Initial Syllabus: I reserve the right to change assignments (with appropriate warning) on the basis of the evolution of our class discussions.

EDCI 753
Foundations of Mathematics Education III
Theory and Research on Mathematics Curriculum
Fall 2010

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Course Goals

Goals for doctoral studies related to curriculum in mathematics education are many. Curriculum is often thought of, rightly or wrongly as we will see, as an important lever for school change. Mathematics educators -- research-active or not, with leadership roles in school systems, in teacher education, in research and development projects, and in the formulation of education policy -- are frequently called on for analytic or creative work related to the content, organization, presentation, and evaluation of school and early collegiate mathematics curricula.

As articulated in its initial proposal to the National Science Foundation, to prepare doctoral candidates for such opportunities and responsibilities, the Mid-Atlantic Center for Mathematics Teaching and Learning seeks to have programs in which doctoral students develop the following knowledge, abilities, and dispositions for work on curriculum related issues.

- Knowledge of mathematical concepts, principles, techniques, and reasoning methods that are central to school and undergraduate curricula, and critical understanding of the ways that this mathematics is developed and evaluated by standard and innovative curriculum, teaching, and assessment materials.

- Knowledge of the historical evolution in practice and thinking about school and collegiate mathematics curricula—approaches that have been tried, experiences with development and implementation of those approaches, and the professional and political interests that shape curriculum decisions.

- Knowledge of the relationships between theories of teaching and learning and the content, organization, pacing, and presentation of mathematics curriculum topics.

- Knowledge of the implications of calculator and computer technologies for goals, structure, and presentation of mathematics curricula.

- Ability to examine critically the research and evaluation literature on mathematics curriculum issues and to design and conduct high quality research on mathematics curriculum variables.

- Knowledge of research findings directly related to teaching and learning of core topics in the K-16 mathematics curriculum.
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- Ability to analyze curriculum framework documents and curriculum materials to identify explicit and implicit assumptions about content goals that are valued and about how that content is most effectively taught.
- Ability to design an effective project to formulate a curriculum framework or to develop and test curriculum materials using print, electronic, and other useful media.
- Disposition to examine critically both existing and proposed mathematics curricula to determine whether they value important mathematics and organize and present that content in ways that reflect understanding of student learning, effective teaching, and assessment of knowledge.

(Taken from MACMTL, 2001).

This course cannot possibly address all of these goals in depth in one semester; we will concentrate on a smaller number of goals. We will concentrate on:

- An overview and structure for understanding the evolution of school mathematics curricula in the US since the inception of public schooling.
- Understanding compulsory schooling in the US as a societal process that involves political and institutional forces that shape disciplinary knowledge into school subjects.
- Developing skill at analyzing written curricular materials and understanding the opportunities for learning that they support teachers in providing students.
- Understanding how curriculum is conceptualized, studied and evaluated currently.

As a byproduct of this work, each participant will gain familiarity with written curricular materials. However, we will not survey the k-16 curriculum topically. And, we will not focus on how curriculum projects develop materials for teachers and students.

Course Structure and Timeline

This course, in the Mid-Atlantic Center’s Foundations of Mathematics Education series, is designed to help doctoral students develop knowledge and skill through reading, discussion, curriculum analysis, and class activities. The class will proceed in four phases:

**Phase 1 (Weeks 1-4)**

During this phase of the course class sessions will focus on two questions:

1. *How has school mathematics curricula in the US developed and changed over time?*

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. This part of the course will be supported by a field trip to the Artemas Martin collection at American University.

2. *What is mathematics, how is it done, and how do images of the discipline offer guidance to school mathematics?*
Schools are organized to impart knowledge to members of a society. School mathematics looks to mathematics -- the discipline that is advanced by research of professional mathematicians, and applied in a broad range of practical, technical, and scientific disciplines – to legitimate what it offers to members of our society. Given our long experience with school mathematics and comparatively little experience with mathematics as a discipline, and the influence of the history and philosophy of mathematics on some current developments in school mathematics, we will focus on the question What is mathematics and how is it done? by examining part of Imre Lakatos’ Proofs and Refutation.

For many people involved in curriculum policy decisions, the content of school mathematics is not at all problematic. They have an image of mathematics as an immutable discipline (at least in its foundations), so they believe that school mathematics curricula should simply replicate the experience of earlier periods. Those who are involved in mathematical research or in application of mathematics to problems in other disciplines know that the subject is anything but static. They know that a 20th century school mathematics experience is unlikely to prepare students well for personal and working lives stretching well into the 21st century. However, the outlines of appropriate change in school mathematics are not at all obvious. This phase of the course will conclude with pieces from mathematics educators and mathematicians about potential relationships between school mathematics and mathematics in the discipline.

Phase 2 (Weeks 5-7): How do researchers analyze written curricular materials to understand what opportunities for teaching and learning these materials support?

This part of the course is strongly connected to the course project outlined in a separate handout. 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 a small number of articles that offer frameworks for comparing curricula and understand how the offered frameworks fit with the questions the researchers seek to answer.

Phase 3 (Weeks 8-12): How do researchers conceptualize the role of curriculum in education? What is the state of the art in research on school mathematics curricula?

This phase of the course will focus on current research on curriculum and the question “What is the state of the art in research on school mathematics curricula?” Using an influential piece by Janine Remilliard to help us conceptualize the field, we will look at studies of curriculum effectiveness, international comparisons of school curricula, studies of students’ experience of curricula, and factors influencing teachers’ use of curricula.

Phase 4 (Weeks 13-14): In the US what are current and proposed curriculum evaluation procedures? How do these relate to our political system of organization?

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
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Interventions that have been shown to be effective in experimental design evaluations. A now, with federal support, the states are moving to adopt a common core of standards.

In this segment of the course, we will begin to touch on the politics of the curriculum process, particularly as it relates to issues of evaluation. These issues will be taken up in more depth in FME 4.

Course expectations and assignments

Attendance and Participation: This course is a doctoral seminar. Participants are expected to come to class and to participate actively. In case of an emergency, please contact me, preferably by email, or another participant.

Weekly messages: The class will involve careful reading of a comparatively small number of readings. I encourage you to do these readings during the first part of the week and do your course project work during the later part of the week.

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 (login at https://elms.umd.edu/webapps/portal/frameset.jsp) discussion board by the Saturday evening before the next class session. The purpose of these weekly 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 often 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.*** 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?

We will explore creating subgroups for the weekly messages. Participants are expected to read the comments of other participants in their subgroup before class and to come ready to discuss the readings and the comments. The instructor will expect everyone to come with insights to share and questions for discussion each week.

Course Project: This course has two major assignments that culminate in the completion of an empirical study.

The first project, done during the first half of the semester, gives participants an opportunity to explore a particular curricular topic and to familiarize themselves with curricular materials of different kinds. In order to keep participants’ projects to a manageable size and to keep the work progressing during the first part of the semester, each week, participants will be asked to put online their work on the project. Constructive formative feedback will be given on this project twice before a summative assessment is given.
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Carrying out an empirical study during a semester is an ambitious goal. During the second part of the semester, approximately every two weeks, there will be a deadline related to this course assignment. Participants are expected to meet these deadlines with appropriate work. This part of the project will be assessed three times, ones with a formative grade, once with feedback, and then with a summative grade.

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. Each participant will be expected to present their progress on to their project to the seminar.

**Course Grading Procedures**

Written assignments and presentations will be graded holistically on a scale of 0-4(A) with basic consideration given to quality of reasoning and clarity of expression. Items will be weighted in proportion to the time/effort required by the assignment. The three graded course project drafts will be weighted at 20%, 20% and 30% of the course grade. Presentation of the course project will be weighted at 10%.

Contributions to the Blackboard discussion site and to class discussions will also count for 20% of the course grade. Those contributions will be assessed informally, with feedback when more active participation seems called for.

There will not be a final examination.

**Tentative Reading List**

The literature relevant to this course is vast, indeed many of the issues we will examine could easily be the focus of a course themselves. The readings listed below are posted in our BlackBoard site. I reserve the right to change these readings (with appropriate warning) on the basis of the evolution of our discussions). A final syllabus reflecting what we read as a group will be posted on the Blackboard site at the end of the semester.

*For this date:*  
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- 1923. The Reorganization of Mathematics in Secondary Education. Download from CSMC.
- Lakatos, until p. 23

9/20

- 1975. Conference on basic skills and learning. Download from CSMC.
- 1975. Overview and Analysis of School Mathematics Grades K-12. Download from CSMC.
- Lakatos, until p. 33.

9/27


(One of next four)

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(one of next five: pick from first three if you have not read them before, pick from last two if you have)


Lakatos, until p. 50

Optional:


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uncovering the way a textbook may position the mathematics learner. For the Learning of Mathematics, 27(2), 8-14.
Lakatos, until p. 83

Optional:


10/18

Optional:
TIMSS, Document Analysis: Data Collection And Processing.


10/25

(2 of 3 empirical studies)
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Optional:


(2 of 4 empirical studies)


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29(3): 248-274.


(3 of 4)


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11/29


12/6


