking the two-course Object-Oriented or Interactive Media programming sequence.
    - MSTU 4031 and 5031 Object-Oriented Programming and Theory I & II
    - MSTU 5003 and 5013 Theory and Programming of Interactive Media I & II
- At least 15 points of additional MSTU courses
- Other courses chosen in consultation with an advisor

Doctoral Certification Process

The Doctoral Certification Process for CMLTD students has three steps. Students' names are not sent forward to the Office of Doctoral Studies to be certified until all three of the following requirements have been successfully completed.

1. An Integrative Question that the student answers in writing during the regular certification examination session that the Office of Doctoral Studies schedules each semester.

   This question is about some currently prominent educational technology topic that students answer by pulling material from CMLTD courses and course-related as well as independent readings. The best way to prepare for this question is to think of currently important educational technology topics related to your area of interest and try to think of how you would integrate

content covered in different courses to address these topics. Please note: The CMLTD certification written examination will be a take-home exam (exam question will be distributed on Friday, written exam collected on the following Monday). The written integrative question part of the certification process is not available during the summer.

2. A Literature Review or critical assessment of scholarship (a paper of around 30 pages, double-spaced) related to what is planned for the dissertation. This gives a head start on the literature review section of the dissertation. This paper is graded by the faculty advisor. Approved papers may be posted and generally available to others for future reference.

3. A Certification Pilot Project that would be a smaller scale version of what might be done in the dissertation or a project or pilot study that leads to the dissertation project. This certification project has three steps:
    1. Write a short proposal (five or fewer double spaced pages) of the planned project, which the faculty advisor must approve. The nature of the project would vary depending on the student's interests;
    2. Complete the project;
    3. Write a project report (around 30 pages), which is graded by the advisor.

When the faculty advisor verifies that the student has completed the Integrative Question portion, the Literature Review paper, and the Certification Pilot Project, the student is recommended for certification. The CMLTD program has designed its certification requirements to help prepare students for work on their dissertations and to document that preparedness. To receive full certification for doctoral work, students must also meet certain college-wide requirements, as explained in the Degree Requirements section of this bulletin.

Policies on the Written Examination Portion of the CMLTD Certification Process

The exam question is constructed broadly so that it can be addressed by people from different perspectives and program strands within CMLTD. CMLTD students may refer to resources (books, journal articles, notes, etc.) while responding to the take-home exam question. References to people and articles are expected in the body of the response and work must not be mischaracterized. Please include a

formal reference list at the end of the response. Past questions are available for students upon request. Please contact the program secretary to see the past exams on file.

Students can attempt to successfully complete the written response portion of the certification process no more than two times.

Evaluation Procedures

Each response is evaluated by the CMLTD faculty, who meet as a group to read students' examinations. Students' names are removed from their examinations and the examinations are then circulated during the meeting of the faculty. The examination is read and discussed and a decision is made about its grade.

Basic Evaluation Criteria

All responses are evaluated with regard to the following four questions:

1. Does the response address the question asked?
2. Does the response integrate material (using several references and sources) from each of three different core courses or from various perspectives or theories?
3. Does the response present a coherent and meaningful discussion?
4. Is the response substantive enough to convince the reader that the student has an advanced, graduate-level grasp of the field?

Application Information

Master's (M.A. and Ed.M.) applicants are reviewed on an ongoing basis. For scholarship awards, applicants who meet the early deadlines receive preference (January 15 for summer and fall and November 1 for spring) with the most aid going to doctoral students who meet the Ed.D. January 2 early deadline. All applicants should consult the Admissions Office (www.tc.columbia.edu/admissions/) for additional application information.

Doctoral (Ed.D.) applicants are required to submit a writing sample, prior transcripts, letters of recommendation, a personal statement, and results from the GRE General Test (a TOEFL test score is required of international students). They are also strongly encouraged to arrange for an interview. In making financial aid decisions, CMLTD reviews doctoral applications once a year in late February with the expectation that doctoral students will start during summer or fall sessions. Consequently, doctoral candidates are encouraged to meet the January 2 early deadline. There is no guarantee of progression from a master's program to a doctoral program within CMLTD. In addition to academic criteria, CMLTD takes into account the relevance of its resources to a prospective student's professional goals as described in the personal statement when making admission decisions.

Faculty List

Faculty

Paulo Blikstein
Associate Professor of Communications, Media and Learning Technology Design

Nathan R. Holbert
Assistant Professor of Communication, Media and Learning Technologies Design

Ioana Literat
Assistant Professor of Communication, Media, and Learning Technologies Design

Ellen B. Meier
Professor of Practice

Sandra Okita
Associate Professor of Technology and Education

Detra Michelle Price-Dennis
Associate Professor of Education

Lalitha M Vasudevan
Professor of Technology and Education

Lecturers

Yoo Kyung Chang
Lecturer

Jin Matthew Kuwata
Lecturer

Joey Lee
Lecturer

Adjunct

Tara Lynn Conley
Adjunct Assistant Professor

Mark Dzula
Adjunct Assistant Professor

Tucker Brown Harding
Adjunct Assistant Professor

Susan Lowes
Director, Research and Evaluation

Reshan Benedict Richards
Adjunct Assistant Professor

Instructors

Bradley Wells Ashley
PT Instructor

Daniel Leo Buckley
Part Time Instructor

Michael John Cennamo
Part Time Instructor

Nigel Frazier
PT Instructor

Kristin Gorski
Director of Academic Administration

Sharmin Ara Hakim
Senior Research Associate

Elliot Matthew HuAu
Part Time Instructor

Charles Kinzer

Ahram Park
Administrative Coordinator

Course List

MSTU 4000 Core seminar in communication, media, and learning technologies design

Required for incoming students. Discussion of critical issues; reading of key works; development of project in Communication, Media, and Learning Technologies Design; presentation of work in progress; conversations with leaders in the field.

MSTU 4001 Technology and school change

This course explores how technology is currently used in our schools and how technology can be used more effectively as a catalyst for larger school reform efforts. Participants will examine some of the institutional forces shaping the integration of technology into our schools and some of the institutional change theories that influence these forces to address the question: What can technology contribute to school improvement and how can we facilitate those changes?

MSTU 4005 Equity, ethical and social issues in educational technology

Addresses a wide range of issues concerning equity and access, including differential gender, racial, and ethnic uses of computers. Examines legal and ethical issues in students' use of technology with an emphasis on improving access and use of technology for all students.

MSTU 4010 Theories of communication

A broad, multidisciplinary survey of contemporary perspectives on communication. Topics include: definitions, models and theories of information processing, history of media change, cross-cultural communication, interpersonal communication, and the uses and effects of mass media.

MSTU 4012 Video as art: An exploration

This course will take an aesthetic approach to the exploration of emerging forms of video, including anime, music videos, do-it-yourself video, video sharing websites, and more. Students will be engaged in video production throughout the course.

MSTU 4016 The history of communication

A comprehensive survey of the history of communication, tracing the development of the dominant modes of transmitting knowledge from speaking to writing, from printing to the electronic media.

MSTU 4020 Social and communicative aspects of the Internet

Examines social communicative practices as synergistic; how space, time, and social networks evolve and interact; and what this implies for the design and use of technology.

MSTU 4022 Online learning, online communities, and collaborative interchange

Introduction to the use and educational implications of online learning, online communities, and the collaborative interchange and activities that take place using information and communication technologies (ICT).

MSTU 4023 Cinema as cross-cultural communication

Analyzes how films explore culture. Discussion of the film as well as the cultural messages portrayed.

MSTU 4024 Visual media and the development of youth

This course brings a sociocultural lens to issues related to youth (including children and adolescents) and the evolving terrain of visual media. Students will review research and theories and experiment with media production in this course. No prior media production experience is necessary.

MSTU 4028 Technology, culture, and society

This course examines the relationship between technology, culture and society, with a particular emphasis on new and emerging media. Course readings include sources both popular and academic, theoretical and empirical, contemporary and non-contemporary, optimistic and skeptical, thus representing a wide variety of perspectives regarding the relationship between technology and culture.

MSTU 4029 Managing educational technology resources

For educators involved in the planning, implementation, and maintenance at the building/campus level. Students learn how to apply educational technology to achieve educational objectives and to manage interpersonal relations in the process.

MSTU 4031 Object-oriented theory and programming I

Communicating with computers and humans through programming language in an object oriented style. Uses Java to formalize the concepts behind software structure and construct representative applications.

MSTU 4037 Computers and the uses of information in education

This course examines how computers can structure and present information, evaluates current educational software that uses information, and considers the design of software for integrating information applications into education. Prerequisite: MSTU 4030 or equivalent computer experience.

MSTU 4039 Video games in education

Provides students with tools they will need to understand, analyze, and build games. Focus is on gaining an understanding of rules, interactivity, play, social interaction, and all other factors that go into making an innovative and fun game. Primary focus is on the basic language of games: game play and game design. Course also addresses games from an educational perspective.

MSTU 4040 Mobile learning

This course considers both theoretical and practical perspectives in using mobile apps and devices for learning. The focus is on three primary goals: (1) explore, analyze and critique mobile apps and related technologies and their affordances for learning; (2) practice user-centered design principles and basic user-experience research techniques to design mobile interfaces for learning; (3) review and discuss relevant research studies and pedagogical and theoretical frameworks for mobile learning.

MSTU 4049 Technologies and literacies

An examination of the relationship between computers and the writing process. The course explores the effect of electronic text on traditional notions of text, literacy, and communication. Assumes no computing experience.

MSTU 4050 New models for K-12 schooling : Online and virtual schools

This course examines the different models of the K-12 virtual school and virtual schooling experience in the United States and internationally.

MSTU 4052 Computers, problem solving, and cooperative learning

What makes a "good problem" and how can computer-based technologies support active learning processes, to get learners to negotiate their understanding through cooperative/collaborative approaches? This course

challenges students to think BEYOND: 1) problems as simply prefixes to recalled solutions, 2) computer-based technologies as mere delivery platforms, and 3) collaboration/cooperation as a byproduct of sharing information. Instead, by the end of the course students will understand the nature of different kinds of problems in relation to specific learning contexts and goals. We'll explore an array of computer-based technologies and examine specific features and functions that encourage learners to actively grapple with deep structures of a problem while engaging in desired learning processes. Students will design great problems and supporting activities that leverage the specific strengths of computer-based technologies, inspiring meaningful solutions through a collaborative/cooperative learning experience.

MSTU 4083 Instructional design of educational technology

The nature of instructional technology. Systems approaches to planning, managing, and evaluating instructional processes and materials. Emphasis is on instructional design.

MSTU 4088 Introduction to educational technology and the learning sciences

This course examines how learning may be effectively facilitated by different social and organizational settings and new learning environment designs, particularly those incorporating information and communication technologies (ICT), and in computer supported collaborative learning (CSCL) through the lens of educational technology. The course draws from the major disciplinary foci that are found within the general framework of studies in the learning sciences (STEM areas, communication/literacy, and teacher education) and the different methodologies that are used to design technology tools and study their effects on learning. The course will provide the interdisciplinary knowledge foundational to educational technology solutions to learning in and out of school settings, and link this to the general category that has become known as the learning sciences.

MSTU 4133 Cognition and computers

This course explores ideas about cognition and knowledge representation and how they relate to the use of computers in instruction. Students select a subject area, learn to represent knowledge from it so that it can be implemented in a computer instructional system, and use the knowledge representation to characterize the cognitive prerequisites and consequences of learning to use computers.

MSTU 4134 Cognition and computers lab

Permission required. Corequisite: MSTU 4133.

MSTU 4141 Social media & learning

In this course, we examine the impacts, benefits, and risks of social media as it relates to a variety of learning endeavors. The course focuses on three things: 1) Exploring the unique learning opportunities present in different types of social media and social interactive platforms, 2) understanding the phenomenon of social learning through theories and principles grounded in empirical research, and 3) reflecting on how our experiences, both personal and that of others, are shaped by the expression and interpretation of social factors inherent to the medium. Students will explore and actively use different social media throughout the term and collaboratively design social-media driven learning experiences rooted in theory.

MSTU 4504 Ethical issues in technology design

This course addresses a wide range of issues regarding ethics and values in technology design, and their unintended or intended effects on cognition, behavior and society. Focuses especially on social media, virtual reality, games, robotics, artificial intelligence, interactive media, interaction design and related areas.

MSTU 4700 Student teaching practicum in educational technology

The Technology Specialists student practicum supports the school practicum experiences through readings and weekly classes focused on key issues: addressing diversity, classroom project design, technology integration, and professional development. The Practicum provides an opportunity to reflect on classroom experiences, to design technology-integrated projects, and to match the unique skills of each candidate with the unique demands of each placement.

MSTU 5000 Extended reality and games as learning tools

Explores possibilities of virtual worlds for gaming and education. Through readings and theoretical discussions of identity construction, positioning, and social aspects of virtual and traditional communities, participants explore how virtual environments may support teaching and learning and how virtual communities are affecting people's lives.

MSTU 5001 Assessing the impact of technology in our schools

This course examines the evidence of technology's effectiveness in educational settings. Key concepts related to quantitative and qualitative research perspectives are explored in the process of understanding how technology research has evolved. An examination of key concerns reflected in the current research literature provides a foundation for designing an original research project.

MSTU 5002 Culture, media and education

In this course, we consider the cultural implications of media and technologies for education by pairing theoretical frameworks with case studies and other examples of empirical research.

MSTU 5003 Theory and programming of interactive media: Part 1

This course introduces the fundamentals of design and development for interactive front-end web applications. Students are provided with tools and theoretical knowledge for understanding and analyzing specific learning problems in order to their develop ideas into multimodal web-based learning experiences, through hands-on projects. UX theory and methods are integrated to ensure that students emerge as authors of well-designed and documented web artifacts. This course lays the foundation for the computational and design thinking necessary to conceive, plan, and build learning technologies. This course is a prerequisite for Part II.

MSTU 5004 Digital geographies and virtual spaces

Explore newly-developed spaces and consider how the evolving relationship between new technologies and new modes of communication and literacy are making these spaces available.

MSTU 5005 Case-based teaching in electronic environments

Focuses on theory related to designing, developing, and using multimedia case methodology in education. Students are encouraged to examine educational case methodology within their interest area.

MSTU 5006 Database-driven website development

Explores and provides a working knowledge of the technical and theoretical underpinnings of web application development by examining the layers of database construction, web programming, and user interface design.

MSTU 5010 Boundaries and theories of learning with technological artifacts

This course will explore learning partnerships that take place between people and technological artifacts (robots, agent-avatars). The course examines social components of technological artifacts, introduces current research findings on learning in social interactions with such artifacts, and links these to cognitive factors that influence learning, knowledge construction, design, and assessment. Emphasis will be placed on the learning effect on the human partner. Small groups of students will work on a project throughout the semester.

MSTU 5013 Theory and programming of interactive media: Part II

This course is the second-level course in a sequence beginning with MSTU 5003. Students acquire advanced theoretical and technical knowledge needed to design and develop interactive web-based instructional applications grounded firmly in learning theory and design principles. The course is project-based whereby students delve into specific learning research to produce a theoretical model and well-aligned technical solutions. While the introductory course focuses on basic theory and technical implementation of instructional interactive media, Part II dives deeper into all aspects of the topic.

MSTU 5015 Research/programming in serious games

This seminar-based course features an in-depth exploration of a range of research topics related to games in education, especially tailored for students currently involved in game-based research or those who are interested in pursuing a research project in the area. It provides a forum for students to present, receive feedback, and make progress on their current research. It also permits students with an interest in Serious Games to launch a research project of their own. Experience with game design and programming skills are highly recommended.

MSTU 5018 Sociable technologies and robots in learning and behavior

Many technological artifacts have sociable and engaging characteristics that can influence the learner's knowledge construction. This course explores the design and impact of robots, robotic devices, and robotic systems on human learning, cognition, and behavior. Through research and hands on activities, this course will examine the background history, strengths, limitations, and challenges of sociable technologies as learning tools and companions in assisting collaborative learning activities with and between students.

MSTU 5020 Computer-mediated communication

Analyzes characteristics of such computer-mediated communication systems as networked multimedia, electronic mail, bulletin boards, and computer conferencing and situates these systems in the context of the emerging national information infrastructure. Students will participate in online communication systems.

MSTU 5025 Researching technology in educational environments

This course is designed as an overview of research designs and methodologies for students who are interested in researching the uses of technology in education, including both face-to-face and online/distance learning environments. The course looks at the theoretical bases for, and practical implementation of, different quantitative and qualitative research approaches, methodologies, and instruments. It is structured around a series of hands-on case studies in which students design research studies, revise existing instruments, and analyze previously collected data for technology-related projects in classrooms and online. Students are encouraged, but not required, to come with a research project in mind.

MSTU 5027 Tools & toys for knowledge construction

This course is a hands-on design course intended to introduce students to the core tenets and techniques of constructionist design. In this course students will explore, use, and evaluate existing educational technologies specifically designed to engage learners in personally meaningful construction. These technologies include virtual construction environments and tools (NetLogo, Scratch, Pencil Code, etc.) for creating digital games, simulations, or interactive stories as well as state-of-the-art prototyping equipment (3D printers, laser cutters, microcontrollers, etc) for developing wearables, robotics, interactive exhibits, and electronic toys. While a portion of this course will be devoted to becoming familiar with the affordances of these technological tools, the primary goal will be for students to design and develop a new tool or environment for knowledge construction.

MSTU 5029 Technology leadership and schools

This course identifies appropriate key leadership theories and recent findings from educational technology research to inform the most relevant and timely leadership concerns for technology policy and practice. The class uses case studies to explore leadership challenges related to technology integration and

provides an opportunity to develop an original case study based on leadership theories and the research literature on technology challenges for today's schools.

MSTU 5030 Intelligent computer-assisted instruction

Prerequisite: MSTU 4133. Participants study ideas about the representation of knowledge, models of the learner, and teaching strategies that have been developed in artificial intelligence and cognitive psychology, as well as develop and test intelligent computer-assisted instruction materials for topics of interest.

MSTU 5031 Object-oriented theory of programming II

Prerequisite: MSTU 4031 or a solid basic knowledge of programming. Applies programming to significant problems using Java or C++ to construct salient applications.

MSTU 5033 Educational technology policy: Challenges and opportunities

This course will examine current technology policy issues confronting schools at the federal, state, and local level. Students will explore existing policy in three critical areas: digital capacity, digital content, and digital use. Within these categories, students will discuss key questions, identify critical policy players, and investigate various perspectives related to various policy dilemmas.

MSTU 5035 Technology and metacognition

This course explores how theories of learning, development, and cognition can shape the design of instruction. Readings cover a range of instructional theories and highlight the underlying influences of those theories. Although the course includes a brief survey of historical trends in the field, the primary course focus is on current and emerging theories of instruction, such as distributed and dynamical views of cognition and learning. Students are encouraged to present and discuss their research interests and projects as they relate to the focus of the course.

MSTU 5102 Art in the digital age: Implications of new media technologies on culture and creativity

This course investigates, from the perspective of communication and new media studies, the role of the Internet in shaping the field of art and creativity. How do the Internet and other interactive communication technologies impact the creation, exhibition, interpretation, reappropriation and funding of creative

works? How can new media technologies enhance participation in these processes, and what are the social, cultural, ethical, and legal implications of this participatory shift?

MSTU 5191 Educational video production I

Practical studio and field production experience of educational video programs with special concern for realizing educational purposes through directing, scripting, staging, camera operation, lighting, and sound design.

MSTU 5515 New media teaching and learning

Permission required. This course provides students with experience in the development of new media projects and a forum for discussing the implications for new media on education, particularly in higher education. The course involves a fieldwork component.

MSTU 5555 Technology and the emergence of a global curriculum

This course deals with the impact of technology on human society over the ages, how technology in particular is shaped by, and in turn shapes, the vision informing a specific culture and its curriculum, and how the global sharing of technology is inexorably contributing to the emergence of a common global curriculum.

MSTU 5606 Readings in communication theory and social thought

The aim of this course is to introduce students to foundational works and influential ideas in the study of communication and culture.
Topics include semiotics, Marxism, feminist theory, cultural analysis, global communication frameworks, and other topics relevant to students enrolled in the class. We will apply these theoretical tools to examine a wide range of communication practices, popular media and sites of cultural expression.

MSTU 5814 Work conference

Occasional brief conferences convened by Communication, Media, and Learning Technologies Design on subjects of special interest.

MSTU 6000 Advanced design of educational games

This course serves as an intensive workshop for designing and producing educational games as well as a scholarly opportunity for students interested in the advanced study of games.

MSTU 6532 Seminar in communication, media, and learning technologies design

This course will focus on a variety of multimodal approaches to conducting qualitative research. Texts will draw from a range of theoretical and conceptual traditions in which multimodal methods have been explored. Students' own data will also serve as central texts for the course, and they will be expected to engage in data analysis with either their own existing data or data that they will collect as part of this course. The course will follow a seminar style that will include ample peer feedback, trying out different forms of multimodal analysis, and a culminating analytical project.

MSTU 6600 Colloquium in Communication, Computing, and Technology in Education

Continuous participation required of certified doctoral students. Discussion of critical issues, reading of key works, formal proposal of dissertation topics, presentation of work in progress, and conversations with leaders in the field.

MSTU 7501 Dissertation seminar

Permission required. Presentation of dissertation proposal for approval by a sponsoring committee. Student arranges one two-hour meeting with his or her sponsoring committee.

MSTU 8900 Dissertation advisement

Advisement on doctoral dissertations. Fee to equal 3 points at current tuition rate for each term. See section in this bulletin on Continuous Registration for Ed.D. degree.

Mathematics Education

Department of - Mathematics, Science & Technology

Contact Information

Phone: (212) 678-3381

Fax: (212) 678-8319

Email: tcmath@tc.edu

Director: Professor Alexander Karp

Program Description

Over its long and distinguished history, the Program in Mathematics Education has stressed the preparation of leaders in education. These leaders are successful scholars in their discipline, as well as educators. Faculty and staff are committed to leadership training through a variety of courses, workshops, and research experiences and through domestic and international study offerings. Many of the local learning experiences are performed in collaboration with private, public, and parochial schools in the tri-state metropolitan region.

Master's-level offerings in Mathematics Education are appropriate for both initial and professional teachers. Advanced master's and doctoral programs complete preparation for a variety of positions including: teaching, supervisory, and research roles spanning the elementary through college levels of instruction. Some courses offered through these programs are intended especially for students from other areas of study at Teachers College who need to acquire knowledge and skills in mathematics but who do not wish to earn a degree in this area.

A hallmark of Teachers College Mathematics Education program is a strong emphasis on mathematics content and the role of mathematical ways of thinking in the teaching and learning of mathematics. Our graduates take positions in college teaching of mathematics, in addition to pre-college professional roles.

Master of Arts

Emphasis is placed on those competencies necessary for effective mathematics teaching as a means of enhancing professional growth of initial and professional teachers. Conceptual issues in teaching are translated into practice through group and individualized instruction in special methods courses. Master of Arts requirements include a culminating scholarly project.

A minimum of 32 points of coursework is required, along with a final essay or project. No transfer credit for graduate courses completed elsewhere can be applied to the M.A. degree. Courses taken through these programs and elsewhere at Teachers College in mathematics, mathematics education, and professional education to meet individual needs may be supplemented with permission by courses taken in other faculties of Columbia University.

Master of Science and Master of Education

Both programs require a minimum of 60 points, a formal essay or integrative project, and involve extensive preparation in mathematics, as well as education. For the Master of Science degree, the college requires that a minimum of 32 points with an integrative project be completed under the auspices of Teachers College. Master of Science and Master of Education students who choose to do a formal essay may apply a maximum of 30 semester hours of graduate credit toward their degree requirement. Please refer to the Degree Requirements section of this bulletin for college-wide minimum point requirements. For the M.S. degree, there is greater emphasis on preparation in mathematics content. In the Ed.M. program, there is greater emphasis on preparation in professional education. Programs are arranged in consultation with the major professor to meet both program and college requirements.

Applicants for the M.S. and Ed.M. degrees must also prepare a written integrative project.

Doctoral Degrees

The department provides programs for the Ed.D. Ed.DCT, and the Ph.D. degrees. In general, the Ed.D. degree places emphasis on breadth of professional coursework with a focus on educational practice. All candidates are required to be competent in statistical research methodology and computing and to have knowledge of the epistemology of mathematics and of psychology sufficient to be an informed scholar-practitioner. All doctoral candidates must have a written program plan approved by their advisor. The approved plan then must be approved by the Office of Doctoral

Studies. The student then completes doctoral coursework and engages in doctoral research and writing. Refer to the Ph.D. and Ed.D. Requirements Bulletin, prepared by the Office of Doctoral Studies, for a fuller description of degree requirements.

In planning a program of study, it should be noted that doctoral students are required to complete a minimum of 20 points after taking the certification examination for the first time, including points taken during the term in which that examination is taken.

Specializations:

Elementary School Mathematics

The Elementary School Mathematics Specialist specialization is designed for those who are preparing for positions of leadership in elementary schools or in the training of elementary school teachers. Programs for elementary school specialists emphasize knowledge of subject matter, methodologies, and curricula of mathematics and include appropriate field experiences with elementary school students and teachers. In addition to program offerings, students have access to courses in related departments and institutions.

Secondary School Mathematics

The Secondary School Teaching specialization includes an in-service component for experienced teachers and preservice education for students entering the profession. Programs are designed individually in consultation with a faculty advisor to reflect each teacher's background and goals. The program stresses the direct application of theory to practice with particular emphasis on experiences with teaching strategies that match classroom activities to student characteristics, that examine teacher and student interpersonal interaction, and that reflect the historical and philosophical roots of the discipline. The final project for the degree should include evidence that these components have been fulfilled.

Supervision in Schools

Students interested in mathematics supervision in schools may elect to develop individual programs that reflect their specific background and interests and that draw on the resources of the department and college, or they may work as part of the staff of the field-based teacher education programs. School and university faculty work with graduate students in a collaborative effort where teaching, preservice, and supervision training and education research are intimately related.

Teacher Education in Mathematics

The Teacher Education in Mathematics specialization is designed to prepare scholars for educational leadership roles as education professors in colleges and universities. Participants in the program have opportunities to build their mathematics content background through content courses in the department and the offerings of Columbia University. There are opportunities also for professional experiences in the initial and professional teacher education programs.

College Teaching of an Academic Subject

Teachers College offers a doctorate in college teaching that emphasizes preparation in content supplemented by a program of professional education. Field experiences can be pursued in mathematics, computing, and several related disciplines. The course content and sequence are especially organized to meet the unique needs and career goals of each candidate within the general requirements of the Ed.D. degree at Teachers College.

Degree Summary

MATHEMATICS EDUCATION (MATH)

Degrees offered:

- Master of Arts (M.A.)
- Master of Science (M.S.)
- Master of Education (Ed.M.)
- Doctor of Education (Ed.D.)
- Doctor of Education in the College Teaching of an Academic Subject (Ed.D.C.T.)
- Doctor of Philosophy (Ph.D.)

MATHEMATICS EDUCATION-INITIAL CERTIFICATION (MATH-INIT)

Degree offered:

- Master of Arts (M.A.)

Initial Certification Master of Arts degree students and applicants should direct admissions and certification questions to Dr. Stuart Weinberg at (212) 678-3717 or saw29@tc.columbia.edu.

MATHEMATICS EDUCATION-PROFESSIONAL CERTIFICATION (MATH-PROF)*

Degree offered:

- Master of Arts (M.A.)

  * Program not currently accepting applications

MATHEMATICS EDUCATION-TRANSITIONAL B (MATH-TRAN)

Degree offered:

- Master of Arts (M.A.)

For a complete listing of degree requirements, please continue on to this program's "Degrees" section in this document

Degree Requirements

General

Programming competencies in at least one computer language and further computer science training equivalent to at least 6 points of graduate study ordinarily are required of all students seeking degrees beyond the Master of Arts. These points either can be included in the mathematics/mathematics education requirement or can be taken as electives.

In addition to content courses in mathematics, students should enroll in at least two professional courses in mathematics education such as MSTM 4019, MSTM 4020, MSTM 5011, or MSTM 5520.

Master of Arts

Normally students complete 24 points in courses in mathematics and mathematics education including MSTM 4019 and selected courses in related disciplines such as statistics and discrete mathematics. The remaining 8 points (3 courses) are reserved for electives chosen from professional areas such as psychology, philosophy, curriculum, etc. Programs for specialists in the teaching of elementary school mathematics should include MSTM 5010. Secondary school specialists should enroll in MSTM 5023, MSTM 5032, and MSTM 5037.

Prospective community college teachers should select courses in at least three mathematical areas such as analysis, algebra, and computing, in preparation for study beyond the master's level. Preparation in computing is recommended for all specializations. Initial certification students should refer to the program brochure for information on additional requirements for state certification. All applicants for the M.A. degree must prepare a written project as a culminating integrative experience.

Master of Science

Normally the program of studies for the Master of Science (M.S.) degree should include 42 points in courses in mathematics and mathematics education. Preparation in mathematics content should be of sufficient depth in two or three areas to communicate content effectively at the freshman and sophomore college levels. Algebra and analysis are recommended as areas of concentration. Content courses can be selected from courses offered by the department or from courses offered by the Graduate School of Arts and Sciences of Columbia University. Preparation in statistics is also recommended.

Master of Education

Typically, the program of studies for the Master of Education (Ed.M.) degree should include 42 points in courses in mathematics and mathematics education. Preparation in mathematics content should be of sufficient depth to provide leadership to elementary and secondary school teachers. Content courses can be selected from courses offered by the department or from courses offered by the Graduate School of Arts and Sciences of Columbia University. Students interested in developing research competencies for further graduate study should elect at least 6 points in statistics. HUDM 4122, Probability and statistical inference, and HUDM 5123, Linear models and experimental design, are recommended.

Doctoral Degrees

All candidates for the Ed.D., Ed.D.C.T., or Ph.D. degrees are expected to demonstrate both mathematics and mathematics education competencies through a series of certification examinations taken upon the completion of 60 graduate points. Certification examinations test the student's knowledge of current research and theory in mathematics education and mathematics content. Examinations are

offered once in the fall, spring, and summer terms. Courses recommended as preparation for the examinations include MSTM 4019/4020, MSTM 6037, and 6000-level mathematics content courses.

Students must demonstrate acceptable proficiency in at least three of the following six mathematics content areas: algebra, analysis, computer mathematics, foundations of mathematics, geometry and topology, and probability and statistics. Students may sit for the examination in mathematics content during the regular certification examination times. Alternatively, they may register for advanced content courses and, with permission of the program, sit for the content area certification examination upon completion of the course. Incoming doctoral candidates should register for Professional Seminar in Mathematics during the first year of doctoral studies.

Doctoral students whose dissertations require statistical analysis should include appropriate statistics courses in their programs. These points can be included either in the mathematics/mathematics education requirement or can be taken as research electives.

- Learn more about our Topic Study Groups (use your UNI to sign in)

Doctor of Education

A program of study for the Doctor of Education (Ed.D.) degree must include a minimum of 90 semester hours of approved graduate credit, at least 45 points of which must be taken under Teachers College registration. In order to permit the acquisition of broad basic scholarship, each program of study should include at least 70 points in mathematics and mathematics education. At least 24 points should be at an advanced level. Ordinarily, points in mathematics and mathematics education should include at least 45 points in mathematics content courses, 12 points in mathematics education courses, and 12 points of research preparation including MSTM 6500 and MSTM 7500.

Professional courses taken outside the program of Mathematics Education normally should include 15 points in the curricular, psychological, and social foundations of education. Students specializing in teacher education are

encouraged to select elective courses related to higher education programs and practices. Preparation in computing and statistics is also recommended. Programming competencies in at least one computer language and further computer science training equivalent to at least 6 points of graduate study are desirable. Students whose dissertations involve statistical analysis are required to include appropriate statistics courses in their programs. These points can be included either in the mathematics/mathematics education requirement or can be taken as electives.

The Ed.D. culminates in a dissertation contributing knowledge to the field and should be planned early in the doctoral program when sufficient advanced courses have been completed to permit the candidate to enroll in relevant research courses and pertinent advanced study to enable efficient preparation of the dissertation. Dissertations in mathematics education can be (1) experimental studies in learning, (2) design and formative evaluation of mathematics curricula, or (3) analytical studies in policy theory in mathematics education.

Doctor of Education in the College Teaching of an Academic Subject

The Program in Mathematics Education at Teachers College offers a program of study leading to the Doctor of Education Degree in the College Teaching of Mathematics (Ed.D.C.T.) to prepare students for positions as teachers of mathematics in two- and four-year colleges.

This degree program is designed to develop both the depth and breadth in the students' knowledge of mathematics but is intended to prepare graduates for careers in teaching rather than in mathematics research. For further details concerning general degree requirements, students should consult the bulletin, "Requirements for the Degree of Doctor of Education in the College Teaching of an Academic Subject" available in the Office of Doctoral Studies.

A program of study for the Ed.D.C.T. degree must include a minimum of 90 semester hours of approved graduate credit, at least 45 points of which must be taken under Teachers College registration. In order to permit the acquisition of broad and basic scholarship, each program of study should include at least 75

points in mathematics and mathematics education, with at least 30 points in advanced courses and 15 points in professional educational disciplines and including at least two courses related to higher education programs and practices.

Ordinarily, points in mathematics and mathematics education should include at least 50 points in mathematics content courses, three points in either MSTM 5012 or MSTM 5520 and 12 points of research preparation including MSTM 6500 and MSTM 7500. Preparation in mathematics content should be of sufficient depth in three areas to communicate content effectively at the freshman and sophomore college levels. Algebra and analysis are recommended as initial areas of concentration. Content courses can be selected from courses with the department or from courses offered by the Graduate Faculties of Columbia University.

Candidates for the Ed.D. in College Teaching who have not completed the equivalent of at least one year of full-time service as a college teacher of mathematics/computing/statistics are required to include MSTM 6400 within their doctoral programs. Interns will teach college mathematics courses under the supervision of experienced college teachers for a period of at least one semester. Incoming doctoral candidates should register for Professional Seminar in Mathematics during the first year of doctoral studies.

Candidates for the Ed.D.C.T. are required to demonstrate competency in one language chosen from among French, German, and Russian. Students who require other languages for the preparation of their dissertation may petition the department to request substitution. Students in mathematics may not use computer languages to satisfy the language requirement. The Ed.D.C.T. degree requirements include a dissertation contributing knowledge to the field and should be planned early in the doctoral program when sufficient advanced courses have been completed to permit the candidate to enroll in relevant research courses and pertinent advanced study to enable efficient preparation of the dissertation. Doctoral dissertations in the college teaching of mathematics can be (1) experimental studies in adult learning, (2) design and formative evaluation of college mathematics curricula, or (3) analytical studies in policy theory in mathematics post-secondary education.

Doctor of Philosophy in Mathematics Education

The Doctor of Philosophy (Ph.D.) degree emphasizes research competencies. The degree requires a scholarly dissertation of intellectual merit and sound research methodology. Dissertation research may include analytical studies of the process of teaching or experimental studies of the teaching-learning process, including studies of verbal learning and laboratory practice or historical studies.

Candidates are encouraged to develop an association with a faculty member early in their studies to identify a problem area of mutual interest to plan a course of studies that leads to the competencies needed to complete dissertation research and prepare for a professional role. Further details are available in the brochures on doctoral studies and in the general descriptions of doctoral programs available from the Office of Doctoral Studies.

A program of study for the Doctor of Philosophy degree must include at least 45 points taken under Teachers College registration. In order to permit the acquisition of broad and basic scholarship, each program of study should include at least 60 points in mathematics, mathematics education, statistics, and computing. At least 35 points should be in advanced courses – including research courses (MSTM 6500 or 6501 and MSTM 7500). (Any Teachers College course at the 6000 level or above, any Columbia University Graduate School of Arts and Sciences course with a "G" prefix, any "W" course numbered above 4000, or any transferred course with a graduate-level prerequisite will be considered an advanced course.) Further, 15 points in the philosophical, psychological, and curricular foundations of education must be included in every Ph.D. program.

Candidates for the Ph.D. degree are required to demonstrate competency in two languages chosen from among French, German, and Russian. Students who require other languages for the preparation of their dissertation may petition the program to request one substitution. Students in mathematics may not use computer languages or statistics to satisfy the language requirement.

The Ph.D. dissertation is a scholarly study contributing new knowledge to the field and should be planned early in the program when sufficient advanced courses have been completed to permit the candidate to enroll in relevant research courses. Ph.D. dissertations in mathematics education should be (1) experimental studies in

learning, (2) analytical studies in policy theory in mathematics education, or (3) other scholarly investigations of problems and issues of broad significance in the field.

Application Information

Applications are reviewed on an ongoing basis. Preference in scholarship awards will be given to applicants who meet the early deadline.

Mathematics education students seeking Master of Arts, Master of Science, and Master of Education degrees are expected to have completed at least 24 credits of undergraduate mathematics.

Applicants who wish to receive Initial New York State teaching certification should apply to the Master of Arts degree program.

Mathematics education students seeking Doctor of Education or Doctor of Education in the College Teaching of an Academic Subject degrees are expected to have completed an undergraduate major in mathematics. Mathematics education students seeking a Doctor of Philosophy degree should have both undergraduate and master's degrees in their specialization.

Faculty List

Faculty

Alexander P. Karp
Professor of Mathematics Education

Erica Walker
Clifford Brewster Upton Professor of Mathematical Education

Nicholas Henning Wasserman
Assistant Professor of Mathematics Education

Lecturers

Chaya R Flint
Lecturer

Stuart Allan Weinberg
Lecturer

Visiting Faculty

Daniel L. Goroff
Adj/PTVisiting Prof/PTLecturer

Heather Gould

Neil Grabois

Visiting Professor

J Philip Smith
Adjunct Professor

Adjunct

Joseph Peter Garrity
Adjunct Professor

Joseph Malkevitch
Adjunct Professor

Instructors

Henry Landau

Henry O Pollak

Course List

MSTM 4005 Teaching mathematics in diverse cultures

Principles, techniques, and issues in the teaching of mathematics in other cultural and national settings. Study tour of schools and institutions in various nations.

MSTM 4019 Mathematics teaching and learning I

Cognitive development and learning strategies for teaching and the use of instructional materials. Current research in mathematics education. Required for pre-service students.

MSTM 4020 Mathematics teaching and learning II

Historical/comparative study of mathematical education programs in the United States and abroad. Current research in mathematics education.

MSTM 4023 Mathematics for exceptional students

Content, methods, and instructional models for teaching exceptional students, including LED, LD, and MT students.

MSTM 4025 Teaching mathematics using technology

A review of teaching methods and curricular innovations in computing and computer mathematics.

MSTM 4026 Teaching applied mathematics

The role of applications in mathematics curriculum. Mathematical models, use of calculators and computers. Applications in the natural and social sciences.

MSTM 4031 Number theory

Primes, composites, divisibility and factorization, congruence, historical topics.

MSTM 4034 Exploring secondary school mathematics

For students who are preparing to teach in secondary school. The mathematical content of advanced secondary school mathematics and the development and application of fundamental ideas in mathematics.

MSTM 4038 Finite mathematics

Statements, propositions, and sets; vectors and matrices; probability. Applications: finite Markov chains, game theory.

MSTM 4760 Student teaching in mathematics

Permission required. Prerequisite: MSTM 5011. Open only to students enrolled in the pre-service program. Students do supervised teaching in metropolitan area schools.

MSTM 4901 Guided study in mathematics education

Permission required from the instructor with whom the student wishes to work. Independent study in selected areas.

MSTM 5010 Mathematics in the elementary school

Problems, issues, and methods in the teaching and supervision of elementary school mathematics.

MSTM 5011 Mathematics in the secondary school

Problems, issues, and methods in the teaching and supervision of secondary school mathematics. Includes field experiences. Required for preservice students.

MSTM 5017 Mathematical game theory

Taxonomy of games, two-person zero-sum games, transferable and non-transferable utility, equilibrium concepts, two-sided markets, elections and voting, bankruptcy, apportionment, combinatorial games. Game theory and the K-12 curriculum.

MSTM 5019 Mathematics in popular culture and media

Survey of mathematical topics, methods, and issues related to teaching and learning as represented in popular culture and media, including literature, film, art, advertising, and the press.

MSTM 5020 Mathematics and multicultural education

Survey of mathematical topics and methods appropriate for multicultural and bilingual programs.

MSTM 5022 Mathematics curriculum development

Principles, strategies, and techniques for curriculum development and textbook preparation in mathematics.

MSTM 5023 Problem solving

Theories and methods of mathematical problem solving with applications to classroom instruction.

MSTM 5030 Topics in probability theory

Simple, compound, and conditional probabilities and applications. Doctoral students should register for MSTM 6030.

MSTM 5031 Topics in the foundations of mathematics

Propositional and predicate calculi, set theory, axiomatics, order types, the linear continuum, and Goedel's theorem.

MSTM 5032 Topics in geometry / topology

Foundation of geometry/topology. Emphasis upon the relationship between topology and geometry and other mathematical areas.

MSTM 5033 Topics in algebra

Groups, rings, fields. Doctoral students should register for MSTM 6033.

MSTM 5034 Topics in analysis

Real or complex functions and their properties. Doctoral students should register for MSTM 6034.

MSTM 5035 Topics in mathematical modeling

Simulation, information theory and coding, stochastic models, probabilistic systems, simple harmonic motion. Topics vary between natural sciences and behavioral sciences.

MSTM 5036 Topics in discrete mathematics

Discrete mathematics, combinatorics, graph theory.

MSTM 5037 History of mathematics

Historical development of major ideas in mathematics. Contributions of noteworthy mathematicians. Analysis of mathematical classics.

MSTM 5038 Topics in mathematical logic

Prepositional calculus, Church-Turing thesis, Goedel's incompleteness theorem.

MSTM 5039 Comparative mathematics education

A review and comparison of mathematics education in other nations.

MSTM 5061 Research, evaluation, and policy in mathematics education

Theory and methods of evaluating pupils and programs in the cognitive and affective d of research and policy in evaluation of mathematics outcomes.

MSTM 5126 Mathematical foundations of statistics

Prerequisite: MSTM 5030 or MSTM 6030. Estimation, hypothesis testing, and tests based on the chi-square distribution. The normal distribution and its applications. Analysis of variance and regression. Doctoral students should register for MSTM 6126.

MSTM 5264 Guided supervision of student teaching in mathematics

Permission required. Open only to doctoral students. Guided field experience in supervising student teachers.

MSTM 5520 Seminar in the college teaching of mathematics

Current issues in undergraduate mathematics. Examination of relations between elementary and advanced mathematics.

MSTM 5800 Mathematics colloquium

Lecture series featuring presentations by distinguished guest speakers.

MSTM 5801 Mathematics colloquium

Lecture series featuring presentations by distinguished guest speakers.

MSTM 6017 Advanced topics in mathematical game theory

Open only to doctoral students. Advanced study of game theory.

MSTM 6030 Advanced topics in probability theory

Open only to doctoral students. Emphasis on proof and advanced applications.

MSTM 6031 Advanced topics in the foundations of mathematics

Open only to doctoral students. Advanced study of axiom systems and 19th – 20th century developments in the logical foundations of mathematics.

MSTM 6032 Advanced topics in geometry/topology

Foundation of geometry/topology. Emphasis upon the relationship between topology and geometry and other mathematical areas.

MSTM 6033 Advanced topics in algebra

Open only to doctoral students. Advanced study of groups, rings, and fields.

MSTM 6034 Advanced topics in analysis

Open only to doctoral students. Advanced study of real or complex functions.

MSTM 6035 Advanced topics in mathematical modeling

Open only to doctoral students. Advanced study of mathematical modeling.

MSTM 6036 Advanced topics in discrete mathematics

Open only to doctoral students. Advanced study of discrete mathematics, combinatorics, and graph theory.

MSTM 6037 Advanced selected topics and issues in mathematics education

Topics will vary

MSTM 6039 Advanced comparative mathematics education

A review and comparison of mathematics education in other nations.

MSTM 6126 Advanced topics in the mathematical foundations of statistics

Open only to doctoral students. Prerequisite: MSTM 5030 or MSTM 6030. Advanced topics including hypothesis testing, distribution theory, and analysis of variance and regression.

MSTM 6400 Internship in mathematics education

Permission required. Supervised intern service in a variety of field settings including classroom teaching at various levels, supervision, curriculum development, and inservice education.

MSTM 6500 Research seminar in mathematics education

Permission required. Research oriented seminars dealing with a variety of issues and leading to preparation of preliminary proposals for the doctoral dissertation. Required for doctoral students.

MSTM 6501 Research seminar in mathematics education

Permission required. Research oriented seminars dealing with a variety of issues and leading to preparation of preliminary proposals for the doctoral dissertation. Required for doctoral students.

MSTM 6901 Research and independent study in mathematics education

Permission required. Guided independent study leading to the preparation of a major project or paper. May be taken repeatedly by doctoral candidates engaged in research.

MSTM 7500 Dissertation seminar in mathematics education

Development of final doctoral dissertation proposals and presentation of proposals for departmental review.

MSTM 8900 Dissertation advisement in mathematics education

Individual advisement on doctoral dissertations. Fee to equal 3 points at current tuition rate for each term. For requirements, see section in catalog on Continuous Registration for Ed.D./Ph.D. degrees.

Science Education

Department of - Mathematics, Science & Technology

Contact Information

Phone: (212) 678-8174

Fax: (212) 678-8145

Email: tcscience@tc.edu

Director: Professor Christopher Emdin

Program Description

The Science Education Program at Teachers College was one of the first in the nation to encompass both professional teacher education and a research-based doctoral program that prepares leaders for science education roles in pre-college and higher education. The guiding principle for our program offerings is that professional science educators should be thoroughly educated in their content discipline and bring modern theories of learning and education to bear on their scholarship as professional teachers and in their research for the doctoral degree.

Master's-level offerings in science content are coordinated with methodology and supervision appropriate for both initial and professional teachers. Advanced master's and doctoral programs include preparation for a variety of positions including teaching, supervisory, and research roles spanning the elementary through college levels of instruction. Some courses offered through these programs are designed especially for students from other areas of study at Teachers College (for example science education methods for elementary school teaching) who need to acquire knowledge and skills in science but who do not wish to earn a degree in these areas.

Our graduates have been appointed in major universities as science and/or science education professors. Many of our graduates have become major leaders in school leadership and educational reform nationally and internationally. Our work in reforming urban science education and broadening the scope of the theoretical base for

teaching and learning in science has become more sharply focused in recent years to include neurocognitive, multicultural, and learning theory-based innovations in guiding teaching and research.

Degree Summary

INITIAL CERTIFICATION-
Biology 7-12 (SCIB-INIT)
Chemistry 7-12 (SCIC-INIT)
Earth Science 7-12 (SCIE-INIT)
Physics 7-12 (SCIP-INIT)

Degree offered:

- Master of Arts (M.A.)

TRANSITIONAL B-
Biology 7-12 (SCIB-TRAN)
Chemistry 7-12 (SCIC-TRAN)
Earth Science 7-12 (SCIE-TRAN)
Physics 7-12 (SCIP-TRAN)

Degree offered:

- Master of Arts (M.A.)

SUPERVISOR/TEACHING OF SCIENCE (SCSS)

Degree offered:

- Master of Arts (M.A.)

TEACHER EDUCATION IN SCIENCE (SCTE)

Degrees offered:

- Master of Science (M.S.)
- Master of Education (Ed.M.)

SCIENCE EDUCATION (SCSD)

Degrees offered:

- Doctor of Education (Ed.D.)
- Doctor of Philosophy (Ph.D.)

SCIENCE AND DENTAL EDUCATION (SCDT)

Degree offered:

- Master of Arts (M.A.)

For a complete listing of degree requirements, please continue on to this program's "Degrees" section in this document

Degree Requirements

Master of Arts

Emphasis is placed on those competencies necessary for effective science teaching as a means of enhancing professional growth of in-service and pre-practice through group and individualized instruction in a general methods course and in courses applicable to specific sciences.

In order to meet New York State Certification requirements, the M.A. degree for teacher preparation programs is comprised of 36 credits of coursework in the areas of professional education, science content, and science methods. The 32-point M.A. degree in Supervision/Teacher of Science Education serves students whose professional interests are centered in the enhancement of science teaching and learning including teacher professional development, curriculum improvement, personal professional development, and preparation for more advanced studies leading to advanced master's degrees in science teacher supervision. In consultation with your advisor upon acceptance to a degree program, a program plan will be outlined based on your specific content certification area.

For preservice candidates, i.e., those who intend to fulfill the requirements of New York State for initial certification to teach science in secondary schools, MSTC 4000 and MSTC 4363 are required and should precede the semester in which student teaching is completed. MSTC 4000 and MSTC 4363 are both offered in the fall and student teaching in the spring.

Other requirements that must be met before graduation include completion of a science safety workshop, successful completion of the program's Gateway Performance Assessments for Teaching, and a final master's portfolio project. See the Teacher Education section of this bulletin for details on other requirements.

Initial Science Education M.A. applicants may refer admissions questions to the Masters program director. Inquiries should be sent to Dr. Jessica Riccio (riccio@tc.columbia.edu).

Master of Arts in Science and Dental Education

This degree is offered in conjunction with the College of Oral and Dental Medicine of Columbia University. Students in the College of Oral and Dental Medicine at Columbia University who are planning to enter teaching of dental medicine are eligible to enroll for this degree. The curriculum includes content courses in dental medical science, basic courses in adult learning, teaching of science-related disciplines, and culminating research studies on current medical educational theory and practice. Candidates are prepared for a life-long commitment to scholarly reflection and practice as professors of oral and dental medicine.

Inquiries should be sent to Professor Felicia Mensah (fmm2140@tc.columbia.edu).

Master of Science & Master of Education

The Science Education program offers curricula leading to a Master of Science (M.S.) degree and a Master of Education (Ed.M.) degree. Both programs require a minimum number of graduate points of coursework and a master's paper.

The M.S. and Ed.M. degrees require a program planned in consultation with an advisor who may also sponsor the master's paper. The M.S. degree requires more science subject matter coursework than the Ed.M. degree, while the Ed.M. degree requires more intensive work in education including science education. The M.S. degree is recommended for science educators who want a professional degree with intensive preparation in science subject matter. This degree is especially appropriate for prospective community college instructors who do not intend to pursue a doctorate immediately. The Ed.M. degree is recommended for science educators who want a professional degree with intensive preparation in science education. Both programs include some depth of study in science, work in the candidate's specialization, and the development of competence in methods of scholarly analysis. Some credits obtained at the M.A. level may be applied toward the Ed.M. or M.S.

Master of Science

In total, a minimum of 60 course points are required: A minimum of 30 points in breadth of science content courses, 12 points in core science education courses, 6-9 points in professional education courses, 3-6 points in research methodology courses, and 3 points in technology courses. This leaves at most a remaining 6 points of optional studies to be determined in consultation with the advisor.

Master of Education

In total, a minimum of 60 course points are required: A minimum of 15 points in breadth of science content courses, 15 points in core science education courses, 9 points in professional education courses, 6 points in research methodology courses, and 3 points in technology courses. This leaves 12 points of optional studies to be determined in consultation with the advisor.

Master's Integrative Project

For the M.S. and the Ed.M. degrees in the Science Education Program, a master's paper will be required. This project may be an extension of some paper that has been prepared for a course included in the program of the student. The paper may take a variety of forms. It may be a report of an empirical investigation, or it may be a library-type research paper dealing with some problem in which the candidate has a special interest. The form of the paper should be carefully chosen in the context of the candidate's professional goals.

The M.S. paper must address a problem in science content either through scientific laboratory research, a synthesis of scientific knowledge from the literature, and/or the production of a novel model synthesizing data. The M.S. paper may be a research thesis in basic science within the candidate's field of specialization.

The Ed.M. project should focus more on science education topics and can be either a synthesis of information or an empirical study. The paper may form the basis for a subsequent doctoral dissertation. In other cases, it may be the culmination of studies that have been carried out in the 60-point master's degree program.

The paper should be planned and prepared in cooperation with a full-time member of the Science Education Program faculty. It must be approved by a full-time member of this faculty before the application is made for the degree. Hence, the master's paper is a departmental requirement for the M.S. and/or the Ed.M. degree. Its acceptance needs to be noted on the candidate's application by faculty

for the award of either the M.S. or Ed.M. degree. However, the approved paper is not to be submitted to the Office of the Registrar as part of general college-wide degree requirements but will remain in the departmental files.

Doctoral Degrees General

The Department provides programs for both the Ed.D. and the Ph.D. degrees. In general, the Ed.D. degree places emphasis on breadth of professional coursework with a focus on educational practice. All candidates are required to be competent in both quantitative and qualitative research methodology and to have knowledge of the epistemology of science and of psychology sufficient to be an informed scholar-practitioner.

All doctoral candidates must have a written program plan approved by their advisor. The approved plan should then be forwarded to the Office of Doctoral Studies. The student normally then completes doctoral coursework and engages in doctoral research and writing. Refer to the Ph.D. and Ed.D. Requirements Bulletin, prepared by the Office of Doctoral Studies, for a fuller description of requirements.

Specializations

Students enrolled in the doctoral program may specialize in an area of interest to them pertinent to science education by taking courses in their area of interest. Some potential areas to pursue include elementary school science, secondary school science, urban science education, and technology studies.

Doctor of Education

The Program offers curricula leading to the degree of Doctor of Education (Ed.D.). This program is intended to prepare students for leadership in science education. Most students entering this program are classroom teachers. This program is designed to prepare professional science educators who are (1) educated both broadly and deeply in science subject matter, (2) competent in methods of scholarly analysis, and (3) have a deep understanding of education and science education.

Students should also consult the Requirements for the Degree of Doctor of Education bulletin, available from the Office of Doctoral Studies, for College-wide Ed.D. requirements.

In total, a minimum of 90 course points are required: A minimum of 15 points in breadth of science content courses, 15 points in core science education courses, 12 points in professional education courses, 9 points in research methodology courses, 3-6 points in technology courses, and 6 dissertation study points. This leaves a remaining 27-30 points of optional studies to be determined in consultation with the advisor. These additional points may be used to create a minor in an area of interest.

The student, in consultation with an advisor, plans a program of study consistent with the student's prior education and oriented toward professional goals. This program plan is approved by the advisor and then submitted to the Office of Doctoral Studies. In planning a program of study, the student would be wise to pay particular attention to the time when the certification exam is taken. Students are required to complete a minimum of 20 points after taking the certification examination for the first time, including points taken during the term in which that examination was taken.

The certification examination is ordinarily taken no later than the term in which the student completes 65-75 percent of coursework. A special certification examination is designed for each candidate. The certification exam generally takes place in the student's third year of full-time study. Please refer to the Office of Doctoral Studies bulletin and the departmental advisor for details.

Dissertation Guidelines

The Ed.D. dissertation is a scholarly endeavor contributing new knowledge to the field and should be planned early in the doctoral program when sufficient advanced courses have been completed to permit the candidate to enroll in relevant research techniques courses and pertinent advanced study to enable efficient and high-quality preparation of the thesis. Dissertations in science education can be (1) empirical or theoretical studies in learning, (2) design and formative evaluation of science curricula, or (3) analytical studies in policy theory in science education. The candidate is recommended to seek an advisor within the department who can best guide the design and completion of the type of thesis chosen.

Doctor of Philosophy

This program is designed to prepare students for leadership in science education. The program includes advanced preparation in science to develop both breadth and depth in science subject matter background. Preparation in research methods in science education, as well as study of recent developments in the broad field of professional education, is included in the program. Students should refer to the bulletin, Requirements for the Degree of Doctor of Philosophy, available from the Office of Doctoral Studies, for information on admission, residence, certification, examinations, and the dissertation.

The general requirement is for a minimum of 75 points of approved graduate credit, at least 45 points of which must be taken through Teachers College registration. In order that candidates become familiar with recent investigations in the broad fields of professional education, each program will include one or more courses in the nature of education and the nature of persons and the learning process.

In total, a minimum of 75 course points is required: A minimum of 15 points in breadth of science content courses, 15 points in core science education courses, 12 points in professional education courses, 12 points in research methodology courses, 3-6 points in technology courses, and 6 dissertation study points. This leaves a remaining 12-15 points of optional studies to be determined in consultation with the advisor.

Dissertation Requirements

In addition to all other guidelines, it should be noted that the dissertation must be a research thesis based on a theoretical rationale and must exhibit thorough and comprehensive mastery of a research discipline.

Application Information

Preference in scholarship awards will be for those applicants who meet the early deadline.

Applicants who wish to receive New York State teaching certification must apply to the M.A. degree program in a science content area. Science education students seeking M.A., Ed.M., M.S., Ed.D., and/or Ph.D. degrees should have at least the equivalent of an undergraduate degree in the sciences.

Ed.D. and Ph.D. applications are reviewed once a year for study beginning in the fall. All other programs admit students on a rolling basis. See the Admissions section of the catalog for application deadlines as advertised by the college.

Faculty List

Faculty

O. Roger Anderson
Professor of Natural Sciences

Christopher Emdin
Associate Professor of Science Education

Felicia Mensah
Professor of Science and Education and Associate Dean

Ann Rivet
Associate Professor of Science Education

Lecturers

Denise Marcia Mahfood
Lecturer

Jessica Fitzsimons Riccio
Senior Lecturer

Adjunct

Patrick Decla Ashby
Adjunct Assistant Professor

Arturo Hale
Adjunct Assistant Professor

Stefania Macaluso
Assistant Adjunct Professor

Renhong Wang
Adjunct Assistant Professor

Instructors

Roseanna Graham

Maritza Macdonald

Lisa Ann Neesemann
Adjunct Assistant Professor

Robert Victor Steiner

Laureen Anne Zubiaurre Bitzer

Course List

MSTC 4000 Science in secondary school

Foundations of science education. Planning, assessment, and management of instruction. Required of initial science students.

MSTC 4007 Urban and multicultural science education

Students will explore the intersections of policy, science, and society and the impact these have on standard K-12 urban science curriculum and multicultural teaching practices. This course challenges commonly used practices where multiculturalism is often taught as one distinct and often separate component of the science curriculum.

MSTC 4010 Hip hop and the cultural studies of urban science education

Studies about the teaching and learning of science in urban settings have been a large component of contemporary research in science education. This course provides a means to interrogate the teaching and learning of science in urban settings through an exploration of the sociopolitical and aesthetic aspects of hip-hop/youth culture.

MSTC 4040 Science in childhood education

This is an integrated lecture/laboratory course. This course provides an introduction to the creation of science curriculum and instruction that attends to current state and national standards. The course is based in constructivist perspectives and has as a goal the teaching of science well with all children.

MSTC 4043 Science in the environment

Exploration of environmental science from an earth physiology perspective. Focus on connections between contemporary environmental issues and environmental science concepts. A community study utilizing scientific inquiry procedures and applying pertinent environmental science concepts will be conducted.

MSTC 4044 Biology methods and curriculum laboratory

Theoretical basis of secondary school science education and its practical application to biology teaching and laboratory experiences.

MSTC 4045 Earth science methods and curriculum laboratory

Theoretical basis of secondary school science education and its practical application to earth science teaching and laboratory experiences.

MSTC 4047 Physical science curriculum and methods laboratory

The primary goal of this course is to provide tools to teach middle school science. Teacher candidates should gain a deepened understanding of inquiry-based science activities; the new science standards; ways to make science engaging for students and effective ways to conduct varied, student-centered explorations. Teacher candidates will be reflecting on the process of learning and teaching while creating materials to use with their own students. The assignments for this course are designed to help you create different units that you may use in your future teaching.

MSTC 4048 Researching science knowledge and curriculum design

Analysis of the organization of and relationships between learning sciences and scientific concepts, with a focus on classroom-based analytical techniques suitable for curriculum design research.

MSTC 4049 Middle school living environment methods laboratory

Discussion of middle school life science methods.

MSTC 4055 Concepts of biology

Professional content knowledge course examining the major concepts in biology and their applications in teaching secondary school biology.

MSTC 4056 Concepts in earth science

Study of models of our planet, Earth in space, and weather and climate.

MSTC 4059 Concepts in chemistry I

Prerequisite: one year of college chemistry. The growth of, and change in, the major concepts of the science of chemistry are explored, from the Greek philosophers to the alchemists to those of modern chemistry. Concepts explored: chemical composition and the elements; chemical change, the acids, activity; the nature of matter; and the structure of the atom and bonding. Lesson Plans for high school chemistry teaching are prepared and students misconceptions are probed and discussed.

MSTC 4060 Concepts in chemistry II

Prerequisite: MSTC 4059 or instructor permission. The historical development of selected chemical concepts are examined with respect to the arguments developed in their support, with the intent that current meanings will be elucidated in the process. High school and college chemistry laboratory activities and classroom demonstrations are discussed and prepared. Some

experiments and classroom demonstrations are performed. Some higher level chemistry problems and computer animations applied in chemistry teaching are discussed.

MSTC 4075 Concepts in physics I

Exploration of physics themes of molecules and molecular kinetic theory, heat, mechanics, waves, electricity and magnetism, and modern physics. Exploration of electricity, magnetism, light, optics, quantum mechanics, and selected topics in atomic, nuclear, and elementary particle physics and astrophysics. Of particular interest to introductory physics, physical science, and general science teachers.

MSTC 4076 Concepts in physics II

Practical basis of secondary school science education and its application to physics teaching and laboratory activity.

MSTC 4151 Modern principles of evolution

Interdisciplinary study of scientific theories about the origin and evolution of life on earth. Includes demonstration and laboratory experiments.

MSTC 4363 Introduction to science education practice

Corequisite: MSTC 4000. Directed field experiences and seminars explore school environments and teaching strategies.

MSTC 4761 Student teaching in science

Permission required. Prerequisites: MSTC 4000 and MSTC 4363. Students do supervised teaching in metropolitan area schools.

MSTC 4852 Informal science education

Study of museums and the development of curriculum and teaching practices that support learning in informal settings.

MSTC 4902 Guided study in science education

Permission required from the instructor with whom the student wishes to work. Independent study in selected areas. Use of professional laboratory facilities.

MSTC 5001 Qualitative methods in science education research

This course is designed to support students in qualitative research methods. Students will complete pilot studies as a requirement in the course. Open only to doctoral students.

MSTC 5009 Educational practices and research in dental sciences

This course is an advanced seminar that focuses on the theoretical, conceptual, and empirical literature on dental science curriculum, research, and pedagogy.

MSTC 5040 Science curriculum improvement in the elementary school

This course provides an introduction to the creation of science curriculum and instruction that attends to current state and national standards at the elementary level.

MSTC 5041 The nature and practice of science

This course is one of the required core courses in the science education doctoral and advanced masters programs. It is designed to help students develop an adequate understanding of the nature of science or of how science is practiced. In this course, through the analysis of a number of current issues and problems in science and the extensive use of case studies, students will address questions such as: What is science? What distinguishes science from other ways of knowing? What standards of evidence and scientific explanations, processes, and conventions are used in science? What philosophical, social, ethical, and historical perspectives are important in understanding the nature of science?

MSTC 5042 Science, technology, and society

The nature and interrelationships of science, technology, and society as represented in policy and curriculum for education.

MSTC 5047 Science teacher education

MSTC 5047 is a required core course in the Science Education doctoral and advanced master's programs. The course concerns both inservice and preservice teacher education. In the course, students will conduct research with preservice teachers, as well as practicing and expert teachers. We will examine the classic and contemporary knowledge base of teacher education, as well as current issues and questions in the education of science teaching professionals. Open to students who are not in the Science Education Program with the professor's permission.

MSTC 5048 Curriculum and pedagogy in science education

This course offers students in the Science Education doctoral and advanced master's programs the opportunity to ask fundamental questions about curriculum in multiple ways.

MSTC 5056 General oceanography

Explore physical, earth, and life science content topics through a study of Earth's most visible feature. Particular attention paid to modern socioscientific issues such as coastal development, pollution, and management of energy resources.

MSTC 5155 Critical voices in teacher education

This course is designed for doctoral students interested in teacher education and becoming teacher educators with an emphasis on self, race in teacher education, and teacher education research and policy.

MSTC 5265 Guided supervision of student teaching in science

Permission required. Open only to doctoral students. Guided field experience in supervising student teachers.

MSTC 6000 Quantitative methods in science education research

A critical analysis of current published research in science education with special attention to strategies of applying statistical and other quantitative methods. Designed largely for doctoral students and advanced master's students.

MSTC 6401 Internship in science education

Permission required. Supervised intern service in a variety of field settings including classroom teaching at various levels, supervision, curriculum development, and inservice education.

MSTC 6502 Science education research seminar

Research oriented seminars dealing with a variety of issues and leading to preparation for the doctoral certification examination. Required for doctoral students.

MSTC 6902 Research and independent study in science education

Permission required. Guided independent study leading to the preparation of a major project or paper. May be taken repeatedly by doctoral candidates engaged in research.

MSTC 7501 Dissertation seminar in science education

Development of doctoral dissertation proposals and presentation of proposals for departmental review.

MSTC 8901 Dissertation advisement in science education

Individual advisement on doctoral dissertations. Fee to equal 3 points at current tuition rate for each term. For requirements, see section in catalog on Continuous Registration for Ed.D./Ph.D. degrees.