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

EDCI 856 - Mathematics Education Curriculum Design and Evaluation
Credits 3, Spring 2022
Wednesdays 4:30-7:10 p.m.
Face-to-face (Horizon Hall 3001) and
Synchronous online (Zoom Link on Blackboard)

Faculty

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Prerequisites/Co-requisites
Admission to MEL Ph.D. program or advisor's approval

University Catalog Course Description
Engages in research, analysis, design, and evaluation of school mathematics curricula from various methodologies and theoretical approaches. Examines how mathematics education and mathematics curricula is culturally, historically, and politically situated.

Course Overview and Connection to Professional Standards
EDCI 856 is designed to enable mathematics education leaders to evaluate and develop mathematics curriculum materials appropriate for school mathematics. The course was developed according to the joint position statement of the Association of Mathematics Teacher Educators (AMTE) and the National Council of Teachers of Mathematics (NCTM) on Principles to Guide the Design and Implementation of Doctoral Programs in Mathematics Education. This position statement indicates that the core knowledge expectations for doctoral study in mathematics education include:

- Design effective curricula and learning environments to facilitate the development of deep and connected mathematical understanding,
- Curriculum design, analysis and evaluation,
- Studies of different strands of curricula,
- Comparisons of international curricula,
- Knowledge of historical, social, political, and economic factors impacting mathematics education, and
- Studies of mathematical concepts across grade levels.

This course is divided into four major phases that are guided by overarching questions.

Phase 1 – ***How have school mathematics curricula in the US developed and changed over time? What images of the discipline of mathematics offer guidance to school mathematics?***
We will examine the evolution of school mathematics curricula in the US through secondary readings, as well as primary documents, chiefly reports of various committees calling for

reforms to mathematics education. As a result of differences between schooling in the past and in the present, our historical work will help us see the process of setting curriculum for school as a societal process.

Phase 2 - *How do researchers conceptualize the role of curriculum in education? What is the state of the art in research on school mathematics curricula?*" We will look at studies of learning trajectories, curriculum effectiveness, international comparisons of school curricula, and studies of students' experience of curricula.

Phase 3 - How do researchers analyze written curricular materials to understand what opportunities for teaching and learning these materials support? How do researchers study teachers' enactment of mathematics curricula? During these sessions, we will concentrate on the question of how researchers compare and contrast written curricular materials to understand what opportunities for teaching and learning these materials support. We will read of articles that offer frameworks for comparing curricula and understand how the offered frameworks fit with the questions the researchers seek to answer. We will also examine factors influencing teachers' use of written mathematics curricular materials.

Phase 4 - In the US, what are current and proposed curriculum evaluation procedures? How do these relate to our political system of organization? What is on the horizon for US mathematics curriculum? The federal government has legislated the use of scientific evidence in making educational decisions. In mathematics education, this call intertwines itself with the Math Wars and leads to questions about whether implementation of National Science Foundation-funded and *Standards*-based reform mathematics curricula lead to improvements in student achievement. A special committee of the National Research Council has produced a report assessing the available evidence on that question and outlining guidelines for high quality curriculum evaluations in the future. The What Works Clearinghouse now issues 'reports' that identify curriculum

Course Delivery Method

This course will be delivered using a combination of lecture, discussion, independent study/research, student presentation, and writing. Reading is a critical component of the course, and as an advanced graduate level course, the reading load is substantial. It is expected that students will come to class having read the assigned material thoroughly and thoughtfully and that they will be willing to share their understanding of the readings in order to contribute to the learning of all class members. For each class session there will be a reading assignment, as indicated in the schedule. Students are expected to bring to class questions or thoughts that the readings have provoked, which will be used to start the conversation about the topic of the day.

A grade of A will be given to students who besides complying with the assignments and deadlines provide thoughtful, creative, and original contributions to the class, provide evidence of deep understanding of the material, and indications that are able to advance their own lines of inquiry. Lower grades will be given when students comply unevenly with assignments, or show partial interest in understanding the readings or assignments, do not suggest nor propose original interpretations or innovative lines of inquiry. A failing grade will be given when students do not comply with the assignments, deadlines, or fail to participate actively in

understanding the material or prevent other members of the class from accomplishing the course goals.

Learner Outcomes or Objectives
At the conclusion of this course, students should be able to:

1. Identify and describe the interconnectedness of policy, society, economics and critical points in education, US history and international history that shape mathematics curricula.
2. Identify standards-based school mathematics curriculum projects; Analyze key characteristics of outstanding curriculum materials for school mathematics.
3. Examine learning theories that have been influential in mathematics education and identify ways those theories have been translated into curriculum materials and strategies for teaching.
4. Evaluate research on NSF-funded and commercially developed school mathematics curriculum materials to make informed choices.
5. Present and discuss a set of school mathematics curriculum materials in depth.
6. Design a school mathematics curriculum project.

Required Texts
Hottinger, S. N. (2016). *Inventing the mathematician: Gender, race, and our cultural understanding of mathematics*. SUNY Press.

Selected articles will also be posted on Blackboard.

Course Performance Evaluation
Students are expected to submit all assignments on time via Blackboard.

Assignments and Examinations
Discussion Board Participation (15 points)
Participants are expected to read the materials for discussion in advance of the session and to post comments and thoughts (roughly 250 words in length each week) on our Blackboard website's discussion board by the TUESDAY evening before the next class session. The purpose of these responses is to give you an opportunity to reflect upon course readings before discussing them in class and for the instructor to get a sense of how the students are processing the readings prior to the class meeting. The content of your responses could include any reactions you had to the readings as connected to your own experiences, but they should also address the text more directly, such as critiques of the author's (or authors') ideas, issues you thought the author could (or should) have addressed, ways the author(s) could have written the text more effectively, and so forth. I will sometimes post a particular prompt for you to consider. You may find it useful to reflect upon portions of the reading that inspired you, led you to think differently, or parts of the reading that you found particularly interesting or compelling. *When you respond to a specific portion of the text, refer to this segment by page number. It is also helpful to share a portion of the quote to assist in finding the segment you are discussing.* ******End every response with 2 – 3 questions you'd like to pose to the class***

community for discussion.** (e.g., What were you left wondering more about in the text? What parts of the text would you like your colleagues to reflect upon with you?)

Curriculum Design and Analysis Project (60 points)

- **Part 1: Understanding Learning Trajectories, Progression Lit Review: (20 Points)** Select a mathematical topic. Review how the learning progressions and student learning trajectories are addressed in the curriculum and standards or how this topic is addressed in *Catalyzing Change* (max 15 pages, excluding references).

- **Part 2: Empirical Study: (30 points)** One of the main foci of the course is to help you practice analyzing data related to mathematics curricular materials.
- Option 1: Textbook Analysis - You will select 3 texts related to your mathematics topic of interest either replicate a previous study by using a coding scheme developed by another researcher who studied the content of mathematics textbooks or develop your own framework of codes to address a researchable question.
- Option 2: Lesson Design Experiment- Select, modify and enhance a curricular unit and conduct design experiments with the lessons with students and analyze their learning using the LT progression addressing a researchable question.

- **Part 3: Recommendations for Curriculum Designers, Math Leaders and Teachers and Symposium Presentation (10 points)**
  *** Special Event: Saturday, April 30 Poster Gallery at the Math Specialist Institute**

In order to keep participants' projects to a manageable size and to keep the work progressing during the first part of the semester, throughout the first half of the semester, participants will be asked to post their work on the project to Blackboard. The instructor will provide constructive formative feedback.

Carrying out an empirical study during a semester is an ambitious goal. Throughout the semester, approximately every two weeks, there will be a deadline related to this overarching project. Participants are expected to meet these deadlines with appropriate work.

Detailed expectations for these assignments will be presented in separate documents. Individuals will be expected to keep the instructor abreast of their progress on this project and on any difficulties they encounter. Participants will present their progress on to their project to classmates during class.

Dissertation Synthesis (10 points)
Select a dissertation that, in some way, addresses an overarching question for this course. Prepare a presentation for the class about the dissertation including the following sections: background information, research questions, methodology, results, and implications for further research.

Discussion Leadership Assignment (10 points)
In order to engage you in synthesizing ideas across readings, pairs of participant pairs will be responsible for coordinating one class discussion (and/or some activity designed to support

ideas presented in the readings). You will be required to complete a self-assessment of your role.

CV and Cover Letter (5 points)
Update your vita and write a cover letter to accompany your CV. The goal of this assignment is to have you critically exam your goals and objectives in the Ph.D. program and articulate those goals to a prospective employer. It is also designed to help you reflect on areas where you might want to do more work or gain more experience.

Course Performance Evaluation Weighting

Assignment	Percentage of Final Grade
Weekly discussion board participation and weekly assignments	15%
Curriculum Design and Analysis Project ● Literature Review (20%) ● Empirical Analysis (20%) ● Recommendation and Presentation (10%)	60%
Dissertation Synthesis	10%
Discussion Leadership Assignment	10%
CV and Cover Letter	5%

Grading Policies
Graduate Grading Scale

A 93%-100%	B+ 87%-89%	C 70%-79%
A- 90%-92%	B 80%-86%	F Below 70%

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

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/ .

Class Schedule

Note: I reserve the right to alter the schedule as necessary, with notification to students. This is a *tentative* list of topics and readings. Based on our discussions, I may change readings to better suit the direction of the course.

Phase 1 - How has school mathematics curricula in the US developed and changed over time? What images of the discipline of mathematics offer guidance to school mathematics? **Guest Speaker: Dr. Toya Frank (Feb 2rd)**	
Session 1 **January 26** **(Online)**	**Mathematics Curricula as Historically, Socially, Politically, and Culturally Situated** Schoenfeld, A. H. (2004). The math wars. *Educational Policy*, *18*(1), 253-268. PDF Ellis & Berry (2005) The paradigm shift in mathematics education: Explanations and implications of reforming conceptions of teaching and learning. *The Mathematics Educator, 15*(1), 7–17. PDF
Session 2 **Feb 2** **(Online)** **Guest Speaker** **Dr. Toya Frank**	**Mathematics Curricula as Historically, Socially, Politically, and Culturally Situated** *Inventing the Mathematician* Chapters 1-3
Session 3 **Feb 9** **(Asynchronous)**	**Mathematics Curricula as Historically, Socially, Politically, and Culturally Situated** *Inventing the Mathematician* – Chapter 4-6 Furuto, L. H. L. (2014). Pacific ethnomathematics: pedagogy and practices in mathematics education. *Teaching Mathematics & Its Applications*, *33*(2), 110–121. https://doi-org.mutex.gmu.edu/10.1093/teamat/hru009 PDF
Phase 2- How do researchers conceptualize the role of curriculum in education? What is seminal in research on school mathematics curricula?	
Session 4 **Feb 16** **Campus**	**Studying and Designing Mathematics Curriculum** Stein, M. K., Remillard, J., Smith, M. S. (2007). How curriculum influences student learning. In Second Handbook of Research on Mathematics Teaching and Learning, Frank Lester, (Ed.) pp. 319-370. Charlotte, NC: Information Age Publishing. Stein, M. K., Grover, B. W., & Henningsen, M. (1996). Building student capacity for mathematical thinking and reasoning: An

	analysis of mathematical tasks used in reform classrooms. *American Educational Research Journal, 33*(2), 455–488. PDF Stein, M. K., & Kaufman, J. H. (2010). Selecting and supporting the use of mathematics curricula at scale. *American Educational Research Journal, 47*(3), 663-693 PDF
Session 5 Feb 23 (Online)	**Curriculum and Task Analysis** Cobb, P., & Jackson, K. (2011). Assessing the Quality of the Common Core State Standards for Mathematics. Educational Researcher, 40(4), 183 -185. PDF Porter, A., McMaken, J., Hwang, J., & Yang, R. (2011a). Common Core Standards: The New U.S. Intended Curriculum. Educational Researcher, 40(4), 103.116. PDF
Session 6 March 2 Campus	**National Policy and Recommendations in Mathematics** Common Core State Standards for Mathematics: http://www.corestandards.org/Math/ Porter, A., McMaken, J., Hwang, J., & Yang, R. (2011b). Assessing the Common Core Standards. Educational Researcher, 40(4), 186 -188. PDF Popkewitz, T. (2004). The Alchemy of the Mathematics Curriculum: Inscriptions and the Fabrication of the Child. *American Educational Research Journal*, *41*(1), 3-34. PDF
pDFPhase 3 - How do researchers analyze written curricular materials to understand what opportunities for teaching and learning these materials support? How do researchers study teachers' enactment of mathematics curricula?	
Session 7 March 9 Online	**Learning Trajectories and Catalyzing Change in High School Mathematics All** Clements, D. H., & Sarama, J. (2004). Learning trajectories in mathematics education. *Mathematical thinking and learning*, *6*(2), 81-89. PDF *Catalyzing Change* – Introduction, The Purposes of School Mathematics, Creating Equitable Structures – See Bb
Session 8 March 23 Campus	**Learning Trajectories and Catalyzing Change** **Arizona Learning Progression Document** Myers, M., Sztajn, P., Wilson, P. H., & Edgington, C. (2015). From implicit to explicit: Articulating equitable learning trajectories based instruction. *Journal of Urban Mathematics Education*, *8*(2), 11-22. PDF

	Catalyzing Change – Essential Concepts ELEM, Middle and in HS Mathematics
Session 9 **March 30** **Online**	**Textbook Analysis** **All** Fan, L., Zhu, Y., & Miao, Z. (2013). Textbook research in mathematics education: development status and directions. *ZDM, 45*(5), 633–646. PDF Sherman, M., Walkington, C. & Howell, E. (2016). A Comparison of Symbol-Precedence View in Investigative and Conventional Textbooks Used in Algebra Courses Journal for Research in Mathematics Education 47(2), 134–146. PDF
Session 10 **April 6** **Campus**	**Textbook Analysis** Herbel-Eisenmann, B. A. (2007). From Intended Curriculum to Written Curriculum: Examining the" Voice" of a Mathematics Textbook. *Journal for Research in Mathematics Education*, *38*(4), 344-369. PDF Brantlinger, A. (2011). Rethinking critical mathematics: a comparative analysis of critical, reform, and traditional geometry instructional texts. *Educational Studies in Mathematics, 78*(3), 395–411. PDF
Session 11 **April 13** **Online**	**Approaches to Studying Mathematics Curriculum** Clements, D. H. (2007). Curriculum research: Toward a framework for "Research-based Curricula." *Journal for Research in Mathematics Education, 38*(1), 35-70. PDF Smith III, J. P., & Star, J. R. (2007). Expanding the Notion of Impact of K-12 Standards-based Mathematics and Reform Calculus Programs. *Journal for Research in Mathematics Education*, *38*(1), 32. PDF
Session 12 **April 20** **Campus**	***Dissertation Synthesis Presentations -* **Studying Teachers' Use of Curriculum Materials** **Teachers, Mathematics, and the Enacted Curriculum** Selected Excerpts – See Bb
Phase 4 - In the US, what are current and proposed curriculum evaluation procedures? How do these relate to our political system of organization? What is on the horizon for US mathematics curriculum and the study and evaluation of it?	
Session 13 **April 27** **Online**	***Dissertation Synthesis Presentations -* Kilpatrick, J. (2001). Where's the evidence? *Journal for Research in Mathematics Education*, *32*(4), 421–427. PDF

	Tran, D. Reys, B., Teuscher, D., Dingman, S., Kasmer, L. (2016). Analysis of curriculum standards: An important research area. *Journal for Research in Mathematics Education, 47*(2), 118-133. PDF *What Works Clearinghouse (Mathematics):* **http://ies.ed.gov/ncee/wwc/MathHome.aspx** SAVE THE DATE *Saturday, April 30 (Special Event) - The Math Specialists Institute Poster Gallery
Session 14 **May 4** **Campus**	Research Symposium