
Department of Mathematics and Science Education

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Chair:

N. G. Lederman

Director, Graduate Programs:

N. G. Lederman

Mathematics and science education is primarily concerned with all aspects of the teaching and learning of mathematics and/or science at the secondary levels (i.e., grades 5–12). The department offers Professional Master's, Master of Science, and Ph.D. degrees in mathe-

tics and science education. The master's programs are specifically focused on experienced teachers, individuals seeking certification and advanced study, or individuals working in educational settings other than schools (e.g., museums, zoos, etc.). Specific attention is placed on curriculum development, evaluation, advanced instructional models, supervision, learning and cognition, and action research.

The Ph.D. programs are designed for those individuals wishing to become university-level teacher educators and researchers. Extensive attention is given to quantitative and qualitative research design, along with advanced work in evaluation, curriculum analysis, and supervision. Both M.S. and Ph.D. students will be required to complete additional subject matter courses (e.g. science and mathematics) equivalent to 9-12 credit hours.

Degrees Offered

Master of Science in Mathematics Education
 Master of Mathematics Education
 Master of Science in Science Education
 Master of Science Education

Doctor of Philosophy in Mathematics Education
 Doctor of Philosophy in Science Education

Research Areas

Research areas include informal science/math education, curriculum development, integration of science/math disciplines and across disciplines, and instructional

methods; students and teachers' conceptions of scientific/mathematic inquiry and nature of science/math, instructional models, evaluation, and research design.

Faculty

Zaur Berkaliyev, Assistant Professor of Mathematics and Science Education. M.Sc., Moscow State University; Ph.D., Moscow State University; Ph.D., Indiana University. Curriculum development, student attitudes.

Daniel Z. Meyer, Assistant Professor of Mathematics and Science Education. B.A., Swartmore College; Ed.M., Harvard Graduate School of Education; Ph.D., Cornell University.

J. S. Lederman, Director of Teacher Education, Senior Instructor of Mathematics and Science Education. B.A., Rhode Island College; M.S., Worcester Polytechnic Institute. Informal science education, curriculum development, integration of science disciplines and across disciplines, and instructional methods.

W. J. Newman, Assistant Professor of Mathematics and Science Education. B.A., Virginia Polytechnic Institute, M.S., University of Connecticut, M.A., College of New Jersey, Ph.D., Purdue University. Discourse in Science Education.

N. G. Lederman, Chair and Professor of Mathematics and Science Education. B.S., Bradley University; M.S. Biology, New York University; M.S. Secondary Education/Biology, Bradley University; Ph.D., Syracuse University. Students' and teachers' conceptions of scientific inquiry and nature of science, instructional models, evaluation, and research design.

J. S. Zawojewski, Associate Professor of Mathematics and Science Education. B.S.Ed., Northwestern University; M.S.Ed., National College of Education; Ph.D., Northwestern University. Teaching and learning of probability and statistics, evaluation and professional development.

Department of Mathematics and Science Education

Admission Requirements

Bachelor's (or Master's, for Ph.D. programs) degree in mathematics (for mathematics education), science (for science education) or another field with documented evidence of success in working with school-aged youth

GRE score minimum for M.S./MAS/Ph.D. applicants (for tests taken prior to Oct. 1, 2002): 1200 (combined)

GRE score minimum for M.S./MAS applicants (for tests taken on or after Oct. 1, 2002): 900 (quantitative + verbal) 2.5 (analytical writing)

GRE score minimum for Ph.D. applicants (for tests taken on or after Oct. 1, 2002): 1000 (quantitative + verbal) 3.0 (analytical writing)

TOEFL minimum 600/250* if from non-English speaking country

A minimum cumulative undergraduate GPA of 3.0/4.0

Two-page professional statement of goals/objectives
Curriculum Vita

Three letters of recommendation

An interview may be required

Additional requirements for Ph.D. programs:

Three years of teaching experience

Meeting the minimum standards does not guarantee admission. Test scores and GPA are just two of several important factors considered, and admission decisions are made based upon the totality of the application file.

* Paper-based test score/computer-based test score.

Master of Science in Mathematics Education (thesis)

Master of Mathematics Education (Professional Master's, non-thesis)

33 credit hours

Thesis (Master of Science) or non-thesis
(Professional Master's) option

The objective of the master's programs is to provide practicing teachers, or individuals in education-related fields, with advanced education in the teaching and learning of mathematics. These advanced studies will enhance graduates' ability to provide meaningful instruction in mathematics; critically analyze and implement empirical research findings in mathematics education; develop and evaluate curriculum; and become a leader in public school education at the state or local levels.

Required courses

Core requirements

MSED 550 Clinical Supervision in Science/Mathematics

MSED 560 Research & Evaluation OR

MSED 552 Assessment and Evaluation

MSED 555 Mathematics Curriculum

PSYC 588 Learning, Cognition and Motivation

MSED 503 Advanced Strategies: Mathematics

MSED 540 Informal Education Practicum

Master of Science thesis option

(Six Credits)

MSED 591 Thesis Research

Professional Master's non-thesis option

(Three credits)

MSED 538 Mathematic Problem Solving

And a minimum of three credits from the following:

MSED 571 Problem Solving
and Nature of Mathematics

MSED 531 Professional Development
and Practicum in Mathematics

MSED 521 History/Philosophy of Mathematics

MSED 562 Action Research

Nine credits of select coursework from discipline-specific mathematics courses

Master of Science in Science Education (thesis option)**Master of Science Education (Professional Master's, non-thesis)**

33 credits

Thesis (Master of Science) or non-thesis
(Professional Master's)

The objective of the M.S. program is to provide practicing teachers, or individuals in education-related fields, with advanced education in the teaching and learning of science. These advanced studies will enhance graduates' ability to provide meaningful instruction in science; critically analyze and implement empirical research findings in science education; develop and evaluate curriculum; and become a leader in public school education at the state or local levels.

Required courses**Core requirements**

MSED 550 Clinical Supervision in Science/Mathematics

MSED 560 Research and Evaluation **OR**

MSED 552 Assessment and Evaluation

MSED 554 Science Curriculum
 PSYC 588 Learning, Cognition and Motivation
 MSED 502 Advanced Strategies: Science
 MSED 540 Informal Education Practicum

Master of Science thesis option

(Six credits)

MSED 591 Thesis Research

Professional Master's non-thesis option:

(Three credits)

MSED 538 Scientific Inquiry

And a minimum of three credits from the following:

MSED 570 Inquiry and Nature of Science

MSED 530 Professional Development
and Practicum in Science

MSED 520 History/Philosophy of Science

MSED 562 Action Research

**Nine credits of select coursework
from discipline-specific mathematics courses****Master of Science/Mathematics Education****Teacher Certification Option**

45 credit hours

The Master of Science/Mathematics Education (Teacher Certification Option) is designed for individuals who already possess a Bachelors degree (preferably in an area of science or mathematics) and wish to pursue both a teaching certification and a Masters degree. This accelerated course of study allows the student to achieve certification and a Masters degree in just 45 credit hours instead of the 54 credit hours that would be required if certification and Masters degree were pursued separately.

Required Courses

MSED 500 Analysis of Classrooms II (Practicum and Seminar)

MSED 554/555 Science/Mathematics Curriculum

MSED 300 Instructional Methods/Strategies I
 MSED 400 Instructional Methods/Strategies II
 MSED 538 Interprofessional Projects
 MSED 540 Informal Education Practicum and Seminar
 MSED 450 Professional Internship (6 credit hours)
 MSED 501/502 Advanced Strategies: Mathematics/Science
 MSED 550 Clinical Supervision in Science/Mathematics
 MSED 552 Assessment and Evaluation
 PSYC 588 Learning, Cognition, and Motivation

Nine credits from graduate level science/mathematics courses**Total credits for this Masters option: 45**

Doctor of Philosophy in Mathematics Education

84 credit hours (Minimum of 51 hours of coursework)
 Qualifying exam within the first two years of Ph.D. study
 Composed of seven position statements
 (ranked by faculty)
 Position Statement 1: Written defense to support
 position with empirical research
 Position Statements 2, 3, 4: Oral defense
 Oral comprehensive exam with the student's graduate
 committee (The dissertation proposal is presented
 orally as part of the comprehensive examination.)
 Oral dissertation defense, involving the final thesis exam

The objective of the Ph.D. program is to provide students
 with advanced education in the teaching and learning
 of mathematics. These advanced studies will enable
 graduates to conduct theoretical and practical research
 in mathematics education, develop and evaluate curricu-
 lum, prepare future teachers, provide professional
 development to in-service teachers, or become a leader
 in public school education at the state or local levels.

Core requirements

MSED 601	Critical Analysis in Quantitative Research
MSED 602	Quantitative Research Design and Practicum
MSED 603	Critical Analysis in Qualitative Research
MSED 604	Qualitative Research Design and Practicum
MSED 550	Clinical Supervision in Science/Mathematics
MSED 552	Assessment and Evaluation
MSED 555	Mathematics Curriculum
PSYC 588	Learning, Cognition and Motivation
PSYCH 545	Statistics I
PYSCH 546	Statistics II
Total	30 credit hours

Elective requirements

(Minimum of nine credits)
 MSED 571 Problem solving and Nature
 of Mathematics
 MSED 503 Advanced Strategies: Mathematics
 MSED 521 History/Philosophy of Mathematics
 MSED 531 Professional Development
 and Practicum in Mathematics
 MSED 597 Special Problems (Ethics)
 MSED 594 Special projects
 (Independent Studies within MSED)
 MSED 560 Research & Evaluation
 MSED 562 Action Research
 Up to eight hours from discipline-specific
 graduate coursework

**12 credits of select coursework from discipline-specific
 mathematics courses/related fields**

Total minimum coursework 51 credit hours

MSED 691 Ph.D. Thesis Research Minimum 25 hours
Total minimum credits 84 credit hours

42 maximum transfer of graduate credits from master's
 (24 credits from coursework/eight credits from research)

Doctor of Philosophy in Science Education

84 credit hours (Minimum 51 hours of coursework)

Qualifying exam within the first two years of Ph.D. study

Composed of seven position statements
(ranked by faculty)

Position Statement 1: Written defense to support position with empirical research

Position Statements 2, 3, 4: Oral defense

Oral comprehensive exam with the student's graduate committee (The dissertation proposal is presented orally as part of the comprehensive examination.)

Oral dissertation defense, involving the final thesis exam

The objective of the Ph.D. program is to provide students with advanced education in the teaching and learning of science. These advanced studies will enable graduates to conduct theoretical and practical research in science education; develop and evaluate curriculum; prepare future teachers; provide professional development to in-service teachers; or become a leader in public school education at the state or local levels.

Required courses

Core requirements

MSED 601	Critical Analysis in Quantitative Research
MSED 602	Quantitative Research Design and Practicum
MSED 603	Critical Analysis in Qualitative Research
MSED 604	Qualitative Research Design and Practicum
MSED 550	Clinical Supervision in Science/Mathematics
MSED 552	Assessment and Evaluation
MSED 554	Science Curriculum
PSYC 588	Learning, Cognition and Motivation
PSYCH 545	Statistics I
PYSCH 546	Statistics II

Total	30 credit hours
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Elective requirements

(Minimum of nine credits)

MSED 570	Inquiry and Nature of Science
MSED 502	Advanced Strategies: Science
MSED 520	History/Philosophy of Science
MSED 530	Professional Development and Practicum in Science
MSED 562	Action Research
MSED 597	Special Problems (Ethics)
MSED 594	Special Projects

(Independent Studies within MSED)

Up to eight hours from discipline-specific graduate coursework

12 hours of select coursework from discipline-specific science courses/related fields

Total minimum coursework	51 credit hours
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MSED 691	Ph.D. Thesis Research	Minimum of 25 credits
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Total minimum credits	84 credit hours
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42 maximum transfer of graduate credits from master's (24 credits from coursework/eight credits from research)

Course Descriptions

Numbers in parentheses represent class hours, lab hours, and total credit hours, respectively.

MSED 502

Advanced Strategies: Science

A course that provides additional exposure and development of instructional strategies and models of science teaching. Special emphasis is placed upon promoting critical thinking and decision making. (3-0-3)

MSED 503

Advanced Strategies: Mathematics

A course that provides additional exposure and development of

instructional strategies and models of mathematics teaching. Special emphasis is placed upon promoting critical thinking and decision-making. (3-0-3)

MSED 512

Problems in the Philosophy of Science

This course looks at some key issues in the philosophy and history of science, including the rationality of science, the role of values in scientific inquiry, and the use of models and analogies in scientific thinking. Given that experiments and observations alone never suffice to determine

theory choice, we seek to understand the values that influence science and investigate how it is that science can make progress. We build towards a picture of science as a social process in which theoretical models are chosen and developed in such a way as to increase our over-all ability to solve important problems. (3-0-3)

MSED 520

History/Philosophy of Science

A course that stresses the logical status of scientific ideas and the interaction of these ideas with their social and cultural contexts. (3-0-3)

Course Descriptions continued

MSED 521

History/Philosophy of Mathematics

A course that stresses mathematics as a way of thinking and knowing. (3-0-3)

MSED 530

Teacher Education/Professional Development in Science

A course that stresses the empirical research on best practices in teacher education and professional development in science. (3-0-3)

MSED 531

Teacher Education/Professional Development in Mathematics

A course that stresses the empirical research on best practices in teacher education and professional development in mathematics. (3-0-3)

MSED 538

Interprofessional Project

A group of authentic inquiry experiences supervised by practicing scientists or mathematicians. (3-0-3)

MSED 540

Informal Education Practicum

Placement in an informal educational setting such as museums and outdoor education. The focus of this course is on the use of informal setting to supplement classroom instruction. (3-0-3)

MSED 550

Clinical Supervision in Science/Mathematics

Provides for the development of a variety of classroom observation techniques and clinical supervision skills. (3-0-3)

MSED 552

Assessment and Evaluation

Contemporary assessment and evaluation theory and the development of valid cognitive, affective, and psychomotor assessment items/tasks. In-depth attention is given to the development and scoring of alternative assessment techniques such as portfolios and projects. (3-0-3)

MSED 554

Science Curriculum

Current trends, history of these trends, and rationale for science curriculum reform. (3-0-3)

MSED 555

Mathematics Curriculum

Current trends, history of these trends, and rationale for mathematics curriculum reform. (3-0-3)

MSED 560

Research and Evaluation

Analysis of qualitative and quantitative empirical research in science and mathematics education. (3-0-3)

MSED 562

Action Research

Reviewing, designing and conducting research studies within the context of the students' own teaching. (3-0-3)

MSED 570

Inquiry and Nature of Science

Developing a functional understanding of nature of science in the context of scientific inquiry. (3-0-3)

MSED 571

Problem Solving and Nature of Mathematics

Developing a functional understanding of the nature of mathematics in the context of problem solving. (3-0-3)

MSED 591

Research and Thesis M.S.

(6-0-6)

MSED 594

Special Projects

Advanced projects involving independent study, and especially fieldwork and modeling projects. (Variable: 1-6)

MSED 597

Special Problems

Independent Study and Project. (Variable: 1-9)

MSED 601

Critical Analysis in Quantitative Research

A study of quantitative research designs and analytical procedures with critical analysis of perspectives of research in science/mathematics education. (3-0-3)

MSED 602

Quantitative Research Design and Practicum

A study of quantitative research designs, analytical procedures, and in-depth analysis with specific applications in science/mathematics education. (3-0-3)

MSED 603

Critical Analysis in Qualitative Research

A study of qualitative research designs and analytical procedures with critical analysis of perspectives of research in science/mathematics education. (3-0-3)

MSED 604

Qualitative Research Design and Practicum

A study of qualitative research designs, analytical procedures, and in-depth analysis with specific applications in science/mathematics education. (3-0-3)

MSED 691

Ph.D. Thesis Research

(Variable: 1-20)