EDCI 650
Trends in Mathematics Education

Fall 2012
Wednesdays, 4:30 - 7:15 p.m.
Room 3230, Building III
Shady Grove campus
Office hours: By appointment

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COURSE OVERVIEW
The masters degree program in mathematics education is designed to enhance teachers' understanding of mathematics content and pedagogy, serving teachers from both elementary and secondary schools. The program addresses research that has implications for practice as well as resources for practice, while spanning topics of learning, teaching, curriculum, policy, and the social context of education. Graduate courses in mathematics education may also be accessed by prospective teacher leaders who wish to broadly sample a range of content fields that are critical to school curriculum.

EDCI 650 identifies and characterizes how developments in educational thinking and practice have affected and are influencing mathematics curriculum and instruction. As such it considers both a historical perspective and the current status of mathematics education.

COURSE OBJECTIVES
Students in this course will complete reading and written assignments, engage in weekly class sessions, and offer presentations so that they may develop knowledge encompassing the following abilities and understandings.

1. Characterize how practice and thinking about school mathematics curricula has evolved historically in the United States, noting what forces influenced the definition of content and instruction.

2. Describe how perspectives on teaching and learning are evidenced in the content, organization, pacing, and presentation of mathematics topics in published curricula.

3. Analyze curriculum frameworks for school mathematics as well as commercial curriculum materials, noting both the mathematics content, the instructional approach, and the assumptions inherent in those frameworks and materials.

4. Describe the current status of mathematics education in the United States with respect to student achievement, curriculum standards, and assessment policies with particular attention to the Common Core Standards, to national and international comparisons as revealed in NAEP, TIMSS and PISA, and to implications for equity (gender, race, and economic status).

5. Identify the important issues, policies, and challenges that are facing mathematics educators today in the United States, describing the advantages and disadvantages of proposed options for response.
REQUIRED TEXT
Readings taken from web sites, book chapters and journals are assigned throughout the semester. Students will access most of these through the Libraries/Research Port selections on the University of Maryland web site, through the campus Blackboard Academic Suite (ELMS), or on the Internet. In addition, all students should have access to this required text:


COURSE EXPECTATIONS

<table>
<thead>
<tr>
<th>Assignments</th>
<th>Points</th>
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<tbody>
<tr>
<td>Issue brief (9/26)</td>
<td>30</td>
</tr>
<tr>
<td>Review of curriculum materials (11/14)</td>
<td>60</td>
</tr>
<tr>
<td>Discussion team for a curriculum trajectory (11/28 or earlier)</td>
<td>50</td>
</tr>
<tr>
<td>Brief presentation of lessons learned from the position paper (12/5)</td>
<td>20</td>
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<tr>
<td>Position paper (12/13)</td>
<td>100</td>
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<tr>
<td>Class discussion and attendance</td>
<td>40</td>
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</tbody>
</table>

**Total Points: 300**

**Issue Brief**
An issue brief is a three-page, double-spaced paper that addresses a current issue in mathematics education. This assignment is due on September 26. The brief should:

- Define a current issue or challenge in mathematics education,
- Describe the advantages and disadvantages of two (or more) approaches for addressing this issue; that is, provide a summary of major arguments,
- State and defend the approach or perspective that you support,
- Include at least three published references, and
- Adhere to APA format.

Grading of this paper will consist of an evaluation of the quality of the presentation and the quality of the writing, as well as the use of APA format. Specifically, this assessment will consider the degree to which the paper evidences: (a) clarity in defining the topic of the brief and in indicating why and for whom this topic is a significant issue in mathematics education; (b) a well-organized and comprehensive presentation of advantages and disadvantages of at least two perspectives; (c) brief defense or case for one of these perspectives; (d) well-founded selection, interpretation and cogent use of published references; and (e) integration of background information from course readings and discussion.

A handy resource for APA format is: [http://owl.english.purdue.edu/owl/resource/560/01/](http://owl.english.purdue.edu/owl/resource/560/01/)

**Review of Curriculum Materials**
This curriculum review is a 6- to 9-page, double-spaced paper that examines a critical content
domain as presented in either a grade-level text (Grades 1–8) or a course text (secondary school) for mathematics. This assignment limits the review to a content domain associated with either: whole numbers and operations from Kindergarten through Grade 4, rational numbers from Grade 3 through Grade 8, or functions from Grade 9 through 12 (up through high school pre-calculus). This assignment expects you to critique the content and alignment between a presentation of curriculum expectations in a textbook, in the Common Core State Standards for Mathematics, and research on learning/teaching for some mathematical topic. This review should:

- Define the focus within whole numbers, rational numbers, or functions that will be the content domain for this review;
- Describe the key conceptual and procedural understandings that are the final target of the trajectory for your review, providing documentation for this definition of target;
- Characterize the content, organization, pacing, presentation, and trajectory of the content objectives in the Common Core State Standards for Mathematics, as related to the content domain you have defined, noting assumptions about learning and assessment inherent in those materials;
- Characterize the content, organization, pacing, presentation, and trajectory of the content objectives in the textbook or commercial materials, as related to the content domain you have defined, noting assumptions about learning and assessment inherent in those materials;
- Analyze the alignment between the Common Core State Standards for Mathematics curriculum and learning goals and those of the textbook or commercial materials, as well as the alignment between those frameworks and implications from research addressing a developmental perspective on students’ learning, noting whether these reflect similar or contradictory beliefs about mathematics and about teaching and learning that content;
- Provide a summary discussion of your findings regarding the alignment, the strengths and weaknesses of the commercial materials, as well as recommendations for improvement; and
- Adhere to APA format.

This review of is due on November 14.

Grading of these reviews will consist of an evaluation of the quality of the presentation and the quality of the writing, as well as the use of APA format. Specifically, this assessment will consider the degree to which the paper evidences: (a) a cogent summary of the trajectory for conceptual and procedural understandings that define the target for your review, with documentation for this definition; (b) a well-organized and comprehensive presentation of the content, organization, pacing, and presentation of the mathematics objectives in the Common Core State Standards for Mathematics curricula and learning goals, as well as in the textbook/commercial materials; (c) well-founded selection and cogent use of objectives to compare and contrast the Common Core State Standards for Mathematics curricula and the textbook/commercial materials in order to define degree of alignment; (d) identification and selection of key published references to support an argument as to how the curriculum materials coincided with or dissented from research perspectives on mathematics teaching and learning; (e) integration of background information from course readings and discussion in the analysis of the strengths and weaknesses of the curricula, the alignment, and recommendations for improvement; and (f) use of APA format. Throughout, consideration of the Common Core State Standards for Mathematics encompasses both the content standards and standards addressing
mathematical practices.

A tool that you may find useful when completing this assignment can be located at: http://www.mathedleadership.org/ccss/materials.html and then, under the heading “CCSS Curriculum Analysis Tool and Professional Development Materials,” select the link titled “Common Core State Standards (CCSS) Mathematics Curriculum Analysis Project.” This will take you to a document that presents and describes use of the tool.

Discussion Team for a Curriculum Trajectory

In order to engage you in synthesizing ideas across the readings and interacting with others regarding aspects and implications of a curriculum trajectory, each participant will be expected to sign up for one of five differing discussion teams that will organize/lead class activities for one session during the period October 24-November 28.

- You will read the materials for “your week” and review the Common Core State Standards for your topic in advance. You should plan to meet with your team 12-14 days prior to the date assigned for class discussion of that topic. Your team may meet in person or “virtually.” At this meeting, you will highlight the key ideas that you feel are critical to discussion of (a) the assigned readings and to an informed discussion of (b) the implications of the Common Core State Standards for Mathematics for teaching your topic, sharing written questions that raise those ideas. This should lead to a discussion of aspects of the readings and the intent of your questions, including why you feel those questions frame the intended discussion. This team discussion frequently results in a re-crafting of the questions and a focusing upon identified aspects of the Common Core.

- The team will then send an electronic copy of the finalized questions to me at least 9 days in advance of class (by Monday morning in the week before your class session is scheduled). It is perfectly reasonable to not spend all of class engaged in a seminar-type discussion, so feel free to suggest a “hand-on” activity springing from the readings and consideration of the implications of the Common Core. But send me your discussion questions and any descriptor of other activity so that I may react to them and provide feedback. Each team is expected to distribute discussion questions or other preparatory requests to all other participants one week in advance of the assigned class date.

- You and your team are then expected to lead the class on the assigned date, which may or may not include a power point presentation of key questions and/or a “hands-on” activity springing from those readings and consideration of the Common Core.

Position Paper

The position paper is approximately 15-20 double-spaced pages in length (+/- 5 pages). This paper argues how an issue, belief, or perspective has influenced (is influencing) the content and instructional approach evidenced in mathematics education. For example, you could argue that perspectives about what is the important mathematics students should learn (or what it means to know mathematics) is critical to defining mathematics curriculum. Or you could argue that technology, standardized assessments, public policy, or some research on/theories of teaching and learning have strongly influenced mathematics curricula. This paper should offer:

- A clear definition of the issue, belief, or perspective and an argument as to how or why this
position has or may influence mathematics curriculum content, instruction, and/or organization,

- Specific examples from published mathematics education materials over time that evidence the influence of the identified issue, belief, or perspective on content and/or instructional approach,
- A documented critical analysis of how and why (or whether) this position or perspective on the issue should be considered, and
- Recommendations for applying this influence or position/perspective within mathematics education.

The position paper must adhere to APA format and offer a substantive citation of literature to clarify the definition of the position as well as to analyze its impact. The position paper is due on December 13.

Grading of the position paper will consist of an evaluation of the quality of the presentation and the quality of the writing, as well as the use of APA format. Specifically, this assessment will consider the degree to which the paper evidences: (a) a clear presentation of the issue, belief, or perspective; (b) a well-organized and evidenced argument as to the influence of this issue or perspective on mathematics curriculum and instruction, including citations from published materials; (c) well-founded selection, interpretation and use of published references that adequately support the premise of the paper; (d) integration of background information from course readings and discussion in the analysis; and (e) clarity and feasibility of recommendations, as well as the potential of these recommendations for future positive impact.

**Position Presentation**

A brief in-class presentation addressing the premise of your position paper on December 5 will consist of preparation and distribution of appropriate written materials, oral presentation of information defining the position and evidence of its influence in mathematics education, and facilitation of class discussion.

**Class Discussion, Attendance and Reflection**

This course addresses how developments in educational thinking and practice have affected mathematics curriculum and instruction. As experienced teachers, you have been actively involved in implementing mathematics curriculum and instructional policy, as well as making instructional decisions within your teaching. As such you have much to offer to the conduct of this course through your participation and contributions. You are expected to read and reflect critically and analytically on the weekly assigned readings and to share your perspectives in weekly class meetings as well as in small group discussions. Thus, your attendance at class sessions is very important. Class discussion will include opportunities for:

- Shared reflections on components of the readings that were especially pertinent to you;
- Questions that the readings triggered in your mind (either questions about material that is new to you or questions that characterize how the readings have challenged your prior conceptions); or
- Responses to commentaries or questions offered by your peers.

Whole class discussion and small group interactions are meant to engage you in an academic
exchange. Your in-class commentaries reflect your efforts to incorporate new ideas into your existing knowledge base and to reflect on how the readings or ensuing discussion align or contribute to your experiences.

Grading for this expectation within the course is not simply a matter of quantity or frequency of input. There is no pre-determined “correct content” for phrasing a question, comment, or reflection. Rather the expectation is for you to offer a legitimate record of your thinking. There is no extra credit for long speeches.

**Evaluation**

Final course grades will be assigned based on the percentage of possible points earned.

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<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
<th>Possible Points</th>
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<tbody>
<tr>
<td>A</td>
<td>90% or better</td>
<td>(270–300 points)</td>
</tr>
<tr>
<td>B+</td>
<td>88–89.7%</td>
<td>(264–269 points)</td>
</tr>
<tr>
<td>B</td>
<td>80–87.7%</td>
<td>(240–263 points)</td>
</tr>
<tr>
<td>C+</td>
<td>78–79.7%</td>
<td>(234–239 points)</td>
</tr>
</tbody>
</table>

**Honor Code**

All students are expected to abide by the code of academic integrity throughout this course. Academic dishonesty, including cheating, fabrication, and plagiarism will not be tolerated and will be reported to the Student Honor Council. The full text of the code is available on the web at [www.inform.umd.edu/Campus_Info/Departments/jpo/code_acinteg.html](http://www.inform.umd.edu/Campus_Info/Departments/jpo/code_acinteg.html). In accordance with the Honor Pledge, you are asked to write the following pledge by hand and sign on submitted papers, unless specifically exempted by the instructor. The Pledge reads:

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.

**Accommodations**

Students with documented disabilities who would like accommodations should contact the instructor as soon as possible to make appropriate arrangements.

Students will not be penalized because of observances of their religious beliefs. Whenever possible, students will be given reasonable time to make up any academic assignment that is missed due to participation in a religious observance. Please let the instructor know as soon as possible (during the first week of classes if possible) about any intended absences for religious observances.

**SEMESTER SCHEDULE**

**I. Introduction**

**August 29: What are standards? What is a curriculum? Why does it matter?**

States identify standards for mathematics instruction. School districts may define a curriculum or produce a curriculum guide. What's the difference? Suppose you were asked to produce a curriculum for an elementary, middle, or high school mathematics program, what would you expect to produce? Could a curriculum differ from a commercial mathematics textbook (textbook series)? Should it? What would be the benefits and dangers of a common, coherent


II. Looking at Achievement

The next two weeks address achievement in mathematics through analysis of data arising from large-scale assessments. Trends in mathematics achievement in the U.S. and in Maryland over time are examined using NAEP data and Maryland data, while trends in mathematics achievements across nations are studied using data arising from TIMSS and PISA.

**September 5: Mathematics achievement in the United States: NAEP and Maryland Assessments**

Mathematics achievement is multi-dimensional as the study of mathematics encompasses conceptual understanding, skill proficiency, and problem solving across a range of content domains (algebra, geometry, data analysis and probability, measurement, and numerical meaning and operations). Further, achievement trend analysis that merely examines cognitive attainment without consideration of demographic, curricular, and instructional influences will be misleading. The National Assessment of Educational Progress (NAEP) provides a repeating snapshot of the status of mathematics education in the U.S that addresses both achievement and the context of education. No Child Left Behind legislation gave new prominence to state assessments, while at the same time confirming that there is wide variation in where states set student achievement expectations and in how they define proficiency.

In class we will be examining released NAEP items and “item maps.” Should you wish to peruse these in advance, go to: [http://nces.ed.gov/nationsreportcard/itemmaps/](http://nces.ed.gov/nationsreportcard/itemmaps/) and [http://nces.ed.gov/nationsreportcard/itmrlsx/landing.aspx](http://nces.ed.gov/nationsreportcard/itmrlsx/landing.aspx)


September 12: International perspectives on mathematics achievement

So how does school mathematics achievement in the United States compare to other nations? How does curriculum and instruction in the United States compare to that in other nations? What influences student achievement? Does testing and comparison of results between nations and between states lead to improvements in curriculum and instruction?


Skim these two references:


NOTE: You need only reference Part 1 of this report.

In class we will be examining student performance in mathematics in both PISA and TIMSS, comparing results to mathematics items as well as questionnaires addressing student background and school resources. Should you wish to peruse these in advance, go to: [http://nces.ed.gov/surveys/international/ide/](http://nces.ed.gov/surveys/international/ide/)

III. Examining Approaches to Mathematics Education

September 19: Historical perspective

Curriculum and instruction influence student achievement, but practices defining mathematics curriculum and instruction are not static. While it may seem that the traditions we experienced as students are enduring, mathematics curriculum has changed over time. To address these changes, consider the status of mathematics curriculum and instruction in the United States in the first 50 years of the 20th century, prior to the New Math movement.

Council of Teachers of Mathematics.


**September 26: New Math**

A so-called revolution in mathematics curriculum occurred in the U.S. during the 1950s and 60s. Termed "New Math," federal funds supported a number of different curriculum projects that offered a new organization and focus for school mathematics in the United States. How did these projects differ? What influenced their design? What, if any, changes generated by "New Math" persisted? What lessons might be learned from this "national experiment in reforming mathematics curriculum"?


**October 3: Calls for change**

At the state and national level, for a number of years, numerous organizations and educators have recommended change in both mathematics curriculum and instruction. Why are they calling for change? What is their vision? What arguments and recommendations do they make to support their vision? What are opposing perspectives? What is the role of curriculum standards?


In addition, each student should read one synopsis addressing standards in mathematics, focusing on either an elementary (*Teaching Children Mathematics*), middle school (*Mathematics Teaching in the Middle School*) or high school issue (*Mathematics Teacher*) and be prepared to share this overview when contributing to a discussion addressing standards for mathematics reform.


**October 10: Current calls for change**

Education is not a simply a cause-effect system. Changing standards and curricula is not enough to yield change in achievement, if for no other reason than changing standards and curricula does not necessarily cause a change in instruction. Yet mathematics education should not remain static, as the current status does not reflect strong and challenging mathematics education for all students. What other aspects influence implementation of changed standards and curriculum? What other forces need to be considered?


In addition, each student should read one synopsis addressing the connections between use of curriculum materials and curriculum vision/coherence, focusing on either an elementary (*Teaching Children Mathematics*), middle school (*Mathematics Teaching in the Middle School*) or high school issue (*Mathematics Teacher*) and be prepared to share this overview when contributing to a discussion addressing standards for mathematics reform.


**IV. Mathematical Proficiency**

The remainder of the semester will mark a shift to consideration of the Common Core State Standards for Mathematics. But prior to immersion in the content of mathematical standards, it is necessary to first consider what is inherent in any effort with the ultimate goal of improving mathematics achievement: Just what does it mean to be mathematically proficient?

**October 17: What does it mean to be mathematically proficient?**

While the vision of school mathematics has differed over time, there has consistently been an assumption that the intended goal of mathematics education is student learning. But what might "successful mathematics learning" be? Approximately a decade ago, a committee of nationally known educators, researchers, and mathematicians met to address this question for PreK-8 mathematics. Their work is still striking and highly referenced.

Read Chapter 4 "The strands of mathematical proficiency" (pages 115-155) of the following text.


In addition, read these additional references:
V. Reforming school mathematics: Rationale, recommendations, and challenges

Over the next five weeks we will consider five strands of school mathematics content and practice that are foci of Common Core Standards and current/future accountability measures. We will be examining the Common Core State Standards for Mathematics for these topics along with illustrative research article(s) addressing the teaching and learning of that content. Throughout, class discussion will address rationale and recommendations for a trajectory of content, as well as challenges for change.

October 24: Standards for school mathematics: Number and operations; the number system


Students should also be prepared to contribute to discussion addressing content standards taken from the following reference for one of the following grade bands: K-2, 3-5, 6-8 or 9-12.


October 31: Standards for school mathematics: Fractions, ratios and proportional relationships (For K-2, to find Fractions, look in Geometry)

Students should also be prepared to contribute to discussion addressing content standards taken from the following reference for one of the following grade bands: K-2, 3-5, 6-8 or 9-12.


In addition, each student should either read the synopsis by Lamon addressing understanding of ratio and proportions or read the other two articles (Barlow and Harmon as well as Polly and Orrill) addressing fractions in the elementary school. All students should be prepared to share this overview when contributing to a discussion addressing standards for mathematics reform.


November 7: Standards for school mathematics: Algebra and algebraic thinking

Students should also be prepared to contribute to discussion addressing content standards taken
from the following reference for one of the following grade bands: K-2, 3-5, 6-8 or 9-12.


In addition, each student should either read a synopsis addressing curriculum perspectives on algebraic thinking (Chazan and Yerushalmy) or read a classic addressing the meaning of the symbol = (Kieran) and be prepared to share these ideas when contributing to a discussion addressing standards for mathematics reform.


November 14: Standards for school mathematics: Statistics (data) and probability


Students should also be prepared to contribute to discussion addressing content standards taken from the following reference for one of the following grade bands: K-2, 3-5, 6-8 or 9-12.


In addition, each student should read one synopsis addressing curriculum issues in data and probability, focusing on either an elementary (Teaching Children Mathematics), middle school (Mathematics Teaching in the Middle School) or high school issue (Mathematics Teacher) and be prepared to share this overview when contributing to a discussion addressing standards for mathematics reform.


November 21: Time for a break.

No class due to Thanksgiving recess. Enjoy the holiday!

November 28: Standards for school mathematics: Geometry and Standards for Mathematical Practice

Students should also be prepared to contribute to discussion addressing content standards taken from the following reference for one of the following grade bands: K-2, 3-5, 6-8 or 9-12.

Common Core State Standards Initiative. (2010). The common core state standards for
In addition, each student should read one of the following reports and be prepared to share this overview when contributing to a discussion addressing standards for mathematics reform.


**VI. Wrap up**

**December 5: Oral presentations**

Each student will have 7 minutes to share and discuss the premise of his/her position paper. Leave time for questions so the class can share in a brief discussion. A one-page handout could be useful, and a power point would make it easier to deliver the presentation.

Finally, as a closing charge, read:


**December 13: Final Examination Week**

No class meeting this week. Position paper is due by 4:30 p.m. on Thursday, December 13.