EDCI 858: Mathematics Education Research Design and Evaluation

Graduate School of Education

Instructor: Jennifer Suh
Office: Thompson 2203
Email: jsuh4@gmu.edu
Office hours: By appointment
Class Meetings: Wednesdays, 4:30-7:10
Thompson Hall 1017

Students must use their MasonLive email account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

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

Course Objectives

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.

Readings

All readings will be posted on Blackboard. Some readings are drawn from the following texts (English et al., 2008; Kelly & Lesh, 2000).

1. Bannan-Ritland, B. (2003). The Role of Design in Research: The Integrative Learning Design Framework. *Educational Researcher*, *32*(1), 21 –24. doi:10.3102/0013189X032001021
2. Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design Experiments in Educational Research. *Educational Researcher*, *32*(1), 9 –13. doi:10.3102/0013189X032001009
3. Doerr, H. M., & Tinto, P. P. (2000). Paradigms for teacher-centered classroom-based research. In A. E. Kelly & R. A. Lesh (Eds.), *Handbook of Research Design in Mathematics and Science Education* (pp. 403–428). Mahwah, N.J.: Erlbaum.
4. Eisenhart, M. A. (1988). The Ethnographic Research Tradition and Mathematics Education Research. *Journal for Research in Mathematics Education*, *19*(2), 99–114.
5. English, L. D., Bartolini Bussi, M., Jones, G. A., Lesh, R. A., Sriraman, B., & Tirosh, D. (Eds.). (2008). *Handbook of international research in mathematics education*. New York, NY: Routledge.

6. Goldin, G. A. (2000). A scientific perspective on structured, task-based interviews in mathematics education research. In A. E. Kelly & R. A. Lesh (Eds.), *Handbook of Research Design in Mathematics and Science Education* (pp. 517–546). Mahwah, NJ: Erlbaum.
7. 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
8. 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.
9. 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.
10. Hjalmarson, M., & Lesh, R. (2008). Engineering and design research: Intersections for education research and design. In A. Kelly, R. Lesh, & J. Baek (Eds.), *Handbook of design research in education: Innovations in science, technology, engineering and mathematics learning and teaching* (pp. 96–110). New York: Routledge.
11. Kelly, A. E., & Lesh, R. A. (2000). *Handbook of research design in mathematics and science education*. Mahwah, N.J.: L. Erlbaum.
12. 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* (pp. 113–149.). Mahwah, NJ: Lawrence Erlbaum.
13. Lesh, R., Doerr, H. M., Carmona, G., & Hjalmarson, M. (2003). Beyond Constructivism. *Mathematical Thinking and Learning*, *5*(2-3), 211–233. doi:10.1080/10986065.2003.9680000
14. 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.
15. 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.
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.
17. Simon, M. A., & Tzur, R. (1999). Explicating the Teacher's Perspective from the Researchers' Perspectives: Generating Accounts of Mathematics Teachers' Practice. *Journal for Research in Mathematics Education*, *30*(3), 252–264. doi:10.2307/749835
18. Steffe, L. P. (2013). Establishing Mathematics Education as an Academic Field: A Constructive Odyssey. *Journal for Research in Mathematics Education*, *44*(2), 354–371. doi:10.5951/jresematheduc.44.2.0353

19. Steffe, L. P., & Kieran, T. (1994). Radical constructivism and mathematics education. *Journal for Research in Mathematics Education*, *25*(6), 711–733.
20. Steffe, L. P., & Thompson, P. W. (2000). Teaching experiment methdology: 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.
21. Zevenbergen, R. (1996). Constructivism as a Liberal Bourgeois Discourse. *Educational Studies in Mathematics*, *31*(1/2), 95–113. doi:10.2307/3482936

Course Assignments

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 6th Edition for formatting.

A. Current Trends in Mathematics Education Article Presentation

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 2013-2015 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 site will be available for posting the articles electronically. You must make a copy of the article available for class distribution at the class meeting prior to your discussion leading. Each person will lead a 30-minute discussion of the article in class.

B. Research Synthesis & Question Development

From your readings in the field of mathematics education, select a particular area of interest. Formulate a question or problem of interest that has not been researched in the literature. This assignment will occur in two phases: (1) peer discussion and feedback about questions and (2) writing your paper (25-30 pages).

1. Peer Discussion (written products to be submitted to course blog on Blackboard)
    a. Explain how you would research the topic using two different questions for which different methods would apply. You must include at least one qualitative approach and one quantitative approach. For each question, explain the strengths and weaknesses of each approach to the investigation.
    b. Explain also the rationale for each approach. Include examples of similar studies conducted using each approach to explain the selection of a particular approach for each question. For example, in the arena of students' knowledge of fractions, one could examine students' knowledge within the context of the classroom, within the context of large-scale international assessments or using task-based interviews.

2. Paper
    a. Analysis of Previous Studies -Write a critical analysis of the previous studies (going beyond reporting simply what others have done and indicating the significance of your question or problem to the current body of literature in mathematics education).
    b. Select a research framework in mathematics education. Find and synthesize articles written from that theoretical research framework (e.g., teaching experiments, design research, curriculum research, task analysis, learning trajectories). Explain what the researchers are trying to learn using the approach as well as the strengths and limitations of the approach.

C. Pick-a-Researcher Biography

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? 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?

<u>Grading</u>

Grades will be assigned as follows.

90-100% = A, 80% - 89% = B, 70% - 79% = C, 60% - 69% = D, Less than 60% = F

Schedule

Note that the schedule may be adjusted at the discretion of the instructor. Changes will be announced on the course site in Blackboard.

Date	Readings	Assignments Due
9/2/15 1	Landscape of research- (Schoenfeld, 2008) *http://www.nsf.gov/pubs/2000/nsf00113/nsf00113.html*	
9/9/15 2	Studying teacher noticing and video studies (Van Es; Sherin) *https://prime.natsci.msu.edu/community/previous-mathematics-education-colloquia/* *Sherin*	
9/16/15 3	Multitiered teaching experiments (Lesh & Kelly HBRD Chapter 9) & Research using multi-tiered teaching experiment *Read a current research article and add to your list* *Knowledge of curriculum and student thinking: Teacher learning from multiple enactments of Standards-based curriculum materials* **Jeff Choppin Streaming Video**	
9/23/15 4	Teaching Experiments - (Steffe & Thompson, 2000) *https://www.youtube.com/watch?v=zRTw4A1iTo4* *Denise Spangler-Task Dialogue*	Research Synthesis – Question Draft
9/30/15 5	Teacher Centered Research - (Chap 15 HBRD Doerr & Tinto, 2000) *http://www.msri.org/web/msri/pages/264* *Lesson Study Research Lessons*	
10/7/15 6	Discourse - (Herbel-Eisenmann & Otten, 2011; Rasmussen & Stephan, 2008) *What Do Students Talk About When They Talk About Their Participation in Mathematics Classroom Discourse?* **Amanda Jansen Streaming Video**	
10/14/15 7	*Researcher Biography Presentations*	Researcher Biography Paper
10/21/15 8	Design Research - (Bannan-Ritland, 2003; Cobb, Confrey, diSessa, Lehrer, & Schauble,	Research Synthesis – Question Final

	2003; Hjalmarson & Lesh, 2008)	
10/28/15 9	Clinical Interviews - (Goldin, 2000; Lesh & Clarke, 2000) *http://www.msri.org/workshops/696/schedules/16544*	
11/4/15 10	Ethnography (Eisenhart, 1988; Gainsburg, 2007) One article from JRME Vol. 6, 1993 –	
11/11/15 11	International Comparisons - (Hiebert & Stigler, 2000; Hiebert et al., 2003)	Research Synthesis – Draft Paper Due
11/18/15 12	Evaluation Research https://sites.tufts.edu/tuftsstemlecture/previous-lectures/alan-schoenfeld/	
11/25/15	*Thanksgiving – No Class*	
12/2/15 13	Mixed Methods	
12/9/15 14	Final Research Synthesis Project Presentations	Research Synthesis – Final Paper Due

BLACKBOARD REQUIREMENTS

Every student registered for any Mathematics Education Leadership course with a required performance-based assessment is required to submit this assessment, Professional Development Project Report and Self-Study Teacher research Project Report to Blackboard (regardless of whether a course is an elective, a onetime course or part of an undergraduate minor). Evaluation of the performance-based assessment by the course instructor will also be completed in Blackboard. Failure to submit the assessment to Blackboard will result in the course instructor reporting the course grade as Incomplete (IN). Unless the IN grade is changed upon completion of the required Blackboard submission, the IN will convert to an F nine weeks into the following semester.

NOTE: This syllabus and schedule has been revised and adapted from the sample syllabus at http://www.sagepub.com/samaras/resources.htm created by Anastasia Samaras (2011).

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/the-mason-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/**).

ATTENDANCE POLICY

Students are expected to attend the class periods of the courses for which they are registered. In-class participation is important not only to the individual student, but also to the class as a whole. Because class participation may be a factor in grading, instructors may use absence, tardiness, or early departure as de facto evidence of nonparticipation. Students who miss an exam with an acceptable excuse may be penalized according to the individual instructor's grading policy, as stated in the course syllabus (GMU University Catalog; AP 1.6; See http://catalog.gmu.edu/content.php?catoid=25&navoid=4845#attendance).

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 http://gse.gmu.edu/.