Minor in Teaching

Program Description

Teach@Mines is an interdisciplinary University Honors and Scholars program that offers undergraduate students a K-12 teaching minor in Math, Science, or Computer Science. Teach@Mines coursework prepares students to teach using best practices from mathematics, science, engineering, and computer science education research. Sample core topics include educational psychology, student motivation and engagement techniques, and classroom management. In addition, students engage in intentional teaching experiences through field hours spent in K-12 classrooms with experienced mentor teachers throughout the program. Any student at Mines can add Colorado teacher licensure to their degree. The state requires a minimum of 24 credits of content in math, science, computer science, or engineering and 24 credits of educational coursework plus 800 hours of K-12 field experience. The educational coursework can be completed simply for the purpose of earning licensure or as part of the teaching minor. The full 24 credits of required educational coursework are built into the Teaching Minor with Licensure. Teach@Mines offers pathways for licensure in: Secondary Science (Grades 6-12), Secondary Mathematics (Grades 6-12), Middle School Mathematics (Grades 6-8), and Computer Science (Grades K-12). Students completing the Teaching minor may continue to graduate school or pursue careers in K-12 teaching.

Student Learning Outcomes

After completing the Teaching Minor, students will be able to:

- Translate the science of teaching, learning, and assessing to formal and informal STEM educational spaces.
- Create engaging learning environments that are effective for all students by providing access, support, and challenge for every student as well as differentiating instruction to meet the needs of all students.
- Apply evidence-based classroom management techniques to create a positive learning environment.
- Nurture and develop students' understanding of science practices and engineering design, mathematical practices, and computer science practices.
- Prepare pre-service STEM teachers to respectfully provide compassionate, ethical, and innovative curriculum and education, resulting in rewarding teaching careers.
- Prepare students to be innovators in STEM education.

Primary Contact

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https://www.mines.edu/teacherprep/
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Teaching Minor

To obtain a Teaching Minor, students must take at least 18 credits related to teacher education. Four specific courses are required: 3 credits of Field Experience (SCED262), Educational Psychology (SCED333), Dynamic Teaching (SCED363) and Capstone Curriculum Design (SCED464 or MAED464 or CSED464). Additionally, students will choose two additional courses, one from each category listed below.

Required Courses:		**9.0**
SCED262	K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS	
SCED333	EDUCATIONAL PSYCHOLOGY AND ASSESSMENT	
SCED363	DYNAMIC TEACHING: MOTIVATION, CLASSROOM MANAGEMENT, AND DIFFERENTIATION OF INSTRUCTION	
One of the following Required Courses:		**3.0**
SCED464	CAPSTONE CURRICULUM DESIGN I	
MAED464	CAPSTONE CURRICULUM DESIGN I	
CSED464	CAPSTONE CURRICULUM DESIGN I - PRACTICUM	
One of the following Practices Courses:		**3.0**
MAED405	MATHEMATICAL PRACTICES AND THE SOCIAL CONTEXT OF MATHEMATICS	
SCED415	SCIENTIFIC PRACTICES VS ENGINEERING DESIGN AND THE NATURE OF SCIENCE	
CSED430	COMPUTER SCIENCE PRACTICES AND TECHNOLOGICAL IMPACTS ON SOCIETY	
One of the following Teaching Techniques Courses:		**3.0**
SCED445	PHYSICS AND CHEMISTRY TEACHING TECHNIQUES	
MAED425	PRE-ALGEBRA AND ALGEBRA TEACHING TECHNIQUES	
CSED435	COMPUTER SCIENCE TEACHING TECHNIQUES	
Total Semester Hrs		**18.0**

Teaching Minor with Licensure

To obtain a Teaching Minor with Licensure, students must take at least 24.0 credits related to teacher education. Five specific courses are required: 3 credits of Field Experience (SCED262), Educational Psychology (SCED333), Dynamic Teaching (SCED363) and Capstone Curriculum Design I (SCED464 or MAED464 or CSED464); 6 credits of Capstone Curriculum Design II (SCED465 or MAED465 or CSED465). Additionally, students will choose two additional courses, one from each category listed below.

Required Courses:		**9.0**
SCED262	K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS	
SCED333	EDUCATIONAL PSYCHOLOGY AND ASSESSMENT	
SCED363	DYNAMIC TEACHING: MOTIVATION, CLASSROOM MANAGEMENT, AND DIFFERENTIATION OF INSTRUCTION	
One of the following Required Courses:		**3.0**
SCED464	CAPSTONE CURRICULUM DESIGN I	
MAED464	CAPSTONE CURRICULUM DESIGN I	
CSED464	CAPSTONE CURRICULUM DESIGN I - PRACTICUM	
One of the following Required Courses:		**6.0**
SCED465	CAPSTONE CURRICULUM DESIGN II	
MAED465	CAPSTONE CURRICULUM DESIGN II	

CSED465	CAPSTONE CURRICULUM DESIGN II - STUDENT TEACHING	
One of the following Practices Courses:		**3.0**
MAED405	MATHEMATICAL PRACTICES AND THE SOCIAL CONTEXT OF MATHEMATICS	
SCED415	SCIENTIFIC PRACTICES VS ENGINEERING DESIGN AND THE NATURE OF SCIENCE	
CSED430	COMPUTER SCIENCE PRACTICES AND TECHNOLOGICAL IMPACTS ON SOCIETY	
One of the following Teaching Techniques Courses:		**3.0**
SCED445	PHYSICS AND CHEMISTRY TEACHING TECHNIQUES	
MAED425	PRE-ALGEBRA AND ALGEBRA TEACHING TECHNIQUES	
CSED435	COMPUTER SCIENCE TEACHING TECHNIQUES	

CSED430. COMPUTER SCIENCE PRACTICES AND TECHNOLOGICAL IMPACTS ON SOCIETY FOR LEADERSHIP AND INNOVATION. 3.0 Semester Hrs.
Students will explore current industry practices in computer science, the impacts major technological changes have had on society, and importantly, how to explicitly incorporate these topics into your teaching K12 students or clients alongside computer science content. You will interact with these topics in the context of software engineering practices and the impact of artificial intelligence while also zooming out to reflect on the future of computer science at a 'meta' level. Students will explore research-based instruction of CS practices and ethics in K-12 through curriculum design and microteaching. By synthesizing industry trends with pedagogical excellence, students will become CS leaders and innovators capable of shaping forward-thinking curricula and advocating the ethical evolution of technology within professional landscapes. Prerequisite: CSCI128 or CSCI200 or CSCI220. Co-requisite: None.
Course Learning Outcomes

- Evaluate the impacts major technological changes have had on society (e.g., internet, mobile phones, AR/VR, AI).
- Analyze current effective computer science industry practices.
- Students will be able to engage in appropriate computer science practices and, as teachers, support their own students in doing the same.
- Students will be able to identify, adapt, and/or develop K-12 lessons to effectively develop students' understanding of computer science practices.
- Students will be able to integrate current issues and events related to computer science, and age-/grade-appropriate controversial topics presented from multiple perspectives into lessons using an analytical approach without bias.
- Students will be able to select, adapt, and/or develop lessons that explicitly engage students in directly learning about innovative computer science practices aligned with the Colorado Academic Standards.
- Students will be able to identify, adapt, and/or develop lessons that reflect the interconnectedness of content areas/disciplines to help erase the disciplinary lines and reflect authentic situations.
- Students will be able to clearly articulate their ideas in writing. This involves a. composing short synthesis opinion papers and longer research papers with an awareness about introductions, conclusions and topic sentences; b. incorporating and cite correctly all evidence used to support a text's claim/s.
- Students will be able to clearly articulate their ideas verbally. This involves a. delineating effective characteristics of multi-media presentations; b. articulating computer science practices in a way that K-12 students can understand and be motivated to explore these practices; and c. collaborating with others toward giving and receiving feedback on both oral and written work about teaching computer science practices.
- Develop professional leadership and communication skills.

CSED435. COMPUTER SCIENCE TEACHING TECHNIQUES: LEADING AND TEACHING TEAMS. 3.0 Semester Hrs.
Students will investigate, deconstruct, and design K-12 Computer Science curriculum while refining their instructional delivery and assessment techniques through the lens of elementary, middle, and high school frameworks. This hands-on course utilizes interactive classroom observations and insights from guest educators to bridge pedagogical theory with real-world practice. Beyond technical content, candidates will develop the leadership capacity to manage a variety of learning environments and implement assessment strategies that support the unique needs of every student. Prerequisite: None. Co-requisite: None.
Course Learning Outcomes

- Students will apply knowledge of computational thinking and programming concepts to the creation of curriculum, appropriate instructional strategies, and related formative and summative assessments. 1. Students will demonstrate in writing (e.g., lesson plans, reflections, essays) and in teaching presentations knowledge of: a. Computational thinking and programming concepts, namely: i. problem-solving skills, variables and control structures, abstraction and algorithms, including: 1. code comments, pseudocode, flowcharts and other documentation. 2. testing and debugging; ii. hardware and software systems, including: 1. inputs and outputs; 2. storage and the process of the transformation of data; 3. specific functions and use of hardware; 4. troubleshooting problems; iii. internet and network systems, including: 1. the internet's role as facilitator of the transfer of information; 2. a network as a series of interconnected devices and the internet as a series of interconnected networks; and 3. basic internet safety; iv. how to collect, store, transform, analyze, evaluate and secure data; and v. the impacts of computing, including: 1. the interaction between human and computing systems; 2. the history of computer science; 3. equity and access considerations; 4. laws and ethics associated with the field of computer science and the ramifications of the misuse of technology; and 5. tradeoffs between usability and security in hardware, networks, and the internet.
- Students will apply knowledge of computer science (CS) pedagogical theory and research-based instructional strategies incorporating age-appropriate and cultural and linguistically responsive curriculum and instruction based on national and state CS standards. 2. Students will demonstrate in writing (e.g., lesson plans, reflections, essays) and in teaching presentations knowledge of and/or the ability to: a. create and foster an engaging environment in which all students develop the requisite computer science skills to participate more fully in a technologically based collaborative society; b. analyze and evaluate computer science curricula to ensure age- and grade-appropriate content; c. effectively integrate technology into instructional and assessment strategies, as appropriate to computer science education and the learner; d. perform laboratory-based, hands-on activities, including unplugged activities, block-based programming and third-generation programming language, that demonstrate grade-appropriate programming concepts and

proficiency; and e. implement instructional practices and grade-appropriate applications on the interrelationships between the field of computer science and disparate content areas to: i. make concrete and abstract representations; and ii. connect computer science with real-world situations.

- Students will apply content knowledge of CS on a variety of subdisciplines, programming concepts, and interdisciplinary approaches to enact engaging and motivating learning. 3. Students will demonstrate in writing (e.g., lesson plans, reflections, essays) and in teaching presentations knowledge of and/or the ability to effectively instruct: a. artificial intelligence; b. computational sciences; c. computer programming; d. cybersecurity; e. data science; f. hardware and network systems; g. machine learning; and h. robotics.
- Students will cultivate K-12 students' CS identities by helping them realize the usefulness of CS by providing connections to students' everyday lives. Build CS self-efficacy by encouraging persistence and demonstrating the belief that every student is capable of learning and expressing their creativity and intelligence with CS.4. Students will demonstrate in writing (e.g., lesson plans, reflections, essays) and in teaching presentations knowledge of specific shifts in general instruction practices required for computer science education and the ability to assist K-12 students: a. develop resilience and perseverance with regard to computer science and computational learning experiences; b. attain a level of comfort with ambiguity and open-ended problems; c. see failure as an opportunity to learn and innovate; d. understand that computational thinking is a fundamental human ability and does not require a computer, and how that understanding can leverage the power of computers to solve a problem; e. recognize that not all problems can be solved computationally; and f. understand the role and importance of cybersecurity.
- Students will collaborate with others towards giving and receiving feedback on both oral and written work about teaching CS as a community of inquiry. 5. Students shall demonstrate in writing (e.g., lesson plans, reflections, essays) and in teaching presentations the ability to self-assess and act upon feedback regarding the effectiveness of instruction based on the achievement of students.
- Students will develop an appreciation for teaching as a practice which requires ongoing study. 6. Students will demonstrate knowledge about pursuing continuous professional development through appropriate activities, coursework and participation in relevant professional organizations to keep abreast of the ever-changing developments in technology.
- Develop professional leadership and communication skills.

CSED464. STUDENT TEACHING PRACTICUM: DEVELOPING STEM EDUCATIONAL LEADERSHIP. 3.0 Semester Hrs.

This course provides Mines students with 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, especially in methods that apply particularly to STEM education. In addition to a total of 15 hours of seminars (on campus and teacher professional development), there is a 100-hour field experience requirement in the students 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). By bridging rigorous academic theory with real-world classroom application, students will cultivate the STEM educational leadership ability necessary to mentor students, advocate for high-quality instruction, and drive innovation within their school partnerships. Prerequisite: Completed/concurrent 3 credits of SCED 262; complete/concurrent with CSED 430 or CSED 435. Co-requisite: Completed/concurrent 3 credits of SCED 262; complete/concurrent with CSED 430 or CSED 435.

Course Learning Outcomes

- Reflect on their practice and use this reflection to set goals for further growth.
- Write standards-based lesson plans that include measurable learning objectives, applicable Colorado Content Standards, required materials, safety considerations, an outline of the lesson scaffolded with the five E's (engage, explore, explain, elaborate and evaluate) or other learning cycle model, accommodations, formative assessment and subject integration.
- Utilize research-based instructional techniques that have been shown to be effective across context, including pairing graphics with words, linking abstract concepts with concrete representations, asking probing questions, repeatedly alternating solved and unsolved problems, distributed practice and assessment to boost retention.
- Identify, adapt, or develop lessons using a variety of active learning techniques based on how all students learn science, engineering or STEM, including lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, and identify relationships and natural patterns. Applications of science-specific technology are included in the lessons when appropriate.
- Use formative-assessment techniques (10 or more) to evaluate students' thinking during classroom activities and assess students' progress towards mastery of the learning outcomes in each lesson; reflect on implemented lessons and provide suggestions to improve future implementations to address gaps or needs identified from the formative assessment data, including but not limited to determining appropriate delivery of instruction based on identified student need; and to select appropriate tasks to reinforce and promote students' development of concepts and skills.
- Apply evidence-based classroom management techniques (e.g., establishing rules and routines, utilizing praise and rewards, consistently disciplining misbehavior, and engaging students) to create a positive learning environment (e.g., acceptable learning behaviors and maximizing time on task.).
- Create engaging learning environments that are effective for all students by providing access, support, and challenge for every student as well as differentiating instruction to meet the needs of all students.
- Identify lessons that are well designed to build students' reading, writing, speaking and listening with science or mathematics classes.
- Engage in professional behavior expected of new teachers including a. appropriate dress, b. attendance and professional commitments, c. teacher presence/appropriate boundaries (specifically, can describe the difference between being a student's teacher and being their friend), d. respectful collaboration (even if do not agree), e. professional initiative, and f. student confidentiality related to both academic performance and personal lives.
- Learn about their individual school context, policies and practices and through reflection on prior field experiences have an appreciation for

different school cultures and understand that these are shaped by the school's teachers, administrators, parents, students and community in which it is situated.
- Provide proactive, clear and constructive feedback to families about student progress and develop a library of mechanisms to work collaboratively with the families and significant adults in the lives of their students.
- Develop professional leadership and communication skills.

CSED465. STUDENT TEACHING RESIDENCY: LEADING AND INNOVATING STEM EDUCATION. 6-12 Semester Hr.
This course provides Mines students with 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 students 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). Through this immersive residency, students will refine their capacity to lead and innovate in STEM education by spearheading collaborative initiatives and designing transformative learning experiences that address the evolving needs of the global workforce. Prerequisite: Completed CSED 464; completed/concurrent with SCED 333, SCED 363, CSED 430, and CSED 435. Co-requisite: Completed/concurrent with SCED 333, SCED 363, CSED 430, and CSED 435.
Course Learning Outcomes

- Utilize research-based instructional techniques that have been shown to be effective across context, including pairing graphics with words, linking abstract concepts with concrete representations, asking probing questions, repeatedly alternating solved and unsolved problems, distributed practice and assessment to boost retention.
- Identify, adapt, or develop lessons using a variety of active learning techniques based on how all students learn science, engineering or STEM, including lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, and identify relationships and natural patterns. Applications of science-specific technology are included in the lessons when appropriate.
- Use formative-assessment techniques (10 or more) to evaluate students' thinking during classroom activities and assess students' progress towards mastery of the learning outcomes in each lesson; reflect on implemented lessons and provide suggestions to improve future implementations to address gaps or needs identified from the formative assessment data, including but not limited to determining appropriate delivery of instruction based on identified student need; and to select appropriate tasks to reinforce and promote students' development of concepts and skills.
- Apply evidence-based classroom management techniques (e.g., establishing rules and routines, utilizing praise and rewards, consistently disciplining misbehavior, and engaging students) to create a positive learning environment (e.g., acceptable learning behaviors and maximizing time on task.).
- Create engaging learning environments that are effective for all students by providing access, support, and challenge for every student as well as differentiating instruction to meet the needs of all students.
- Identify lessons that are well designed to build students' reading, writing, speaking and listening with science or mathematics classes.
- Engage in professional behavior expected of new teachers including a. appropriate dress, b. attendance and professional commitments, c. teacher presence/appropriate boundaries (specifically, can describe the difference between being a student's teacher and being their friend), d. respectful collaboration (even if do not agree), e. professional initiative, and f. student confidentiality related to both academic performance and personal lives.
- Learn about their individual school context, policies and practices and through reflection on prior field experiences have an appreciation for different school cultures and understand that these are shaped by the school's teachers, administrators, parents, students and community in which it is situated.
- Provide proactive, clear and constructive feedback to families about student progress and develop a library of mechanisms to work collaboratively with the families and significant adults in the lives of their students.
- Develop professional leadership and communication skills.

CSED498. SPECIAL TOPICS. 0-6 Semester Hr.
(I, II) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once. Repeatable for credit under different titles.

MAED262. K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS. 1.0 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.
Course Learning Outcomes

- • identify and provide examples of differentiated instruction.
- • identify and provide examples of formative-assessment techniques used to evaluate what students are thinking during classroom activities
- • articulate the value of reflecting on their practice.
- • explain different levels of questioning and how to ask probing questions as well as provide examples of how to use these types of questioning.
- • articulate reasons for, ways to, and examples of how they built relationships with each and every student in their classroom.
- • articulate and document the mathematics or computer science content specific preconceptions that they observed students demonstrate during the field placement.
- • identify the school policies and practices of their field placement.

- • identify factors that shaped the culture and norms of the school they experienced.
- • communicate effectively, model appropriate use of language (e.g., use of proper grammar, use of professional language, and use of discipline-specific vocabulary), and identify unprofessional language.
- • articulate the critical role of high ethical standards, including a belief in being committed to displaying ethical conduct towards students, performance and the profession, colleagues, and parents and the community.
- • recognize that with quality instruction and hard work, all students are capable of learning science and mathematics; use language, activities and feedback that is consistent with a growth mindset.

MAED405. MATHEMATICAL PRACTICES AND THE SOCIAL CONTEXT OF MATHEMATICS FOR EDUCATIONAL LEADERSHIP. 3.0 Semester Hrs.

This course provides teacher candidates an opportunity to develop the skills to promote students' mathematical identity and their understanding of mathematical practices and processes—mathematics as a community of inquiry—as articulated in the Colorado Academic Standards and Common Core. These skills will be modeled, practiced, and mastered in the context of authentic mathematical practices (e.g., the formation of the quadratic equation through the maximization of orange production). 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 context of mathematics, 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 mathematical processes and practices. Ultimately, candidates will emerge as educational innovators and leaders who can leverage math pedagogical tools to spark systemic change and inspire the next generation of critical thinkers.

Course Learning Outcomes

- Nurture development of mathematical processes and practices. They anticipate how students' use of mathematical practices will look and sound within specific grade-band mathematical topics, knowing that over years of experience, their knowledge of students' ways of using mathematical practices will expand to more mathematical topics.
- Identify, adapt, or develop lessons that explicitly teach mathematical process and practices demonstrating these as tools use to solve problems and communicate ideas.
- Demonstrate that doing mathematics is a sense-making activity that promotes perseverance, problem posing, and problem solving.
- Provide examples and connections for students to see that mathematics is a human endeavor that is practice in and out of school, across many facets of life.
- Integrate the history of mathematics into content and share contributions from people with different gender and cultural, linguistic, religious, and racial/ethnic backgrounds.
- Articulate how mathematics is based on constructed conventions and agreements about the meanings of words and symbols, and these conventions vary; algorithms considered as standard in the United States different from algorithms used in other countries.
- Cultivate their students' mathematical identity by helping students realize the usefulness of mathematics by providing connections to students' everyday lives and building their students mathematics self-efficacy by encouraging hard work from every student and demonstrating the belief that every student is capable of learning and using mathematics
- Identify and implement practices that draw on students' mathematical, cultural, and linguistic resources/strengths and challenge practices grounded in deficit-based thinking.
- Select, adapt, or develop lessons that explicitly engage students the mathematical practices defined in the Colorado Academic Standards and Common Core in mathematics.
- Identify, adapt, or develop lessons that reflect the interconnectedness of content areas/disciplines to help erase the disciplinary lines and reflect authentic situations.
- Create a mini-unit (3 days or more) that explicitly teaches some aspect of mathematical practices or the social context of mathematics.
- Clearly articulate their mathematical ideas in writing. o analyze text based on occasion, audience, form and function. o compose one page reflections with an awareness about introductions, conclusions and topic sentences. o articulate the process of and compose with an awareness about the composing process which is an iterative process of formulation, composition and revision. o incorporate and cite correctly all evidence used to support a text's claim/s.
- Clearly articulate their mathematical ideas verbally. o delineate effective characteristics of multi-media presentations. o articulate mathematical practices in a way that secondary students can understand and be motivated to explore these practices. o collaborate with others towards giving and receiving feedback on both oral and written work about teaching mathematics as a community of inquiry.
- Develop professional leadership and communication skills.

MAED425. PRE-ALGEBRA AND ALGEBRA TEACHING TECHNIQUES: LEADING, TEACHING, AND ASSESSING TEAMS AND STUDENTS. 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 is 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. Furthermore, candidates will refine their ability to lead dynamic learning groups by implementing data-driven assessment techniques that inform real-time instructional adjustments and foster collaborative student success.

Course Learning Outcomes

- Plan at least the first month of instruction for a middle or high school pre-algebra or algebra course using standards-based lessons experienced in this course.
- Construct and evaluate mathematical conjectures and argument to validate one's own mathematical thinking.
- Identify and develop lessons that are designed to build students knowledge as defined in the Colorado Academic Standards in mathematics and literacy. Candidates will be able to
- Articulate the scope of the above standards related to the content knowledge necessary for teaching 7-12 students.

- Describe mathematical ideas, using every day and mathematical language, in both verbal and written formats.
- Develop professional leadership and communication skills.

MAED464. STUDENT TEACHING PRACTICUM: DEVELOPING STEM EDUCATIONAL LEADERSHIP. 3.0 Semester Hrs.
This course provides Mines students with 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, especially in methods that apply particularly to STEM education. In addition to a total of 15 hours of seminars (on campus and teacher professional development), there is a 100-hour field experience requirement in the students 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). By bridging rigorous academic theory with real-world classroom application, students will cultivate the STEM educational leadership ability necessary to mentor students, advocate for high-quality instruction, and drive innovation within their school partnerships. Prerequisite: Completed/concurrent 3 credits of SCED 262; completed/concurrent with MAED 405 or MAED 425. Corequisite: Completed/concurrent 3 credits of SCED 262; completed/concurrent with MAED 405 or MAED 425.
Course Learning Outcomes

- Utilize research-based instructional techniques that have been shown to be effective across context, including pairing graphics with words, linking abstract concepts with concrete representations, asking probing questions, repeatedly alternating solved and unsolved problems, distributed practice and assessment to boost retention.
- Identify, adapt, or develop lessons using a core set of pedagogical practices that are effective for developing students' meaningful learning of mathematics which include establishing goals, promoting reasoning and problem solving, connecting mathematical representations, meaningful discourse, purposeful questions, procedural fluency based on conceptual understanding, and productive struggle. While planning lessons program completers will also anticipate and attend to students' prior knowledge, problem solving approaches, mathematical practices, dispositions, mathematical identity, and mathematical communication.
- Use formative-assessment techniques (10 or more) to evaluate students' thinking during classroom activities and assess students' progress towards mastery of the learning outcomes in each lesson; reflect on implemented lessons and provide suggestions to improve future implementations to address gaps or needs identified from the formative assessment data, including but not limited to determining appropriate delivery of instruction based on identified student need; and to select appropriate tasks to reinforce and promote students' development of concepts and skills.
- Apply evidence-based classroom management techniques (e.g., establishing rules and routines, utilizing praise and rewards, consistently disciplining misbehavior, and engaging students) to create a positive learning environment (e.g., acceptable learning behaviors and maximizing time on task.).
- Create engaging learning environments that are effective for all students by providing access, support, and challenge for every student as well as differentiating instruction to meet the needs of all students.
- Identify lessons that are well designed to build students' reading, writing, speaking and listening with science or mathematics classes.
- Engage in professional behavior expected of new teachers including o appropriate dress, o attendance and professional commitments, o teacher presence/appropriate boundaries (specifically, can describe the difference between being a student's teacher and being their friend), o respectful collaboration (even if do not agree), o professional initiative, and o student confidentiality related to both academic performance and personal lives.
- Learn about their individual school context, policies and practices and through reflection on prior field experiences have an appreciation for different school cultures and understand that these are shaped by the school's teachers, administrators, parents, students and community in which it is situated.
- Provide proactive, clear and constructive feedback to families about student progress and develop a library of mechanisms to work collaboratively with the families and significant adults in the lives of their students.
- Reflect on their practice and use this reflection to set goals for further growth.
- Write standards-based lesson plans that include measurable learning objectives, applicable Colorado Content Standards, required materials, safety considerations, an outline of the lesson scaffolded with the five E's (engage, explore, explain, elaborate and evaluate) or other learning cycle model, accommodations, formative assessment and subject integration.
- Develop professional leadership and communication skills.

MAED465. STUDENT TEACHING RESIDENCY: LEADING AND INNOVATING STEM EDUCATION. 6-12 Semester Hr.
This course provides Mines students with 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 students 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). Through this immersive residency, students will refine their capacity to lead and innovate in STEM education by spearheading collaborative initiatives and designing transformative learning experiences that address the evolving needs of the global workforce. Prerequisite: Completed MAED 464; completed/concurrent with SCED 333, SCED 363, MAED 405, and MAED 425. Corequisite: Completed/concurrent with SCED 333, SCED 363, MAED 405, and MAED 425.
Course Learning Outcomes

- Utilize research-based instructional techniques that have been shown to be effective across context, including pairing graphics with words, linking abstract concepts with concrete representations,

asking probing questions, repeatedly alternating solved and unsolved problems, distributed practice and assessment to boost retention.

- Identify, adapt, or develop lessons using a core set of pedagogical practices that are effective for developing students' meaningful learning of mathematics or computer science which include establishing goals, promoting reasoning and problem solving, connecting mathematical representations, meaningful discourse, purposeful questions, procedural fluency based on conceptual understanding, and productive struggle. While planning lessons program completers will also anticipate and attend to students' prior knowledge, problem solving approaches, mathematical practices, dispositions, mathematical identity, and mathematical communication.
- Use formative-assessment techniques (10 or more) to evaluate students' thinking during classroom activities and assess students' progress towards mastery of the learning outcomes in each lesson; reflect on implemented lessons and provide suggestions to improve future implementations to address gaps or needs identified from the formative assessment data, including but not limited to determining appropriate delivery of instruction based on identified student need; and to select appropriate tasks to reinforce and promote students' development of concepts and skills.
- Apply evidence-based classroom management techniques (e.g., establishing rules and routines, utilizing praise and rewards, consistently disciplining misbehavior, and engaging students) to create a positive learning environment (e.g., acceptable learning behaviors and maximizing time on task.).
- Create engaging learning environments that are effective for all students by providing access, support, and challenge for every student as well as differentiating instruction to meet the needs of all students.
- Identify lessons that are well designed to build students' reading, writing, speaking and listening with science or mathematics classes.
- Engage in professional behavior expected of new teachers including o appropriate dress, o attendance and professional commitments, o teacher presence/appropriate boundaries (specifically, can describe the difference between being a student's teacher and being their friend), o respectful collaboration (even if do not agree), o professional initiative, and o student confidentiality related to both academic performance and personal lives.
- Learn about their individual school context, policies and practices and through reflection on prior field experiences have an appreciation for different school cultures and understand that these are shaped by the school's teachers, administrators, parents, students and community in which it is situated.
- Provide proactive, clear and constructive feedback to families about student progress and develop a library of mechanisms to work collaboratively with the families and significant adults in the lives of their students.
- Develop professional leadership and communication skills.

MAED498. SPECIAL TOPICS. 0-6 Semester Hr.

SCED262. K-12 FIELD EXPERIENCE: LEADERSHIP IN THE CLASSROOM, BUILDING STUDENT AND TEAM 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 through the lens of educational leadership. The overall goal is for Mines students to understand who their students are, build relationships, and begin exploring learner development and differences while establishing themselves as leaders of a learning community. Specifically, the course will focus on developing students' ability to identify and practice basic classroom management as a foundational leadership skill, differentiate instruction, and lead inquiry through probing questions. Students will address science content preconceptions, utilize language that promotes a growth mindset, and adopt professional language. Furthermore, students will explore the factors that shape school norms and culture, identifying opportunities for leadership within the broader school ecosystem. In addition to an on-campus seminar, there is a 25-hour field experience requirement in the student's assigned partner school for every credit hour.

Course Learning Outcomes

- Identify and provide examples of differentiated instruction.
- Identify and provide examples of formative-assessment techniques used to evaluate what students are thinking during classroom activities
- Articulate the value of reflecting on their practice.
- Explain different levels of questioning and how to ask probing questions as well as provide examples of how to use these types of questioning.
- Articulate reasons for, ways to, and examples of how they built relationships with each and every student in their classroom.
- Articulate and document the science content specific preconceptions that they observed students demonstrate during the field placement.
- Identify the school policies and practices of their field placement.
- Identify factors that shaped the culture and norms of the school they experienced.
- Communicate effectively, model appropriate use of language (e.g., use of proper grammar, use of professional language, and use of discipline-specific vocabulary), and identify unprofessional language.
- Articulate the critical role of high ethical standards, including a belief in being committed to displaying ethical conduct towards students, performance and the profession, colleagues, and parents and the community.
- Recognize that with quality instruction and hard work, all students are capable of learning science and mathematics; use language, activities and feedback that is consistent with a growth mindset.
- Develop professional leadership and communication skills.

SCED333. EDUCATIONAL PSYCHOLOGY AND ASSESSMENT FOR EDUCATIONAL LEADERSHIP. 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. This course explores the research on effective collaboration techniques that can be utilized by STEM leaders to collaborate with professionals within their field and with professionals outside of their field of expertise. 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.

Course Learning Outcomes

- Describe in general what cognitive science has learned about how the brain works related to the topics of conceptual understanding,

memory, motivation, expertise, study skills, sense of inclusion, problem solving, collaboration, and discovery.

- Analyze various effective teaching practices in math and the sciences and provide examples of how the above topics in cognitive science inform these practices.
- Utilize research based methods of instruction that have been shown to be effective across context, including pairing graphics with words, linking abstract concepts with concrete representations, repeatedly alternating solved and unsolved problems, distributed practice, and assessment to boost retention.
- Effectively integrate technology into instructional and assessment strategies, as appropriate to science and mathematical education and the learner including but not limited to the use of a variety of resources (e.g., manipulative materials, graphing calculators, everyday hands-on materials, probe ware, and computers).
- Explain the value of embedding disciplinary research into the high school classroom and provide an example in science or math of how this can be done.
- Define data driven instruction, brain plasticity, and individual differences.
- Utilize formative assessment daily to adjust to students' needs as they are teaching and to determine where instruction can be improved next time.
- Utilize pre/post-tests as a form of formative assessment on a unit basis to determine change, learning gains, and effect size by group; Then, use the results to modify their future instruction.
- Use summative assessment to determine student level of mastery
- Provide accurate information about the teaching profession related to salary, benefits, and teacher satisfaction.
- Provide evidence for the nations' science and math teacher shortage and describe some research-based actions that can help change the direction of this trend.
- Continuously improve their knowledge and understanding of the ever-changing knowledge base of both content, and science/mathematics pedagogy, including approaches for addressing inequities and inclusion for all students in science and math.
- Developing professional leadership and communication skills.

SCED363. DYNAMIC TEACHING: LEADING CLASSROOMS AND TEAMS THROUGH MOTIVATION, MANAGEMENT, AND DIFFERENTIATION. 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. Participants will gain leadership skills to inspire motivation, effectively manage classrooms and work teams, and adapt their approach to support individuals across both learning and professional environments. 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.

Course Learning Outcomes

- Describe theories of motivation and how classroom practices connect to those theories.
- Describe classroom management theories and how practices connect to those theories.
- Describe how differentiation techniques can be used to assist students with various exceptionalities.
- Create effective lesson plans that differentiate instruction for students in a classroom.
- Evaluate learning environments to recognize effective and ineffective motivation, management, and differentiation techniques in practice.
- Cultivate students' scientific/mathematics identify and confidence in learning science/math by connecting their instruction and content to students' background, providing ample opportunities for students to experience and reflect on success in learning science/mathematics content and practices, making their instruction and content relevant to students' lives, and helping students to contextualize the information being taught.
- Use classroom management, motivation, and differentiation practices to plan for and set the conditions of an effective learning environment.
- Apply evidence-based classroom management techniques (e.g., establishing rules and routines, utilizing praise and rewards, consistently disciplining misbehavior, and engaging students) to create a positive learning environment (e.g., acceptable learning behaviors and maximizing time on task.).
- Demonstrate a commitment to and respect for diversity, while working toward common goals as a community and as a country.
- Develop professional leadership and communication skills.

SCED398. SPECIAL TOPICS. 0-6 Semester Hr.

Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once, but no more than twice for the same course content. Variable credit: 0 to 6 credit hours. Repeatable for credit under different titles.

SCED415. SCIENTIFIC PRACTICES AND ENGINEERING DESIGN AND THE NATURE OF SCIENCE: LEADERSHIP AND INNOVATION. 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. Through this comprehensive approach, students will emerge as science leaders and innovators who can pioneer creative instructional methods and inspire systemic advancements in STEM education.

Course Learning Outcomes

- Engage in appropriate scientific practices and support their students in doing the same.
- Identify, adapt or develop lessons specifically designed to engage students in scientific and engineering practices, including but not limited to, asking questions (for science) and defining problems (for engineering); analyzing and interpreting data; engaging in argument from evidence; constructing explanations (for science) and designing solutions (for engineering); developing and using models; planning and carrying out investigations; obtaining, evaluating,

and communicating information; and using mathematics and computational thinking. o compare and contrast “Scientific Practice” with “Engineering Design” o judge a student’s abilities to do design practices in an informed way. o describe an engineering design cycle and how to apply it to design challenges o define and provide examples of design criteria and design constraints.

- Effectively instruct students about and model the basic understandings about the nature of science: science as a way of knowing, scientists use a variety of methods, science is based on evidence, science is open to revision, scientists use models, laws, mechanisms, and theories, science assumes order and consistency in natural systems, science is a human endeavor, and science addresses questions about the natural and material world. o articulate how scientific knowledge is acquired in a way that secondary students can comprehend. o describe the practices that brought about at least one major breakthrough in each of the four primary disciplines of science and how this contributed to our modern understanding of science. o analyze differences in the process of scientific discovery as described in the course text. o formulate a generalization and assess the evidence used to support a generalization or scientific theory. o provide examples that demonstrate the necessity for observations and characterization of patterns to understand the invisible.
- Integrate current issues and events related to science, and age-/grade-appropriate controversial topics presented from multiple science perspectives into lessons using an analytical approach without bias.
- Select, adapt, or develop lessons that explicitly engage students in scientific and engineering practices defined by the Colorado Academic Standards in science, and the Next Generation Science Standards (NGSS).
- Identify, adapt or develop lessons that reflect the interconnectedness of content areas/disciplines to help erase the disciplinary lines and reflect authentic situations; for example through cross-cutting concepts defined in NGSS.
- Illustrate the value of a model in understanding composition and in science.
- Create a mini-unit (3 days or more) that explicitly teaches some aspect of scientific or engineering practice.
- Clearly articulate their scientific ideas in writing. Analyze text based on occasion, audience, form and function. o compose one page reflections with an awareness about introductions, conclusions and topic sentences. o articulate the process of and compose with an awareness about the composing process which is an iterative process of formulation, composition and revision. o incorporate and cite correctly all evidence used to support a text’s claim/s.
- Clearly articulate their scientific ideas verbally. o delineate effective characteristics of multi-media presentations. o articulate scientific practices in a way that secondary students can understand and be motivated to explore these practices. o collaborate with others towards giving and receiving feedback on both oral and written work about teaching science as a way of knowing.
- Develop professional leadership and communication skills.

SCED445. PHYSICS AND CHEMISTRY TEACHING TECHNIQUES: LEADING AND TEACHING TEAMS. 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. Additionally, candidates will learn to lead collaborative lab teams and design equitable assessment tools that accurately measure student mastery while fostering a supportive, classroom culture.

Course Learning Outcomes

- Plan at least the first month of instruction for a middle or high school physics or chemistry course using standards-based lessons experienced in this course.
- Identify lessons that are designed to build students knowledge as defined in the Colorado Academic Standards in science, mathematics, and literacy and the Next Generation Science Standards (NGSS),
- Articulate and offer recommendations for addressing the common student preconceptions associated with all of the topics listed above for physical science and physics.
- Integrate content within identified student personal interest to build student engagement and connections to the world around them.
- Utilize Just in Time Teaching to plan lessons that meet students current interests and background knowledge.
- Articulate the scope of the above standards related to the content knowledge necessary for teaching 7-12 students.
- Articulate and engage students in investigation of the major concepts, principles, theories, laws, and interrelationships in science that underlie what they encounter in teaching.
- Develop professional leadership and communication skills.

SCED464. STUDENT TEACHING PRACTICUM: DEVELOPING STEM EDUCATIONAL LEADERSHIP. 3.0 Semester Hrs.

This course provides Mines students with 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, especially in methods that apply particularly to STEM education. In addition to a total of 15 hours of seminars (on campus and teacher professional development), there is a 100-hour field experience requirement in the students 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). By bridging rigorous academic theory with real-world classroom application, students will cultivate the STEM educational leadership ability necessary to mentor students, advocate for high-quality instruction, and drive innovation within their school partnerships. Prerequisite: Completed/concurrent 3 credits of SCED 262; completed/concurrent with SCED 415 or SCED 445. Co-requisite: Completed/concurrent 3 credits of SCED 262; completed/concurrent with SCED 415 or SCED 445.

Course Learning Outcomes

- Utilize research-based instructional techniques that have been shown to be effective across context, including pairing graphics with words, linking abstract concepts with concrete representations, asking probing questions, repeatedly alternating solved and unsolved problems, distributed practice and assessment to boost retention.
- Identify, adapt, or develop lessons using a variety of active learning techniques based on how all students learn science, including lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, and identify relationships and natural patterns. Applications of science-specific technology are included in the lessons when appropriate.
- Use formative-assessment techniques (10 or more) to evaluate students' thinking during classroom activities and assess students' progress towards mastery of the learning outcomes in each lesson; reflect on implemented lessons and provide suggestions to improve future implementations to address gaps or needs identified from the formative assessment data, including but not limited to determining appropriate delivery of instruction based on identified student need; and to select appropriate tasks to reinforce and promote students' development of concepts and skills
- Apply evidence-based classroom management techniques (e.g., establishing rules and routines, utilizing praise and rewards, consistently disciplining misbehavior, and engaging students) to create a positive learning environment (e.g., acceptable learning behaviors and maximizing time on task.).
- Create engaging learning environments that are effective for all students by providing access, support, and challenge for every student as well as differentiating instruction to meet the needs of all students.
- Identify lessons that are well designed to build students' reading, writing, speaking and listening with science or mathematics classes.
- Engage in professional behavior expected of new teachers including o appropriate dress, o attendance and professional commitments, o teacher presence/appropriate boundaries (specifically, can describe the difference between being a student's teacher and being their friend), o respectful collaboration (even if do not agree), o professional initiative, and o student confidentiality related to both academic performance and personal lives.
- Learn about their individual school context, policies and practices and through reflection on prior field experiences have an appreciation for different school cultures and understand that these are shaped by the school's teachers, administrators, parents, students and community in which it is situated.
- Provide proactive, clear and constructive feedback to families about student progress and develop a library of mechanisms to work collaboratively with the families and significant adults in the lives of their students.
- Reflect on their practice and use this reflection to set goals for further growth.
- Write standards-based lesson plans that include measurable learning objectives, applicable Colorado Content Standards, required materials, safety considerations, an outline of the lesson scaffolded with the five E's (engage, explore, explain, elaborate and evaluate) or other learning cycle model, accommodations, formative assessment and subject integration.
- Developing professional leadership and communication skills.

SCED465. STUDENT TEACHING RESIDENCY: LEADING AND INNOVATING STEM EDUCATION. 6-12 Semester Hr.

This course provides Mines students with 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 students 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). Through this immersive residency, students will refine their capacity to lead and innovate in STEM education by spearheading collaborative initiatives and designing transformative learning experiences that address the evolving needs of the global workforce. Prerequisite: Completed SCED 464; completed/concurrent with SCED 333, SCED 363, SCED 415, and SCED 445. Corequisites: Completed/concurrent with SCED 333, SCED 363, SCED 415, and SCED 445.

Course Learning Outcomes

- Utilize research-based instructional techniques that have been shown to be effective across context, including pairing graphics with words, linking abstract concepts with concrete representations, asking probing questions, repeatedly alternating solved and unsolved problems, distributed practice and assessment to boost retention.
- Identify, adapt, or develop lessons using a variety of active learning techniques based on how all students learn science or engineering, including lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, and identify relationships and natural patterns. Applications of science-specific technology are included in the lessons when appropriate.
- Use formative-assessment techniques (10 or more) to evaluate students' thinking during classroom activities and assess students' progress towards mastery of the learning outcomes in each lesson; reflect on implemented lessons and provide suggestions to improve future implementations to address gaps or needs identified from the formative assessment data, including but not limited to determining appropriate delivery of instruction based on identified student need; and to select appropriate tasks to reinforce and promote students' development of concepts and skills.
- Apply evidence-based classroom management techniques (e.g., establishing rules and routines, utilizing praise and rewards, consistently disciplining misbehavior, and engaging students) to create a positive learning environment (e.g., acceptable learning behaviors and maximizing time on task.).
- Create engaging learning environments that are effective for all students by providing access, support, and challenge for every student as well as differentiating instruction to meet the needs of all students.
- Identify lessons that are well designed to build students' reading, writing, speaking and listening with science or mathematics classes.
- Engage in professional behavior expected of new teachers including o appropriate dress, o attendance and professional commitments, o teacher presence/appropriate boundaries (specifically, can

describe the difference between being a student's teacher and being their friend), o respectful collaboration (even if do not agree), o professional initiative, and o student confidentiality related to both academic performance and personal lives.
- Learn about their individual school context, policies and practices and through reflection on prior field experiences have an appreciation for different school cultures and understand that these are shaped by the school's teachers, administrators, parents, students and community in which it is situated.
- Provide proactive, clear and constructive feedback to families about student progress and develop a library of mechanisms to work collaboratively with the families and significant adults in the lives of their students.
- Develop professional leadership and communication skills.

Professor

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