

**Systemic Reform in
Mathematics and Science Education**
EDC 385G – Spring 2010

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Office hours: Tuesday & Th. 3:30-4:30

Required Materials: Course Packet. Available from IT Copy on MLK

Students must have access to a computer to submit assignments, use web browser, email, and be able to run selected course-related software.

Course Description: This course approaches understanding the processes of systemic reform in mathematics and science education through the lens and associated methodologies of systems theory. Systems theory has various “schools” and this course will engage many of these with the goal of improving our efforts to bring about and support content-specific reform in mathematics and science education. Systems are considered dynamic entities where structure creates behavior. Structure includes the dynamic interaction of parts, over time, with feedback, and where the “whole is more than the sum of the parts.” To change the behavior of a system (e.g., to bring about reform) the structure must be understood, engaged and, potentially, altered.

As with science and mathematics learning, mental models and modeling are vitally important to systems analyses and systems methodologies. In this course modeling will be the primary focus of our efforts to understand and advance systemic reform at various levels of our personal, and group-level, interest and engagement. The “hard” issues related to the dynamics of systemic reform, situated relative to our efforts to make better sense of systems theory as an approach, will frame our progression through the course. In addition to working through the shared readings and assignments of the course, you and your project team will pursue an analysis of one of the hard issues of systemic reform from within a systems theoretical framework.

Systems theory as applied to education overlaps with, sometimes informs, sometimes complements and often provides an alternative to the dominant theoretical gestalts of educational psychology and educational policy in schools of education. Systems theory is, by nature, interdisciplinary and might, over time, come to be replace the hegemony of these traditional frameworks precisely because its ability to invite these and other frameworks -- such anthropology, sociology, mathematical biology, philosophy, folk/practitioner knowledge, computer science, and even design and the expressive arts -- to the roundtable of those committed to bringing about lived changes in inclusive, diverse and self-reflective educational activity. Worth noting, the integrative aspects of systems theory allow some of us to believe -- and our integrated mathematics and science graduate program is informed by this belief -- that systems theory can be an important framework for deeply integrating mathematics and science content both in

schools and in schools of education (e.g., “Systems” is listed as one of the “common themes” for the Project 2061 *Benchmarks* from AAAS where “Project 2061 defines science literacy broadly, emphasizing the connections among ideas in the natural and social sciences, mathematics, and technology.”).

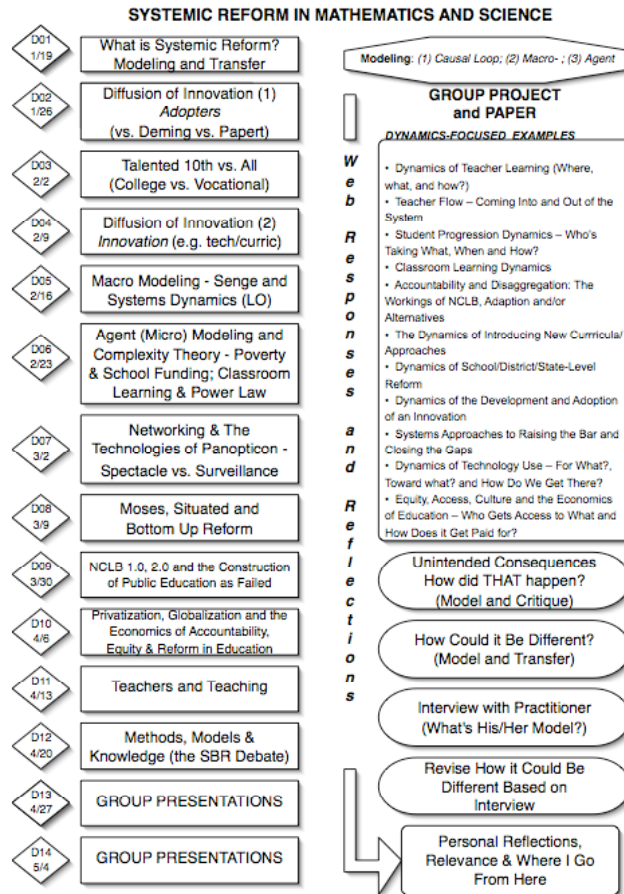
The purpose of the course as a “capstone” experience in our still relatively new graduate program is to be broadly *synthesizing* and *situating*. It is to be synthesizing because it is intended to allow you to bring together, make visible and attempt to apply much of what you have learned related to mathematics and science education. Agency implies moving beyond simply accommodating the systems of which we are part and both requires and supports our assuming an active role in shaping the living structure and related behaviors of educational systems at various levels of engagement (e.g., classrooms, curricula, assessment systems, schools, districts, etc.). A core belief of systems theory is that mental/social models play a vital role in how we organize experience. The good news is by this point in your graduate studies, you should be highly attuned to engaging how learners and teachers, in particular, build and use models (and beliefs) in relation to their activities. We will now extend this engagement with models to the activities of understanding systemic reform.

Closely associated with this, we will look to add appreciable abilities related to three kinds of **modeling** tools associated with systems theory: 1) causal-loop diagrams, 2) finite-difference modeling, and 3) agent-based modeling. These will be engaged as “strands” as we move through the course, discuss various topics of systemic reform, engage the on-going group projects and complete the culminating group and individual projects. Personal and group **modeling** and **transfer**, as summarized in the following causal-loop diagram, will provide an overarching framework for our individual and collective efforts, and our reflective critiques, related to systemic reform in mathematics and science education.



Modeling and Transfer as the Framework for the Activities of the Systemic Reform Course

Course Overview:



Readings:

Class, Date and Topic	Required Readings for Class
<p>D01 1/19</p> <p>What is Systemic Reform? Modeling and Transfer</p>	<p>Introduction to the Course Project Examples</p>
<p>D02 1/26</p> <p>Diffusion of Innovation (1) <i>Adopters</i> (vs. Deming vs. Papert)</p>	<p>(01) <i>Simulacra and Simulations</i> - Baudrillard (02) <i>Diffusion of Innovation, Chapter 7</i> – Rogers (03) Testing Trap - Elmore (04) <i>The Deming Cycle</i> (05) <i>Red Bead Experiment</i> - Deming (06) <i>Mindstorms</i> – Papert</p>
<p>D03 2/2</p> <p>Talented 10th vs. All (College vs. Vocational)</p>	<p>(07) <i>Talented 10th</i> – DuBois (08) <i>Life and Times</i> – Douglas (09) <i>Pre-AP Mathematics and Science: For Some or All</i> – Dana Center</p>

		<p>(10) <i>ACT Scores Suggest Students Not Ready for College</i> - Hanowar</p> <p>(11) <i>Left Behind, Way Behind</i> – Herbert NYT</p> <p>(12) <i>Already on Top</i> – Robinson</p> <p>(13) <i>Misplaced Math Student</i> – Loveless</p> <p>(14) <i>Listen to QuickTimes- Acting White; Blue Collar; Sci. Math & African Americans</i></p>
D04 2/9	Diffusion of Innovation (2) <i>Innovation</i> (e.g. tech/curric)	<p>(15) <i>Diffusion of Innovation</i>, Chapter 6 – Rogers</p> <p>(16) <i>Role of Assessment in a Learning Culture</i> – Shepard</p> <p>(17) <i>Research Mathematicians and Mathematics Education: A Critique</i> – Ralston</p> <p>(18) <i>All models are wrong</i> - Serman</p>
D05 2/16	Macro Modeling - Senge and Systems Dynamics (LO)	<p>(19) <i>Summary of Senge</i> - infEd</p> <p>(20) <i>Beer Game Chapter</i> – Senge</p> <p>(21) <i>Learning in and about Complex Systems</i> – Serman</p> <p>(22) <i>NISE Dynamics of Innovation</i> – Knapp (esp. pp. 22-33)</p>
D06 2/23	Agent (Micro) Modeling and Complexity Theory - Poverty & School Funding; Classroom Learning & Power Law	<p>(23) <i>Beyond the Centralized Mindset</i> – Resnick</p> <p>(24) <i>Learning as a Complex System</i> – Hills & Stroup</p> <p>(25) <i>Across the Scales of Time</i> – Lemke</p> <p>(26) <i>Equity and Adequacy in School Funding</i> - Augenblick et. al.</p> <p>(27) <i>State & Local NCLB - DoE</i></p>
D07 3/2	Networking & The Technologies of Panopticon - Spectacle vs. Surveillance	<p>(28) <i>Panopticism</i> - Foucault</p> <p>(29) <i>Dashboard Lights</i> - Supovitz & Weathers</p> <p>(30) <i>Study: Teachers Coming to Terms with Computers</i> – Sharma NYT</p>
D08 3/9	Moses, Situated and Bottom Up Reform	<p>(31) <i>Radical Equations</i> – Moses</p> <p>(32) <i>Web Excerpts Re: Robert Moses</i></p> <p>(33) <i>Re-Thinking Mathematics</i> – Tate</p> <p>(34) <i>Addressing the Disproportionate Representation</i> - Klingner</p>
D09 3/30	NCLB 1.0, 2.0 and the Construction of Public Education as Failed	<p>(35) <i>Training Teachers Review</i> – Glazer</p> <p>(36) <i>Strengthen Teacher Quality</i> - Ravitch</p> <p>(37) <i>What Works Clearinghouse</i> – Department of Education</p> <p>(38) <i>April Foolishness: The 20th Anniversary of A Nation at Risk</i> – Bracey</p> <p>(39) <i>A Nation At Risk Goals 2000: An Analysis and Critique</i> - Knudsen</p> <p>(40) <i>Tapping America's Potential</i> – Business</p>

	<p>Roundtable et. al. (41) <i>Closing the Gap</i> (ppt) – Department of Education (42) <i>No Child Left Behind</i> – College Board.com (43) <i>How Systemic Reform Harms Urban Schools</i>– Cuban (44) <i>An Insider's View of 'A Nation at Risk' and Why It Still Matters</i> – Holton (45) <i>Fact Check Obama</i> (46) <i>How to Fix NCLB</i> – Phillips (47) <i>Studies Weigh NCLB</i> – Aarons (48) <i>All Students Proficient 2014</i> – NSF (49) <i>Science and Engineering Indicators</i> (50) <i>NCLB by the Numbers</i> – NYT (51) <i>Value-Added Assessment</i> – Hershberg (52) <i>Evaluating NCLB</i> – Darling-Hammond (53) <i>Launch NCLB 2.0</i> - Ravitch</p>
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">D10 4/6</div> <div style="border: 1px solid black; padding: 5px;">Privatization, Globalization and the Economics of Accountability, Equity & Reform in Education</div> </div>	<p>(54) <i>Standardized Test – Defn in Encyclo.</i> (55) <i>Systemic Reform and Minority Student High Achievement</i> – Treisman & Surlles (56) <i>Avoidable Losses</i> - McNeil (57) <i>PME-NA</i> - Stroup (58) <i>Privatization Readings</i> (59) <i>Neo-Liberalism& Reform in Latin America</i> – Henales (60) <i>International Comparative Research</i> - Clarke</p>
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">D11 4/13</div> <div style="border: 1px solid black; padding: 5px;">Teachers and Teaching</div> </div>	<p>(61) <i>Wanted: A National Teacher Supply Policy for Education</i> Darling-Hammond (62) <i>Teacher Quality and Student Achievement</i> – D-H (63) <i>Take Down NCLB</i> – Honawar (64) <i>Better public-school math scores</i> – Lubienski (65) <i>Get Performance Pay Right</i> – Slotnik (66) <i>Majoring in Math</i> – Cavanagh (67) <i>Top-Scoring Nations</i> - Cavanagh (68) <i>Teacher shortage worsens</i> - Stutz (re: Fuller) (69) <i>Who Stays in Teaching</i> - Johnson</p>
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">D12 4/20</div> <div style="border: 1px solid black; padding: 5px;">Methods, Models & Knowledge (the SBR Debate)</div> </div>	<p>(70) <i>IES Standards</i> – DoE (71) <i>The Renaissance</i> – Shadish & Cook (72) <i>Mathematics Intervention</i> – Bryant (73) <i>Design Experiments Literature Review</i> – Hurford</p>

D13 4/27	GROUP PRESENTATIONS	Order To Be Announced
D14 5/4	GROUP PRESENTATIONS	Order To Be Announced

Requirements:

Reading: A graduate class can typically expect roughly 100 pages of reading per week. As currently planned, some weeks may have less than this.

Lead Discussion – Each of you, along with a few others from the class, will prepare for one of the classes a set of reflective questions to be sent out at least a week prior to class and posted. You and your colleagues should read the material, discuss and decide on the questions, email these to all of us, and then lead the discussion of these questions. The burden is not on presenting the material so much as starting the conversation and this typically includes providing a framework for thinking about or situating the ideas. Classes will typically begin with this discussion, then be followed by a presentation and then include some activity related to the readings, modeling, or working on group projects in ways that are informed and situated relative to the topic of that class.

Participation in Class: As reflected in the grading, we assume a participatory approach to learning and teaching and so participation in class is essential to your success.

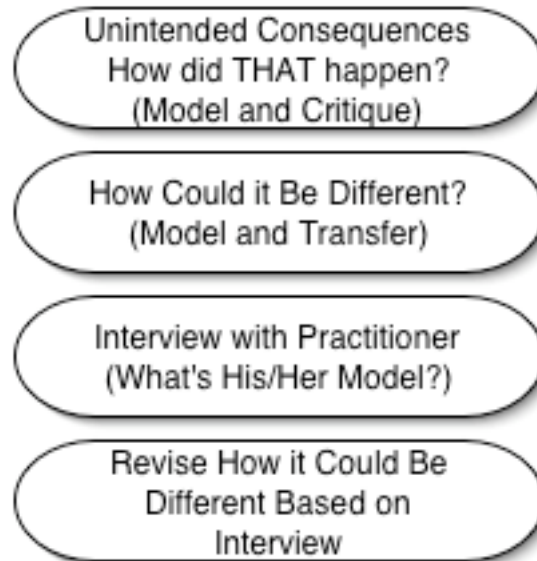
Web Response Questions and Reflection Responses:

- *Web Response Questions:* By **midnight** the night before class you must submit your responses on line to questions for that week's readings. In most cases these questions will come from the group leading the discussion that week. Prior submission is important because we will attempt to share the web responses with the group prior to class to assist with their preparation.
- *Reflection Responses:* At least seven times during the semester (roughly once every 2 weeks but not more than 2 in one week) you will need to submit an online form with reflection questions. These will include: (i) What do I now understand about systems theory or systemic reform, (ii) What do I feel uncertain about and want to understand better, (iii) Other thoughts and reflections.

Group Project: As discussed in class, in the Overview, and elsewhere, your group will prepare and give a 20-minute presentation of your Group Project. The presentations will include addressing the following FIVE elements related to whichever of the Dynamics-Focused Examples your group is addressing:

[1] Introduction – Includes stating what the project is about, why it matters or why your group was interested and situating the project relative to a brief literature review especially as located in the frameworks of this course.

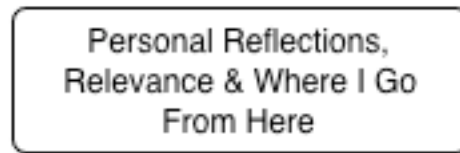
[2] – [5] Discuss each of these elements



You should submit copies of a PowerPoint presentation, models, and other related Group Project related artifacts on the day you present.

Final Paper: 70% of your paper should follow the outline of the presentation above. 30% should then draw on your Web and Reflection responses and sketch an outline of how your thinking has evolved in relation to some of the themes of the course. Connect some of these reflections to the project. And then finish with some reflections on where you might go from here

[1] – [5] above plus [6]



Grading:

Reading and Participation in Class: Attendance is required. Not participating in more than 10% of the classes will result in a letter-grade reduction.

Web and Reflection Responses: As part of preparation for class you will submit the Web Response questions by midnight the night before class. Late = ½ credit, More than a week late ¼ credit. Not prior to the end of the semester, no credit. This is a successful completion grade (credit/no credit). [30% of Grade]

Discussion: You will, possibly with a partner, lead the discussion for one of the themes (as outlined below). This should include: [10% of Grade]

- (a) Sending out questions for each of the readings in that day's theme that would be related to the key ideas in the reading (e.g., "This author, as a policy leader in Texas, wants us to pay attention to what three features of testing?") or that you will draw on in organizing the discussion. These will be integrated with other possible response questions and must be submitted a week in advance of class for posting.
- (b) You should provide an overview of the readings and being prepared to discuss any of the questions posed on the web response form or that you sent out.
- (c) Facilitate a discussion of the issues raised. Coordinate, as needed, use of models or the structuring of the conversations.
- (d) Total time should be more the 30 minutes and less than 60 minutes.

Group Project Presentation: See discussion above. [10% of Grade]

Final Paper: See Discussion above. [50 % of Grade]

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY.