



College of EDUCATION

Department of Education and Human Development

**Ph.D. in Learning Sciences
Program Handbook**

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INTRODUCTION

Welcome to the Department of Education and Human Development (EHD) at Clemson University's College of Education and the Learning Sciences doctoral program. We wish you success at every stage of your academic journey.

This handbook is intended to familiarize you with the requirements, policies and procedures involved throughout your graduate experience. The rules and regulations provided in this handbook govern our academic program and describe the duties and responsibilities of graduate students in the department. Each student is expected to be familiar with the contents of this handbook.

These rules and requirements are in addition to and subordinate to those described in the Graduate School Announcements, which you can find at <http://catalog.clemson.edu/>.

PURPOSE OF THE LEARNING SCIENCES PROGRAM

This program is designed for individuals who seek practical and theoretical training as research scientists, developers, practitioners in professional, non-profit, and academic settings.

Learning Sciences advances understanding of learning processes and the design of innovative learning environments. Students in the Learning Sciences program will learn to develop, deliver, revise, and evaluate effective learning experiences, and implement rigorous research studies in their chosen context.

Learning Sciences believes an interdisciplinary approach offers solutions to understand, design, and implement change as learning is studied across a range of informal and formal real-world settings. The interdisciplinary and personalized nature of the program offers students opportunities to build a strong base of disciplinary knowledge augmented with discrete skills relevant to their area of specialization. Students benefit from multiple perspectives as they apply theoretical, research, and design work to specific topics in learning. For example, they may seek answers to questions regarding best strategies for ensuring that students excel in science, technology and math, or how to leverage digital media to create innovative environments for learning. Psychology, cognitive science, computer science, sociology, technological fields, and anthropology often contribute a context to Learning Sciences.

The Doctor of Philosophy program in learning sciences will train students who are able to:

- develop, deliver, revise and evaluate effective learning experiences;
- conduct rigorous quantitative, qualitative and mixed method research;
- design and implement rigorous research studies in areas related to the learning sciences;
- analyze existing research and participate in scholarly discourse in the field; and
- apply leadership skills in areas such as academia, business, government or health care.

PROGRAM CONTACTS

Learning Sciences Program Coordinator - Dr. Luke Rapa, lrapa@clemson.edu

Learning Sciences Assistant Program Coordinator – Dr. Heather Brooker, brooke2@clemson.edu

Student Services Program Coordinator – Alison Search, alisonp@clemson.edu

Department Administrative Assistant – Suzanne Lusk, lusk6@clemson.edu or (864) 656-7645

Department Chair – Dr. Debi Switzer, debi@clemson.edu

The Program Coordinator is your first contact should any issue arise regarding your academic progress or the program curriculum.

POLICIES AND RESOURCES

[University Policies](#)

[Graduate School Policy Handbook](#)

[Graduate School Resources](#)

[Graduate School New Student To Do List](#)

COHORT INFORMATION AND LOCATION OF DEGREE PROGRAM

The Learning Sciences Program accepts one cohort of applicants each year, to begin each fall. Application deadlines will be no later than April 1st of each year, with a January 15th deadline to be considered for assistantships and fellowships. Per Graduate School policy, applicants are under no obligation to accept offers of financial support prior to April 15th of each year.

The location of the Learning Sciences Program is at the Clemson University main campus. Select courses may be offered at the University Center of Greenville (UGC).

ACADEMIC REQUIREMENTS

MINIMUM DEGREE REQUIREMENTS

Minimum Degree Requirements for the Ph.D. in Learning Sciences	
Total hours of coursework	61 credit hours
Core courses required*	13 credit hours
Research courses required*	12 credit hours
Cognate courses required*	18 credit hours
Comprehensive Exam	
Proposal Defense	
Doctoral Research	18 credit hours
Dissertation Defense	

*Note: All courses in a student's program of study must be approved by the student's Advisory Committee. Courses below the 8000-level may not be used to satisfy doctoral program requirements and should not be listed in the program of study.

CORE COURSES

All doctoral students are required to take all core courses below, constituting a total of 25 credits.

Research Courses: minimum 13 credit hours (4 courses)

- EDF 9270 Quantitative Research Designs and Statistics for Educational Contexts/EDF 9271 Qualitative Research Designs and Statistics for Educational Contexts Laboratory
- EDF 9770 Multiple Regression/General Linear Model in Educational Research
- EDF 9790 Qualitative Research in Education
- An advanced methods research course (note: as with all courses comprising a student's program of study, the advanced methods research course is subject to approval by the student's advisory committee). Example courses that may meet this requirement include:
 - o EDF 9080 Advanced Educational Tests and Measurement
 - o EDF 9710 Case Study and Ethnographic Research
 - o EDF 9720 Phenomenology and Grounded Theory Research Methods and Design
 - o EDF 9730 Narrative and Historical Research Methods and Design
 - o EDF 9740 Emerging Qualitative Research Methods and Design
 - o EDF 9750 Mixed Methods Research
 - o EDF 9780 Multivariate Educational Research
 - o EDF 9810 Design Based Research
 - o EDF 9820 Quantitative Ethnography

Learning Sciences Core Courses: 12 credit hours (4 courses)

- Doctoral Seminars:
 - o EDF 9010 Seminar in the Learning Sciences I
 - o EDF 9020 Seminar in the Learning Sciences II

Note: LS Seminars must be taken during a student's first (EDF 9010) and second (EDF 9020) year in the program.

- Two Learning Theory courses, examples:
 - o EDLT 9000 Sociocultural Theories of Learning
 - o EDF 9300 Bioecological Perspectives on Development and Learning
 - o EDF 9550 Theoretical Bases of Instruction

COGNATE COURSES

All doctoral students are required to take 18 credit hours (6 courses) for a cognate.

The cognate courses are selected by the student and his or her doctoral committee to develop a context in which to embed learning sciences. The selection of the six or more cognate courses may be from more than one content area, as the aim is to give the student a rich background into the multidimensional nature of their focus context. Courses might be chosen from a variety of content areas, for example: Architecture, Communication Studies, Computer Science, Digital Production Arts, Education, Family and Community Studies, Graphic Communications, Human-Centered Computing, Human Factors Psychology, Industrial Psychology, Sociology, Anthropology, History, Communication, and Information Design.

These decisions must be made with your Major Advisor in consultation with your committee, and are

designed to enhance your understanding of your cognate area. Credit received for graduate-level courses in other departments may be counted toward your degree, provided those courses involve subject matter that is relevant to your cognate. You must consult with and receive approval from your Major Advisor *before* taking such classes with the intention of having them count as part of your cognate.

COURSES TAKEN PRIOR TO ADMISSION TO THE PROGRAM

A course taken before admission (at Clemson or another institution) that is equivalent to one of the course requirements, including those from an earned master's degree may be substituted for a required course by demonstration of competency and/or providing evidence of equivalency to the student's Advisory Committee. A special examination may also be offered to meet these requirements.

Substitutions for required courses (12 hours of research, 6 hours of LS seminar, 6 hours of learning theory) are permitted through the following procedure. The student must make his or her request in writing to their Advisory Committee for each course. Substitutions must be doctoral level classes. The doctoral committee must collect evidence from the student demonstrating equivalency via transcripts, catalog description and syllabus and provide it to the Chair. The Department chair must approve substitutions for required doctoral courses after consulting with the faculty member(s) who teaches the doctoral course in question. Under no circumstances can this process be started before a student has chosen a dissertation chair and formed their committee.

SAMPLE CURRICULUM MAP

Year	Fall	Spring
1 st year	LS Seminar*, EDF 9270, Learning Theories	EDF 9770, EDF 9790, Learning Theories or Cognate
2 nd year	LS Seminar*, Advanced Methods, Learning Theories or Cognate	Learning Theories or Cognate, Cognate, Cognate
3 rd year	Cognate, Cognate, Dissertation (3 hours)	Dissertation (6-9 hours)
4 th year	Dissertation (6-9 hours)	Dissertation (6-9 hours)

* LS Seminars must be taken during a student's first (EDF 9010) and second (EDF 9020) year in the program.

Likely Course Offering Timeline (not guaranteed - for planning purposes only)

Research Courses: minimum 13 credit hours (4 courses)

• EDF 9270 Quantitative Research Designs and Statistics	Fall, Mondays
• EDF 9770 Multiple Regression/General Linear Model	Spring, Mondays/Tuesdays
• EDF 9790 Qualitative Research in Education	Fall & Spring, Tuesdays
• An advanced methods research course	
○ One of the following advanced Qualitative methods:	Fall, Tuesdays
○ EDF 9710 Case Study and Ethnographic Methods	
▪ EDF 9720 Phenomenology	
▪ EDF 9730 Narrative and Historical methods	
▪ EDF 9740 Emerging Qualitative methods	
○ One of the following advanced Quantitative methods:	Fall, Mondays
▪ EDF 9780 Multivariate Research	
▪ Other Advanced Quant	
○ EDF 9080 Advanced Educational Measurement	Fall-odd years
○ EDF 9750 Mixed Methods Research	Spring-even years
○ EDF 9810 Design Based Research	Fall-odd years
○ EDF 9820 Quantitative Ethnography	Fall-even years

Learning Sciences Core Courses: 12 credit hours (4 courses)

• Doctoral Seminars	
○ EDF 9010 Seminar in the Learning Sciences I	Fall-odd years, Wednesdays
○ EDF 9020 Seminar in the Learnings Sciences II	Fall-even years, Wednesdays
• Two Learning Theory courses, examples:	
○ EDLT 9000 Sociocultural Theories of Learning	Fall-even years, Thursdays
○ EDF 9300 Bioecological Perspectives on Dev & Learning	Fall-odd years, Thursdays
○ EDF 9550 Theoretical Bases of Instruction	Spring-even years, Thursdays

MENTORED TEACHING REQUIREMENT

During the course of the Learning Sciences Ph.D. program, all graduate students must fulfill the mentored teaching requirement under the supervision of a Learning Sciences faculty member. The objective of this developmental experience is to prepare the future learning scientist to design and teach courses within the field of Learning Sciences. Recognizing the diverse experiences and career goals of doctoral students in the program, as well as the changing course offering needs of the department, the mentored teaching requirement can be fulfilled through one of two options.

1. Students can serve as instructor of record for a course offered by Learning Sciences faculty. Prior to serving as instructor of record for a course, students will shadow the course as taught by a Learning Sciences faculty member (note: shadowing duties may differ across courses and faculty members but could generally include planning, teaching, and grading responsibilities commensurate of a 1-credit course). After shadowing, students will teach the course in a subsequent semester under the supervision of a faculty member. Graduate students are responsible for completing the teaching assessment procedures outlined below when they are instructor of record. Supervising faculty will complete the related course observations and evaluation forms at the student's request. (See Appendix A for Teaching Assessment Packet).
2. It is recognized that course design is an intensive curricular design process that is part of effective teaching. Thus, students can meet the teaching requirement by designing the equivalent of a 3-credit course under the direction of a Learning Sciences faculty member and co-teach portions of the class with the faculty member. Under this option, graduate students are responsible for completing the teaching assessment procedures outlined below during portions of the class they co-teach. Supervising faculty will complete the related course observations and evaluation forms at the student's request. (See Appendix A for Teaching Assessment Packet).

A total of 4 graduate credit hours may be allowed for the mentored teaching experience. For Option 1 (above), 1 credit may be awarded for shadowing, with 3 credits awarded for teaching as instructor of record. For Option 2 (above), 3 credits may be awarded for course design, with 1 credit awarded for co-teaching and assessment.

Once a course has been taught under Option 1, subsequent teaching of that course will be paid as part of an assistantship or as an adjunct for those without an assistantship.

GRADUATE TEACHING ASSESSMENT PROCEDURES

1. The student will contact Melissa Wellborn via email at the beginning of the semester with the following information to have a mid-term and end of course student evaluation set up in their CANVAS course site:
Melissa Wellborn - welbor4@clermson.edu
 - a. Provide your name, user id, section(s) you are teaching, including the CRN.
 - b. Indicate the time period you want them active (* the norm is one week).
 - c. Indicate if you are listed as the sole instructor or TA.
 - d. Indicate that you would like your name only to be listed on the mid-term and end of course evaluations.
 - e. Provide an attached copy of the Graduate Teaching Mid-Term Reflection Form (See Appendix A for Teaching Assessment Packet). Indicate that this is the student evaluation form you would like utilized for BOTH the mid-term and end of course evaluations in your CANVAS course.

2. The student will implement mid-term course evaluations about halfway through the semester, download a summary of the results, compile the data, and complete the Graduate Teaching Mid-Term Reflection Form based on the mid-term student course evaluation responses.
3. The student will complete and share the Mid-Term Reflection Form with their Learning Sciences Faculty Observer and schedule a meeting with them to review results of the mid-term evaluations and the student's plans for improvement.
4. The student will arrange with their Learning Sciences Faculty Observer an avenue for observing their implementation of planned instructional changes based on their meeting with them above (i.e., in person classroom observation, Zoom classroom observation, student engagement/performance on online assessments directly related to proposed instructional changes). The Faculty Observer will complete the Faculty Observer Graduate Teaching Observation Form based on the agreed upon observation plan.
5. Student will schedule a post-observation meeting where the Faculty Observer will debrief the student on the results of the Faculty Observer Graduate Teaching Observation Form, and provide input on their execution of the outlined plan for instructional change provided by the student on the Graduate Teaching Mid-Term Reflection Form.
6. Student will implement end of semester course evaluations, download and compile the data, and complete the Graduate Teaching End of Semester Reflection Form based on the end of semester student course evaluation responses and Faculty Observer's overall rating.

The student will compile, complete, and submit all elements for the Graduate Teaching Packet as outlined below: Course Context descriptions, Graduate Teaching Mid-Term Reflection Form, Faculty Observer Graduate Teacher Observation Form, and Graduate Teaching End of Semester Reflection Form, and submit a copy of the packet to the Assistant Program Coordinator for program records at the end of the semester.

GRADUATE SCHOOL FORMS AND DEADLINES

The Graduate School sets deadlines for the following items. The specific dates are determined according to the academic calendar for the semester in which you plan to graduate (<https://www.clemson.edu/graduate/students/deadlines.html>).

Form	Description	Location	Notes
GS2	Committee Selection and Plan of Study (two-part form)	iROAR	Submit GS2 no later than the beginning of fourth semester of study following matriculation.
GS5D	Results of the doctoral degree comprehensive examination	GS website	Submit GS5D to the Office of Enrolled Student Services within three weeks of examination.
Announcement of Dissertation Proposal	Student provides dissertation information to CoE Student Services.	CoE website	Submit this form no less than 10 days prior to their proposal.
Thesis/Dissertation Research Approval	Advisory committee's approval of student's research proposal	GS website	Student brings form to proposal defense to be submitted when successful proposal defense has been verified.
Apply to Graduate	Student notifies Enrolled Student Services of his or her intent to graduate	iROAR	Submit the Diploma Application only if you are planning to apply for the next graduation date.
Announcement of Dissertation Defense	Student provides dissertation information to CoE Student Services.	CoE website	Submit this form no less than 10 days prior to their defense.
Defense Schedule Notice	Official notification to the Graduate School of student defense	GS website	Submit this form no less than 10 days prior to their defense.
GS7D	Dissertation Defense and Approval Form	GS website	Committee must complete and return to the Office of Enrolled Student Services.
Dissertation Format Approval	Dissertation electronically submitted for format approval	Proquest	See Graduation Deadlines for exact deadline.
Final Dissertation Review	All revisions requested by the Manuscript Review	Proquest	See Graduation Deadlines for exact deadline.

	Office (MRO) must be completed and approved by the MRO		
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All Graduate School forms are available online at <https://www.clemson.edu/graduate/students/forms.html>.

ADVISORS AND ADVISORY COMMITTEE

The Learning Sciences Doctoral Advisory Committee is made up of all faculty members with appointments in the Learning Sciences program within the department of Education and Human Development. Once admitted you will be assigned an initial advisor who is a member of the Learning Sciences Doctoral Advisory Committee. This advisor will help you begin to plan your degree program and will be available to offer guidance on activities that support your development as a doctoral student and answer any questions you may have.

YOUR MAJOR ADVISOR

By the end of the first year, you should identify a Major Advisor from among tenure-track or tenured Learning Sciences faculty with whom you will work throughout the course of your studies. Your Major Advisor helps plan your curriculum and guides your research activities and the preparation of your dissertation.

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 comprehensive examination, evaluate your dissertation proposal and dissertation defense, and initiate the recommendation for awarding your degree. Your Major Advisor will serve as the chair of your Advisory Committee.

At least two members of your Advisory Committee must be regular Learning Sciences faculty members. The third member must be a faculty member within the College of Education. A fourth member must be from outside the department of EHD. The chair of the committee must be a member of the LS Doctoral Advisory Committee. If there is a fifth member, they must be regular faculty from the Learning Sciences Program or the student’s cognate area.

PLAN OF STUDY (GS2)

Your graduate degree curriculum should be planned very early in your program, and the graduate degree curriculum form (form GS2) should be submitted no later than the beginning of your fourth semester of study following matriculation.

Prior to graduation, you may revise your degree curriculum as needed subject to the necessary Advisory Committee and dean approvals. If your curriculum is changed, or the membership of your Advisory Committee is changed, you must submit a revised GS2. Courses comprising your program of study are subject to the approval of your Advisory Committee. Courses below the 8000-level may not be used to satisfy doctoral program requirements and should not be listed in the program of study.

In order to be approved for graduation, your final GS2 must be filed by the deadline listed on the graduation deadlines web page. Failure to meet these deadlines may result in late fees and/or inability to graduate when desired.

DOCTORAL COMPREHENSIVE EXAMINATION

The comprehensive examination will serve to examine your ability to apply the knowledge you have assimilated in your core and cognate coursework, and often an additional reading list assigned by your committee. Examination questions will be prepared by your Advisory Committee and tailored to your area of study and research topic. Your major advisor will inform you once the examination coverage has been determined. You may discuss the expected areas and format of the exam with your Advisory Committee members.

Satisfactory completion of the comprehensive examination must occur at least six months prior to the date of graduation.

TIMING AND CONTENT

The timing of this exam shall be at the discretion of your Major Advisor, but will typically be three written exams within a two-week period. One session will be devoted to examining your foundational knowledge in learning sciences, a second focused on a topic in your area of study, and a third on the methodology to be used during your dissertation research. Each of the three written exams are expected to be no more than ten pages in length.

GRADING THE QUALIFYING EXAM

At least three members of your advisory committee will grade your performance on that exam (see Appendix B for Assessment Rubric for Comprehensive Exams) and report the results to your Major Advisor. Grades of Pass (P), Marginal (M) and Fail (F) will be assigned for each question based on their consensus.

- If you receive a P grade on all questions, you may continue in the Ph.D. program.
- If you receive an M grade on any question, you will be given a short oral or written exam at the discretion of your advisory committee. The sole purpose of the M-grade exam is for the examining committee to obtain additional information in order to determine the final outcome of your exam. The results of the M-grade exam may carry additional committee-determined stipulations such as taking a graduate level course selected by the committee and achieving an A in that course.
- If you receive an F grade on 1 or more questions on your first attempt, you may or may not be permitted to continue in the Ph.D. program; this determination will be made by your advisory committee if they believe your performance is so poor that it is unlikely a second attempt will be successful. If you receive an F grade on 1 or more questions, you must retake that question (a replacement question will most likely be developed). If you receive an F on a second attempt on any of the questions you will not be permitted to continue in the Ph.D. program. At least two months must pass between the first and second attempts.

Satisfactory performance on the comprehensive examination will result in you being declared eligible to defend your dissertation proposal.

PH.D. PROPOSAL DEFENSE

Once you have passed your Comprehensive Exam, the Proposal Defense may be scheduled.

You provide a written plan for your dissertation research that includes, at a minimum,

- An introduction to your project clearly stating your research objectives;
- A review of relevant research to establish uniqueness and originality;
- A description of the method/procedure you will employ;
- A description establishing the significance of the proposed work.

Your committee may require more, for example the full first three chapters (introduction, literature review, and method).

Prior to the proposal defense, the student must have also obtained IRB approval (if applicable) and permission to conduct research from the appropriate school districts.

You then defend this plan orally to your advisory committee (and additional observers as approved by the committee). Your advisory committee listens to and then discusses the proposal, and if a consensus is reached that the proposal passes a rigorous appraisal, the defense is passed and the results (including committee feedback and signatures) forms the contract for the dissertation research.

If a consensus cannot be reached, the process must be repeated with significant changes at a later date.

Upon approval of the student's research plan, the Approval of Thesis/Dissertation Research Proposal form is to be submitted to the college's Student Services to be forwarded to Enrolled Services.

DISSERTATION FORMATS

The Learning Sciences Doctoral Program allows two different dissertation formats – the traditional dissertation and the manuscript style dissertation. The required sections and proposal procedures for the manuscript style dissertation are different from the traditional format and are described in greater detail in Appendix F.

ADMISSION TO DOCTORAL CANDIDACY

Admission to the Graduate School does not qualify a student as a candidate for a doctoral degree. Such candidacy depends on the acceptance by the dean of the Graduate School of a written request for admission to candidacy. You should file this request, Form GS5, once you have completed a major share of the prescribed graduate residence doctoral course work (research credits excepted), have successfully undertaken the comprehensive examination, and successfully defended your dissertation proposal. Your request for admission to candidacy must list each of the major and minor subjects to be offered for the degree and must contain the title of your proposed dissertation. The request must bear the signed approval of your Major Advisor and the department chair.

PH.D. DISSERTATION DEFENSE

An oral examination will serve to examine your dissertation research. You must hold your defense at least two weeks (14 calendar days) prior to the deadline for submission of the GS7D form, or a minimum four weeks (28 calendar days) prior to the commencement at which you plan to graduate. (See deadlines set by the Graduate School for the specific date for each term at <https://www.clemson.edu/graduate/students/deadlines.html>.)

You are required to provide a broad and penetrating interpretation of your research project and conclusions. Your committee members should receive a final draft copy of the dissertation at least three weeks before the examination. This examination will be conducted under the authority of your Advisory Committee. All college faculty members will be invited to participate in the examination and to provide comments to your Advisory Committee. The exam is graded on a Pass/Fail basis. A majority is needed to pass.

Successful completion of this examination and your dissertation will result in a recommendation (GS7D Form) by your Advisory Committee to the Graduate School that the Ph.D. 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 dismissal.

RESIDENCE FOR DOCTORAL DEGREE

Residence is a necessary concept in graduate education, particularly in the preparation of the dissertation. The purpose of residence is to require you to spend a specified minimum amount of time in direct personal association with members of the faculty of the University and under direct advisement of your Major Advisor and Advisory Committee, and to participate in other normal activities pertinent to graduate education such as seminars and close association with other student researchers.

Residency for doctoral degree programs can be accomplished through one of three mechanisms:

- Two consecutive semesters of full-time enrollment on a Clemson University campus: Students will be expected to be immersed in research and professional development activities consistent with the expectations of the residency requirement listed above.
- Alternative program plan: Specific degree programs may propose an alternative plan by which all enrolled students in that program will achieve residency expectations to be approved by the Graduate School. Alternative plans may be proposed for off-campus, online, and traditionally part-time enrolled programs.
- Alternative student plan: An alternative proposal for an individual student to achieve residency goals must be approved by the advisory committee and the Graduate School. The plan must be submitted at least one semester before implementation and included on the GS2 Plan of Study. Approved plans may be revised and resubmitted as warranted.

All students will be required to adhere to the full-time enrollment-based requirement unless an alternative plan has been submitted by the program and approved by the Graduate School.

TIME LIMIT

All requirements for the doctoral degree must be completed within eight (8) years from the date you first

matriculate into a doctoral degree program at Clemson. The time limit applies to all doctoral programs, even cases where a student is receiving a master's degree en route to the doctorate. This clock does not stop for leave of absence. Programs may petition for different time limits for their program for good cause. In exceptional circumstances, a student may petition the Graduate School for additional time with approval of the advisory committee. A student who exceeds the time limit without an extension can be dismissed from the Graduate School for failure to maintain adequate academic progress. Please refer to the graduate school handbook for more information.

ASSESSMENT BENCHMARKS

Each student in the Learning Sciences program will undergo an annual review. The purpose of this task is to review the student's progress in the program and provide feedback. The review will include evaluation of the following benchmarks:

1. Preliminary Annotated Bibliography documented in Learning Sciences Seminar 1 (See Assessment Rubric for Annotated Bibliography in Appendix C).
2. Preliminary Literature Review documented in Learning Sciences Seminar 2 (See Assessment Rubric for Literature Review in Appendix D).
3. Professional Competence (documented by advisor for committee, see Yearly Progress Towards Degree in Appendix E). These competencies will be fulfilled before the student is awarded the doctoral degree.
 - a. Students will teach a college/university undergraduate class and/or demonstrate competency (e.g. course design and co-teaching) in instructional methods as they relate to higher education. (See Teaching Assessment Packet in Appendix A)
 - b. Students will have a national presentation as a primary presenter accepted and/or demonstrate competency in scholarly communication within a professional setting.
 - c. Students will submit a manuscript for publication (national level preferred) as a primary author and/or demonstrate competency in scholarly writing.

4. Comprehensive Examination

The comprehensive examination consists of three written examinations, typically administered during a two-week period to be determined by your advisor. Earning a "passing" score for each of the three portions of the examination will allow the student to proceed to a dissertation proposal defense. A "marginal" score on any of the three portions will require an additional oral examination or a written revision. (See Assessment Rubric for Comprehensive Exams in Appendix B).

5. Dissertation Proposal includes a written proposal and an oral defense.
6. Dissertation Defense includes a written dissertation and an oral defense.

ASSISTANTSHIPS

For information regarding student employment, refer to the [Student Employment FAQ webpage](#) located on the Graduate School's website.

Appendix A

Graduate Teaching Assessment Packet

1. Student will contact Melissa Wellborn via email at the beginning of the semester with the following information to have a mid-term and end of course student evaluation set up in their CANVAS course site:

Melissa Wellborn - welbor4@clermson.edu

- a. Provide your name, user id, section(s) you are teaching, including the CRN.
- b. Indicate the time period you want them active (* the norm is one week).
- c. Indicate if you are listed as the sole instructor or TA
- d. Indicate that you would like your name only to be listed on the mid-term and end of course evaluations
- e. Provide an attached copy of the Graduate Teaching Mid-Term Reflection Form found in the Graduate Teaching Assessment Packet in Appendix A. Indicate that this is the student evaluation form you would like utilized for both the mid-term and end of course evaluations in your CANVAS course.

**See Graduate Teaching Mid-Term Reflection Form. These are the same questions that will be asked on the end of the semester student course evaluations. In order to provide incentive for students to complete BOTH the mid-term and end of semester course evaluations, it is suggested to offer students an extra credit opportunity if they provide evidence (screenshot indicating they have successfully completed the evaluation) by the designated due dates.*

2. Student will implement mid-term course evaluations about halfway through the semester, download a summary of the results, compile the data, and complete the Graduate Teaching Mid-Term Reflection Form based on the mid-term student course evaluation responses.
3. Student will complete and share the Mid-Term Reflection Form with their Learning Sciences Faculty Observer and schedule a meeting with them to review results of the mid-term evaluations and the student's plans for improvement.
4. Student will arrange with their Learning Sciences Faculty Observer an avenue for observing their implementation of planned instructional changes based on their meeting with them above (i.e., in person classroom observation, Zoom classroom observation, student engagement/performance on online assessments directly related to proposed instructional changes). The Faculty Observer will complete the Faculty Observer Graduate Teaching Observation Form based on the agreed upon observation plan.
5. Student will schedule a post-observation meeting where the Faculty Observer will debrief the student on the results of the Faculty Observer Graduate Teaching Observation Form, and provide input on their execution of the outlined plan for instructional change provided by the student on the Graduate Teaching Mid-Term Reflection Form.
6. Student will implement end of semester course evaluations, download and compile the data, and complete the Graduate Teaching End of Semester Reflection Form based on the end of semester student course evaluation responses and Faculty Observer's overall rating.

7. The student will compile, complete, and submit all elements for the Graduate Teaching Packet as outlined below: Course Context descriptions, Graduate Teaching Mid-Term Reflection Form, Faculty Observer Graduate Teacher Observation Form, and Graduate Teaching End of Semester Reflection Form, and submit a copy of the packet to the Assistant Program Coordinator for program records at the end of the semester.

Resources:

<https://www.clemson.edu/otei/evidence-based.html>

<https://www.clemson.edu/otei/documents/ebt%20strategies.pdf>

<https://www.chronicle.com/article/the-new-rules-of-engagement>

Graduate Teaching Assessment Packet

1. Course Context - Provide the following:

- a. Course name and description
- b. Description of participants (i.e. areas of concentration, undergraduate standing, number of students...)
- c. Course delivery methods (in-person, hybrid, synchronous online, asynchronous online)
- d. Instructional strategies employed
- e. Evaluation Criteria

2. Graduate Teaching Mid-Term Reflection Form

Provide the mid-term student evaluation score averages for each of the items below. Based on the quantitative and qualitative results of your mid-term evaluations, choose **two** of the items below as strengths and **two** of the following as weaknesses. For each item chosen, provide either evidence of strengths and/or evidence of areas of growth, and reflection/proposed future instructional practices. Your responses will be used as the focal points for your meeting with your Faculty Observer regarding your progress in teaching this course.

Graduating Teaching Mid-Term Reflection Form

Criteria	Score (Average)	Evidence of Strengths (i.e. student comments)	Evidence of Areas of Growth	Reflection/Proposed Future Instructional Practices
Q1: The Instructor clearly communicates what I am expected to learn.				
Q2: The Instructor makes the relevance of the course material clear.				
Q3: The Instructor is well organized.			18	
Q4: There is a positive interaction between the class and the Instructor.				
Q5: The Instructor's teaching methods helps me understand the course material.				
Q6: The Instructor's communication				

skills helps me understand the course material.				
Q7: Please comment on the strengths of the Instructor and the course.				
Q8: Please comment on the weaknesses of the Instructor and the course.				
Q9: Please comment on any teaching methods you found particularly helpful, and suggest alternative methods that you feel would improve the course.				
Q10: I would recommend this Instructor to a friend. Yes or no? Why?				

Summary of written student comments from the two items you chose as your strengths and two you chose as your weaknesses on your mid-term student evaluations:

A. Strengths

- 1.
- 2.

B. Weaknesses

- 1.
- 2.

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Reflection of your plans for future instructional changes based on the student mid-term scores/responses to the two items you chose as your strengths and two you chose as your weaknesses:

1. Strengths

- 1.
- 2.

2. Weaknesses

- 1.
- 2.

Plans for instructional changes based on the two responses above and meeting with your Faculty Observer:

3. Faculty Observer Graduate Teaching Observation Form

Faculty Observer Graduate Teaching Observation Form

Completed by: _____ Date: _____

Criteria	Exceeds Expectations 5-4	Meets Expectations 3-2	Does Not Meet Expectations 1	Comments
Organization/Presentation	<p>Presentation of content includes all of the following elements:</p> <ul style="list-style-type: none"> a. logical sequencing and segmenting. b. explicit examples, visuals and analogies, related to content. c. concise communication. d. reflective internal summary points. 	<p>Presentation of content includes 2-3 of the following elements:</p> <ul style="list-style-type: none"> a. logical sequencing and segmenting. b. explicit examples, visuals and analogies, related to content. c. concise communication. d. reflective internal summary points. 	<p>Presentation of content includes less than two of the following elements:</p> <ul style="list-style-type: none"> a. logical sequencing and segmenting. b. explicit examples, visuals and analogies, related to content. c. concise communication. d. reflective internal summary points. 	
Motivating students	<p>Content is designed to do all of the following:</p> <ul style="list-style-type: none"> a. be personally meaningful/relevant. b. be intellectually engaging. c. offer learning experiences where inquiry, curiosity and exploration are practiced and valued. d. provide reinforcements and rewards for effort. 	<p>Content is designed to do 2-3 of the following:</p> <ul style="list-style-type: none"> a. be personally meaningful/relevant. b. be intellectually engaging. c. offer learning experiences where inquiry, curiosity and exploration are practiced and valued. d. provide reinforcements and rewards for effort. 	<p>Content is designed to do less than TWO of the following:</p> <ul style="list-style-type: none"> a. be personally meaningful/relevant. b. be intellectually engaging. c. offer learning experiences where inquiry, curiosity and exploration are practiced and valued. d. provide reinforcements and rewards for effort. 	
Content knowledge	<p>Instructor exhibits thorough and complete knowledge of material/subject-specific instructional strategies. Successfully fields all learner inquiries.</p>	<p>Instructor exhibits familiarity with material/subject-specific instructional strategies. Successfully fields most learner inquiries.</p>	<p>Instructor not familiar with material/subject-specific instructional strategies. Struggles with fielding most learner inquiries.</p>	
Activities and Materials	<p>Activities and materials include ALL of the following:</p> <ul style="list-style-type: none"> a. ways to gain and sustain student attention. b. ways to challenge 	<p>Activities and materials include 2-3 of the following:</p> <ul style="list-style-type: none"> a. ways to gain and sustain student attention. b. ways to challenge 	<p>Activities and materials include less than TWO of the following:</p> <ul style="list-style-type: none"> a. ways to gain and sustain student attention. b. ways to challenge 	

	<p>student learning by eliciting a variety of thinking and time for reflection.</p> <p>c. opportunities for student to student interaction/collaboration.</p> <p>d. incorporation of multimedia and technology that enhances student learning and thinking.</p>	<p>student learning by eliciting a variety of thinking and time for reflection.</p> <p>c. opportunities for student to student interaction/collaboration.</p> <p>d. incorporation of multimedia and technology that enhances student learning and thinking.</p>	<p>student learning by eliciting a variety of thinking and time for reflection.</p> <p>c. opportunities for student to student interaction/collaboration.</p> <p>d. incorporation of multimedia and technology that enhances student learning and thinking.</p>	
Formative Assessment Practices	<p>1. Instructor questions are varied and high quality providing a mix of ALL of the following question types: a. knowledge and comprehension, b. application and analysis, and c. creation and evaluation. AND</p> <p>2. Feedback is academically focused, and high quality.</p>	<p>1. Instructor questions are varied and high quality providing a mix of TWO of the following question types: a. knowledge and comprehension, b. application and analysis, and c. creation and evaluation. AND</p> <p>2. Feedback is mostly academically focused, and high quality.</p>	<p>1. The variation and quality of instructor questions and feedback are inconsistent.</p>	
Student Engagement	<p>The lesson/activities motivates and engages all students in course content.</p>	<p>The lesson/activities motivates and engages most students in course content, but leaves others uninvolved and/or passive participants.</p>	<p>The lesson/activities leaves most students uninvolved and/or passive participants in course content.</p>	
Respectful Culture	<p>1. Instructor-student interactions demonstrate caring and respect for one another.</p> <p>2. Instructor seeks out, and is receptive to the interests and opinions of all students.</p>	<p>1. Instructor-student interactions mostly demonstrate caring and respect for one another, with occasional inconsistencies.</p> <p>2. Instructor is often receptive to the interests and opinions of students.</p>	<p>1. Instructor-student interactions are sometimes authoritarian, negative, or inappropriate.</p> <p>2. Instructor is not receptive to interests and opinions of students.</p>	
Improvements in Instructional Practice based on	<p>Instructor was responsive in applying the majority of concerns</p>	<p>Instructor was responsive in applying some of the concerns</p>	<p>Instructor was responsive in applying few to none of the</p>	

mid-term evaluations	highlighted by students in the mid-term evaluations.	highlighted by students in the mid-term evaluations.	concerns highlighted by students in the mid-term evaluations.	
Faculty Observer Observation Score	Exceeds Expectations	Meets Expectations	Does Not Meet Expectations	

Exceeds Expectations (5-4): Consistent evidence of student-centered learning/student ownership of learning; instructor facilitates learning.

Meets Expectations (3-2): Some evidence of student-centered learning/student ownership of learning; teacher facilitates the learning.

Does Not Meet Expectations (1): Heavy emphasis on teacher directed learning; minimal evidence of student ownership of learning.

Written comments regarding overall assessment of teaching observation:

4. Graduate Teaching End of Semester Reflection Form

Provide the end of semester student evaluation score averages for each of the items below. Based on the quantitative and qualitative results of your end of semester evaluations, choose **two** of the items below as strengths and **two** of the following as weaknesses. For each item chosen, provide evidence of strengths and/or evidence of areas of growth, and reflection/proposed future instructional practices.

Graduate Teaching End of Semester Reflection Form

Criteria	Score	Evidence of Strengths (i.e. student comments)	Evidence of Areas of Growth	Reflection/Proposed Future Instructional Practices
Q1: The Instructor clearly communicated what I was expected to learn.				
Q2: The Instructor made the relevance of the course material clear.			22	
Q3: The course was well organized.				
Q4: There was a positive interaction between the class and the Instructor.				
Q5: The Instructor's teaching methods helped me understand the course material.				

Q6: The Instructor's communication skills helped me understand the course material.				
Q7: Please comment on the strengths of the Instructor and the course.				
Q8: Please comment on the weaknesses of the Instructor and the course.				
Q9: Please comment on any teaching methods you found particularly helpful, and suggest alternative methods that you feel would improve the course.				
Q10: I would recommend this Instructor to a friend. Yes or no? Why?				

Mentor's Evaluation Score	Exceeds Expectations	Meets Expectations	Does Not Meet Expectations

Summary of written student comments from the two items you chose as your strengths and two you chose as your weaknesses on your end of semester student evaluations:

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A. Strengths

- 1.
- 2.

B. Weaknesses

- 1.
- 2.

Reflection of your plans for future instructional change based on student end of semester course evaluation scores/responses AND Faculty Mentor's score and recommendations:

Appendix B
Assessment Rubric for Comprehensive Exams
 Learning Sciences

Student's Name:
Degree/PhD _____
Cognate:

University ID:
Date:

Question #: 1 2 3

Holistic Score: Pass Marginal Fail

Criteria		Advanced (3)	Proficient (2)	Unsatisfactory (1)
I	Completeness and Breadth	Responses reveal a comprehensive level of knowledge of the topic at hand.	Responses reveal a satisfactory breadth of knowledge of the topic at hand.	Responses are brief and/or reveal a narrow level of knowledge of the topic at hand.
II	Accuracy and Depth	Responses demonstrate depth of knowledge and the ability to analyze and synthesize information.	Responses demonstrate depth of knowledge of the topic at hand.	Responses are inaccurate and/or superficial.
III	Logic and Organization	Responses are logical and easy to follow.	Responses contain all of the elements but take effort to follow.	Responses are poorly organized and difficult to follow.

Comments to committee:

Comments to student:

Appendix C

Application of Relevant Theory and Research

Learning Sciences Seminar I – Annotated Bibliography Assessment

Name of Student:

Course Professor:

Semester Assessed:

The Annotated Bibliography is an individual assignment in Learning Sciences Seminar I. The goal of this assignment is to help students develop their understanding of foundational theory and research connected to their interests.

	1 Not Evident	2 Fair	3 Proficient	4 Advanced
<i>Summaries</i> Summaries should provide a clear and concise encapsulation of the article. They should also illuminate important points related to the individual's research interests.				
<i>Annotations</i> Annotations should make explicit connections between the source and the individual's research interests, defining how the source applies to their work.				
<i>Collection</i> The overall collection should include annotations of assigned readings and self-selected readings. The self-selected sources should connect assigned readings to the individuals' research interests.				

Comments:

Rating scale

1 – not evident: does not show evidence for this criterion

2 – fair: provides minimal evidence for this criterion

3 – proficient: provides acceptable evidence for this criterion

4 – advanced: provides exceptional evidence for this criterion

Rating expectation

Assignment rubric to be completed after course completion by professor who taught Learning Sciences Seminar I. Students are expected to achieve an average score of 3.

Appendix D

Application of Relevant Theory and Research

Learning Sciences Seminar 2 – Literature Review Assessment

Name of Student:

Course Professor:

Year Assessed:

Students will complete a literature review on a topic relevant to their cognate and research interest in the learning sciences. For this assignment, students will present evidence of improving critical thinking skills and meeting each of the critical thinking objectives below.

	1 Not Evident	2 Fair	3 Proficient	4 Advanced
Situate the review as a problem of learning / problem of the Learning Sciences				
Identify, analyze, and evaluate key assumptions				
Build an argument from literature proximal and relevant to the selected topic; Comprehensive in nature; Include a variety of scholarly sources				
Identify and evaluate alternative positions or competing interpretations, explanations, evidence, and conclusions				
Make evidence-based claims; Identify and evaluate implications of research findings				
Develop and justify one's own hypotheses, positions, or interpretations				
Communicate complex ideas effectively				

Comments:

Rating scale descriptors

1 – Indicates that the student has failed to show evidence of the critical thinking objective in the literature review.

2 – Indicates that the student has shown minimal evidence of the critical thinking objective in the literature review. There are either few examples present or the examples present do not represent good examples of the particular critical thinking objective.

3 – Indicates that the student has shown evidence of the critical thinking objective in the literature review that is commensurate with progress in the program. There are multiple examples present, and the examples present represent emerging expertise in the particular critical thinking objective.

4 – Indicates that the student has shown extensive, high-quality evidence of the critical thinking objective in the literature review that is commensurate with progress in the program. There are multiple examples present, and the present examples represent emerging expertise in the particular critical thinking objective.

Rating expectations

Assignment rubric to be completed and scores rated by professor who teaches Learning Sciences Seminar II; successful students should receive an average score of 3.

Appendix E
Application of Relevant Theory and Research
 Yearly Progress Towards Degree
 Learning Sciences - Advisor Rubric

Name of Student:

Advisor:

Year Assessed:

	1 Not Evident	2 Fair	3 Proficient	4 Advanced
Coursework				
Ethical Judgment				
Communication Skills				
Research Activities				

Comments:

Rating scale descriptors

1 – indicates student is not progressing in coursework; fails to use ethical judgment during research, writing, collegial interactions or collaborative work; does not communicate with peers, professors, participants in research, or others; evidences no effort towards research commensurate with progress in program.

2 – indicates student is making minimum progress in coursework; at times demonstrates a lack of ethical judgment in research, writing, collegial interactions or collaborative work, communicates ineffectively with peers, professors, participants in research, or others; evidences little effort towards research commensurate with progress in program.

3 - indicates student is making adequate progress in coursework; demonstrates ethical judgment in research, writing, collegial interactions or collaborative work, communicates effectively with peers, professors, participants in research, or others; evidences steady effort towards research commensurate with progress in program.

4 - indicates student making excellent progress in coursework; uses outstanding ethical judgment during research, writing, collegial interactions or collaborative work; posses excellent communicate skills with peers, professors, participants in research, or others; evidences commendable research commensurate with progress in program.

Completion and progress in program rubric to be completed and scores rated by advisor each year; students should receive an average score of 3.

Complete if applicable:

(1) Conference submissions:

- (2) Journal submissions:
- (3) Completion of Comprehensive finals (date, pass/fail):
- (4) Successfully defended dissertation (date, pass/fail)

Appendix F

Manuscript Style Dissertation

Introduction

A manuscript-style or three-article dissertation is one that takes the form of three thematically linked papers plus an integrative introduction and conclusion. The integrative introduction is a narrative that explains how the papers collectively make progress on the same broad research questions but focus on that questions in different ways. Each of the three papers needs to be stand alone in that they could be submitted independently for publication. The manuscripts-style dissertation entails special preparation and comes with its own set of requirements. Students should decide as early as possible, in concert with their dissertation chair, whether to pursue the manuscript-style format.

The manuscript-style dissertation is not the ideal format for all students and is not suitable for all cognates. The manuscript-style dissertation is a useful alternative for students who intend to pursue academic careers and want to build a publication record. There must be coherence among the articles that make up the dissertation, and the rationale for grouping the three articles together must be clear. Students may find it difficult to manage their time between writing the dissertation and the publishing “revise and resubmit” cycle, so careful consideration of the time commitment is needed before undertaking this dissertation format. The manuscript-style option is *as rigorous* as the traditional dissertation.

Requirements

- The completion of a manuscript-style dissertation must be approved by the student’s dissertation committee. Ideally this conversation should be undertaken with committee members early in the student’s graduate work.
- Each manuscript included in the manuscript-style dissertation must represent an original contribution to the field. The dissertation must contain a minimum of two empirical articles, each of which must be suitable for submission to refereed journals for publication. A third article, could describe a relevant *theoretical framework* (e.g., propose a theoretical model pertinent to the students’ empirical papers), be a *critical review of the literature* (a systematic or integrated review) that is broader than the literature review provided for each article (i.e. a state of the field type of article), or take the form of an *additional empirical article*.
- Students must be first author on all articles. As first authors of each article, students are responsible for developing and articulating the concept or idea for research, developing the proposal to pursue this idea, developing the research design, conducting research and analysis, writing major portions of the manuscript, designing an intervention or assessment (if relevant), and interpreting results.
- The journals to which the articles are being submitted must be approved by the dissertation committee. The committee should assist in choosing refereed research journals that represent high quality and offer a reasonable chance of publication success.
- A maximum of one article initiated prior to the proposal defense may be included. This article must represent work undertaken while the student is enrolled in the PhD program and be approved by the committee at the time of the student’s proposal defense. This article must be connected to the theme or themes of the dissertation. This is the only article out of the three that may have co-authors. Co-authors for this article must be identified and approved, including their relative roles and contributions, at the student’s proposal defense. If a previously published article is approved by the committee, the student will be responsible for securing necessary permissions from the copyright holder and role confirmation signatures from other authors.

- If three new articles are proposed, each must be sole authored by the student. Co-authors are only allowed on a paper initiated prior to the proposal defense.
- The articles submitted for the defense must be of publishable quality. The student's dissertation committee decides whether the articles meet this standard.
- The dissertation must follow our field's formatting requirements (i.e., APA) and the same style guide must be used throughout the entirety of the dissertation, even if the journals to which you have submitted or plan to submit utilize different style guides. In the event of a discrepancy between style guides, the Graduate School's formatting standards will take precedence over others.

The Dissertation Proposal

The dissertation proposal for the manuscript-style dissertation involves additional considerations and requirements. The written proposal should include a completed manuscript, another manuscript that is partially complete, and a description of plans for the remaining manuscript(s). The proposal should be introduced by a 10 to 15-page introduction or integrative statement, describing the conceptual and theoretical linkages among all three manuscripts. Further, a timetable should be included that details the completion and planned submission of each paper to a peer-reviewed journal.

The proposal meeting typically presents the rationale and logic for each of the three papers. The dissertation committee chair and the dissertation committee will ultimately determine the details of the proposal defense. A successful proposal defense entails:

- approval to conduct a manuscript-style dissertation instead of a traditional dissertation;
- approval of the existing manuscripts that will constitute part of the dissertation or approval of revisions to the existing manuscripts;
- approval of the proposed work for the final manuscript(s);
- review and approval of the student's principal authorship role on each of the manuscripts that comprise the dissertation.

Copyright Considerations and Requirements

The inclusion of any previously published articles or articles that have been accepted for publication requires permission from the copyright holder as required by US law. The sections not copyrighted by another party may be covered under the publication of the new manuscript. Up to one article may have been published before the defense. However, if so, the student must obtain copyright permission from the publishing journal to include the article in his or her dissertation. Doing so is required by U.S law.

Order of Required Manuscript Elements for the Three-Article Dissertation

The final dissertation manuscript must follow the Graduate School's formatting standards. Beyond those requirements, the three-article dissertation should include the following:

Prefatory Material

- Copyright Information

Please see the introductory information, above, regarding copyright concerns

- Abstract

The abstract should synthesize the three articles and the work as a whole.

- Acknowledgements and Dedication (Optional)

Follow the same layout and format as for a traditional dissertation.

- **Table of Contents**

Each article included should be identified in the Table of Contents as a separate section by giving the complete title as it appears on each manuscript. Do not list subheadings that occur within the individual manuscripts (unless required by the Graduate School's formatting requirements). List subheadings from the introductory and summary sections.

- **Lists of Tables and List of Figures (if applicable)**

List all tables and figures that appear within the entire document. Numbering of tables and figures will be dependent upon the chosen style and formatting guide for the document as a whole.

Main Body

- **Introduction**

The introduction should explain why the previously published or publishable papers were chosen, including a substantive discussion of the relationship between the various articles and parts of the research that tie together the articles. The introduction should include a clear statement of the student's purpose or singular research hypothesis to be tested. It should provide necessary background information and a broad statement summarizing study findings. The minimum of three articles should form a cohesive body of work that supports themes that are expressed clearly in this introduction. The need for three articles should be clear and, as noted previously, must be approved by the dissertation committee. Minor tweaks of a work that would be more appropriately reported in just one or two articles is not permitted.

- **Chapter/Article 1**

- Subsections (e.g., Introduction, Review of Literature, Method, Results, Conclusions)
- Article 1 Reference List
- Article 1 Appendices (if applicable)

- **Chapter/Article 2**

- Subsections (e.g., Introduction, Review of Literature, Method, Results, Conclusions)
- Article 2 Reference List
- Article 2 Appendices (if applicable)

- **Chapter/Article 3**

- Subsections (e.g., Introduction, Review of Literature, Method, Results, Conclusions)
- Article 3 Reference List
- Article 3 Appendices (if applicable)

Concluding Material

- **Overall Conclusion**

State the conclusions for the dissertation as a whole. The conclusion should include a general discussion, applications, and ideas for future research that emerge from the three separate articles as well as from the dissertation as a whole.

- **References**

All general references from the introduction, overall conclusion, and any supplementary sections should be included here and should conform to the same style and format as the articles.

- **Appendices**

Include here only any additional appendices that relate to the manuscript as a whole.