

STEM Teaching

Master of Science in STEM Education (Non-Thesis)

Teach@Mines, situated within University Honors and Scholars Programs, offers a Master of Science in STEM Education (Non-thesis). This degree program is designed to prepare students with at least a Bachelor of Science degree in a STEM discipline to teach K-12 or at the college level. The coursework prepares students to teach using best-practices from mathematics, science, engineering, and computer science education research.

Non-thesis master of science in STEM Education

The Master of Science degree (non-thesis option) requires 30 credits of coursework. Students pursuing the degree may double count up to six credits which were used in fulfilling the requirements of their undergraduate degree, towards their graduate program. One additional 400-level course may be counted toward the graduate degree, if the course is not counted towards the undergraduate degree. All courses must have been passed with a "B-" or better. For all three specialty areas - Science Teaching, Mathematics Teaching, and Computer Science Teaching - the curriculum structure consists of (i) a set of required courses, (ii) a pair of discipline specific pedagogy courses, and (iii) general elective courses that serve to supplement the student's technical interests.

Specialty in Science Teaching

Required (18 credits):

SCED562	K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS	3.0
SCED533	EDUCATIONAL PSYCHOLOGY AND ASSESSMENT *	3.0
SCED563	DYNAMIC TEACHING: MOTIVATION, CLASSROOM MANAGEMENT, AND DIFFERENTIATION OF INSTRUCTION	3.0
SCED564	CAPSTONE CURRICULUM DESIGN I	3.0
SCED565	CAPSTONE CURRICULUM DESIGN II	6.0

Discipline specific pedagogy courses (6 credits):

SCED515	SCIENTIFIC PRACTICES VS ENGINEERING DESIGN AND THE NATURE OF SCIENTIFIC KNOWLEDGE *	3.0
SCED545	PHYSICS AND CHEMISTRY TEACHING TECHNIQUES	3.0

Finally, the remaining six credits come from general elective courses that may be taken in other departments on campus to satisfy this requirement.

* SCED533, SCED563, and SCED515 are approved to count as H&SS Restricted Electives.

Specialty in Mathematics Teaching

Required (18 credits):

SCED562	K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS	3.0
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SCED533	EDUCATIONAL PSYCHOLOGY AND ASSESSMENT	3.0
SCED563	DYNAMIC TEACHING: MOTIVATION, CLASSROOM MANAGEMENT, AND DIFFERENTIATION OF INSTRUCTION *	3.0
SCED564	CAPSTONE CURRICULUM DESIGN I	3.0
SCED565	CAPSTONE CURRICULUM DESIGN II	6.0

Discipline specific pedagogy courses (6 credits):

MAED505	MATHEMATICAL PRACTICES AND THE SOCIAL CONTEXT OF MATHEMATICS	3.0
MAED525	PRE-ALGEBRA AND ALGEBRA TEACHING TECHNIQUES	3.0

Finally, the remaining six credits come from general elective courses that may be taken in other departments on campus to satisfy this requirement.

* SCED533, and SCED563 are approved to count as H&SS Restricted Electives.

Specialty in Computer Science Teaching

Required (18 credits):

SCED562	K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS	3.0
SCED533	EDUCATIONAL PSYCHOLOGY AND ASSESSMENT *	3.0
SCED563	DYNAMIC TEACHING: MOTIVATION, CLASSROOM MANAGEMENT, AND DIFFERENTIATION OF INSTRUCTION *	3.0
SCED564	CAPSTONE CURRICULUM DESIGN I	3.0
SCED565	CAPSTONE CURRICULUM DESIGN II	6.0

Discipline specific pedagogy courses (6 credits):

MAED505	MATHEMATICAL PRACTICES AND THE SOCIAL CONTEXT OF MATHEMATICS	3.0
or SCED515	SCIENTIFIC PRACTICES VS ENGINEERING DESIGN AND THE NATURE OF SCIENTIFIC KNOWLEDGE	
MAED535	COMPUTER SCIENCE TEACHING TECHNIQUES	3.0

Finally, the remaining six credits come from general elective courses that may be taken in other departments on campus to satisfy this requirement.

* SCED533, SCED563, and SCED515 are approved to count as H&SS Restricted Electives.

Mines Combined Undergraduate / Graduate Degree Program

Students enrolled in Mines' combined undergraduate/graduate program may double count up to six credits of graduate coursework to fulfill requirements of both their undergraduate and graduate degree programs. These courses must have been passed with "B-" or better, not be substitutes for required coursework, and meet all other University, Department, and Program requirements for graduate credit.

Students are advised to consult with their undergraduate and graduate advisors for appropriate courses to double count upon admission to the combined program.

SCED515. SCIENTIFIC PRACTICES VS ENGINEERING DESIGN AND THE NATURE OF SCIENTIFIC KNOWLEDGE. 3.0 Semester Hrs.

The goal of this course is to prepare students to integrate knowledge of scientific and engineering practices into their teaching as articulated in the Colorado Academic Standards and the Next Generation Science Standards, including asking questions, defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, obtaining, evaluating and communicating information. These skills will be modeled, practiced and mastered in the context of science, specifically: 1) earthquakes and waves, 2) mitosis, meiosis, and reproduction, 4) periodic table of the elements, 5) energy conservation, and 6) forces in static equilibrium. In addition this course will prepare students to be able to communicate effectively in a variety of mediums (written, oral, and digital) as educators about scientific and engineering practices.

SCED533. EDUCATIONAL PSYCHOLOGY AND ASSESSMENT. 3.0 Semester Hrs.

An explosive growth in research on how people learn has revealed many ways to improve teaching and catalyze learning at all ages. The purpose of this course is to present this new science of learning so that educators can creatively translate the science into exceptional practice. This course covers field-defining learning theories ranging from behaviorism to cognitive psychology to social psychology and some lesser-known theories exceptionally relevant to practice, such as arousal theory. Together the theories, evidence, and strategies can be combined endlessly to create original and effective learning plans and the means to know if they succeed.

SCED545. PHYSICS AND CHEMISTRY TEACHING TECHNIQUES. 3.0 Semester Hrs.

In this course students will engage as learners of physics and chemistry through evidence-based teaching strategies. After each unit of instruction, students will reflect on the practices used during the unit and why these practices are effective techniques for teaching science. The goal of this course is for teacher candidates to develop an awareness of 1) the common misconceptions and learning progressions associated with physics and chemistry; 2) evidence-based teaching strategies for physics and chemistry; and 3) the importance of and techniques for placing all content within a context that is familiar to and interesting to your specific student body. Students will leave this course with a minimum of a full month of curriculum annotated and ready to deliver to middle or high school physical science and high school physics courses.

SCED562. K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS. 1-3 Semester Hr.

This course is designed to provide Mines students with opportunities to participate in, analyze, and reflect on issues in a science K-12 school classroom setting. The overall goal is for Mines students to understand who their students are, build relationships, and begin exploring learner development and learner differences. Specifically, the course will focus on developing Mines students' ability to identify and practice basic classroom management, differentiate instruction, ask probing questions, science content preconceptions, language/activities that promote a growth mindset, and professional language. Furthermore, Mines students will begin exploring the factors that shape school norms and culture. In addition to an on-campus seminar, there is a 25-hour field experience requirement in the student's assigned partner school.

SCED563. DYNAMIC TEACHING: MOTIVATION, CLASSROOM MANAGEMENT, AND DIFFERENTIATION OF INSTRUCTION. 3.0 Semester Hrs.

Effective teaching is a dynamic process that requires the instructor to motivate, manage, and vary instruction for all learners in the classroom. The purpose of this course is to prepare future educators to be able to motivate students, manage classroom behavior, and differentiate their instruction so that all students can learn. This course will cover the field-defining theories of motivation, classroom management, and differentiation. Additionally, this course will introduce research-based practices that can be used to create learning environments where students are motivated and given the tools to be successful in their individual learning.

SCED564. CAPSTONE CURRICULUM DESIGN I. 3.0 Semester Hrs.

This course provides Mines students an intensive teaching experience in a K-12 science, engineering, or STEM classroom. The goal of this course is for the student to develop and demonstrate competencies in the areas of planning, instructional methods, assessments, creating effective learning environments for all learners, classroom management and organization, content knowledge, and professionalism. In addition to a total of 15 hours of seminars (on campus and teacher professional development), there is an approximately 6 hours per week (100-hours total) field experience requirement in the student's assigned partner school. During this semester, the student will be responsible for planning and teaching at least five periods of classroom instruction as well as participate in other school related professional roles and will develop a mini-work sample (min-unit of instruction including: description of setting, learning objectives, three class periods or more of standards-based lesson plans, pre/post assessment, and reflection).

SCED565. CAPSTONE CURRICULUM DESIGN II. 6-12 Semester Hr.

This course provides Mines students an immersive student teaching experience in a K-12 science, engineering, or STEM classroom. The goal of this course is for the student to develop and demonstrate competencies in the areas of planning, instructional methods, assessments, creating effective learning environments for all learners, classroom management and organization, content knowledge, and professionalism. In addition to a total of 15 hours of seminars (on campus and teacher professional development), there is a 32-hour per credit hour enrolled field experience requirement in the student's assigned partner school. During this semester, the student will be responsible for planning and teaching at least five periods of classroom instruction for each 3 credit hours enrolled as well as participate in other school related professional roles and will develop a work sample (unit of instruction including: description of setting, learning objectives, three class periods or more of standards-based lesson plans, pre/post assessment, and reflection).

MAED505. MATHEMATICAL PRACTICES AND THE SOCIAL CONTEXT OF MATHEMATICS. 3.0 Semester Hrs.

n/a.

MAED525. PRE-ALGEBRA AND ALGEBRA TEACHING TECHNIQUES. 3.0 Semester Hrs.

In this course teacher candidates will be exposed to evidence-based instructional practices to support students' learning of pre-algebra and algebra and model meaningful learning opportunities, common misconceptions and ways of thinking, and students' learning progressions (i.e., content trajectory). The goal of this course is for teacher candidates to develop an awareness of 1) the common misconceptions and learning progressions associated with pre-algebra and algebra; 2) students learning progressions in pre-algebra and algebra, and 3) evidence-based and meaningful instructional strategies for pre-algebra and algebra. The teacher candidate analyzes conceptual algebra underpinnings, common misconceptions, and students' ways of thinking to create opportunities to learn.

MAED535. COMPUTER SCIENCE TEACHING TECHNIQUES. 3.0 Semester Hrs.

This course provides teacher candidates an opportunity to develop the skills to promote students' computer science (CS) identity and their understanding of CS practices and processes including computational thinking as articulated in (1) the Computer Science Teachers Association and (2) the Colorado Academic Standards. These skills will be modeled, practiced and mastered in the context of authentic CS practices (e.g., the development of websites and computer programs that analyze datasets). Teacher candidates will engage as learners, reflect as practitioners, and finally develop their own 3-day mini-unit. To promote candidates' awareness of the social and ethical context of CS, candidates will explore the historical development of content and perspectives from diverse cultures. In addition, this course will prepare students to be able to communicate effectively in a variety of mediums (written, oral, and digital) as educators about CS concepts, processes, and practices. Prerequisites: CSCI101, CSCI260.

MAED562. K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS. 1-3 Semester Hr.

This course is designed to provide Mines students with opportunities to participate in, analyze, and reflect on issues in a mathematics or computer science K-12 school classroom setting. The overall goal is for Mines students to understand who their students are, build relationships, and begin exploring learner development and learner differences. Specifically, the course will focus on developing Mines students' ability to identify and practice basic classroom management, differentiate instruction, ask probing questions, mathematics or computer science content preconceptions, language/activities that promote a growth mindset, and professional language. Furthermore, Mines students will begin exploring the factors that shape school norms and culture. In addition to an on-campus seminar, there is a 25-hour field experience requirement in the student's assigned partner school.

MAED564. CAPSTONE CURRICULUM DESIGN I. 3.0 Semester Hrs.

This course provides Mines students an intensive teaching experience in a K-12 mathematics or computer science classroom. The goal of this course is for the student to develop and demonstrate competencies in the areas of planning, instructional methods, assessments, creating effective learning environments for all learners, classroom management and organization, content knowledge, and professionalism. In addition to a total of 15 hours of seminars (on campus and teacher professional development), there is an approximately 6 hours per week (100-hours total) field experience requirement in the student's assigned partner school. During this semester, the student will be responsible for planning and teaching at least five periods of classroom instruction as well as participate in other school related professional roles and will develop a mini-work sample (min-unit of instruction including: description of setting, learning objectives, three class periods or more of standards-based lesson plans, pre/post assessment, and reflection). Prerequisites: Completion of MAED562, SCED533, SCED563, MAED505 and MAED525 or MAED535 with a grade of B- or higher in each course.

MAED565. CAPSTONE CURRICULUM DESIGN II. 6-12 Semester Hr.

This course provides Mines students an intensive teaching experience in a K-12 mathematics or computer science classroom. The goal of this course is for the student to develop and demonstrate competencies in the areas of planning, instructional methods, assessments, creating effective learning environments for all learners, classroom management and organization, content knowledge, and professionalism. In addition to a total of 15 hours of seminars (on campus and teacher professional development), there is a 2 hours per week (32-hours total) per credit hour enrolled field experience requirement in the student's assigned partner school. During this semester, the student will be responsible for planning and teaching at least five periods of classroom instruction for each 3 credit hours enrolled as well as participate in other school related professional roles and will develop a mini-work sample (min-unit of instruction including: description of setting, learning objectives, three class periods or more of standards-based lesson plans, pre/post assessment, and reflection).