EDUCATION 783-001
MATHEMATICS CURRICULUM: RESEARCH AND DEVELOPMENT
WINTER 2012

Professor: Vilma Mesa
vmesa@umich.edu
3111 SEB/647-0628

Class Meetings: Thursdays 9:00-12:00 pm
Room: SEB 4212
Class website: http://www.ctools.umich.edu/

Description

What are researchable questions in investigating curriculum in mathematics? What are the methods that will yield interesting answers to those questions? What are basic principles for developing curriculum in mathematics? These and other related questions will be addressed in this course.

The main goal of this course is to help students develop an understanding of the school mathematics curriculum, with a particular emphasis on the U.S. and grades K-16. In this course, the curriculum is understood as both the explicit planned course of learning put before students and the learning experiences that students encounter in school settings. Students will become familiar with key issues faced by diverse stakeholders concerned with the school mathematics curriculum, including teachers, curriculum designers, researchers, evaluation specialists, assessment developers, and policy makers.

To provide useful contrasts that should deepen students’ understanding of contemporary mathematics curriculum issues in the U.S., the course incorporates historical and international perspectives. In this course we will get acquainted with the intended curriculum (e.g., the nature of curriculum guidelines or textbooks), the implemented curriculum (e.g., teachers’ enactments of curriculum goals), and the attained curriculum (e.g., assessment of the effectiveness of curriculum).

Because this course is intended to help develop emergent scholars in the field of mathematics education, there will be in-depth investigations leading to potential publications on these topics.

COURSE EXPECTATIONS

This 3-credit course is organized as a seminar format, in which the essential feature will be the in-class discussion of the weekly readings by all the attendees. Supportive, productive, and critical inquiry into the mathematics curriculum is both an aim and a means for the course. Students are expected to attend all class sessions, to complete course readings prior to the class for which they are assigned, and participate actively in the discussions. Students are expected to inform the instructor, in advance, of absences.
Reading and writing are critical components of the course. As an advanced graduate level course, the reading and writing is substantial. Students are expected to come to class having read the assigned material thoroughly and thoughtfully and willing to share their understandings of the readings in order to contribute to the learning of all class members. For each class session there will be an assigned reading and a short writing assignment. Students are expected to post a reflection on the readings, as indicated in the schedule, by the previous Wednesday, at 9am. These contributions will be tracked in the Forum section of CTools. Limit your contributions to 750 words.

Special Forms of Participation

Textbook review: Each student will select a textbook from the list of curricula provided and write a review that will address at least two questions within each of the categories noted below. These categories provide a framework for beginning an inquiry into the mathematics curriculum:

Content dimension
1. What is worth knowing and what is worth experiencing?
2. Who should learn what and by when?
3. What theories of knowledge are implicit in the curriculum?

Cognitive dimension
4. What kinds of skills should students demonstrate?
5. What theories of learning are implicit and explicit in the curriculum?
6. For what kind of future is the curriculum explicitly or implicitly preparing students?

Pedagogical dimension
7. What is the relationship between the knowledge embedded in the curriculum and those enacting the curriculum?
8. What theories of teaching underline the design of the curriculum?
9. What are the expectations about how teachers should teach the curriculum?
10. What assumptions are made about who should teach the curriculum?

Social dimension
11. What conception of good life is implied by the curriculum?
12. Whose interests does the curriculum serve?
13. What stand does the curriculum take on questions of democracy, justice, and diversity?
14. What kinds of relationships among school participants are best for enacting the curriculum?
15. How do the broader social conditions influence the shape of the curriculum and students’ experiences of the curriculum?

The students will select the textbook for reviewing from the following curriculum list. Students may borrow textbooks from the instructor, from the individual research projects in the School, or from instructors in the math department:

1. Investigations
2. Math Trailblazers
3. University of Chicago School Mathematics Project
4. MathThematics
5. Connected Mathematics Project
6. Mathematics in Context
7. Core Plus Mathematics
8. Integrated Mathematics Program
9. Calculus: Honors (e.g., Spivak, Apostol), Harvard Consortium, or Alan Selby’s calculus
10. Developmental Mathematics or Curricula for community colleges
11. Mathematics for Elementary/Secondary School Teachers (e.g., Bassarear, Bennet & Nelson; Musser, Berger, & Peterson; Beckman).

The review must include a final recommendation about the value of using the curriculum (as represented by the textbook) for teaching mathematics to the anticipated audience. The reviews will be presented to the class throughout the semester. The presentation should have two components. First the presenter will engage the class in one activity or task proposed by the curriculum in such a way that all dimensions of curriculum are evident. Then the presenter will give a professional presentation of no more than 3 slides (if needed) and 9 minutes, summarizing the review of the textbook. Students are expected to discuss with the instructor their choice and review two weeks prior the due date. Post your review in CTools, one week ahead to the class when you will give your review in the corresponding folder under Resources, for the other students to read and comment.

*The New Math, The NCTM Standards Era, & The Common Standards Era: A Debate.* Each student will participate in a special class session on March 8. In preparation for this session, the class will be split into three groups. One group will be the experts on the “New Math” reforms; the second group will be the experts on the “Standards” movement; and the third will be the experts on the “Common Curriculum Standards.” The instructor will assign these groups. Each group will prepare a non-talking-head presentation (i.e., a parody, a dramatization, a personification, a song, a poem, a video) about the principles and rationale behind each of these approaches to drive change of the school mathematics curriculum. In the first part of the class, each group will have 15 minutes for such presentation. In the second part of the class, we will conduct a debate. The instructor and students will play different stakeholder roles in the debate, asking questions of each group and demanding action for issues that are aligned with their own stakeholder roles. A portion of class on February 2 will be devoted to helping groups organize and prepare for this presentation. More details about the expectations for these presentations will be given at that time.

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Research Project. Students are expected to conduct an investigation of a topic, and to prepare a paper and a poster presentation based on this investigation. In many cases, the written paper will take the form of a review and synthesis of literature related to the topic, but other formats are also possible, depending on the nature of the topic being pursued. Students should select a topic in consultation with the instructor, who can provide initial guidance in finding appropriate sources for the investigation. I encourage students to work with a partner in this project because that gives both students an opportunity to share ideas, discuss options, and think through analyses. Joint projects are logistically more demanding than individual projects but they are more rewarding, as it is possible to cover more ground.

The following listing of possible focus areas and topics is meant to be suggestive rather than exhaustive. Typical foci for this project might include:

- an analysis of a curriculum topic, either from a historical or a cross-national perspective (e.g., multiplicative reasoning, ratio, variables, proof, problem solving, functions, statistical reasoning, discrete mathematics); or

- an analysis of an innovative curriculum development project within or outside the United States (e.g., Harvard Calculus Reform Project, Adult Literacy and Numeracy, Statway-Quantway, a national teacher education curriculum); or

- an analysis of one curriculum-related issue touched on in the course but not considered fully (e.g., the evolution and curricular implications of “mathematics for all” or “mathematics and democracy,” research and theory related to teacher learning through engagement with innovative student curriculum materials; the evolving role/place of technology in the school mathematics curriculum).

There are two products of this research project, a poster presentation and a written paper (max 20 pages in length). The poster session will be held on April 19 and it will be conducted as a conference poster session. The written paper is due at that time.

The investigation will be a 4-stage process as follows:

1. **Selection of project focus**: Once students have identified the focus of their investigation, they should write a memo describing their topic, motivation (why is this topic important to you?), rationale (why is this topic important to the world?), and learning goals (what would you like to learn or get better at?). This memo is due on February 2nd by 5pm on CTools. Submit only one memo if you are working in a group.

2. **Data collection and analysis**: Students should discuss with the instructor the types of sources they will use for their investigation. After such discussion, they will write a second memo including the timeline for working on the project, an outline of the paper, and, in the case of group projects, assigned responsibilities for collecting data, reporting, editing, etc., for both the paper and the poster. The memo should be posted on February 23 by 5pm on CTools.

3. **Paper draft**: Two weeks before the presentation of the poster (March 29 by 5pm, CTools), students should post a draft of their written paper (including references in
APA style but not appendices) that will summarize the investigation on CTools. This draft will receive feedback from the instructor.

4. Reporting: Students will present both orally and in writing the results of their investigation. For the oral presentation (April 19) the students will use a poster, in which they will convey the main questions answered with the investigation, and insights and either potential lines of research or practical applications of the investigation. Other graduate students or faculty in the SoE may attend the poster session. The written report is due on at the end of the day on April 20th and it will contain both a description of the project and a critique of the findings. More details about these activities will be given throughout the term.

Unless otherwise indicated, all written submissions should be double-spaced, use a 12-point size font (Times family recommended), have one-inch margins, and be submitted as a word .DOC file via CTools (no e-mail, please). All documents should have a title that is pertinent to the content (not, MEMO 1), the name of the author(s), and have a footer that will have the name of the file, page, and EDUC 783-Fall12. Please follow the following convention for labeling your file (the original one that you have in your computer!): LastName_mm.dd (e.g., Mesa_01.15, indicates that Mesa posted the file on Jan 15). CTools will not accept late submissions. A special folder labeled, “Late Submissions” can be used when the time for submitting assignments has passed.

Grading

A letter grade (A, B, etc.) will be determined based on assessment of performance in each of the special forms of assessment plus class participation, as follows:

Class participation. Assessed considering attendance, thoughtful contribution to the class (active listening, following up on students’ ideas, using sources rather than personal opinions to back up claims), respectful contribution to the class discussion (active listening and professional interventions), meeting the weekly reading assignment, and quality of the weekly writing memos (no typos, coherent thoughts and ideas relevant to the reading). Class participation counts towards 20% of the final grade.

Textbook review and discussion. Assessed considering thoughtfulness in answering the analytical questions, the ability to select supporting evidence from the textbook, creativity delivering the radio report, and compliance with the guidelines. This assignment counts towards 20% of the final grade.

Debate. Assessed considering originality, accuracy, and completeness of the information presented, and the ability to deal with the questions posed during the debate by the stakeholders. This assignment counts for 20% of the final grade. This is a group assignment and therefore, the final grade will be adjusted according to the level of contribution of each participant in the group. Such contribution will be assessed after the debate.

Group research project. The several stages outlined in the description will be considered in assessing students’ performance on this project. This assignment will count for 40% of
the final grade. For group projects, the final grade will be adjusted according to the level of contribution of each participant. Such contribution will be assessed throughout the duration of the project, via a peer assessment form that will be tailored for the project.

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 engagement and 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 on 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 to accomplish the course goals.

**TEXTBOOKS AND OTHER READINGS**

The following texts are required:


HIR and ST give us examples of current Standards-based K-12 curricula, their origin, implementation, and evaluation of impact. We will read almost all of their chapters. RHL has a number of chapters that summarize the current thinking on curriculum as it is enacted in classrooms.

In addition the following texts will be extensively used:


Copies of the NCTM standards may be obtained from NCTM’s website or borrowed from faculty or advanced graduate students at U-M. The document may also be available for examination electronically. Useful web sites for NCTM documents and/or related materials: [http://standards.nctm.org](http://standards.nctm.org) and [http://forum.swarthmore.edu/mathed/nctm.new.pedagogy.html](http://forum.swarthmore.edu/mathed/nctm.new.pedagogy.html)

Copies of the AMATYC document can be downloaded directly from their website, AMATYC.ORG.
Other readings—journal articles, chapters from reports and books—are assigned throughout the semester. A list of assigned readings for each week is contained in this syllabus. The readings may be obtained by locating the source document in one of the campus libraries or in the resource section of CTools. The instructor has a number of the books and references for consultation purposes.

Schedule

The following is the plan for the course. The assigned reading is to be done before the corresponding class meets. All students are responsible for all the readings for a given session. Most of the articles are available in electronic form, either in the Resources Folder in CTools or in the library Catalog. They can also be requested via 7Fast free of charge. Post your reflection on the reading in the discussion section of CTools by Wednesday at 9am.

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<tr>
<th>CLASS 1</th>
<th>JANUARY 5</th>
<th>HISTORICAL PERSPECTIVES OF THE (SCHOOL) MATHEMATICS CURRICULUM</th>
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Readings:


Reflection on the readings: The readings are from different eras and from different school levels. What is similar, what is different, what is transient, what is permanent?

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<th>CLASS 2</th>
<th>JANUARY 12</th>
<th>MODELS OF CURRICULUM</th>
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Readings:

6. PSSM chapters 1-2.

Reflection on the reading: Before reading, write down your definition of curriculum. After reading, explain how the article changes (or not) that definition.

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<th>CLASS 3</th>
<th>JANUARY 19</th>
<th>ELEMENTARY SCHOOL CURRICULA</th>
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Readings:

7. HIR chapters 1, 2, 3 and the corresponding chapters from
8. ST, chapters 3, 4, 5
9. PSSM, standards for representation for PreK-2, and grades 3-5

Reflection on the reading: to what extent is the representation standard a driving feature of the curriculum examined?

### Final Project Memo 1 Due by 5 pm

<table>
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<th>CLASS 4</th>
<th>JANUARY 26</th>
<th>MIDDLE SCHOOL CURRICULA</th>
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<td>Readings:</td>
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<tr>
<td>10. HIR chapters 5, 6, 8 and the corresponding chapters from</td>
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<tr>
<td>11. ST, chapters 9, 10, 11</td>
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<td>12. PSSM, standards for connections for grades 6-8</td>
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Reflection on the reading: to what extent is the connection standard a driving feature of the curriculum examined?

### Class 5 February 2 High School Curricula

| Readings: |
| 13. HIR chapters 10, 11, 15 and the corresponding chapters from |
| 14. ST, chapters 14, 16, 28 |
| 15. PSSM, standards for reasoning and proof for grades 9-12 |

Reflection on the reading: to what extent is the reasoning and proof standard a driving feature of the curriculum examined?

### Time allotted for debate preparation

**Final Project Memo 2 Due by 5pm**

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<th>CLASS 6</th>
<th>FEBRUARY 9</th>
<th>REACTIONS TO THE STANDARDS</th>
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<tr>
<td>Readings:</td>
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Reflection on the reading: Find definitions of “standard.” How are those definitions reflected in the discussion? What ideologies are behind those uses?

### Class 7 February 16 The New Math

| Readings: |

Reflection on the reading: How are these reactions similar or different to the reactions to the Standards?

**FEBRUARY 23:** NO CLASS: RUME CONFERENCE

Data collection and analysis memo due, by 5pm on CTools

Readings for debate class posted by 5pm on CTools

**MARCH 1:** NO CLASS: SPRING BREAK

**CLASS 8** MARCH 8 SCHOOL MATHEMATICS CURRICULUM REFORM: A DEBATE

There are no readings assigned by the instructor. But each group will post a reading for the rest of the class.

**CLASS 9** MARCH 15 TEXTBOOK STUDIES

During this session we will be scanning articles to identify research questions, methods, findings, and paradigms regarding investigations of textbooks. See list at the end of the syllabus.

In lieu of the forum you will add information to a Google spreadsheet for collecting information on your article

**Midterm Student Feedback**

**CLASS 10** MARCH 22 TEACHERS AND SCHOOL MATHEMATICS CURRICULUM

Readings:

23. MTW Chapter 2.


Reflection on the readings: Describe the theoretical ideas behind the conceptualization of uses of curriculum by teachers.

**Book Review Presentations:** Three presentations due today

**CLASS 11** MARCH 29 STUDIES ON THE RELATIONSHIP BETWEEN CURRICULUM AND TEACHERS

Readings:
26. MTW chapters 9 and 11 in detail
27. MTW chapters 8, 10, 12, scan
28. MTW chapters 13 and 14 for argument

Reflection on the readings: With which of the two position papers, Pimm’s or Schepp’s do you agree the most? Why?

**Book Review Presentations:** Three presentations due today

**Final Project Draft Paper Due by 5pm**

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<th>CLASS 12</th>
<th>APRIL 5</th>
<th>STUDIES ON THE RELATIONSHIP BETWEEN CURRICULUM AND TEACHERS</th>
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**Readings:**

29. MTW select one from chapters 15 and 17 to read in detail
30. MTW select one from chapters 20, 21, and 22 to read in detail
31. MTW select one commentary from each section (18, 19, 23, 24) for argument

Reflection on the readings: Propose two unresolved issues in the relationship between curriculum and teachers that would be worth investigating.

**Book Review Presentations:** Three presentations due today

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<th>CLASS 13</th>
<th>APRIL 12</th>
<th>INTERNATIONAL COMPARISONS OF CURRICULUM</th>
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**Readings:**


Reflection on the readings: Select one statement from either “rationality” piece or from the “change” piece. Argue for and against it in light of the findings about curriculum from SIMS and TIMSS.

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<th>CLASS 14</th>
<th>APRIL 19</th>
<th>POSTER SESSION</th>
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In the first section of the class, we will hear from each presenter, ask questions and give feedback. In the second section, visitors will be invited to interact with the presenters.

**Final Paper Due at the end of the day on April 20th**
CURRICULUM BIBLIOGRAPHY

The following are readings that are worth reviewing to gain in-depth information about curriculum in mathematics in the United States. They are loosely organized by ‘topic.’

DEBATE READINGS


HISTORICAL READINGS


CRITICAL READINGS

REFORM


STUDIES ON TEXTBOOKS

The following articles will be used during the textbook section. We will spend the first part of the class identifying research questions, units and frameworks of analysis, methods, sample sizes, and results, in order to learn a bit about what is that researchers have been attending to, what has been neglected, and what could be studied further.


