

George Mason University
College of Education and Human Development
Mathematics Education Leadership

EDCI 858 001 – Mathematics Education Research Design and Evaluation
3 Credits, Fall 2023
Mondays/4:30-7:10 pm Innovation Hall 330 – Fairfax Campus

Faculty

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Prerequisites/Corequisites

Admission to the Mathematics Education Leadership PhD program.

University Catalog Course Description

Examines methods of research appropriate for mathematics education. Develops knowledge of the scope and evolution of research methodologies from a range of perspectives. Offered by Graduate School of Education. May not be repeated for credit.

Course Overview

Students review methods of research appropriate for mathematics education settings and develop theoretical framework and action plan for conducting research project.

Course Delivery Method

This course will be delivered using a lecture format.

Learner Outcomes or Objectives

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

1. Explore the scope of mathematics education research methods and their evolution over time.
2. Develop an understanding of the design of mathematics education research at a variety of scales (e.g., qualitative, quantitative)
3. Examine the development of a research agenda over time and the conceptual development of mathematics education research.

Required Texts

All readings will be posted on Blackboard.

Bannan-Ritland, B. (2003). The role of design in research: The integrative learning design framework. *Educational Researcher*, 32(1), 21–24.
<https://doi.org/10.3102/0013189X032001021>

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, 32(1), 9–13.
<https://doi.org/10.3102/0013189X032001009>

Common guidelines for education research and development: A report from the Institute of Education Sciences, U. S. Department of Education and the National Science Foundation. (2013). Washington D.C. Retrieved from
<https://www.nsf.gov/pubs/2013/nsf13126/nsf13126.pdf>

Confrey, J. (2017). Research: To inform, deform or reform. In J. Cai (Ed.), *Compendium for research in mathematics education* (pp. 3-27). National Council of Teachers of Mathematics.

D'Ambrosio, B., Martin, D. B., Frankenstein, M., Moschkovich, J., Gutierrez, R., Taylor, E., Kastberg, S., & Barnes, D. (2013). Positioning oneself in mathematics education research: JRME equity special issue editorial panel. *Journal for Research in Mathematics Education*, 44(1), 11-22.

Davis, J. (2019). Using critical race theory as a pedagogical, theoretical, methodological, and analytical tool in mathematics education for Black students in urban areas. In J. Davis & C. C. Jett (Eds.), *Critical race theory in mathematics education* (pp. 183-205). Routledge.

de Freitas, E., Lerman, S., & Parks, A. N. (2017). Qualitative methods. In J. Cai (Ed.), *Compendium for research in mathematics education* (pp. 159-182). National Council of Teachers of Mathematics.

Eisenhart, M. A. (1988). The ethnographic research tradition and mathematics education research. *Journal for Research in Mathematics Education*, 19(2), 99–114.

Frank, T. J. (2019). Using critical race theory to unpack the Black mathematics teacher pipeline. In J. Davis & C. C. Jett (Eds.), *Critical race theory in mathematics education* (pp. 98-122). Routledge.

Herbel-Eisenmann, B. A., & Otten, S. (2011). Mapping mathematics in classroom discourse. *Journal for Research in Mathematics Education*, 42(5). Retrieved from
<http://search.proquest.com.mutex.gmu.edu/docview/905712144/1402B1AEF6A7557A948/3?accountid=14541>

Hiebert, J., Gallimore, R., Bogard Givvin, K., Hollingsworth, H., Miu-Ying Chui, A., Wearne, D.,

- ... Stigler, J. (2003). *Teaching Mathematics in Seven Countries: Results from the TIMSS 1999 Video Study* (No. NCES 2003–013 Revised). Washington D.C.: U.S. Department of Education, National Center for Education Statistics.
- Hiebert, J., & Stigler, J. W. (2000). A proposal for improving classroom teaching: Lessons from the TIMSS video study. *The Elementary School Journal*, 101(1), 3–20.
- Hjalmarson, M. A., & Lesh, R. (2008). Design research: Engineering, systems, products and processes for innovation. In L. English (Ed.), *Handbook of international research in mathematics education* (2nd ed., pp. 520–534). New York: Routledge.
- Jett, C. C. (2019). Mathematical persistence among four African American male graduate students: A critical race analysis of their experiences. *Journal for Research in Mathematics Education*, 50(3), 311-340.
- Larnell, G. V. (2016). More than just skill: Examining mathematics identities, racialized narratives, and remediation among black undergraduates. *Journal for Research in Mathematics Education*, 47(3), 233–269. <https://doi.org/10.5951/jresematheduc.47.3.0233>
- Lesh, R., & Clarke, D. (2000). Formulating operational definitions of desired outcomes of instruction in mathematics and science education. In A. Kelly & R. A. Lesh (Eds.), *Handbook of research design in mathematics and science education* (p. 113–149.). Mahwah, NJ: Lawrence Erlbaum.
- Lewis, C., & Perry, R. R. (2017). Lesson study to scale up research-based knowledge: A randomized, controlled trial of fractions learning. *Journal for Research in Mathematics Education*, 48(3), 261–299.
- Martin, D. B. (2013). Race, racial projects, and mathematics education. *Journal for Research in Mathematics Education*, 44(1), 316-333.
- McGraw, R., Lubienski, S. T., & Strutchens, M. E. (2006). A closer look at gender in NAEP mathematics achievement and affect data: Intersections with achievement, race/ethnicity, and socioeconomic status. *Journal for Research in Mathematics Education*, 3(1), 129–150.
- Powell, A. B., Francisco, J. M., & Maher, C. (2003). An analytical model for studying the development of learners' mathematical ideas and reasoning using videotape data. *The Journal of Mathematical Behavior*, 22(4), 405-435. <https://doi.org/10.1016/j.jmathb.2003.09.002>
- Rasmussen, C., & Stephan, M. (2008). A methodology for documenting collective activity. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.), *Handbook of design research in education: Innovations in science, technology, engineering and mathematics learning and teaching* (pp. 195–215). Mahwah, N.J.: Taylor and Francis.
- Schoenfeld, A. H. (2008). Research methods in (mathematics) education. In L. D. English, M. Bartolini Bussi, G. A. Jones, R. A. Lesh, B. Sriraman, & D. Tirosh (Eds.), *Handbook of international research in mathematics education* (2nd ed., pp. 467–519). New York, NY: Taylor and Francis.

- Shih, J. C., Ing, M., & Tarr, J. E. (2015). Addressing measurement issues in two large-scale mathematics classroom observation protocols. In J. A. Middleton, J. Cai, & S. Hwang (Eds.), *Large-Scale studies in mathematics education* (pp. 363–371). Springer, Cham. https://doi.org/10.1007/978-3-319-07716-1_16
- Simon, M. A. (2000). Research on the development of teachers: The teacher development experiment. In A. E. Kelly & R. A. Lesh (Eds.), *Handbook of research design in mathematics and science education* (pp. 335–360). Mahwah, N.J.: Erlbaum.
- Sloane, F. C. & Wilkins, J. L. M. (2017). Aligning statistical modeling with theories of learning in mathematics education. In J. Cai (Ed.), *Compendium for research in mathematics education* (pp. 183-207). National Council of Teachers of Mathematics.
- Steffe, L. P. (2013). Establishing mathematics education as an academic field: A constructive odyssey. *Journal for Research in Mathematics Education*, 44(2), 354–371. <https://doi.org/10.5951/jresematheduc.44.2.0353>
- Steffe, L. P., & Thompson, P. W. (2000). Teaching experiment methodology: Underlying principles and essential elements. In A. E. Kelly & R. A. Lesh (Eds.), *Handbook of research design in mathematics and science education* (pp. 267–306). Mahwah, N.J.: Erlbaum.
- White, D. Y. (2003). Promoting productive mathematical classroom discourse with diverse students. *The Journal of Mathematical Behavior*, 22(1), 37-53. [https://doi.org/10.1016/S0732-3123\(03\)00003-8](https://doi.org/10.1016/S0732-3123(03)00003-8)
- Wood, T., Cobb, P., & Yackel, E. (1991). Change in teaching mathematics: A case study. *American Educational Research Journal*, 28(3), 587–616. <https://doi.org/10.2307/1163150>

Course Performance Evaluation

Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard, VIA, hard copy). Detailed instructions and rubrics for all assignments will be posted to the Blackboard site for the course at <http://mymason.gmu.edu>. Please refer to these documents when completing your work. All written assignments should be submitted using APA 7th Edition for formatting.

All assignments should be submitted in Blackboard by 11:59 pm on the due date for the assignment. Extensions may be provided at the instructor's discretion only with permission provided by email *prior* to the deadline. Assignments submitted after the deadline will be subject to a 10% reduction in grade for the assignment.

- **Assignments and/or Examinations**

All assignments are to be completed on time so that class members might benefit from the expertise and contributions of their colleagues. **Additional details and rubrics for all assignments will be posted on Blackboard.**

A. CLASS PARTICIPATION & READING ANALYSIS (10%)

Participation and engagement is an important part of engaging in a scholarly community such as mathematics education research. Hence, participation and timely attendance in class is a critical part of development as a researcher in mathematics education. Consistent lack of participation (including late arrival or inconsistent attendance) will result in deductions from the participation grade. Some absences are unavoidable and should be communicated to the instructor in advance if possible.

The expectations, demands, and workload of this course are professional and high. Class discussions require a commitment to reading reflectively and critically the assigned readings. These questions should be posted in the Google class slide deck at the start of each class

B. CURRENT TRENDS IN MATHEMATICS EDUCATION ARTICLE PRESENTATION (20%)

This assignment is designed to encourage reading and discussion about current trends in mathematics education research in order to become familiar with new directions in mathematics education. Reading current publications and staying up-to-date with current trends is a critical aspect of mathematics research and leadership. For this assignment, select an article published in 2022-2023 about mathematics education in a peer-reviewed research journal (e.g., *Journal for Research in Mathematics Education*, *Mathematics Thinking and Learning*, *Educational Studies in Mathematics*, *Educational Researcher*). A Blackboard discussion board will be available for posting the articles electronically. You must make a copy of the article available for class access the class session prior to your discussion leading. Each person will lead a 30-minute discussion of the article in class.

C. PICK-A-RESEARCHER BIOGRAPHY (20%)

In this project students will select a significant researcher in mathematics education, seek out their articles and papers, and summarize their work from a historical perspective. What were the origins of their work? What were early topics they began investigating? What are major projects or themes they have pursued? What methodologies have they used to conduct their work? How has their work evolved over time? Finally, what can you as a mathematics education researcher and leader take away from their work? What have you learned about the nature of mathematics education research?

D. RESEARCH METHODOLOGY SYNTHESIS (50%)

From your readings in the field of mathematics education, select a particular area of interest. In this assignment, the final paper will focus on summarizing the research from a methodological perspective by examining how different methods were used in different studies on a related topic. Formulate a question or problem of interest to design a research project. This assignment will occur in two major phases: (1) Peer discussion and feedback about topic and questions; and (2) Writing a synthesis paper.

- **Other Requirements**

All assignments require APA (7th edition) formatting:

American Psychological Association (2020). *Publication manual of the American psychological association*. Washington, DC.

- **Grading**

A 90%-100%

C 70%-79%

F Below 60%

B 80%-89%

D.60%-69%

Professional Dispositions

Students are expected to exhibit professional behaviors and dispositions at all times. Education professionals are held to high standards, both inside and outside of the classroom. Educators are evaluated on their behaviors and interactions with students, parents, other professionals, and the community at large. At the College of Education and Human Development, dispositions may play a part in the discussions and assignments of any/all courses in a student's program (and thus, as part or all of the grade for those assignments). For additional information visit:

<https://cehd.gmu.edu/students/polices-procedures/>

Class Schedule

| Date | Topic(s) | Readings Due | Assignments Due |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------|
| Class 1 August 21 Format F2F | Designing & Evaluating Research | No Assigned Readings Due | |
| Class 2 August 28 Format F2F | Landscape of Research What is a research synthesis? | Shoenfeld (2008) Steffe (2013) | Researcher Biography 1. Read Assignment 2. Choose Researcher |
| Class 3 September 4 Format Asynchronous | Read Cai et al. (2019) editorials Research Synthesis Topic Summary Due | No Assigned Readings | |

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|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <p>Class 4 September 11</p> <p>Format F2F</p> | <p>Reforming Math Education Research</p> | <p>Confrey (2017) Martin (2013) D'Ambrosio et al. (2013)</p> | |
| <p>Class 5 September 18</p> <p>Format Synchronous</p> | <p>Quantitative Research</p> <p><i>Current Trend Presentation #1</i></p> | <p>Sloane & Wilkins (2017)</p> | |
| <p>Class 6 September 25</p> <p>Format Asynchronous</p> | <p>Writer's Workshop</p> | | |
| <p>Class 7 October 2</p> <p>Format Synchronous</p> | <p>Qualitative Research</p> <p><i>Current Trend Presentation #2</i></p> | <p>de Freitas et al. (2017)</p> | |
| <p>Class 8 October 9</p> <p>Format Asynchronous</p> | <p>Writer's Workshop</p> <p>Researcher Biography Peer Feedback</p> | <p>No Assigned Readings</p> | |
| <p>Class 9 October 16</p> <p>Format Synchronous</p> | <p>Teaching Experiments</p> <p>In Class Researcher Biography Presentations</p> | <p>Simon (2000) Steffe & Thompson (2000)</p> | <p>Researcher Biography Paper Due</p> <p>Researcher Biography Presentations Posted</p> |
| <p>Class 10 October 23</p> <p>Format F2F</p> | <p>Critical Race Theory</p> <p>Research Synthesis Workshop</p> | <p>Davis (2019) Frank (2019)</p> | |

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|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------|
| Class 11 October 30 Format Asynchronous | Research Synthesis Workshop Research Synthesis Reference List Creation | No Assigned Readings | |
| Class 12 November 6 Format Synchronous | Case Study <i>Current Trend Presentation #3</i> | Larnell (2016) | |
| Class 13 November 13 Format F2F | Design Research | Cobb et al. (2003) Hjalmarson & Lesh (2008) | |
| Class 14 November 20 Format Synchronous | Observation Research Synthesis Workshop: Conferences | Gleason et al. (2017) White (2003) | |
| Class 15 November 27 Format F2F | Sharing Our Research Syntheses | No Assigned Readings | Research Synthesis Final Draft Due at Start of Class -Peer Feedback |
| Class 16 December 4 Format NO CLASS MEETING | | No Assigned Readings | Research Synthesis Final Paper 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 <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 VIA should be directed to viahelp@gmu.edu or <https://cehd.gmu.edu/aero/assessments> . 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, sexual harassment, interpersonal violence, and stalking:

As a faculty member, I am designated as a “Non-Confidential Employee,” and must report all disclosures of sexual assault, sexual harassment, 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 or support measures 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/> .