George Mason University
College of Education and Human Development
PhD in Science Education Research

EDCI 810.001 – Foundations of Science Education Research
3 Credits, Spring 2017
Mondays 7:20 – 10 pm Thompson Hall L003 – Fairfax Campus

Faculty

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Prerequisites/Corequisites

A. Prerequisite: Permission from instructor
B. Co-Requisite: EDUC 800

University Catalog Course Description

Explores and analyzes the range of research designs currently utilized by science education researchers. Develops an understanding of the assumptions and frameworks of different types of science education inquiry through an examination of ways of knowing. Examines historical trends that have taken place in science education.

Course Overview

The purpose of this course is to introduce students to foundational work in science education research. From the perspective of major areas of study in science education research, we will also analyze types of science education research methods, adaptation of findings to other research and/or teaching practice, and epistemological underpinnings of science education. The course can be visualized as

1. Science Learning
2. Culture, Gender Society and Science Learning
3. Science Teaching
4. Curriculum and Assessment
5. Science Teacher Education

Course Delivery Method

This course will be delivered using a majority of face-to-face format. However, several classes will be online and will be delivered asynchronously. Course contents will be available through the library or on Blackboard.

Learner Outcomes or Objectives

This course is designed to enable students to do the following:

1. Read and critique studies in science education.
2. Identify theoretical frameworks used by authors in published studies.
3. Locate science education research and describe the research focus of common science education and education research journals.
4. Identify issues in science education research and relate to practices and policies in science educational settings (i.e., precollege, higher education, and informal).
5. Conduct a literature review of research in a selected area of science education research.

Professional Standards - National Science Teachers Association STANDARDS:
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 historical literature found in science education journals available through the library electronically. Required readings for this course are included in the class schedule.

Lederman, N. G., & Abell, S. K. (Eds.). (2014). *Handbook of research in science teaching.* New York: Routledge.

It is recommended that students have access to the 6th edition to the APA manual, as all papers are required to be in APA format:
American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.

Course Performance Evaluation

Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard, Tk20, hard copy).

Assignments are listed on the syllabus and are available on the Blackboard site. Submit all assignments through Blackboard unless otherwise instructed.

Assignments and/or Examinations

A. Article Critiques (10%)

Questions and analysis assignments will accompany the weekly readings and should be completed on the Blackboard discussions 24 hours prior to each class. Looking across each of these studies students will identify:

- the research questions that guided the study,
- the research methodology(s) used,
- the number of participants in the study,
- the theoretical framework used, and
- the strengths and weaknesses of the article.

Beyond these provide,

- personal views of the writing style,
- the practical implications of the findings and
- how the study has or could impact educational policy.

Critiques should be well thought out and written without grammatical and spelling errors.

B. Review of Literature (60%)

Each student will be asked to complete a review of literature of an area of interest in science education. This should include a search for relevant literature, an examination of these readings and the preparation of a paper that describes the review of literature including the historical changes in the area of interest. The paper should include a review of a minimum of 15 published journal articles (not magazine or web reviews) and the paper should be 15-20 pages (double spaced, 12-font, Times New Roman, 1-inch margins) in length. The review should have a methods section for the journal search and focus on the methodologies, assessments used in the studies, and the contributions they make to the field of science education. Papers should be APA format and written as if for publication (i.e., proof read extensively).

C. Presentation of Research (10%)

From your literature review, consider the critical ideas, trends in research, and assessment issues that are present for this area of inquiry.

- What are the theoretical frameworks that are used in these studies?
- How would you describe the progression of findings?
- What unanswered questions remain and what are some fruitful areas for future research?

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.

- **Other Requirements**

Discussion of readings/class participation (20%)

Each week readings will be assigned that represent different types of research from different threads in science education. We will discuss each reading and you will be required to talk about the articles in a scholarly manner. Further, we will discuss the process of scholarly writing and focus on writing abstracts, annotated bibliographies, conceptual frameworks and literature

reviews. At some point in the semester, you will be given an article without an abstract and you will be asked to write one for that article.

- **Grading**

A 93-100%
A- 90-92%
B+ 88-89%
B 83-87%
B- 80-82%
C 70-79%
F below 70%

Professional Dispositions

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

Class Schedule

Date	Topic	Assignment Due	Reading Due
Jan 23	Introductions – research interests Introduction to the course Journals in the field Library skills Expectations Writing Abstracts Building academic community (BAC): Doctoral Committees		Review the syllabus Review the NARST website – find the Strands www.narst.org
Jan 30	**Student Learning** Foundations of science education research BAC: Finding critical friends		Hechinger Report: Important dates in U.S. science education history http://hechingerreport.org/timeline-important-dates-in-u-s-science-education-history/ Science curriculum reform in the U.S. http://www.nas.edu/rise/backg3a.htm Chapter 1 in Handbook of Research on Science Education -

			Perspectives on Science Learning
Feb 6	**Student Learning** Epistemologies BAC: Program of Study	Bring in your Program of Study Summarize each article of the two articles in one paragraph (2 total paragraphs) for today's discussion	Matthews, M.R. – In Defense of Modest Goals when Teaching about the Nature of Science Berland et al. – Epistemologies in Action
Feb 13	**Student Learning** Conceptual learning, Attitudinal, and Motivational Constructs in Science BAC: Organizing your writing tools; tips for being a productive writer	Find an article on conceptual learning, attitudes or motivation in science and Critique on Blackboard	Chapter 2 in Handbook of Research on Science Education - Student Conceptions and Conceptual Learning in Science Chapter 4 in Handbook of Research on Science Education - Attitudinal and Motivational Constructs in Science Learning Glynn et al. – Science Motivation Questionnaire
Feb 20	**Culture, Gender, Society and Science Learning** Student Diversity BAC: Writing Annotated Bibliographies and Literature reviews	Annotated bibliography of 3 articles due	Chapter 7 in Handbook of Research on Science Education – Science Education and Student Diversity Chapter 10 in Handbook of Research on Science Education – Gender Issues Rodriquez – Strategies for Counter-resistance
Feb 27	**Culture, Gender, Society and Science Learning** International Perspectives BAC: Class' choice	Write an abstract for article posted online	Chapter 9 in Handbook of Research on Science Education – Issues in science learning: An international perspective DeBoer – The Globalization of Science Education
Mar 6	**Science Teaching** Discourse and Argumentation BAC: Professional Organizations, Journals and Conferences	Annotated Bibliography with 15 articles due	Chapter 16 in Handbook of Research on Science Education – Discourse in Science Classrooms Osborne et al. - Argumentation Learning Progression
Mar 13	**Spring Break – no class**		
Mar 20	**Science Teaching** Domain-based	Be ready to present your work	Choose one chapter in Handbook of Research on Science Education based on

	teaching BAC: Publishing and authorship	to the class based on the Article Critique criteria	content area – Chapter 20 – biology Chapter 21 – physics Chapter 22 – chemistry Chapter 23 – Earth sciences Chapter 24 – environment
Mar 27	**Curriculum and Assessment** Curriculum Reform BAC: Class' choice	Outline of literature review due Summarize all three standards (AAAS, NSES, and NGSS) and find one example of curriculum written from the standards	Chapter 26 in Handbook of Research on Science Education – History of Science Curriculum Reform in the U.S. and the U. K. Benchmarks for Science Literacy http://www.project2061.org/publications/bsl/ National Science Education Standards (download for free) – https://www.nap.edu/catalog/4962/national-science-education-standards Next Generation Science Standards - http://www.nextgenscience.org/
Apr 3	**Curriculum and Assessment** Inquiry and NOS BAC: Pursuing an academic position	Write an abstract for an article posted online	Chapter 27 in Handbook of Research on Science Education – Inquiry as an Organizing Theme for Science Curricula Chapter 28 in Handbook of Research on Science Education – Nature of Science: Past, Present and Future Dolan et al. – Tool for Categorizing Complexity of Reasoning
Apr 10	**Curriculum and Assessment** Assessment BAC: Grant writing	Draft Literature Review Due Bring in one article to present on assessment in science education	Chapter 32 in Handbook of Research on Science Education – Classroom Assessment Chapter 33 in Handbook of Research on Science Education – Large Scale Assessment
Apr 17	**Science Teacher Education** Pre-service teachers Teacher professional development BAC: Class' choice	Bring in all articles you can find by Peter W. Hewson	Chapter 37 in in Handbook of Research on Science Education – Learning to Teach Science Chapter 38 in Handbook of Research on Science Education – Teacher Professional Development
Apr 24 **Online class –**	Learning outside of the science classroom	Answer blackboard questions and	Chapter 6 in Handbook of Research in Science Education - Learning outside of school

NARST		respond to at least 2 other students.	
May 1	Presentations and Celebration!		
May 11		Final literature review due	

Note: Faculty reserves the right to alter the schedule as necessary, with notification to students.

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 http://oai.gmu.edu/the-mason-honor-code/).
- Students must follow the university policy for Responsible Use of Computing (see http://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 http://ods.gmu.edu/).
- Students must follow the university policy stating that all sound emitting devices shall be silenced 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 http://coursessupport.gmu.edu/.

- The Writing Center 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/).

- The 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/).

- The Student Support & Advocacy Center staff helps students develop and maintain healthy lifestyles through confidential one-on-one support as well as through interactive programs and resources. Some of the topics they address are healthy relationships, stress management, nutrition, sexual assault, drug and alcohol use, and sexual health (see http://ssac.gmu.edu/). Students in need of these services may contact the office by phone at 703-993-3686. Concerned students, faculty and staff may also make a referral to express concern for the safety or well-being of a Mason student or the community by going to http://ssac.gmu.edu/make-a-referral/.

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