

# GRADUATE STUDENT HANDBOOK 2021-2022



*Department of*  
**ENGINEERING AND  
SCIENCE EDUCATION**

## ENGINEERING AND SCIENCE EDUCATION

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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 a graduate student in ESED, with the requirements, policies and procedures involved throughout your graduate experience. The rules and regulations provided in this handbook govern our academic programs and describe the duties and responsibilities of graduate students in the department. This handbook is approved by the faculty of ESED. Each student is expected to 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*, found at <https://www.clemson.edu/graduate/students/policies-procedures/index.html> 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 the Graduate Coordinator.

## Contact Information

The Graduate Affairs Committee oversees the regulations and procedures of the program, coordinates curriculum updates and interacts with the Graduate School on matters such as student status, assistantships and fellowships. The chairperson of the Graduate Curriculum Committee is the Graduate Coordinator. The Graduate Coordinator is your first contact should any issue arise regarding your academic progress or the program curriculum. The current Graduate Coordinator is Dr. Karen High. Contact information for Dr. High:

Office location: M-15C Holtzendorff Hall

Office phone: 864-656-4240

Email: [khigh@clemson.edu](mailto:khigh@clemson.edu)

Students in the program are also supported by a Student Services Coordinator (SSC), who also serves as the first point of contact for application inquiries. The current SSC is Barbara Smith. She can be reached at [ESEgradinquiries@clemson.edu](mailto:ESEgradinquiries@clemson.edu).

A current list of all committee members and their contact information is available from the Graduate Coordinator or the Student Services Coordinator upon request. The handbook is available at <https://www.clemson.edu/cecas/departments/ese/>.

## **Program Overview**

The PhD program in ESED 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 in a college of science/engineering. As such, it includes faculty who are experts in engineering education, science education and mathematics education, and who have active research programs in these areas. Students in this program will be exposed to the wide breadth of STEM education research under current investigation and will be prepared to interface between the development of new theory in STEM education and the implementation of new research findings in practice. This field is also referred to as Discipline Based Education Research (DBER), which combines research on teaching and learning with deep knowledge of discipline-specific science or engineering content. It describes research into the discipline-specific difficulties learners face and the specialized intellectual and instructional resources that can facilitate student understanding.

The objectives of the ESED PhD program are to prepare students for academic careers in STEM education, science education policy in higher education or informal education institutions, and a range of other careers that require a deep disciplinary knowledge coupled with understanding of the factors that affect student learning, retention, and inclusion in STEM. Students who enroll in this program will be expected to be (or become) content experts in a STEM discipline with at least a Master's degree or equivalent in their content area of expertise, either previously completed or earned en route to the PhD. Graduates from this program will be prepared to become faculty in traditional STEM departments, as well as STEM education departments. They will be prepared to lead curricular and pedagogical reform at the post-secondary level as well as conduct research in the burgeoning fields of STEM education research.

## ENTERING THE PROGRAM

### Admission Requirements

Minimum requirements to be considered for admission to graduate study in ESED generally follow those of the Graduate School (see the *Graduate School Policy Handbook* at <https://www.clemson.edu/graduate/students/policies-procedures/index.html>) In addition to the requirements of the Graduate School, all students admitted into the program must have at least a Bachelor of Science (BS) or Bachelor of Arts (BA) degree in a science, technology, engineering, and mathematics (STEM) discipline from an accredited program with preference being given to those who have completed graduate studies in a STEM discipline.

Admission to ESED is restricted to applicants whose academic record indicates a high potential to be successful in graduate studies. This determination is made through a holistic review process by the faculty of ESED and is affirmed by the Graduate School. The various indicators used to arrive at this determination may include, but are not limited to: previous academic performance, letters of recommendation, personal interviews, a writing sample, and statements of interest.

Admission to graduate studies in ESED begins with your submission of an official application to the Clemson University Graduate School via their website at <https://www.clemson.edu/graduate/admissions/>. Upon receipt of all admission materials through the online application process (<https://www.applyweb.com/clemson/>), the Graduate School will forward your application to the ESED department for review. Applicants must meet all admission requirements of the Graduate School and the ESED department before official acceptance will be granted.

### Prerequisites

The program is designed for students who are content specialists in a STEM discipline and who seek to pursue discipline-based education research. Thus, preference is given to applicants already holding a Master's in a STEM discipline. If you are enrolled in a Master's program in a science or engineering discipline, you may be accepted directly into the ESED PhD program prior to completion of your Master's degree with the consent of your Major Advisor of your Master's program. Applicants entering directly from a BS/BA program, or who have not completed a Master's in a STEM discipline, must successfully complete 18 credit hours at the graduate level in a single STEM discipline (e.g., mechanical engineering, physics, chemistry, etc.) The purpose of this requirement is to ensure that students meet accreditation requirements for teaching in a STEM discipline and are thus eligible for faculty roles in STEM disciplinary departments.

### Admission Procedures

Upon your completion of the online application, your application is reviewed by the Graduate Affairs Committee through the Clemson University admissions platform,

ADMIT. You can check your application status at (<https://www.applyweb.com/clemson/>). The Graduate Affairs Committee uses the following approach for recruitment and application review.

- 1) Prospective students obtain information about our program primarily through the website, professional conferences, and through direct contact.
- 2) The Student Services Coordinator (SSC) emails a response to inquiries and applications.
- 3) The graduate student applies to the program through the Graduate School website <https://www.clemson.edu/graduate/admissions/apply/>
- 4) The Graduate Affairs Committee reviews the application to verify that the application is complete and meets the admission requirements described above.
- 5) The Graduate Affairs Committee and interested faculty member(s) arrange a video conference interview that includes the interested faculty member and at least one member of the GAC.
- 6) The Graduate Affairs Committee and the interested faculty member(s) individually complete the “Department of Engineering & Science Education Holistic Graduate Applicant Review” rubric with a recommendation on admittance.
- 7) The Graduate Affairs Committee decides to recommend admission or to not recommend admission.
- 8) The application is processed accordingly in ADMIT (the Clemson University online application system) by the Graduate Coordinator.
- 9) The Graduate School sends the student information if they are accepted or not.
- 10) Accepted students receive an offer letter and information about their assistantship from the Graduate Coordinator.
- 11) Students are paired with an initial Major Advisor who will guide them through the first year of study.

If you are not accepted for admission, the Graduate Curriculum Committee will indicate this in the admissions database and the Graduate School will then send you a letter of rejection. You may appeal the rejection to the Graduate School.

## **Costs**

For current tuition and fees, see <https://www.clemson.edu/graduate/finance-tuition/index.html>. For more information about academic costs, financial aid and making payments, contact Student Financial Services ([studentbillquestions@clemson.edu](mailto:studentbillquestions@clemson.edu)).

## **Financial Assistance**

Financial support through assistantships is awarded on a competitive basis to qualified students, both domestic and international. All qualified students are considered for assistantships when applications are processed. Award decisions are based on academic record, statement of purpose, and letters of recommendation.

Assistantships are awarded based on availability of funds in the area of desired study and academic merit. If you change your subject area after support has been extended, support eligibility is reviewed, and funding may or may not be provided.

Eligibility for assistantships is governed by the policies in the Graduate School Policy Handbook.

### **Employment Paperwork**

If you have been awarded an assistantship, you must report to the departmental staff prior to the beginning of your assistantship and complete required forms.

### **Registration**

Prior to registration for your first semester of study, you must report to your assigned Major Advisor or the Graduate Coordinator.

### **Orientation**

All graduate students are required to attend the Graduate School orientation. Orientation information is available at <https://www.clemson.edu/graduate/students/new-student-to-do.html>.



## COMPLETING THE PROGRAM

### Student Responsibilities

The ESED department expects you to approach your graduate study in a serious and focused manner. Students on assistantship will have a weekly time commitment for work obligations stated in their letter of appointment (typically 20 hours per week). Coursework and dissertation research will occupy additional time for satisfactory progress to degree.

### Requirements for the ESED Doctoral Degree

Students in the ESED doctoral program will be exposed to the wide breadth of current STEM education research as well as be prepared to interface between the development of new theory in STEM education and the implementation of new research findings in practice. Students who enter the degree with either a Master's degree or equivalent expertise (18 credit hours at the graduate level) in a STEM discipline must meet the following minimum requirements to complete the ESED PhD.

#### ***Minimum degree requirements for the ESED PhD***

Total credits of ESED coursework:	11
Total credits of courses outside ESED:	3
Doctoral research credits (ESED 9910):	18
<hr/>	
Total credits earned:	32
Exams:	Qualifying, Comprehensive and Dissertation Defense

### Engineering & Science Education PhD Curriculum

Students will be required to take a minimum of eleven (11) credits from ESED courses, which include the following eight (8) required core credit hours (these core courses are taught every year):

- ESED 8000 - Seminar in Engineering, Science and Mathematics Education (1 credit). Brings contemporary issues in engineering and science 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.

- ESED 8200 OR 8210 OR 8220 - Teaching Undergraduate Engineering OR Science OR Mathematics (3 credits).
  - ESED 8200 Teaching Undergraduate Engineering - 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.
  - ESED 8210 Teaching Undergraduate Science - 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.
  - ESED 8220 Teaching Undergraduate Mathematics - 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.
  
- ESED 8710 - Foundations of Research Methods in Engineering, 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.
  
- ESED 8620 - Practicum in Engineering, Science and Mathematics Education Research (1 Credit). Students conduct educational research in engineering, science or mathematics within the General Engineering department, the student's home department or another department approved by course instructor. May be repeated for a maximum of three credits.

*Note: The goal of the class 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.*

Plus, a minimum of three (3) credit hours from the following elective ESED courses (these courses are taught periodically, but not necessarily every year):

- ESED 8240 (with permission of committee) – 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.
- ESED 8250 – Student Strategies in Engineering, Science and Mathematics Education (3 credits). This course explores strategies students employ when working through problems or projects in science, engineering and mathematics. Content includes underlying theories of student strategies such as self-regulation, epistemic cognition and motivation; characteristics of problems; and instructional approaches to facilitate effective student problem-solving strategies.
- ESED 8700 –Theories of Engineering, Science and Mathematics Learning (3 credits). Provides graduate student in engineering and the sciences a foundation in theories of learning with a particular focus on their application to the teaching and learning of science, technology, engineering or mathematics.
- ESED 8750 - Current Issues in STEM Education Research (3 credits). Designed for doctoral students interested in STEM education research. Covers research issues of current relevance to a breadth of STEM education fields. Students have the opportunity to investigate a current topic of their choosing.
- ESED 8790 - Current Topics in STEM Education Policy (3 credits). Provides a foundation for doctoral students in engineering and science to critically analyze current topics and pertinent historical precedence in United States policy affecting STEM education at multiple levels of the educational system. Students learn to communicate issues related to STEM education policy to various audiences and stakeholders.

#### Recommended Course

- ESED 8100 – Orientation to Engineering, Science and Mathematics Education Research (1 credit). Studio-based orientation to the Engineering and Science Education graduate program. Includes programmatic orientation and development of foundational skills and certifications required for success in the PhD program.

#### Additional Requirements

- As directed and approved by each student’s doctoral committee, students will take a minimum of three (3) additional credit hours in supporting areas outside of

ESED which include (but are not limited to): education, psychology, sociology, or statistics.

- Enrollment in ESED 9910 – Doctoral Thesis Research and Writing (18 credit hours)
- Disciplinary requirement – 18 credit hours at the graduate level in a single STEM discipline (i.e., mechanical engineering, physics, chemistry, etc.), unless a student holds a Master of Science (M.S.), Master of Engineering (M.E.), or higher in a STEM discipline.
- Qualifying and Comprehensive Dissertation Examinations - In addition to the regular course requirements detailed above, students in the ESED PhD program will be required to pass a qualifying examination as well as a comprehensive dissertation examination before undertaking their dissertation research. The qualifying examination should be scheduled within 12 months after completing the three required courses: seminar (ESED 8000), pedagogy (ESED 8200, 8210, or 8220), and research methods (ESED 8710). It is recommended that students take additional ESED courses before taking the Qualifying Examination. Upon successfully passing the qualifying examination, the comprehensive dissertation examination will follow within another 12 months.
- All graduate students will generally be required to make at least one presentation of their research in a public forum such as a conference or at the ESED seminar course.

### Withdrawing from Courses

As an ESED graduate student, you will be permitted to drop courses in which you are enrolled only in exceptional cases and with the prior approval of your Major Advisor and the course instructor. If you drop a course when you have an assistantship, and your course load drops below nine credit hours, your assistantship may be revoked.

### Qualifying Examination

#### *Overview*

The ESED program requires that each student pass a qualifying examination given by your advisory committee (see page 21) testing understanding of scholarly literature and theoretical knowledge in the discipline of STEM education research. We strongly recommend that you take the Qualifying Examination no later than 12 months after you complete the required coursework (the three required courses are: seminar (ESED 8000), pedagogy (ESED 8200, 8210, or 8220), and research methods (ESED 8710)).

The purpose of the qualifying exam is to verify that you have the prerequisite skills and knowledge to develop a proposal for your dissertation study. In addition, the qualifying exam serves as a checkpoint to identify areas of strengths that you have and develop a plan for addressing any identified areas for growth as you progress toward the PhD.

The exam topics may include theoretical frameworks appropriate for STEM education research, qualitative research methods, quantitative research methods, mixed research methods, and implications (theory to practice) of the research topics. At the discretion of the advisory committee, the qualifying exam may also include topics from the student's STEM discipline, depending on the student's background and research focus areas. Your Major Advisor will coordinate all aspects of your qualifying exam.

The qualifying exam will consist of both written and oral parts. The written part will contain four questions written by the advisory committee. Students will have an allotted time of four hours (roughly one hour per question) to write responses to the questions, which may be broken up into more than one session. Students may request a variance in the time allotment through their Major Advisor, to be reviewed by the Graduate Advisory Committee. Students may use a computer to compose responses and are allowed to use external sources such as the internet, textbooks or journal articles in composing their responses. The responses must be written in paragraph form. Clarifying figures/tables/lists, etc. can be added as needed. The oral part will be given 5 to 9 business days after the written exam and will expand on topics from the written exam. It may also include other STEM education topics at the discretion of the advisory committee.

### *Timing for the Qualifying Exam*

- 1) Generally, the qualifier exam will be taken after ESED 8710, typically in the summer or fall.
- 2) Form your advisory committee (see page 21).
- 3) Submit form GS-2 Committee Formation to the Graduate School.
- 4) Submit form GS-2 Plan of Study to the Graduate School.
- 5) Prepare in consultation with your Major Advisor a summary (1-2 pages) that describes in brief your research interests and relevant theory or background. References must be included and do not count in the page limit. Examples from other students are available through the Canvas repository or directly from the Student Services Coordinator.
- 6) Send your summary to the Graduate Coordinator to approve. Once approved, your Major Advisor will send the summary out to your advisory committee.
- 7) After the Graduate Coordinator has approved your summary, you may schedule your qualifying exam (both the written and oral part). The scheduling for the oral part of the exam should be done at the same time as the scheduling for the written part.
  - a. The written part of the exam should be scheduled at least 4 weeks after the summary is sent to the committee.
  - b. The oral part of the exam must be scheduled 5-9 business days (when the university is in session) after the written part of the exam is to be

completed. The oral part of the exam must be scheduled at a time when all members of the advisory committee are available for a 3-hour block of time.

- 8) The Major Advisor will work with the advisory committee at this point to develop the exam. Typically, each member of the committee will write one question. General knowledge of the topics will be expected and assessed as ESED graduate students are expected to be education generalists.
- 9) It is possible and appropriate to discuss your research with your advisory committee at any point in the process. However, it is not appropriate to ask the advisory committee members what type of question they will ask during the exam.
- 10) After the written part of the exam is completed, the Major Advisor will send the responses to the advisory committee members.
- 11) The oral part of the qualifying examination should be scheduled as a three-hour block of time. No more than two hours of that time will be in direct examination. A typical time flow for the three-hour block might be:

10 min	Introductions and overview of procedures and goals
2 hours	Direct engagement with all four prompts and related topics
30 min	Committee deliberation and paperwork (student out of room)
20 min	Discussion of decision and feedback (student in room)

Your particular Major Advisor and advisory committee might structure the time in a different manner but the direct engagement period will not exceed two hours. The format of the oral part of the exam is at the discretion of the student and the Major Advisor and might include a PowerPoint presentation, handouts, or other materials as appropriate.

### *Assessing the Qualifying Examination*

Members of the advisory committee will assess your performance on the written and oral parts of the exam using the rubric in the table on page 31, "Item 1 – Qualifying Exam." The first four items in the rubric (Theoretical frameworks, Quantitative and/or mixed research methods, Qualitative and/or mixed research methods, and Application of research to practice) are intended to assess your responses to the questions on the written part of the exam, including any elaboration made during the oral part of the exam. The descriptors of these items are subject to change at the discretion of the student's Major Advisor to be in keeping with the specific topics addressed on the exam. Writing skills will be assessed with the understanding that the written responses were constructed within a limited time period. Oral presentation skills will reflect the student's ability to elaborate on their written responses and communicate well-reasoned responses to other questions posed during the oral part of the exam.

Summary grades of Pass, Conditional Pass and Fail for the qualifying exam will be based on the consensus of the advisory committee.

- If you receive a Pass, you may continue in the PhD program.

- If you receive a Conditional Pass, your committee will determine stipulations such as taking additional graduate level courses selected by the committee and achieving an A in those courses, redoing portions of the written or oral exams, or other tasks as deemed appropriate by the committee. The committee will determine the timeline for completion and your Major Advisor will inform the Graduate Coordinator of the Conditional Pass by email cc'ed to you and to your committee, along with a list of the conditions and timeline for completion to the Graduate Coordinator. Upon completion of the conditions, the Conditional Pass converts to a Pass. If you do not complete the stipulations within the timeline, or do not meet the quality determined by the committee, the Conditional Pass converts to a Fail.
- If you receive a Fail grade on your first attempt, the committee will determine if a second attempt is allowed. If you are not allowed a second attempt you will not be permitted to continue in the PhD program, and the Graduate Coordinator will recommend to the Graduate School that you should be dismissed from Graduate School. The Graduate School will make the final determination. Appeals to this determination must be made to the Graduate School as outlined in *Graduate School Policy Handbook*.
- If you receive a Fail grade on a second attempt you will not be permitted to continue in the PhD program, and the Graduate Coordinator will recommend to the Graduate School that you should be dismissed from the Graduate School. The Graduate School will make the final determination. Appeals to this determination must be made to the Graduate School as outlined in *Graduate School Policy Handbook*.

### *Internal Appeal Procedure*

The student may appeal the result of a qualifying exam in writing to the department chair within 10 business days of the committee decision. The chair, at their discretion, may request that the Graduate Affairs Committee review the process for procedural errors. If errors are evident, the department chair will recommend a remedy to the Graduate Affairs Committee. If the department chair is in the advisory committee, they will appoint an ESED faculty member that is not on the advisory committee to serve in this capacity. The department chair will present the student with a decision within 30 calendar days from the date the appeal is received.

### Comprehensive Examination (Defense of Research Proposal)

You should take this examination (both written and oral portion) within 12 months of successfully completing the qualifying exam. Part-time students may request a variance on the timing of the exam. The variance must be approved in writing by your Major Advisor and the Graduate Coordinator.

Many of the policies surrounding the comprehensive examination are set by the Graduate School and consistent across all departments. The information in this section

is intended to describe the particular form that the comprehensive examination takes in ESED.

The comprehensive examination will serve to examine your ability to apply the knowledge assimilated through coursework and preliminary research projects to design a STEM education research study. The examination comprises all of the following:

- a written doctoral dissertation proposal,
- a public presentation of the proposal,
- an oral examination by your committee, and
- revisions to your proposed research as recommended by your committee during the oral examination.

### *Written Proposal*

You must complete a final draft of your written proposal for your Major Advisor's approval at least 20 working days before your proposal defense. You must provide a copy of your proposal approved by your Major Advisor to your committee members at least 15 working days prior to your oral proposal defense. The written proposal should contain all of the following components organized into a logical and coherent flow.

1. One-page summary that includes a project overview and addresses intellectual merit and broader impacts of the proposed study. For definitions and guidelines regarding intellectual merit and broader impacts, see the National Science Foundation Proposal Guidelines (PAPPG) ([https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=nsf19001](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf19001)). The one-page summary does not count in the 15-page narrative limit.
2. 15-page maximum project narrative. The narrative must include one or more clearly stated research questions. It must also address context and significance, literature review, theoretical framework, methodology, specific plans for data collection and analysis, quality considerations within the proposed study, a plan for dissemination, and a brief statement about your prior experiences relevant to the proposed research. Additional content within the narrative may be required by the Major Advisor or may be added at the discretion of the student. The addition of content, whether required by the Major Advisor or not, does not alter the 15-page limit for the project narrative.
3. A complete list of references cited in the narrative. The list of references does not count in the 15-page narrative limit.
4. Appendices for all data collection instruments, e.g. surveys, interview protocols, reflection prompts, etc. The appendices do not count in the 15-page narrative limit.



### *Public Presentation*

After your advisor reviews the proposal and consents to going forward, you should schedule a three-hour uninterrupted block of time for the comprehensive examination. The comprehensive examination will include a public presentation of your proposed research (30 to 45 minutes), a public question-and-answer period (15 to 30 minutes) and an oral examination by your committee. Your major advisor will end the public question-and-answer-period at the appropriate time to transition directly into the oral examination.

If the University closes for any reason, the exam will be rescheduled for the next available time for the student and the committee. You will schedule this based on the availability of your committee and will arrange location with the ESED Student Services Coordinator.

### *Oral Examination*

Immediately following the public question and answer period, the audience will be excused and the oral examination by your committee will begin. After a period of time, your major advisor will excuse you for a closed-door discussion with the committee. You will be called back in following the committee deliberation. At this time, the committee will tell you what revisions, if any, you are required to make to the written proposal, as well as a time limit for completing those revisions. It is strongly recommended that you audio-record the post-deliberation discussion for your own benefit in satisfying any revision requirements. If you are not required to make revisions, your comprehensive examination is considered complete at the end of the oral examination. Otherwise, your exam continues to the revision stage.

### *Revisions*

After addressing all revision requirements in the written proposal, write a summary response indicating how you addressed the revisions and email both the summary and the revised proposal to your committee. Once you email these documents to your committee, the comprehensive doctoral examination is concluded. The committee will consider your revisions and vote within five business days of receipt to determine the outcome of your doctoral comprehensive examination.

### *Formative Assessment*

Members of the advisory committee will assess your performance on the written proposal and oral defense using the rubric in the table on page 31, "Item 2 – Comprehensive Examination (Research Proposal Defense)". The first four items in the rubric are intended to assess knowledge, information and insights that would be expected in a competitive research proposal. They are:

- Research topic knowledge

- Theoretical knowledge
- Research design and methods, and
- Data analysis

The names of these items are subject to change at the discretion of the student's Major Advisor. Writing skills will be assessed with the understanding that the written responses were constructed within a page limit (15 pages, not including summary, references, and appendices). Oral presentation skills will reflect the student's ability to elaborate on written work and communicate well-reasoned responses to other questions posed during the oral part of the exam. These results are used to guide your further professional development and are not reported directly to the Graduate School.

### *Summative Assessment*

After completion of the doctoral comprehensive examination, your committee will determine a grade of either "Pass" or "Fail" in accordance with Graduate School guidelines. The next steps after a decision of "Fail" are determined by the *Graduate School Policy Handbook*. Results will be reported to the Graduate School and to Enrolled Student Services by your Major Advisor using Form GS5D and Form GS-ResearchApproval.

### Doctoral Dissertation

The purpose of a dissertation is to demonstrate your capability to:

- Formulate a research problem;
- Demonstrate knowledge relevant to a meaningful resolution of a specific problem;
- Effectively plan the work leading to the completion of the problem;
- Report the results of your research in concise, precise professional style.

### *Writing the dissertation*

The writing process may begin at any point in the research process; the earlier, the better. Deadlines are described in the *Graduate School Announcements* or *Graduate School Policy Handbook*.

As you near completion of your dissertation, you must present your work to your advisory committee in a formal, public setting. This will include a public oral presentation and a closed-door oral examination. Your committee will typically ask questions relevant to your dissertation topic and provide comments about and/or edits to the dissertation.

As a result of their review of the written document and your oral examination/defense, your advisory committee may require that you do more work. After completion of that work and a successful final oral examination, your advisory committee will provide any comments or corrections that you must make to your manuscript. After you make the

corrections, you must submit your dissertation electronically to the Graduate School for formatting review.

### *Supporting information and documents related to dissertation research*

All graduate students should keep a formal notebook for recording research procedures and results. Under the [Clemson University Intellectual Property Policy](#), all data, research notebooks and related materials (slides, pictures, graphs, publication reprints, etc.) generated by any graduate student within the department are the property of the University. Graduate students own the copyright to their dissertation and, as Creators of research data or results related to the dissertation, “shall have a nonexclusive, perpetual license to use such data for nonprofit educational research and scholarly purposes.”

### *PhD Dissertation Defense*

You are required to provide a broad context and focused interpretation of your research project and conclusions. This examination will be conducted under the authority of your advisory committee. All ESED faculty members will be invited to participate in the examination and to provide comments to your advisory committee.

Members of the advisory Committee will assess your performance on the written dissertation and oral defense using the rubric in the table on page 31, “Item 3 – Dissertation Defense.” The first four items in the rubric (Research topic knowledge, Research design and methods, Interpretation of results, and Conclusions supported by evidence) are intended to assess knowledge, information and insights that would be expected in a publication-ready manuscript; the names of these items are subject to change at the discretion of the student’s Major Advisor. Writing skills will be assessed based on the quality of the manuscript in terms of being publication-ready. Oral presentation skills will reflect the student’s ability to elaborate on written work and communicate well-reasoned responses to other questions posed during the oral part of the exam. Results will be reported to your Major Advisor. Successful completion of this examination and your dissertation will result in a recommendation (GS7 Form) by your advisory committee to the Graduate School that the PhD degree be awarded.

Unsatisfactory performance on the final examination will result in a requirement for complete re-examination (with or without recommendations for additional work) or, in rare cases, dismissal.

### *Expectations*

The oral exam is based on:

1. An oral defense of your research
2. General questions related to your research
3. Basic questions about STEM education research beyond your area of specialization.

You will be expected to have an in-depth knowledge in your selected research area. In addition, you are also expected to be ready to answer all pertinent questions in the area based on all courses completed prior to the time of the examination that the panel deems relevant to the area of the proposed area of research. You must also be able to critique/defend approaches and methodologies you used and others cited in the literature.

### **Final Check-Out/Exit Interview**

When you leave the University due to graduation or any other reason, you must do the following pertaining to the department:

- Turn in all keys to your Major Advisor or their designee.
- Be sure that any portion of the graduate student office that you occupied is clean and ready for another occupant.
- Return all borrowed materials (books, journals, etc.) to their appropriate location.
- Inform the Graduate Affairs Committee that you are leaving and have complied with all regulations.
- Schedule an exit interview with the Department Chair.

### **Continuous Enrollment**

All graduate students in the ESED program are expected to maintain continuous enrollment during fall, and spring semesters. Students on assistantship over the summer are required by University policy to be enrolled during the summer semester. The ESED Department makes every effort to schedule relevant courses so that students can easily maintain their enrollment.

### **Advisory Committee**

Each graduate student must have a faculty advisor (Major Advisor) who will also be the chair of the student's advisory committee. The Major Advisor must be a regular member of the ESED faculty or, in special circumstances only by approval of the Graduate Curriculum Committee, an adjunct faculty of ESED. Students need to fill out the GS2 form to select committee. More information about the GS2 can be found in the *Graduate School Policy Handbook* at <https://www.clemson.edu/graduate/students/policies-procedures/index.html>.

### **Your Major Advisor**

The selection of your Major Advisor is one of the most important decisions you will face as a graduate student. Your Major Advisor supports you in your academic journey, helps plan your curriculum, guides your research activities, and scaffolds the preparation of your dissertation. You will be assigned an initial Major Advisor to guide

your studies in the first year and factors associated with selecting a Major Advisor for the duration of your studies will be addressed in ESED 8100 Orientation to ESED.

During each semester, you should meet with your Major Advisor to discuss your research project on a regular basis.

### Advisory Committee

You will form an advisory committee in consultation with your Major Advisor. Your advisory committee will approve your curriculum, supervise your graduate program, administer your qualifying and comprehensive examinations, and initiate the recommendation for awarding your PhD. The chair, co-chair, or at least half of the committee must have a primary appointment in ESED. Your Major Advisor will serve as the chair of your advisory committee.

A majority of your advisory committee (50% or more) must be regular, joint or adjunct members of the ESED faculty. Committee membership must total at least four.

You are responsible for forming your advisory committee and keeping them apprised of your progress. Committee formation should typically occur during spring of your first year in the program, and certainly no later than the fourth semester of your doctoral program. Appointment is made via [form GS2](#) by the department chair, subject to the approval of the deans of the college and the Graduate School.

### **Process and Procedures**

The following table lays out a typical progression through the ESED program.

<b>A Sample PhD Program of Study</b>	
Year 1 – 1 <sup>st</sup> Semester	Choose a Major Advisor, take 3 graduate courses, attend seminars, attend faculty research presentations, begin work on research projects within your research group.
Year 1 – 2 <sup>nd</sup> Semester	Take 3 graduate courses, attend seminars, continue to work on research projects within your research group. Form advisory committee and file GS2 form.
Year 2	Take graduate courses (as needed/desired), attend seminars. Continue work on research projects within your research group. Take qualifying exam. Develop your research proposal for your comprehensive exam.
Year 3 and beyond	Complete the comprehensive exam and advance to candidacy. File the GS5 form. Continue working on research projects within your research group, including your dissertation research. Present a student seminar. Take more graduate courses as needed/desired, attend seminars. Write and defend your dissertation when research is completed.

\* See specific deadline dates for Graduate School forms at <https://www.clemson.edu/graduate/students/deadlines.html>

## PROFESSIONAL DEVELOPMENT

### Departmental Seminars

All graduate students should enroll in ESED 8000 during their first semester in residence and attend on a regular basis thereafter while in enrolled in the PhD program. Time and place may vary from the schedule to suit outside speakers.

### Lunch and Learn

The department holds “Lunch and Learn” every Friday. This is an opportunity for faculty and students to discuss current research. On days when the department is hosting a seminar speaker, this is an opportunity to interact in a less formal environment with our department guest. Students and faculty are encouraged to attend Lunch and Learn whenever possible for their own professional development and for the strength of the community.

### Writing Week

Writing Week is an important tradition for the department and provides students and faculty with an opportunity to dedicate time to completing work at the end of each term in a relaxed and communal environment. Writing Week typically occurs the week following Final Exam Week in the Spring and Fall semesters. Students should consult their advisors for specific expectations for Writing Week.

### ESED Graduate Teaching Scholar/Instructional Scholar

Funded teaching experience is possible through the ESED Graduate Teaching Scholar and Instructional Scholar positions. The Graduate Teaching Scholar is akin to a graduate teaching assistantship (GTA), while the ESED Instructional Scholar allows students to serve as an instructor of record. Faculty advising ESED PhD students are eligible to nominate ESED PhD students for either position (two positions are available each year). The teaching terms begin August 15<sup>th</sup>.

The chart below outlines the submission materials required for each position. Questions about these positions can be directed toward the Department Chair.

Position	Qualifications	Nomination Package
ESED Graduate Teaching Scholar (GTA)	Either: (1) Served as a GTA or equivalent in their discipline at Clemson/previous institution with satisfactory performance, or (2) Recommendation from Major advisor laying out teaching experience	Letter from Major advisor (max 2 pgs) Teaching Statement (1 pg) CV  If qualifications are (1), also include letter of support by previous instructor of record (max 2pgs)

ESED Instructional Scholar	At least 18 graduate credit hours in discipline and, (1) passed practicum, or (2) previously served as an instructor of record	Letter from Major advisor (max 2 pgs) Teaching Statement (1 pg) CV Transcript  If qualifications are (1), observation report; If qualifications are (2), student evaluation report from previous instructor of record position
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**Leadership Positions**

The following table outlines the leadership opportunities available to ESED graduate students. Most terms are one year in length and self-nominations are typical. The Graduate Affairs Committee Graduate Student Liaison will facilitate the selection of student leaders for positions appointed by the graduate students (appointment mechanism indicated in the last column).

<b>Position</b>	<b>Description</b>	<b>Minimum Time in Program</b>	<b>Term length</b>	<b>Appointment</b>
College of Engineering, Computing, and Applied Sciences Graduate Student Advisory Board (CECAS GSAB) Representative (1)	CECAS GSAB is a group that meets and talks about college issues specific to grad students. They host a mentoring group for new graduate students, game nights and a discord server throughout the semester and other CECAS graduate student events. This group meets once a month August- May for an hour. Attending meetings is the only commitment however you can become more involved if you wish.	none	1-year, starting in January	Self-nomination, selected by the graduate students
Graduate Student Government (GSG) Senator (2)	GSG Senators are expected to attend senate meetings every other week, vote on GSG legislations, disseminate GSG information to ESED, complete senator training in Canvas, and serve on at least one GSG committee. The time commitment is the two hour meeting twice a month and time spent working on committee responsibilities which varies based on committee.	none	1-year, starting in August	Self-nomination, selected by the graduate students



Social Director (no limit on number of positions)	The Social Director tries to plan at least 1-2 Social Events every month to help foster building community among faculty and students of the Engineering Science and Education Department. The types of events may vary to help encourage participation and new opportunities to connect with one another. Events should be aimed to be affordable, inclusive, and advertised. The time commitment fluctuates for each event depending on the amount of prep work that may be required.	none	1 year, starting in August	Self-nomination
ESED Peer Mentors (based on incoming cohort enrollment)	ESED peer mentors are expected to reach out to their assigned mentees to introduce themselves and attend particular orientation class sessions to share their experiences with the class. On boarding for this position occurs during the summer prior to the Fall orientation course. The time expectation for this position is a few hours during the specified term.	Completion of orientation course	May-December	Self-nomination then selected by Graduate Affairs Committee
Lunch and Learn Leaders (2)	Lunch and Learn leaders are responsible for coordinating with the seminar instructor to broadcast meeting times, locations, and reading material for the weekly meetings. They facilitate discussion of the meetings and select topics for sessions when there is not a visiting speaker to the department. Typical weekly time requirements outside of the session is under two hours.	Completion of seminar course	1 year, starting in May	Self-nomination, selected by the graduate students

<p>Seminar Exchange Coordinator (1)</p>	<p>The graduate seminar exchange coordinator meets with the other coordinators from participating universities and plans the seminar exchange including the application process and the visits themselves. This includes coordinating with the faculty member that is teaching seminar that semester for dates, and with Administrative Coordinator to help plan meetings for the visiting speaker. This also includes ensuring Clemson has at least one representative participating in the exchange and that the contact is being made between that speaker and the school they are visiting. Typical time requirement is a few hours a semester.</p>	<p>Completion of seminar course</p>	<p>1 year, starting in May</p>	<p>Self-nomination, selected by the graduate students</p>
<p>Graduate student liaison to the ESED Graduate Affairs Committee (1)</p>	<p>The Graduate Student Liaison's primary role is to serve as a point of communication between the ESED graduate students and faculty. This entails holding graduate student town halls and attending meetings with the Graduate Affairs Committee when necessary, to discuss departmental matters. The graduate student liaison also allows for an anonymous way of getting information from students to faculty. This position is also in charge of facilitating the process of appointments of the positions listed in this table. The time commitment for this position varies based on the needs of the department.</p>	<p>At least 1 year</p>	<p>1-year starting in May</p>	<p>Self-nomination, selected by the graduate students</p>

## **ASSISTANTSHIPS/FINANCIAL SUPPORT**

### **Description of Assistance Available**

Graduate research assistantships are available through individual faculty members to conduct research on specific projects. These may be either ¼-time, ½-time, or ¾-time appointments.

Fellowships are available from organizations outside Clemson University. Information on these opportunities is available from the department and from the Graduate School website ([www.grad.clemson.edu/fellowships.php](http://www.grad.clemson.edu/fellowships.php)).

Your responsibilities and details of your financial support are included in your official offer letter from the department. This letter requires your signature indicating your acceptance of any terms. Teaching assistants will receive a separate communication with more detail as to their specific assignments, such as course sections, etc. To maintain your assistantship, you must complete the duties in a satisfactory manner and make satisfactory progress toward your degree, determined by your supervisor and/or Major Advisor.

### **Assistantship Funding**

The ESED program uses primarily external funding sources for graduate students (research grants and contracts). Students supported by research funds are assigned research duties. All assistantships may be subject to time limits as described below and are contingent upon your satisfactory performance and progress toward your degree.

- Assistantships for doctoral students will normally extend for 3 years beyond the Master's degree.
- Continuation of assistantships is contingent upon satisfactory academic performance, as well as satisfactory performance of assigned duties associated with the assistantship.
- All research contract- and grant-supported graduate assistantships are subject to continued funding by the contracting agency. If a research contract or grant is terminated before you have completed your degree program, your Major Advisor will endeavor (on an individual basis) to provide financial support to allow continuation of your program. This should not be construed as an assurance of funding. You are expected to complete your degree program in a timely fashion.
- All graduate students holding graduate assistantship appointments at Clemson University shall be compensated based on a standard full-time (100%) equivalent (FTE) rate (12-month basis) established by the department. This rate shall also serve as the basis for all rate adjustments described below. Generally, appointments shall be ½-time appointments (50% of the standard FTE rate).
- Compensation at a rate exceeding the standard FTE rate is allowed according to the following guidelines:

- Funds for such additional compensation may be derived from a fellowship, traineeship or similar form of award in which the awardee is selected competitively from a group of applicants on the basis of scholarly excellence. In this case, such additional compensation is limited to a maximum of 25% of the standard FTE rate. In the event that such an award exceeds this limit, the assistantship appointment shall be diminished in like proportion such that the total compensation does not exceed 75% of the standard FTE rate.
- Funds for such additional compensation may also be derived from a research grant or contract provided you had a significant intellectual role in preparing the research proposal leading to the grant or contract, as judged by your Major Advisor. In this case, such additional compensation is limited to a maximum of 25% of the standard FTE rate.
- Upon each anniversary of your matriculation, your Major Advisor may, at their discretion, reward you for exceptional performance by increasing your pay rate in an amount not to exceed 15% of the standard FTE rate using either incentive, research contract or other funds. NOTE: You are responsible for submitting the required paperwork to initiate such a raise.
- The maximum compensation limit does not apply to students who do not hold an assistantship appointment at Clemson University.

## **Employment-related Information**

### Vacation Policy

Graduate students are expected to work during the time period specified in their offer letter. Your work time frame should not be perceived to be the same as the semester class schedule in that you are expected to work during exam week and the period before classes start. Graduate assistants do not accrue paid vacation time. Students who must interrupt their graduate studies may request a leave of absence in accordance with the *Graduate School Policy Handbook* at <https://www.clemson.edu/graduate/students/policies-procedures/index.html>.

With the exception of university holidays, graduate students are expected to work during the week when the university is in session. This includes days during exam week and before and after academic semesters.

### Holidays

Graduate students are entitled to take as holidays the days on which the University is officially closed. See the official University holiday schedule at <http://www.clemson.edu/employment/benefits/holiday.html>.

### Termination of Pay

Pay for any session will end when you leave Clemson or are no longer available for work assignments. Normal termination dates for the spring and fall semesters for students not continuing into the next session is graduation day. Any deviations from these dates must be approved by your Major Advisor or the department chair.

## Outside Employment

One of the purposes of a graduate assistantship is to support you during your graduate studies. Therefore it is the policy of the department to disallow you from outside employment if you hold at least a ½-time assistantship. Exceptions to this policy include temporary consulting and/or tutoring jobs, which you may undertake if you receive prior approval from your Major Advisor.

## ADMINISTRATIVE POLICIES AND PROCEDURES

### Student offices/desks

The ESED department will provide a desk for each graduate student, contingent on available space. New students should meet with the ESED office manager concerning a desk assignment.

### Student travel

Clemson University travel information and guidelines are available at [www.clemson.edu/procurement/travel](http://www.clemson.edu/procurement/travel). Before you travel, complete “Request to Travel” form, obtain appropriate signatures (PI or faculty member responsible for the account number to which it will be charged) and submit to your Major Advisor. If your travel is self-funded, you still need to complete a “Request for Travel” for insurance and workers’ compensation purposes.

### *Travel awards*

The Graduate Student Government (GSG) awards amounts of up to \$750 to full-time graduate students toward their attendance at conferences and other professional development events on a competitive application basis. See the GSG website for application information ([people.clemson.edu/~gsg/GTGS](http://people.clemson.edu/~gsg/GTGS) ).

# ENGINEERING AND SCIENCE EDUCATION RUBRIC FOR PH.D. EXAMINATIONS

The Major Advisor, in consultation with the graduate committee, shall use the examination results to evaluate specific strengths and weaknesses of the candidate and his/her graduate program in the areas indicated below.

**Circle one score, using a 5-pt. scale (1=Unsatisfactory, 2=Fair, 3=Good, 4=Very Good, 5=Excellent).**

Student Name: \_\_\_\_\_ ID# \_\_\_\_\_

**Item 1 - Qualifying Exam**

Date: \_\_\_\_\_

<b>1. Theoretical frameworks:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>2. Quantitative and/or mixed research methods:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>3. Qualitative and/or mixed research methods:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>4. Application of research to practice</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>5. Writing skills:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>6. Oral presentation skills:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

**Item 2 - Comprehensive Examination (Research Proposal Defense)**

Date: \_\_\_\_\_

<b>1. Research topic knowledge:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>2. Theoretical knowledge:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>3. Research design and methods:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>4. Data analysis:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>5. Writing skills:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>6. Oral presentation skills:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

**Item 3 - Dissertation Defense**

Date: \_\_\_\_\_

<b>1. Research topic knowledge:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>2. Research design and methods:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>3. Interpretation of results:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>4. Conclusions supported by evidence:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>5. Writing skills:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>6. Oral presentation skills:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>