



ENGINEERING AND SCIENCE EDUCATION

GRADUATE CERTIFICATE

STUDENT HANDBOOK 2024-25

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Department of
**ENGINEERING AND
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INTRODUCTION

Welcome/Purpose of this Handbook

Welcome to the Department of Engineering and Science Education (ESED) at Clemson University. We wish you success at every stage of your academic journey.

This handbook is intended to familiarize you, as an ESED Certificate student, with the requirements, policies and procedures involved throughout your Certificate experience. The rules and regulations provided in this handbook govern our academic programs and describe the coursework required to complete the Certificate. This handbook was approved by the faculty of ESED. Each student should be familiar with the contents of this handbook and that of the Graduate School. These rules and requirements are in addition to and subordinate to those described in the [Graduate School Policy Handbook](#) (online link) or through the Graduate School office in E-108 Martin Hall. Any inconsistencies within this handbook or between this handbook and the *Graduate School Announcements* or [Graduate School Policy Handbook](#) should be brought to the attention of Dr. Karen High, Certificate Program Advisor.

Contact Information

Dr. Karen High serves as the primary advisor for certificate students. Dr. High's office is in Sirrine 273, and her email is khigh@clemson.edu.

The Graduate Affairs Committee oversees the regulations and procedures of the program, coordinates curriculum updates and interacts with the Graduate School.

[The Certificate Student Handbook is available online.](#)

Program Overview

The ESED Certificate program is a nationally unique graduate program in science, technology, engineering, and mathematics (STEM) education research. The Department of Engineering & Science Education, in the College of Engineering, Computing and Applied Sciences (CECAS) at Clemson University, is the only department in the country that includes engineering education, science education and mathematics education (also called discipline-based education research, or DBER) in a STEM college rather than a college of education. As such, it includes faculty who are experts in DBER, and who have active research programs in these areas. Students in this program will be exposed to the wide breadth of current and foundational STEM education research and will be prepared for education-related positions in their discipline.

The objectives of the ESED Certificate program are to prepare students, post docs, and faculty, who are pursuing a PhD in a specific STEM discipline, for pedagogical and andragogical aspects of an academic career in STEM, positions in training and education in STEM-based industries, or as educators in non-traditional settings such as museums, outreach centers, or non-profit organizations. Andragogy, adult learning, is a

focus of this certificate as we focus on post-secondary education and is a perfect fit to prepare STEM faculty for teaching and research. Certificate-holders will be prepared to become faculty in traditional STEM departments or academic staff through the combination of their education in their STEM discipline and the coursework of the ESED Certificate. They will be prepared to be scholarly teachers, action researchers, and agents of change in their workplaces.

ENTERING THE PROGRAM

Admission Requirements

The ESED Certificate program is designed for students who are content specialists in STEM disciplines and who seek to pursue education-related careers. Any PhD student at Clemson University who is in a STEM discipline is eligible for the ESED Certificate program. MS students in a STEM discipline may be considered on a case-by-case basis. Post-doctoral associates and faculty are also eligible but must apply and be accepted as non-degree students. Students must apply to the program through the graduate school website to receive the certificate. Students should reach out to Barbara Smith, ESED Student Services Coordinator (barbar2@clemson.edu) for any questions. It is highly recommended that PhD students begin the Certificate program in their second or third year of their PhD studies to allow acclimation to their disciplinary department, advisor, and research topic.

Costs

For currently enrolled PhD students, there is no additional tuition and fees if the course credits do not exceed the maximum credit hours allowed. Students at the CURI and ICAR campuses are charged a fee for main campus courses if they are taking >6 hours. [See the online information about tuition costs.](#)

For post-doctoral associates and any full-time employee, up to six credit hours per semester can be taken as part of the fringe benefits of employment. To be eligible for the benefit, the employee must have full-time employment status with the university for 12 consecutive months prior to enrolling and be in good standing in relation to conduct and job performance.

Students and faculty from outside the University will be charged tuition according to their residency. [See the online information about tuition costs.](#)

COMPLETING THE PROGRAM

Requirements for the ESED Certificate

Students in the ESED Certificate program will be exposed to STEM education research, pedagogy, andragogy, professional preparation, and teaching/mentoring practice. The curriculum consists of eleven (11) credits. The recommended sequence is to take ESED 8000 (Seminar in Engineering, Science, and Mathematics Education) first. ESED 8720 (Action Research in Engineering, Science, and Mathematics Education) should be taken next. ESED 8610 (Practicum in Engineering, Science, and Mathematics Education) should be taken last. Students can fulfill the Pedagogy and Professional Preparation requirements by selecting among three course options.

The certificate is offered in a hybrid modality meaning some online components and some face-to-face components are required. See individual course syllabi for specifics.

Component	Course Sequence for the ESED Certificate	Credits
Required Courses (8 credits)	ESED 8000 Seminar in Engineering, Science and Mathematics Education	1 cr.
	ESED 8200 Teaching Undergraduate Engineering or ESED 8210 Teaching Undergraduate Science or ESED 8220 Teaching Undergraduate Mathematics	3 cr.
	ESED 8720 Action Research in Engineering, Science, and Mathematics Education ^{1,2} (can be substituted by ESED 8710 Foundations of Research Methods in Engineering, Science, and Mathematics Education)	3 cr.
	ESED 8610 Practicum in Engineering, Science & Mathematics ^{1,2}	1 cr.
Professional Preparation Elective (3 credits)	ESED 8240 Teaching Postsecondary STEM Through E- Learning or ESED 8300 Professional STEM Communication or ESED 8310 STEM Communication for Broader Impact or ESED 8400 Diversity, Equity, and Inclusion in STEM Education or ESED 8880 Preparing for the Professoriate ³	3 cr.
Total (minimum) credits earned:		11 cr.

¹Has pre- or co-requisites. (See catalog descriptions below.)

² Must be admitted into the ESED Certificate Program to be registered

³ Enrollment in a doctorate program in the College of Engineering, Computing and Applied Science or the College of Science or the College of Agriculture, Forestry, and Life Sciences. (Offered fall semester).

Engineering & Science Education Certificate Curriculum

Seminar

ESED 8000 | Seminar in Engineering, Science, and Mathematics Education (1 Credit)

Brings contemporary issues in engineering, science and mathematics education research into the classroom. Experts from academia, industry and the corporate world give presentations on various issues, including recruitment of minorities, retention issues, technology integration into engineering curricula, distance learning, engineering content into K-12 curriculum, learning theories and education policy issues. (Offered each fall and spring semesters.)

Pedagogy (*Choose one of the following courses*)

ESED 8200 | Teaching Undergraduate Engineering (3 Credits)

Designed for STEM graduate students seeking a career in academe. Includes both discussion and practice of effective teaching techniques, assessments and technologies, an overview of current engineering education research, and equity and inclusion in the undergraduate engineering classroom. (Offered fall semester.)

ESED 8210 | Teaching Undergraduate Science (3 Credits)

Designed for STEM graduate students seeking a career in academe. Includes both discussion and practice of effective teaching techniques, assessments and technologies, an overview of current science education research, and equity and inclusion in the undergraduate science classroom. (Offered spring semester session.)

ESED 8220 | Teaching Undergraduate Mathematics (3 Credits)

Designed for STEM graduate students seeking a career in academia. Includes both discussion and practice of translating modern mathematics education research to instructional practice. Topics include effective teaching techniques, assessment issues, the role of technology in mathematics instruction, and equity and inclusion in the undergraduate mathematics classroom. (Offering TBA)

Research Methods

ESED 8720 | Action Research Engineering, Science, and Mathematics (3 Credits)

This course provides an overview of action research with qualitative/quantitative/mixed methodologies. Students produce a written action research proposal demonstrating competencies in research methodologies. This course does not satisfy the Research Methods

requirement for the PhD in Engineering and Science Education. Pre- or co-requisite of ESED 8200, ESED 8210 or ESED 8220. (Spring semester.)

May be substituted by:

ESED 8710 | Foundations of Research Methods in Engineering, Science, Science, and Mathematics Education (3 Credits)

Introduces methods and tools available for conducting pedagogically sound engineering, science, and mathematics education research. Quantitative, qualitative, and mixed methods are discussed and practiced. Prerequisite: Enrollment in the Engineering and Science Education PhD program or consent of instructor. (Offered fall semester)

Professional Preparation (*Choose one of the following courses*):

ESED 8240 | Teaching Postsecondary STEM Through E-Learning (3 Credits)

This course is designed to better equip professors and graduate students to teach STEM classes online while fostering an inclusive environment. Participants will implement course redesign, explore best online teaching practices, and collaborate for peer editing. (Offered TBA)

ESED 8300 | Professional STEM Communication (3 Credits)

Prepares STEM students to successfully communicate with technical, professional, academic, public, and other appropriate audiences. This communication occurs across a range of professional genres and media. Students produce communications individually and as part of a team. Topics such as ethical communication, critical thinking, and audience analysis are explored. (Offered spring semester)

ESED 8310 | STEM Communication for Broader Impact (3 Credits)

This course challenges students to consider the broader impacts of their STEM research by practicing different types of STEM communication targeted at different audiences. Course focus is on STEM storytelling, best practices in community and stakeholder engagement, ethical and equitable STEM communication, and STEM communication in informal learning environments. (Offered fall semester)

ESED 8400 | Diversity, Equity, and Inclusion Research in STEM Education (3 Credits)

This course examines issues related to diversity, equity, and inclusion research within STEM fields. Students make connections between structural, institutional, and historical inequities; apply frameworks to conduct equity-focused STEM research; and learn how individual and

interpersonal factors influence diversity, equity, and inclusion initiatives in STEM environments. (Offered fall semester)

ESED 8880 | Preparing for the Professoriate (3 Credits)

Prepares students for obtaining a faculty position and achieving tenure in science, mathematics, and engineering disciplines. Students develop a professional portfolio, prepare for the application/interview process and write a mini proposal. Students should take this class when they are one to two years away from graduation. Preq: Enrollment in a doctorate program in the College of Engineering, Computing and Applied Science or the College of Science or the College of Agriculture, Forestry, and Life Sciences. (Offered fall semester).

Practicum

ESED 8610 Practicum in Engineering, Science, and Mathematics Education (1 credit)

Practicum that includes teaching or mentoring undergraduates in Engineering, Science or Mathematics (General Engineering or student's home department). Counts towards a Certificate in Engineering and Science Education. May be repeated for a maximum of three credits. Preq: ESED 8710 or 8720. (Offered each fall and spring semester).

Note: The goal of ESED 8610 is to provide a means to reflect, engage others, and critically examine the role of teacher and mentor in the learning process. Each student should be engaged in a concurrent teaching or mentoring experience that equates to roughly 25-30 hours of contact time with undergraduate students over the semester.

Course substitutions may be possible with approval by the Certificate Advisor. A list of courses and descriptions are available in [Clemson's Graduate Catalog available through this direct hyperlink](#) or available upon request from the student services coordinator.

Advising

Prospective and current Certificate students may schedule an advising session with the Certificate Advisor. The advising session will help with sequencing the coursework, providing information about courses and jobs held by Certificate alumni, and answering any other questions or concerns.

Additional Opportunities

Departmental Seminars

All certificate students will be invited to ESED seminars that feature speakers. Students who do not wish to remain on the email list after completing ESED 8000 will be given the option to be removed from the list.

ESED Social Activities

Social activities organized by ESED graduate students are open to certificate students.

FINISHING THE PROGRAM

Certificate Completion Requirements

Any students who have completed all the coursework requirements should contact the Student Services Coordinator at barbar2@clermson.edu to indicate that all requirements have been completed. A form will be provided that ESED will submit to enrolled student services indicating that all requirements have been met. Enrolled Student Services will confirm by checking the transcript and issuing the Certificate to ESED at the close of the semester in which the courses were completed. ESED obtains the signatures necessary on the Certificate and delivers it to the student. The student does not have to be finishing the PhD requirements to receive the Certificate or to have the Certificate appear on the transcript.

A recognition ceremony and reception are held near the time of May graduation for all who have completed the Certificate. The actual Certificate will be available after the transcript has been through the enrolled student services process, which typically occurs after the graduation date for the semester in which the coursework has been completed. ESED will mail the Certificate to anyone who has graduated. Make sure that the ESED Student Services Coordinator has your correct mailing address.