

Freshman Seminar Draft Syllabus

Making the Grade? Middle and High School Math Education in the U.S.

Wednesdays 2:30 - 4:30 pm in Sever 204

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What are the goals of mathematics education at the middle and high school level, and how do these goals impact our evaluation of the success or failure of math education in America? Why does math education at these levels matter? What societal structures (historic, economic, political, cultural) impact mathematics education? How does math education in turn impact societal structures? As the world changes, how do the goals of mathematics education change, and in what ways? These are questions we will grapple with in this seminar. We will sharpen the lens through which we view math education in the U.S. by looking at some international case studies.

Readings in preparation for weekly discussions and activities will include a combination of newspaper articles, articles by experts in the field and findings of large-scale national and international studies. This will help us make sense of the debate in the press, inside the mathematics and math education communities, and amongst policymakers about the state of mathematics education and what should be done about it.

This is a seminar course, so our class meetings will be discussion-based. Students are expected to be active participants in seminar discussions and therefore students are expected to read the material for the class before the class and be ready to think critically about it. Often readings will present different viewpoints on an issue. On occasion, students will (in pairs) be responsible for reporting out on different points of view and will debate issues from the perspective of a particular viewpoint (not necessarily their own) before staking out their own perspectives by the end of the seminar. The topic of mathematics education is integrative and has been debated for decades. Throughout the semester, students will be asked to turn in one to two page response papers, due the day before the seminar meets. Some of these will involve organizing your thoughts and reflections on the readings; others will involve reflecting on your own math learning in light of the readings.

Final paper: Suppose you were a consultant at a city, state, or national level (you choose) who could make one suggestion to improve math education. What suggestion would you make? What is the goal your suggestion works towards and why do you think this particular suggestion would have impact? Back up your suggestion with information from four of the articles/books that we have read. Think about the push-back to your suggestion (from whom would this come?) and respond to it.

As a companion piece to this paper, write an editorial, one that could be sent to a newspaper for publication. In this editorial, make the case that this improvement is important and put forth your proposal.

Draft syllabus:

- **Week 1: What are the goals of middle and high school math education?**

While an enormous number of collective hours are spent on middle and high school mathematics education in the U.S., the quality of learning varies. What would excellence in math education look like? Would it be universal?

In education there is seldom one correct agreed upon answer. Along what parameters might you expect answers to this question to vary? Would it vary with the person asked? With the target audience? Would it vary depending upon whether math is viewed as a tool, a language, a science, or an art? How would you answer this? How would different people in the Harvard community answer this?

In order to unearth some of the variety of ideas and preconceptions in the community around us (the Harvard community, our home community), we will construct some informal survey questions. What will your survey ask? Who would be interesting to survey? What kind of variation (in people surveyed) would you want?

Reading:

- Varied respondents, Views on High School Mathematics Education. Notices of the AMS, vol. 43, No. 8, pp. 866 - 873. August 1996. <http://www.ams.org/notices/199608/comm-views.pdf> (research mathematicians' answers)

- Varied respondents, Views on High School Mathematics Education. Notices of the AMS, vol. 43, No. 9, pp. 979-986. September 1996. <http://www.ams.org/notices/199608/comm-views.pdf> (math educators' answers)
- Varied respondents, Views on High School Mathematics Education. Notices of the AMS, vol. 44, No. 2, pp. 197-207. February 1997. <http://www.ams.org/notices/199608/comm-views.pdf> (math educators' answers)
- Reys, Dingman, Nevels, and Teuscher. High School Mathematics: State-Level Curriculum Standards and Graduation Requirements. Center for the Study of Mathematics Curriculum, An NSF Center for Learning and Teaching, April 2007.

• **Week 2: Historical Context: Math education in America**

What are the factors shaping education in America? What is particular to mathematics and what are factors that are relevant to education as a whole?

Reading

- Graham, Patricia. Schooling America: How the Public Schools Meet the Nation's Changing Needs. Oxford University Press, 2007 (selected pages).
- Klein, David. A Brief History of American K-12 Mathematics Education in the 20th Century. Mathematical Cognition, ed. James Royer, Copyright Information Age Publishing, 2003.
- Wilson, David McKay. Do the Math! The Magazine of the Harvard Graduate School of Education, Winter 2013. <http://www.gse.harvard.edu/news-impact/2013/01/do-the-math/>
- Phillips, Christopher J. The New Math and Mid-Century American Politics 2013 preprint supplied by the author.

• **Week 3: Cross Cultural Comparisons: Looking at large scale data**

Reading

- TIMSS report (Trends in International Mathematics and Science Study) <http://nces.ed.gov/timss/>
- Hiebert, J.; Stigler, J. ; Jacobs, Givvin, ; Garnier, Smith, M., Hollingsworth, A.; Wearne, D.; and Gallimore, R. Mathematics Teaching in the United States Today (and Tomorrow): Results from the TIMSS 1999 Video Study. Educational Evaluation and Policy Analysis, 27(2), 111-132. (2005). <http://www.jstor.org.ezp-prod1.hul.harvard.edu/stable/3699522>
- Stigler, James; Hiebert, James. The Teaching Gap. Simon and Schuster, 2007

• **Week 4: Case Studies: math education and related societal structures and attitudes in other nations** (and perhaps an additional focus on Massachusetts as a TIMSS outlier)

Reading

- Hancock, LynNell. Why Are Finlands Schools Successful? Smithsonian magazine, September 2011.
- Stigler, James; Hiebert, James. The Teaching Gap. Simon and Schuster, 2007. (selected chapters)
- (possibly also Stevenson, Harold; Stigler, James. The Learning Gap. Simon and Schuster 1994.)

• **Week 5: Equity issues in mathematics education in America**

Why are equity issues in math especially relevant? What are the costs of inequity and who pays the price? What is the "Achievement Gap" in Mathematics? What is the Benchmark movement and what motivates its formation?

Reading

- The Economic Impact of the Achievement Gap in America's Schools, Summary of Findings. McKinsey and Company, April 2009.
- Achievement Gap reports from the National Assessment of Educational Progress (NAEP), available at: <http://nces.ed.gov/nationsreportcard/studies/gaps/>
- Moses, Robert P.; Cobb, Charles Jr. Radical Equations: Civil Rights from Mississippi to the Algebra Project. Boston : Beacon Press, 2001. (selected pages)

- **Week 6: Case study: What is the place of algebra in the curriculum?**

Algebra is a topic that has been debated recently. Students will choose a working group and report on the views expressed by the writers in their working group. For example, students may read a couple of the articles below. Students will present the writer's viewpoint and critique it from perspectives taken up in previous classes.

After the class you will write a policy suggestion, an editorial essay. You will reference at least two of the articles that we have read.

Reading:

- The Algebra Initiative Colloquium. vol. 2 1993 Ed. Carole B. Lacampagne, William Blair, and Jim Kaput, U.S. Department of Education, Office of Educational Research and Improvement, National Institute on Student Achievement, Curriculum, and Assessment.
 - * Moses, Bob. Algebra, The New Civil Right. pp 53-68
 - * Schoenfeld, alan H. Is Thinking about Algebra a Misdirection. pp. 83-6
 - * Kepner, Henry , Jr. Algebra: The Next Public Stand for the Vision of Mathematics for All Students. pp. 151-154
 - * Forman, Susan; Davis, Paul; Greeno, James; Lesh, James Richard; McCray, Patrick Dale; Romberg, Thomas, Spence, Mary. Reshaping Algebra to Serve the Evolving Needs of the Technical Workforce. 155-196
- Garfunkel, Sol; Mumford, David. How to Fix Our Math Education. The New York Times The Opinion August 24, 2011.

- **Week 7: Impact of tracking in mathematics**

Reading

- Stiff, Lee V.; Johnson, Janet L. ; Akos, Patrick. Examining What We Know for Sure: Tracking in Middle Grades Mathematics, Linking Research and Practice in Mathematics Education. National Council of Teachers of Mathematics, pp. 63- 69, 2011.
- Boaler, Jo. Whats math got to do with it? Penguin Books, Ltd, 2008, selected chapters.

- **Week 8: Standards, frameworks and standardized testing: What is the impetus? What is the impact?**

What is their purpose? What do they look like? How do they work in practice? What are the implications? There is great debate over intended curriculum, implemented curriculum, assessed curriculum, and standards versus curriculum.

Reading

- Progressions for the Common Core Standards in Math (draft) Algebra, Functions, The Common Core Standards Writing Team, 3 December, 2012.
- Look at the actual standards, such as p. 6-8 of the standards document on the “Standards for Mathematical Practice.

- **Week 9: Math instruction in the classroom: Aligning classroom instruction with students tasks with learning goals; a brief look**

Select three of these questions and respond to these questions given the framework of the goals (from your perspective) of mathematics education. Then respond from the perspective of an author we have read.

- .What place, if any, does confusion have in a math class?
- .What place, if any, does a discovery moment, have in a math class?
- .What place, if any, do puzzles have in a math class?
- .What place, if any, do applications have in a math class?
- .What place, if any, do proofs have in a math class?

.What place, if any, do calculators have in a math class

Reading

- Lipson, Abigail. Learning: A Momentary Stay Against Confusion. Teaching and Learning. The Journal of Natural Inquiry, 4(3), 1990, pp 2-11.
- McLeod, Douglas B. Research on Affect in Mathematics Education: A Reconceptualization. pp. 575 -596, from the Handbook of Research on Mathematics Teaching and Learning / A Project of the Mathematics Council of Teachers of Mathematics, Douglas A Grouws, Editor, Macmillian Publishing Company, NY 1992.
- additional readings to be determined - probably Jo Boaler

• **Week 10: Aligning instruction and curriculum with goals: A critical look at various instructional and curricular movements**

The Math Wars, the Moore Method, The New Math : What issues are at the root of differing trends in mathematics? Do math wars spring up due to differences in goals, or differences in opinions of how to reach the goals, or differences in values?

Reading

- Briggs, Bailey, and Cooper. Is Moore Better (in Precalculus)? Notices of the AMS, August 2011 pp. 963-956.
- Klein, David. A quarter century of US 'math wars' and political partisanship. BSHM Bulletin: Journal of the British Society for the History of Mathematics, Volume 22, Issue 1, p. 22-33 (2007), Taylor and Francis.
- Herrera, Terese A, and Owens, Douglas, The "New New Math"?: Two Reform Movements in Mathematics Education, from Theory into Practice. Talyor and Francis, Ltd, Vol. 40, No. 2 Spring 2001 pp. 84-92
- Schoenfeld, A. The Math Wars. Educational Policy, Vol. 18 No. 1, (2004) 253-286.

• **Week []: Math instruction outside the classroom**

Kumon Math, Math Circle, Newton Russian School of Mathematics, ALOHA (an acronym for Abacus Learning of Higher Arithmetic), Girls Angle, IDEA Math, all these are local businesses (some for profit some non-profits) centered around math instruction.

The math education venues listed above are all local resources. Students will research one of these (in pairs) and present information: goal, methods, assessment, place in the educational landscape. What are the goals and strategies of the numerous local math instruction venues and what is their impact? What need is each filling?

Reading

- Danielson, Christopher, and Goldenberg, Michael Paul. How well does Kahn Academy teach? Washington Post, July 27, 2012.
- Friedman,Hilary Levey. "Are After-School Math Centers Really Worth the Money? Parents and education experts do the math. Boston Globe Magazine Jan. 22, 2012

• **Week 11: Student oral presentations of the editorial versions of their final projects**

• **Week 12: Student oral presentations of the editorial versions of their final projects**