

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

**EDCI 811.001 Current Trends in Science Education Research
3 Cr. Spring 2023
In person - Jan. 25th, March 1st, April 5th, and May 3rd
Wednesday 7:20-10 PM
All other dates Synchronous online - Wednesday 7:20-10 PM**

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Prerequisites/Corequisites
Admission to Science Education Research Program

UNIVERSITY CATALOG COURSE DESCRIPTION:

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. Offered by Graduate School of Education. May not be repeated for credit.

EXPANDED COURSE DESCRIPTION:

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, critiques research, and examines trends in emerging science education research. The overarching goal of the course is to provide students with an understanding for the current academic terrain of the science education field. Namely, what are the key issues that have endured over time and how have they evolved into their current manifestation? What new issues and challenges does science education face as we proceed into the 21st century? This simultaneous task of both “looking forward and looking back” will provide the framework for how we engage with major issues and trends across the field. As a means to engage a broad array of topics the course will utilize multiple approaches including presentations by science education researchers, opportunities for graduate students to lead discussions, engaging with the writing and publication process, exploration of multiple research areas, as well as student presentations involving their own areas of interest and possible future research.

Course Delivery Method

This course will be delivered online (75%) using synchronous format via Blackboard Learning Management system (LMS) housed in the MyMason portal and 25% face-to-face on Mason's Fairfax campus. You will log in to the Blackboard (Bb) course site using your Mason email name and email password. The course site will be available on Wednesdays beginning at 7 PM for class beginning at 7:20.

Under no circumstances, may candidates/students participate in online class sessions (either by phone or Internet) while operating motor vehicles. Further, as expected in a face-to-face class meeting, such online participation requires undivided attention to course content and communication.

Technical Requirements

To participate in this course, students will need to satisfy the following technical requirements:

- High-speed Internet access with standard up-to-date browsers. To get a list of Blackboard's supported browsers see:
https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#supported-browsers

To get a list of supported operation systems on different devices see:

https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#tested-devices-and-operating-systems

- Students must maintain consistent and reliable access to their GMU email and Blackboard, as these are the official methods of communication for this course.
- Students will need a headset microphone for use with the Blackboard Collaborate web conferencing tool. [Delete this sentence if not applicable.]
- Students may be asked to create logins and passwords on supplemental websites and/or to download trial software to their computer or tablet as part of course requirements.
- The following software plug-ins for PCs and Macs, respectively, are available for free download: [Add or delete options, as desire.]
 - Adobe Acrobat Reader: <https://get.adobe.com/reader/>
 - Windows Media Player:
<https://support.microsoft.com/en-us/help/14209/get-windows-media-player>
 - Apple Quick Time Player: www.apple.com/quicktime/download/

Expectations

- Course Week:
Our course week will begin on the day that our synchronous meetings take place as indicated on the Schedule of Classes.
- Log-in Frequency:
Students must actively check the course Blackboard site and their GMU email for communications from the instructor, class discussions, and/or access to course materials at least 2 times per week. In addition, students must log-in for all scheduled online synchronous meetings.
- Participation:
Students are expected to actively engage in all course activities throughout the semester, which includes viewing all course materials, completing course activities and assignments, and participating in course discussions and group interactions.
- Technical Competence:
Students are expected to demonstrate competence in the use of all course technology. Students who are struggling with technical components of the course are expected to seek assistance from the instructor and/or College or University technical services.
- Technical Issues:
Students should anticipate some technical difficulties during the semester and should, therefore, budget their time accordingly. Late work will not be accepted based on individual technical issues.
- Workload:
Please be aware that this course is **not** self-paced. Students are expected to meet *specific deadlines* and *due dates* listed in the **Class Schedule** section of this syllabus. It is the student's responsibility to keep track of the weekly course schedule of topics, readings, activities and assignments due.
- Instructor availability:
Students may schedule a one-on-one meeting to discuss course requirements, content or other course-related issues. These meeting can be face to face on campus or via my Zoom office. Students should email the instructor to schedule a one-on-one session, including their preferred meeting method and suggested dates/times.
- Accommodations:
Online learners who require effective accommodations to ensure accessibility must be registered with George Mason University Disability Services.

NATURE OF COURSE DELIVERY:

Online 100%.

Course contents will be available through Blackboard as well as through synchronous platforms.

LEARNER OUTCOMES:

This course is designed to enable students to:

- Identify personal assumptions and values related to designing science education 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^[L]_[SEP]
- Critique and identify differing types of research designs correlational, policy, case, ethnographic, interpretive, 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 (10%)

You will discuss each week's readings through a series of activities during each class session. There will be guiding questions each week to focus your thinking and prepare you for engaging in the major themes of the works we are reading for that week. The expectation of that every student will be well prepared for each session. Your responses each week should be well thought out and should demonstrate your engagement with the assigned pieces. These will also entail some asynchronous online discussion boards for a few of our sessions throughout the semester.

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 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 as we work together.

B. Writing Abstracts (10%)

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 (15%)

You will choose a current topic/area of inquiry in science education 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 45 minute to one-hour session with the class based on your selected articles. You have complete control for how you will run the time. 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 (65% total grade ~ Matrix 15%, Presentation 20%, Written manuscript 30%)

Using current science education research journals, select an important issues or trend within science education. Your job is to trace the inception, evolution and current manifestation of this research area. In addition, you will analyze findings and research designs used over the duration and evolution of that issue. What brought this issue to bear? What are some key findings that have been articulated within the research? What are the key questions that remain going forward? The goal in this project is to contextualize the work currently being done in an area of study that you find interesting or an area that you may consider as part of your future research/dissertation.

After locating and carefully reading numerous key articles, that form the basis for the issue, synthesize and trace the essential aspects of those educational challenge the research is addressing, epistemological underpinnings, hypotheses, research designs, findings, calls for further research and associated gaps in the literature. The goal is better understand this issue's current manifestation in terms of design, findings and impact/importance to the field. Lastly, you will articulate possibilities for how you plan to move this issue forward in the future and articulate a possible research design for how you could approach the issue.

This project will include the following pieces:

Written manuscript (Proposal 5 pts. and manuscript 25 pts.)

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. 15 pages maximum.

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. This visual will represent your articulation and interpretation of the issue across the literature. This will be included as part of your written paper and poster presentation.

Presentation/Poster (20 pts.)

Based on the description of your area of study provide an introduction and vision for the key aspects of the literature associated with that issue... provide the audience with a vision for 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. It should be accessible and clear to others involved in science education and of a similar quality that you would present at a professional conference. This poster presentation will be delivered using Google Slides.

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>

Also see the following on blackboard as you craft your manuscript:

Lederman & Lederman (2015) What is a theoretical framework? A practical answer. *Journal of Science Teacher Education*. 26, 593-597.

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

G. Grading scale^[1]_[SEP] 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%

OTHER EXPECTATIONS

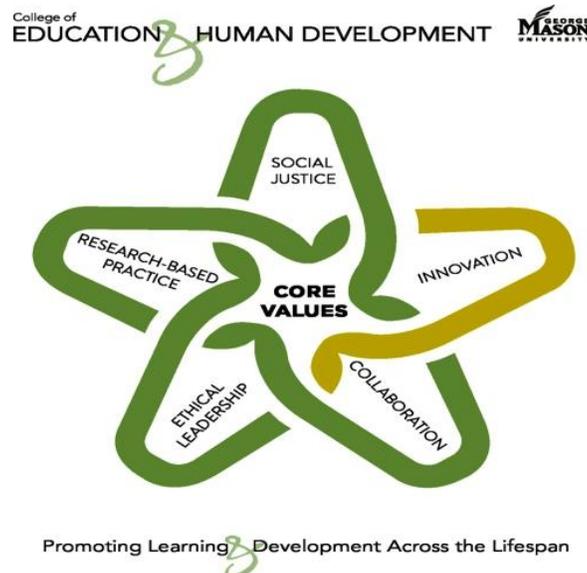
All written papers are **expected to be double-spaced, with 1” margins, and in 12-point font** (Times New Roman, Calibri, or Arial). **APA format is expected.** If you do not have a 7th Edition APA manual, the OWL at Purdue is an excellent resource: <http://owl.english.purdue.edu/owl/resource/560/01/>

***Please Note:** The GMU Writing Center offers online support via email. They will provide feedback on your writing within one hour. Graduate and professional writing can be difficult; I encourage you to take advantage of this service. http://writingcenter.gmu.edu/?page_id=177

It is expected that all class assignments will be submitted on time. Therefore, **All assignments are to be completed by the date listed in the syllabus. Written work will not be accepted after the due date unless prior arrangements have been made with the instructor.** Please just communicate, I will work with you. All assignments must be submitted by the beginning of class (Eastern standard time) on the due date stated within the syllabus (see below) and should only be submitted via **Blackboard**.

Professional Dispositions

Students are expected to exhibit professional behaviors and dispositions at all times See <https://cehd.gmu.edu/students/policies-procedures/>



Core Values Commitment

The College of Education and 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/>.

GMU Policies and Resources for Students

Policies

- Students must adhere to the guidelines of the Mason Honor Code (see <https://catalog.gmu.edu/policies/honor-code-system/>).
- Students must follow the university policy for Responsible Use of Computing (see <https://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>).
- Students are responsible for the content of university communications sent to their Mason 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.
- Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (see <https://ds.gmu.edu/>).
- Students must silence all sound emitting devices during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to Tk20 should be directed to tk20help@gmu.edu or <https://cehd.gmu.edu/aero/tk20>. Questions or concerns regarding use of Blackboard should be directed to <https://its.gmu.edu/knowledge-base/blackboard-instructional-technology-support-for-students/>.
- For information on student support resources on campus, see <https://ctfe.gmu.edu/teaching/student-support-resources-on-campus>

Notice of mandatory reporting of sexual assault, interpersonal violence, and stalking:

As a faculty member, I am designated as a “Responsible Employee,” and must report all disclosures of sexual assault, interpersonal violence, and stalking to Mason’s Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason’s confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance from Mason’s Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

For additional information on the College of Education and Human Development, please visit our website <https://cehd.gmu.edu/students/> .

EMERGENCY PROCEDURES

You are encouraged to sign up for emergency alerts by visiting the website <https://alert.gmu.edu>. There are emergency posters in each classroom explaining what to do in the event of crises. Further information about emergency procedures exists on <http://gmu.edu/service/cert>

TENTATIVE CLASS SCHEDULE:

Note: Calendar is tentative. It will be modified in line with course needs, student expertise, and interest in terms of readings and topics for each week.

Date	Guiding Questions/Topics	Readings/Assignments Due
1/25 <i>In person</i>	Introduction Thematic design of the course Why we do research? What is the purpose? Creating our wonders How do you envision the nature of knowledge and knowing?	Choose discussion topic and dates for facilitation (we will complete in first class session) In class ... What is a Theoretical framework
2/1	Building Conceptual frameworks Direction of the field What are the areas of contention?	<i>NGSS/Practices</i> Bybee (2014) Lilly et al. (2022) Assessing practice/NGSS Tekkumru-Kisa (2020)

2/8	<p>Elements of Research Design - Quantitative Experimental / Quasi-Experimental Qualitative</p>	<p><i>Argumentation</i> Osbourne et al. (2016) Governor et al. (2021)</p>
2/15	<p>Pushing boundaries...thinking about old problems in new ways</p> <p>Human Subjects Elements of Research Design – Mixed method Survey design, survey research</p>	<p><i>Affect/wonder</i> Jaber et al. (2021) Gilbert and Byers (2017)</p>
2/22	<p>What makes science?</p> <p>Elements of Research Design - Qualitative</p> <p>Descriptive, Case-study, Ethnography</p>	<p><i>Identity</i> Carlone & Johnson (2007) Ibourk (2022)</p>
3/1 <i>In person</i>	<p>Science for all? Discuss abstract construction Review process</p> <p>Timeline project discussion and progress</p>	<p><i>Care</i> Gunckel and Tolbert (2018)</p> <p>Due: Abstract from paper</p>
3/08	<p>Science for all?</p> <p>Building LFLB projects and preparation for discussion sessions</p>	<p><i>Equity</i> Calabrese-Barton Boda and Brown (2019)</p>
3/15	<p>Spring Break</p>	
3/22	<p>Designing Research in Science Education: Applying Designs to Research</p>	<p><i>Student discussion facilitation # 1</i></p>

	Progress toward LFLB project (Matrix and research design)	
3/29	Discussion session	<i>Student discussion facilitation #’s 2 and #3</i>
4/5 <i>In person</i>	Discussion session	Student discussion facilitation #’s 4 and 5
4/12	Progress toward LFLB project (presentation/poster consideration) Sense making in science	DUE: Matrix for LFLB project
4/19	Work session	
4/26	Building and delivering professional presentations Making sense of methods, goals, design and audience	Final papers Due
5/3 <i>In person</i>	Presentation night LFLB Poster sessions, In person	DUE: LFLB Presentation/Poster due