GEORGE MASON UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT
EDCI 810
Foundations of Science Education Research
3 Credit hours

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COURSE DESCRIPTION:
A. Prerequisite: Admission to Ph.D. in Education Science Education Research
Concentration
Corequisite: EDUC 800

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.

This course has three major strands:

1. Types of science education research methods;
2. Practical uses or research design and
3. Epistemological underpinnings of science education.

A number of central concepts will be considered across different designs. These include: evidence, hypothesis, sample, population, validity, reliability, objectivity, neutrality, prediction, and theory.

NATURE OF COURSE DELIVERY:
This class will be delivered 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:
This course is designed to enable students to:

- Read and critique studies in science education.
- Identify theoretical frameworks used by authors in published studies.
- Locate science education research and describe the research focus of common science education and education research journals.

- Identify issues in science education research and relate to practices and policies in science educational settings (i.e., precollege, higher education, and informal).
- Conduct a literature review of research in a selected area of science education research.

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 on e-reserve. Required readings for this course are included in the class schedule.

COURSE REQUIREMENTS AND EVALUATION CRITERIA:

A. *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. 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.

B. *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 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.

C. *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 and electronic (and hand) search for relevant literature, an examination of a set of these readings and the preparation of a paper that describes the review of literature including the historical changes in the area of inquiry. 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 focus on the methodologies and 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). You will be required to also submit a file of the review as Endnote, RefWorks and/or Zotero.

D. ***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? 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.

E. ***Grading scale***
F. Letter grades will be assigned as follows:
G.
H. **A+** 97.5 - 100%, **A** 92.5 - 97.49%, **A-** 89.5 - 92.49%,

I. **B+** 87.5 - 89.49%, **B** 82.5 - 87.49%, **B-** 79.5 - 82.49%,

J. **C** 70-79.49%, and

K. **F** below 70%

COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT

Student Expectations

- Students must adhere to the guidelines of the George Mason University Honor Code [See **http://academicintegrity.gmu.edu/honorcode/**].
- 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/**].
- Students must follow the university policy for Responsible Use of Computing [See **http://universitypolicy.gmu.edu/1301gen.html**].
- 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.
- Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- Students are expected to exhibit professional behaviors and dispositions at all times.
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Campus Resources

- 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/**].

- 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/**].

PROPOSED CLASS SCHEDULE

Class Meeting	Topic	Assignment Due	Reading Due
January 23	Introduction to class; The Conceptual Framework; Critical Pathways toward doctorate; References and library skills;		
January 30	**Tip of the Week**: Advisors & the Committee; Using ERIC; Discussion: Historical view of Science Ed research Thread: Foundations of science education Research	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	Piaget, J. (1964). Development and learning. Journal of Research in Science Teaching, 2, 176-186. (pdf p.8) What is science? Rowe, M. (1974). Wait time and rewards as instructional variables. Journal of Research in Science Teaching, 11, 81-94. (pdf p. 19) Lawson,A. & Wollman, W. (1976). Encouraging the transition from concrete to formal cognitive functioning. Journal of Research in Science Teaching, 13, 413-430. (pdf p.33)
February 6	**Tip of the Week**: The Program of Study; Discussion of readings; Using Endnote, RefWorks and Zotero Thread: Epistemologies	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	World's Fair Karplus, R. (1977). Science teaching and the development of reasoning. Journal of Research in Science Teaching, 14,169-175. (pdf2 p.1) Roth, W., & Roychoudhury, A. (1994) A. Physics students'

			epistemologies and views about knowing and learning. Journal of Research in Science Teaching, 31, 5-30.(pdf3 p. 16)
February 13	**Tip of the Week**: Preparing for the Portfolios; Discussion of readings	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates Literature Review Topic	Shymansky, J., Kyle, W., & Alport, J. (1983). The effects of new science curriculum on student performance. Journal of Research in Science Teaching, 20, 387-404. (pdf2 p.18) Hewson, M., & Hewson, P. (1983). Effect of instruction using students' prior knowledge and conceptual change. Journal of Research in Science Teaching, 20, 731-744.(pdf2 p.36)
February 20	**Tip of the Week**: Funding your doctorate; Thread: Multicultural education, equity and gender Thread: Equality	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates What is your theoretical perspective?	Tobin, K., & Gallagher, K. (1987). The role of target students in the science classroom. Journal of Research in Science Teaching, 24, 61-76. (pdf3 p.1) Kahle, J. 7 Lakes, M. (1983). The myth of equality in science classrooms. Journal of Research in Science Teaching, 20,131-140. (pdf2 p.8) Baker, D. & Leary, R. (1995). Letting girls speak out about science. Journal of Research in Science Teaching, 32, 3-28. (pdf4 p.22)
February 27	Choosing a dissertation topic; Thread: Conceptual Change	Blackboard Course online - students will read specified articles and respond to professor's prompt and the	Trowbridge, J., & Wandersee, J. (1994) Identifying critical junctures in learning in a college course on evolution. Journal of Research in Science Teaching,

		responses to at least 3 other classmates	31,459-474. (pdf3 p.42)
		Write an abstract	Lewis, E., & Linn, M. (1994). Heat energy and temperature concepts of adolescents, adults, and experts: Implications for curricular improvements. Journal of Research in Science Teaching, 657-678. (pdf4 p.1)
March 6	**Tip of the Week**: Professional organizations and conferences; Thread: Qualitative Studies	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	Gruenewald, D. (2003). Foundations of place: A multidisciplinary framework for place-conscious education. American Educational Research Journal. 40, (3), 619-654
March 20	**Tip of the Week**: Publishing & authorship; Thread: Technology	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	Annetta, L.A., Mangrum, J., Holmes, S., Collazo, K., & Cheng, M. (2009). Bridging reality to virtual reality: Investigating gender effect and student engagement on learning through video game play in an elementary school classroom. International Journal of Science Education, 31 (8), 1091-1113 Irving, K.E., & Bell, R.L. (2004). Double vision: Educational technology in standards and assessment for science and mathematics. Journal of Science Education and Technology. 13, (2), 255-266
March 27	**Tip of the Week**: Journal Quality; Thread: Research on Teacher Education	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	Yore, L.D., Hand, B.M., & Florence, M.K. (2004). Scientists' views of science, models of writing, and science writing practices. 41, (4), 338-369 Simmons, P.E., Brunkhorst, H., & Lunetta, V. (2005). Developing a

			research agenda in science education. Journal of Science Education and Technology. 14, (2), 239-252
April 3	**Tip of the Week**: Grant writing; Thread: Informal Education	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	Astor-Jack, T., McCallie, E., & Balcerzak, P. (2007). Academic and informal science education practitioner views about professional development in science education. Science Education. 91, (4), 604-628 Falk, J., & Stokrsdieck, M.(2005). Using the contextual model of learning to understand visitor learning from a science center exhibit. Science Education. 89, (5), 744-778
April 10	**Tip of the Week**: Research Intensive/extensive and the track to the professorship; Thread: Nature of Science	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	Bell, R.L., & Lederman, N.G. (2003). Understandings of the nature of science and decision making on science and technology based issues. Science Education. 87, (3), 352-377. Ackerson, V.L., Flick, L.B., & Lederman, N.G. (2000). The influence of primary children's ideas in science on teaching practice. Journal of Research in Science Teaching. 37, (4), 363-385 NSTA Reports
April 17	**Tip of the Week**: Science Education positions outside the Academy;	Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates	Mixed Method Design Designing Experiments Defining Literature Scholars Before Researchers

| April 24 | Thread: Social Issues in Science Education | Blackboard Course online - students will read specified articles and respond to professor's prompt and the responses to at least 3 other classmates Literature Review | Zeidler, D.L., Sadler, T.D., & Simmons, M.L. (2005). Beyond STS: A research-based framework for socioscientific issues in education. Science Education. 89, (3), 357-377 |
| May 1 | Presentations | | |

ASSESSMENT RUBRIC(S)

Article Critiques

	Does not meet expectation	Meets Expectation	Exceeds Expectation
Research questions correctly Identified			
Methodology correctly identified			
Participants correctly identified			
Theoretical framework correctly identified			
Strengths and weaknesses addressed			
Comments on writing style and implications			

Literature Review:

Criteria and qualities	Poor	Good	Excellent	Point Value
Introducing the idea: Problem statement	Neither implicit nor explicit reference is made to the topic that is to be examined.	Readers are aware of the overall problem, challenge, or topic that is to be examined.	The topic is introduced, and groundwork is laid as to the direction of the report.	Up to 2 points
Body: Flow of the report	The report appears to have no direction,	There is a basic flow from one section to	The report goes from general	Up to

	with subtopics appearing disjointed.	the next, but not all sections or paragraphs follow in a natural or logical order.	ideas to specific conclusions. Transitions tie sections together, as well as adjacent paragraphs.	2points
Coverage of content	Major sections of pertinent content have been omitted or greatly run-on. The topic is of little significance to the educational/training field.	All major sections of the pertinent content are included, but not covered in as much depth, or as explicit, as expected. Significance to educational/training field is evident.	The appropriate content in consideration is covered in depth without being redundant. Sources are cited when specific statements are made. Significance is unquestionable. The report is between 1,000 and 2,000 words.	Up to 2 points
Clarity of writing and writing technique	It is hard to know what the writer is trying to express. Writing is convoluted. Misspelled words, incorrect grammar, and improper punctuation are evident.	Writing is generally clear, but unnecessary words are occasionally used. Meaning is sometimes hidden. Paragraph or sentence structure is too repetitive.	Writing is crisp, clear, and succinct. The writer incorporates the active voice when appropriate. The use of pronouns, modifiers, parallel construction, and non-sexist language are appropriate.	Up to 2 points
Conclusion: A synthesis of ideas and hypothesis or research question	There is no indication the author tried to synthesize the information or	The author provides concluding remarks that show an analysis and	The author was able to make succinct and precise	Up to 2

				points
	make a conclusion based on the literature under review. No hypothesis or research question is provided.	synthesis of ideas occurred. Some of the conclusions, however, were not supported in the body of the report. The hypothesis or research question is stated.	conclusions based on the review. Insights into the problem are appropriate. Conclusions and the hypothesis or research question are strongly supported in the report.	
Citations/References: Proper APA format	Citations for statements included in the report were not present, or references which were included were not found in the text.	Citations within the body of the report and a corresponding reference list were presented. Some formatting problems exist, or components were missing.	All needed citations were included in the report. References matched the citations, and all were encoded in APA format.	Up to 2 points
Timeliness	Material was submitted more than one class late.	Material was submitted up to one class late.	Material is submitted on time.	Up to 2 points

Comments: