

COMPUTER SCIENCE EDUCATION (CSED)

CSED199. INDEPENDENT STUDY. 1-6 Semester Hr.

CSED299. INDEPENDENT STUDY. 1-6 Semester Hr.

CSED399. INDEPENDENT STUDY. 1-6 Semester Hr.

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: CSC1128 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.

CSED499. INDEPENDENT STUDY. 1-6 Semester Hr.

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CSED530. 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: CSCI 128 or CSCI 101/102 or CSCI 200 or CSCI 220. 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.

**CSED535. 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.

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. Outcome: 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. Outcome: 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. Outcome: 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. Outcome: 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. Outcome: 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. Outcome: 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.

- Students will develop professional leadership and communication skills.

CSED564. 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 562; complete/concurrent with CSED 530 or CSED 535. Co-requisite: Completed/concurrent 3 credits of SCED 562; complete/concurrent with CSED 530 or CSED 535.

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.

CSED565. 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 564; completed/concurrent with SCED 533, SCED 563, CSED 530, and CSED 535. Co-requisite: Completed/concurrent with SCED 533, SCED 563, CSED 530, and CSED 535.

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.

CSED598. 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.

CSED599. INDEPENDENT STUDY. 1-6 Semester Hr.

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