

**GEORGE MASON UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT
GRADUATE SCHOOL OF EDUCATION**

EDCI 811 SEC. 001 Current Trends in Science Education Research,
3 Cr. Spring 2016
Tuesday 7:20-10 PM, L018 Thompson Hall



Promoting Learning & Development Across the Lifespan

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COURSE DESCRIPTION:

Prerequisite: EDCI 810

EDCI 811 provides an in-depth examination and analysis of literature and research in science education. Examines theoretical foundations of research studies in science education, discusses methodologies of research, critique research, and examines trends in emerging science education research. Includes presentations by science education researchers as well as opportunities for graduate students to explore research ideas with colleagues within the class.

NATURE OF COURSE DELIVERY:

This class will be delivered through face-to-face where class will meet in person. The instructor will determine the amount and delivery strategy for online learning. Course contents will be available through Blackboard as well as through synchronous platforms.

LEARNER OUTCOMES:

- Identify personal assumptions and values related to designing science education

This course is designed to e

research

- Articulate current trends within science education
- Describe the assumptions and epistemological underpinnings of different types of science education research
- Describe the role of hypothesis generation in research
- Identify the essential components of quality research in manuscript review
- Discuss validity and reliability across different forms of science education research
- Distinguish different forms of research and identify associated assumptions
- Critique and identify differing types of research designs correlational, policy, case, ethnographic, quasi-experimental, mixed-methods, and experimental designs of research in science education
- Identify the essential components of quality research

National Science Teachers Association STANDARDS: All of the standards below are addressed by building foundational knowledge regarding the emerging educational research for K-16 science in the relevant areas.

Standard 1: Content

Standard 2: Nature of Science

Standard 3: Inquiry

Standard 4: Issues

Standard 5: General teaching skills

Standard 6: Curriculum

Standard 7: Science in the community

Standard 8: Assessment

Standard 10: Professional growth

REQUIRED TEXTS:

This course will use contemporary literature found in science education journals available through the library and weekly readings will be posted on course blackboard site. The final project will require researching and finding articles based on your selected theme.

COURSE REQUIREMENTS AND EVALUATION CRITERIA:

A. Discussion of readings/class participation (15%)

You will discuss each week's readings through a series of activities during each class sessions. There will be guiding questions each week to focus your thinking and prepare you for engaging in class discussion. Your responses each week should be well thought out and you should demonstrate your engagement with the assigned pieces.

Questions will typically entail:

What are the overarching goals of the research?

How does the author/s view knowledge and knowing?

Did this vision of knowing impact research design?

And other more general notions of the readings such as:

* Quality of Abstract

* Timeliness and relevance of literature cited (how old are the citations and do they either support or refute the research questions)

- * Type of research method and design
- * Do results answer the research question?
- * Are there implications for teacher practice and/or policy?

Your preparation and engagement during our class sessions will be essential to making meaningful progress on your work as academics. Like all things, the more you put in, the more you get out of it. We have much to learn from one another no matter where we are in our doctoral journeys and a Bakhtinian notion for socially constructed understanding is an essential component to the course. So bring your best each week and it will be a great Tuesday evening as we work together.

B. Writing Abstracts (15%)

Nearly every writing activity you do as an academic will require a written abstract including conference papers, research papers, theses and dissertations, etc. The main point to remember is that it must be concise and informative. In fact, not only are abstracts short, they must almost always be a certain, specified length. I will give you two articles to read throughout the semester (each without an abstract) and you will need to write the abstract for each article. You will need to succinctly address the following in your abstracts:

- * Establish the topic of the research.
- * Give the research problem and/or main objective of the research.
- * Indicate the methodology used.
- * Present the main findings.
- * Present the main conclusions

C. Research Discussion Facilitator (20%)

You will choose a current topic/area of inquiry in science education (from the list below) and you will locate three recent examples from current science education journals. Try and find a range of research design approaches.

At least one week prior to your presentation, post your articles on the class discussion board so that classmates may read and prepare for the class session. You will then be responsible for designing a one-hour session with the class based on your selected articles. You have complete control for how you will run the hour. However, the goal will be to address the following questions.

1. What are the research designs of your articles? What are the major components? Why did the author choose these approaches?
2. How do the research questions facilitate the design used in the study? Could a different design have been used to answer the question(s) of interest to the researcher(s)?
3. What assumptions did the researcher(s) make in the process of conducting the study?
4. Are the conclusions and implications for practice appropriate for the presented data?
5. What concerns or questions do you have about this study? Do these studies push the boundaries of our understanding in this area?

D. Looking forward-Looking Back (LFLB) on a Science Education Issue (50% total grade ~ Matrix 15%, Presentation 10%, Written manuscript 25%)

Using current science education research journals, select a current issue/trend within science education and to analyze findings and research designs used over the duration and evolution of that issue. This topic should be in your area of interest and/or current research efforts. Locate key articles that formed the basis for the issue and trace those through to its current manifestation in terms of design, findings and impact/importance to the field. Lastly, you will articulate possibilities for how to move this issue forward in the future and articulate a research design for how you plan to approach the issue.

This project will include the following pieces:

Matrix (15 pts.)

Each student will create a matrix comparing research designs and findings over the duration of the issue they have chosen. This visual should clearly articulate the evolution of the work within this area over at least a decade.

Presentation/Poster (10 pts.)

From your introduction and literature review pitch your research design...

What are the theoretical frameworks that are used in these studies? What unanswered questions remain and what are some fruitful areas for future research? How will your design be well positioned to answer a key question pertaining to this idea? The presentation should be 10 minutes with 5 minutes for questions. Each student should be prepared to ask/challenge the presenter during those last 5 minutes.

Written manuscript (Proposal 5 pts. and manuscript 20 pts.) (15 pages max)

Introduction

Provide an introduction for the issue/area of inquiry... give the reader an overview of the key points and a roadmap for the rest of the manuscript.

Literature Review:

Provide a thorough review of the literature across the timeframe for your area of inquiry. Provide some of the key theoretical frameworks used within many of these pieces. Think how you can build a story by weaving together the review of literature. This is not intended to be a laundry list of prior work, rather a compelling insight to work that you find interesting and how that work has taken shape.

Research Plan:

Based on the recommendations from authors and your own insights into possible areas for growth within this issue build a research design that will allow you to study some aspect of this area of inquiry. You are encouraged to work with your advisor as you build and develop these ideas.

Rubrics for this project will be constructed as a class during the semester.

Resources and websites that may help you along the journey:

a) This site provides insights into building literature reviews and APA guidelines. I highly suggest reading this site before we begin the course as it will help you think about the literature you will be reviewing in the articles chosen for the class.

<http://www.duluth.umn.edu/~hrallis/guides/researching/litreview.html>

b) General APA and abstract advice: <https://owl.english.purdue.edu/owl/resource/560/01/>

G. Grading scale Letter grades will be assigned as follows:

A+ 97.5 - 100%, **A** 92.5 - 97.49%, **A-** 89.5-92.49%
B+ 87.5 - 89.49%, **B** 82.5 - 87.49%, **B-** 79.5 - 82.49%,
C 70-79.49%, and **F** below 70%

GMU Policies and Resources for students

- a. Students must adhere to the guidelines of the George Mason University Honor Code
[See <http://oai.gmu.edu/honor-code/>].
- b. Students must follow the university policy for Responsible Use of Computing [See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>].
- c. Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- d. The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu/>].
- e. Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu/>].
- f. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- g. The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See <http://writingcenter.gmu.edu/>].

Professional Dispositions

Students are expected to exhibit professional behaviors and dispositions at all times.

Core Values Commitment

The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles. <http://cehd.gmu.edu/values/>

For additional information on the College of Education and Human Development, Graduate School of Education, please visit our website [See <http://gse.gmu.edu/>]

TENTATIVE CLASS SCHEDULE:

Note: Calendar is tentative and may be modified in line with course needs.

Date	Guiding Questions/Topics	Readings/Assignments Due
January 19	Introduction Thematic design of the course Creating our wonders How do you envision the nature of knowledge and knowing? Overview of the field	Choose discussion topic and dates for facilitation (we will complete in first class session)
January 26	Why we do research? What is the purpose? Building Conceptual frameworks Writing an abstract	<i>NoS</i> Lederman et al. (2014) Burton (2015) Akerson et al. (2014)
February 2	Direction of the field What are the areas of contention? Elements of Research Design - Quantitative Experimental / Quasi-Experimental	<i>STEM/NGSS</i> Moore et al. (2015) Brown et al. (2016) Randler, C. & Bogner, F. X. (2008). Due: Abstract #1
February 9	Pushing boundaries...thinking about old problems in new ways Human Subjects Elements of Research Design – Mixed method Survey design, survey research	<i>Technology</i> Nielsen & Hoban (2015) Annetta et al. (2014)
February 16	What makes science? Elements of Research Design - Qualitative Descriptive, Case-study, Ethnography	<i>Inquiry</i> Geier et al. (2008) Gilbert (2013) Due: topic proposal for Looking forward-Looking backward (LFLB) project
February 23	Who does science? Longitudinal research	<i>Identity</i> Tan et al. (2013) Carlone et al. (2014) Kane, J. (2016)

March 1	Science for all? Timeline project discussion and progress	<i>Equity</i> Yerrick & Gilbert (2011) Archer et al. (2015) Due: Abstract #2
March 7-11	SPRING BREAK	
March 15	Designing Research in Science Education: Applying Designs to Research	<i>Student discussion facilitation # 1</i> <i>-Gender</i>
March 22	Progress toward LFLB project (Matrix) Argumentation in K-12 contexts	<i>Student discussion facilitation # 2</i> <i>- Argumentation</i>
March 29	Progress toward LFLB project (Research Design) Sense making in science #1	Student discussion facilitation # 3 <i>- Models and modeling</i>
April 5	Progress toward LFLB project (presentation/poster consideration) Sense making in science #2	<i>Student discussion facilitation # 4</i> <i>- Multiple representation</i>
April 12	Building and delivering professional presentations Making sense of methods, goals, design and audience	<i>Student discussion facilitation # 5</i> <i>- Informal Ed.</i> DUE: Matrix for LFLB project
April 19	Future goals beyond K-12 and working with future teachers	<i>Student discussion facilitation # 6</i> <i>- Science teacher education</i>
April 26	Presentation night	DUE: LFLB Presentation/Poster due Final papers Due 5/2