EDCI 858: Mathematics Education Research Design and Evaluation
Graduate School of Education
George Mason University

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Office hours: By appointment
Class Meetings: Wednesdays, 4:30-7:10, Blue Ridge 127

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).

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

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

Confrey, J., & Kazak, S. (2006). A thirty-year reflection on constructivism in mathematics education in PME. In A. Gutierrez & P. Boero (Eds.), *Handbook of research on the psychology of mathematics education* (pp. 305–345). Rotterdam, The Netherlands: Sense Publishers.

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.

Eisenhart, M. A. (1988). The Ethnographic Research Tradition and Mathematics Education Research. *Journal for Research in Mathematics Education*, *19*(2), 99–114.

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.

Gainsburg, J. (2007). The mathematical disposition of structural engineers. *Journal for Research in Mathematics Education*, *38*(5), 477–506.

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.

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., & 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.

Kelly, A. E., & Lesh, R. A. (2000). *Handbook of research design in mathematics and science education*. Mahwah, N.J.: L. Erlbaum.

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.

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

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.

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.

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

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

Steffe, L. P., & Kieran, T. (1994). Radical constructivism and mathematics education. *Journal for Research in Mathematics Education*, *25*(6), 711–733.
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.
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 2012-2013 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 pair 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?

Grading

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
8/28/13	*None*	
9/4/13	Landscape of research- (Schoenfeld, 2008; Steffe, 2013)	
9/11/13	Constructivism (Confrey & Kazak, 2006; Steffe & Kieran, 1994)	
9/18/13	Beyond Constructivism - (Lesh, Doerr, Carmona, & Hjalmarson, 2003; Zevenbergen, 1996)	
9/25/13	Teaching Experiments - (Simon, 2000; Steffe & Thompson, 2000)	
10/2/13	Teacher Centered Research - (Doerr & Tinto, 2000; Simon & Tzur, 1999)	
10/9/13	Discourse - (Herbel-Eisenmann & Otten, 2011; Rasmussen & Stephan, 2008)	
10/16/13	*Researcher Biography Presentations*	Researcher Biography Paper
10/23/13	Design Research - (Bannan-Ritland, 2003; Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Hjalmarson & Lesh, 2008)	
10/30/13	Clinical Interviews - (Goldin, 2000; Lesh & Clarke, 2000)	
11/6/13	International Comparisons - (Hiebert & Stigler, 2000; Hiebert et al., 2003)	
11/13/13	Ethnography (Eisenhart, 1988; Gainsburg, 2007)	
11/20/13	Technology - TBD	
11/27/13	*Thanksgiving – No Class*	
12/4/13	TBD	
12/11/13	Final Project Presentations	

College of Education & Human Development Policies

Core Values

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/.

University Policies

University Catalog: http://catalog.gmu.edu/
University Policies: http://universitypolicy.gmu.edu/

Electronic Devices

Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.

Responsible Use of Computing

Students must follow the university policy for Responsible Use of Computing [See http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/].

Student Support Services

A variety of support services related to learning, health and wellness, careers and other areas are available to students. For a summary, please see http://ctfe.gmu.edu/teaching/student-support-resources-on-campus/

Academic Integrity

The integrity of the University community is affected by the individual choices made by each of us. GMU has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using APA 6th Edition format. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.

Disability Accommodations

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Office of Disability Services (SUB I, Rm. 4205; 993-2474;http://ods.gmu.edu) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Diversity Statement
For the complete Mason Diversity Statement please see:
http://ctfe.gmu.edu/professional-development/mason-diversity-statement/