

**GEORGE MASON UNIVERSITY  
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT  
GRADUATE SCHOOL OF EDUCATION  
Mathematics Education Leadership**

EDCI 855 001: Mathematics Education Research on Teaching and Learning  
3 Credits, Spring 2016  
4:30 p.m. - 7:10 p.m. Tuesdays Thompson Hall 2022

**PROFESSOR(S):**

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**COURSE DESCRIPTION:**

**A. Prerequisites/Corequisites**

Admissions into the Mathematics Education Leadership Program

**B. University Catalog Course Description**

Students survey most current research literature in mathematics education and engage in research, study and discussion on teaching and learning in school settings.

**C. Expanded Course Description**

Not Applicable

**LEARNER OUTCOMES or OBJECTIVES:**

This course is designed to enable students to:

- Analyze and reflect on mathematics education research about student learning.
- Understand major theoretical positions in mathematics education.
- Explain the development of theories of mathematics education.
- Begin to conduct mathematics education research.

**PROFESSIONAL STANDARDS (Association of Mathematics Teacher Educators (AMTE)):**

EDCI 855 is designed to enable mathematics education leaders to understand learning and teaching in mathematics as introduction to foundational theories and research in the field. The course was developed according to the joint position statement of the Association of Mathematics Teacher Educators and the National Council of Teachers of Mathematics,

*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 the following under “learning”: “Fundamental theories of learning mathematics provide the foundation for thinking about issues in mathematics education. Mathematics educators need to understand these theories and the distinctions among them in terms of both the kind of learning they are trying to explain and the theoretical constructs that have proven useful over time. A treatment of both historic and contemporary theories of learning should be a part of all doctoral programs in mathematics education. Drawing on current theories and research, doctoral students should understand how people of different ages, mathematical backgrounds, and aptitudes learn mathematics. This understanding may be accomplished by various means including courses, seminars, or special readings focusing on theories of learning and the accompanying research evidence. In addition, a doctoral program should provide opportunities for candidates to link their knowledge to practice in designing or evaluating curricula, setting learning goals, and creating cognitively appropriate patterns of instruction” (p. 5-6, AMTE, 2002).

#### **REQUIRED TEXTS:**

- Carpenter, T. P., Dossey, J. A., & Koehler, J. L. (2004). *Classics in mathematics education research*. Reston, VA: National Council of Teachers of Mathematics.
- Lester, F. (2008). *Second handbook of research on mathematics teaching and learning*. Charlotte, NC: Information Age Publishing.
- National Council of Teachers Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: National Council of Teachers of Mathematics.

#### **COURSE ASSIGNMENTS AND EXAMINATIONS:**

##### **Performance Based Assignments**

All assessments have more detailed descriptions available on the Blackboard site for the course. Students will need to review these detailed descriptions prior to submission. Final papers should be submitted in Blackboard.

1. *Curriculum Vitae* – Submit a copy of your CV. For samples, you can visit CEHD faculty web pages to find their CVs. <http://gecd.mit.edu/jobs/find/prepare/cv> is a guide to CV writing and provides additional links.
2. *Mathematics Knowledge and Understanding Review* – Submit a 20-page paper reviewing the research literature related to a particular mathematics topic. The review should include

references from peer-reviewed journals and books describing the development of students' understanding and how various researchers have examined the topic.

3. *Position Paper* – Compare and contrast two positions in mathematics education (e.g., Behaviorism vs. Constructivism, problem-based learning vs. drill and practice, using calculators vs. paper-based activities) examining the fundamental tenets and propositions of each position. Describe the strengths and weaknesses of each position. Your arguments should be supported by literature from the field.
4. *Clinical Interview* – Find 3 students or adults and create a problem set to provide them during a clinical interview session about their understanding of a particular mathematical topic. Write a 5-10 page analysis of the interview results. What were their struggles? What concepts do they understand? Part of your work as a mathematics educator and researcher involves conducting interviews and understanding how people think about mathematics. This assignment is intended to help you develop both of these skill sets.

All assignments and supplemental readings will be available on the course Blackboard site (<https://mymasonportal.gmu.edu>). All students enrolled in the course are enrolled in the Blackboard site. Use your Mason email login and password to enter the site.

**NOTE: All assignments and readings are subject to change at the discretion of the instructor. Any changes will be announced in class and posted on the course Blackboard site.**

Assignment	Points
Curriculum Vitae	50
Mathematics Knowledge and Understanding Review	200
Position Paper	200
Clinical Interview	200
Class Participation	150
<b>TOTAL</b>	<b>800</b>

### **Formatting Assignments**

All papers should follow the guidelines in the *Publication Manual of the American Psychological Association (6<sup>th</sup> Ed.)* for formatting reference lists, citations, the body of the paper, etc. As most classes and your dissertation will require APA 6<sup>th</sup> formatting, I strongly recommend purchasing the APA 6<sup>th</sup> Handbook.

### **Late Assignments**

All assignments are due on the date listed in the schedule. 10% of points earned will be deducted for late work if students have not notified the instructor in advance of late submission and had

the late submission approved.

### Grading Scale

Grade	Points
A	720+
B	640-719
C	560-639
F	Less than 559

### TK20 PERFORMANCE-BASED ASSESSMENT SUBMISSION REQUIREMENT

Every student registered for any Mathematics Education Leadership course with a required performance-based assessment is required to submit this assessment, Curriculum Vitae, Mathematics Knowledge and Understanding Review, Position Paper, and Clinical Interview to Tk20 through Blackboard (regardless of whether the student is taking the course as an elective, a onetime course or as part of an undergraduate minor). Evaluation of the performance-based assessment by the course instructor will also be completed in Tk20 through Blackboard. Failure to submit the assessment to Tk20 (through 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 Tk20 submission, the IN will convert to an F nine weeks into the following semester.”

### 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 George Mason University Disability Services and inform their instructor, in writing, as soon as possible. Approved accommodations will begin at the time the

written letter from Disability Services is received by the instructor (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/>).

## **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/>.**

**PROPOSED CLASS SCHEDULE:**

<b>Date</b>	<b>Readings Due</b>	<b>Assignments Due</b>
January 19, 2016	p. vii-16 (PTA) p. 109-118 (PTA)	
January 26, 2016		
February 2, 2016	Skemp, Erlwanger p. 35-41 (PTA) p. 78-108 (PTA)	CV
February 9, 2016 <i>Number</i>	Verschaffel et al (HRMTL, 13) Lamon (HRMTL, 14) Brownell (CME) p. 42-47 (PTA)	Clinical Interview Problem Set
February 16, 2016 <i>Constructivism</i>	Steffe & Kieran (CME) Cobb & Yackel (CME) p. 48-52 (PTA)	
February 23, 2016 <i>Learning Trajectories</i>	Sztajn, Confrey, Wilson & Edgington (2012) Szilágyi, Clements & Sarama (2013) p. 70-77 (PTA)	
March 1, 2016 <i>Equity</i>	Fennema & Sherman (CME) Bishop & Forgasz (HRMTL, 26) p. 59-69 (PTA)	Clinical Interview Paper
March 8, 2016	No Class - Spring Break	
March 15, 2016 <i>Algebra</i>	Carraher & Schliemann, (HRMTL, 15) Kieran (HRMTL, 16)	
March 22, 2016 <i>Problem Solving</i>	Schoenfeld (CME) Kilpatrick (CME) Lesh & Zawojewski (HRMTL, 17) p. 17-34 (PTA) p. 53-58 (PTA)	
March 29, 2016 <i>Geometry</i>	vanHiele (CME) Battista (HRMTL, 19)	
April 5, 2016 <i>Early Childhood</i>	Clements & Sarama (HRMTL, 12)	Math Knowledge Paper

April 12, 2016 <i>Proof</i>  Online Class	Tall & Vinner (CME) Harel & Sowder (HRMTL, 18)	
April 19, 2016 <i>Statistics</i>	Jones & Langrall, HRMTL, 20 Shaughnessy, HRMTL, 21	
April 26, 2016 <i>Post Secondary</i>	Artigue et al (HRMTL, 22)	
May 3, 2016 <i>Informal Math</i>	Carraher et al (CME) D'Ambrosio (CME)	Position Paper
May 10, 2016 <i>Diversity</i> <i>Reflection</i>	Diversity (HRMTL, 10)	

CME=*Classics in Mathematics Education Research*

HRMTL ## = *Second handbook of research on mathematics teaching and learning, Chapter XX*

PTA = *Principles to Actions*

**ASSESSMENT RUBRIC(S):**

**Position Paper Rubric**

<b>Category</b>	<b>Excellent (100%)</b>	<b>Acceptable (85%)</b>	<b>Needs Improvement (75%)</b>	<b>Unacceptable (50%)</b>
<b>Introduction (30 pts)</b>	Introduction identifies the topic clearly and grounds it in relevant literature. It avoids general statements about math education and is focused toward the topic.	Introduction identifies the topic but may be too general in explanation of the relevance of the topic or disconnected from the literature.	Introduction identifies the topic but is too general in explanation of the relevance of the topic and disconnected from the literature.	Introduction is disconnected from the topic of the paper.
<b>Appropriate References (50 pts)</b>	Articles reviewed are relevant and represent journals, books, and other authoritative publications. Use of references indicates substantial research. Research is summarized appropriately	Articles reviewed are relevant represent primarily journals, books, and other authoritative publications. Use of references indicates some research	Articles reviewed may be irrelevant or be a mix of authoritative and non-authoritative sources (e.g., non-peer reviewed pieces) without justification. Few or incorrect references.	Insufficient articles were reviewed or were taken primarily from non-authoritative sources. No references or incorrect references.
<b>Meaningful Development of Ideas (50 pts)</b>	Depth and complexity of thought supported by rich, pertinent details; supporting evidence leads to high-level idea development.	Depth of thought supported by elaborated, relevant supportive evidence provides clear vision of the idea; contains details	Unelaborated ideas that are not fully explained or supported; repetitive details	Ideas are unclear and/or not well-developed
<b>Conclusion (30 pts)</b>	The conclusion summarizes the research, raises new questions and is supported by the themes explained in the analysis.	The conclusion summarizes the research and is supported by the themes explained in the analysis.	The conclusion is unclear, limited or not well connected to the previous work described.	Conclusion is missing, irrelevant or insufficient
<b>Organization (20 pts)</b>	Careful and relevant organization of ideas	Logical organization of ideas	Somewhat unfocused and/or unclear	Weak organization of ideas
<b>Writing Quality (20 pts)</b>	Nearly error-free which reflects clear understanding and thorough proofreading. Citations are appropriate.	Few grammatical and/or stylistic errors. References cited appropriately.	Some errors in grammar and/or format that do not interfere with clarity. Most references cited appropriately.	Multiple grammatical and stylistic errors. References are not cited appropriately.



## Mathematics Knowledge and Understanding Review Rubric

Category	Excellent (100%)	Acceptable (85%)	Needs Improvement (75%)	Unacceptable (50%)
<b>Introduction (30 pts)</b>	Introduction identifies the topic clearly and grounds it in relevant literature. It avoids general statements about math education and is focused toward the topic.	Introduction identifies the topic but may be too general in explanation of the relevance of the topic or disconnected from the literature.	Introduction identifies the topic but is too general in explanation of the relevance of the topic and disconnected from the literature.	Introduction is disconnected from the topic of the paper.
<b>Appropriate References (50 pts)</b>	Articles reviewed are relevant and represent journals, books, and other authoritative publications. Use of references indicates substantial research. Research is summarized appropriately	Articles reviewed are relevant represent primarily journals, books, and other authoritative publications. Use of references indicates some research	Articles reviewed may be irrelevant or be a mix of authoritative and non-authoritative sources (e.g., non-peer reviewed pieces) without justification. Few or incorrect references.	Insufficient articles were reviewed or were taken primarily from non-authoritative sources. No references or incorrect references.
<b>Meaningful Development of Ideas (50 pts)</b>	Depth and complexity of thought supported by rich, pertinent details; supporting evidence leads to high-level idea development.	Depth of thought supported by elaborated, relevant supportive evidence provides clear vision of the idea; contains details	Unelaborated ideas that are not fully explained or supported; repetitive details	Ideas are unclear and/or not well-developed
<b>Conclusion (30 pts)</b>	The conclusion summarizes the research, raises new questions and is supported by the themes explained in the analysis.	The conclusion summarizes the research and is supported by the themes explained in the analysis.	The conclusion is unclear, limited or not well connected to the previous work described.	Conclusion is missing, irrelevant or insufficient
<b>Organization (20 pts)</b>	Careful and relevant organization of ideas	Logical organization of ideas	Somewhat unfocused and/or unclear	Weak organization of ideas

<b>Writing Quality (20 pts)</b>	Nearly error-free which reflects clear understanding and thorough proofreading. Citations are appropriate.	Few grammatical and/or stylistic errors. References cited appropriately.	Some errors in grammar and/or format that do not interfere with clarity. Most references cited appropriately.	Multiple grammatical and stylistic errors. References are not cited appropriately.
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## Clinical Interview Assignment Rubric

<b>Category</b>	<b>Excellent (100%)</b>	<b>Acceptable (85%)</b>	<b>Needs Improvement (75%)</b>	<b>Unacceptable (50%)</b>
<b>Interview Protocol (50 pts)</b>	Problems/tasks clear and mathematically correct. No revisions needed to clarify problems for students or improve responses.	Problems/tasks clear and mathematically correct. Minor revisions needed to clarify problems for students or improve responses.	Problems/tasks unclear but mathematically correct. Some additional problems/revision would be necessary for a complete interview.	Problems/tasks unrelated to content, mathematically incorrect, or insufficient to assess intended topic.
<b>Literature Summary (40 pts)</b>	Use of references indicates substantial research. Summary is clear and comprehensive.	Use of references indicates some research. Summary is clear.	Few references or some incorrect references. Summary is incomplete or incoherent	No references or incorrect references. Summary is not included.
<b>Analysis of Interviews (40 pts)</b>	Analysis is detailed, thoughtful, logical and comprehensive.	Analysis includes relevant supporting details, is logical, and coherent.	Analysis may be limited or not include some relevant details. Supporting evidence for claims is not included.	Analysis is insufficient or not supported by evidence from the interviews. Analysis does not provide insight into participants' thinking.
<b>Meaningful Development of Ideas (30 pts)</b>	Depth and complexity of thought supported by rich, pertinent details; supporting evidence leads to high-level idea development	Depth of thought supported by elaborated, relevant supportive evidence provides clear vision of the idea; contains details	Unelaborated ideas that are not fully explained or supported; repetitive details	Ideas are unclear and/or not well-developed
<b>Organization of Paper (20 pts)</b>	Careful and relevant organization of ideas	Logical organization of ideas	Somewhat unfocused and/or unclear	Weak organization of ideas
<b>Writing Quality (20 pts)</b>	Nearly error-free which reflects clear understanding and thorough proofreading. References cited appropriately.	Few grammatical and/or stylistic errors. References cited appropriately.	Some errors in grammar and/or format that do not interfere with clarity. Most references cited appropriately.	Multiple grammatical and stylistic errors. References are not cited appropriately.