MTE 653 – Theories of Mathematical Learning

Time: Tuesday, 4:00-6:30
Place: The Kaput Center/STEM Dept.

Instructor: Dr. Maria Blanton (Brekka)  
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Office Hours: T 11 – 1; W by appt; Th 11 – 1

Text:

Recommended Text:

Evaluation Procedures:
- Weekly assignments 40%
- Research Projects 40%
- Class participation and presentations 20%

It is expected that homework be turned in when it is due.

General Information:
• All written work (reports) must be in APA format.
• Attendance is expected. Please notify me in advance regarding extenuating circumstances.
• Please see http://www.umassd.edu/studenthandbook/academicregs/ethicalstandards.cfm for a statement on the university’s policy on academic dishonesty, including plagiarism.
• Please see Center for Access and Success regarding information about available academic support services, including services for learning and physically disabled students.
MTE 653 – Theories of Learning in Mathematics Education

This course examines central contemporary theories of learning psychologies and their applications to research in mathematics education. Students will explore ways of knowing and how this drives research and will critically examine the literature regarding the role and plurality of theories in mathematics education. Attention will be given to the nature of theoretical frameworks in mathematics education research as a way to help students situate their research in relevant theories of learning and understand the implications of theoretical frameworks for research design.

The course is designed to use an investigation of current big theories of learning as a framework for thinking about research perspectives in mathematics education. For practical and philosophical reasons, it does not include a study of earlier theories of learning (e.g., behaviorism).

Course Structure:

1. Overview
   a. What is a learning theory?
   b. Brief history of emergence of developmental theories of learning
   c. Relationships between ‘world views’ and views of human development

2. Situating our work: The issue of multiple theories in mathematics education

3. Big Theories and applications to research in mathematics education
   a. Constructivism
      i. Piaget
      ii. Radical (or Not) Constructivism
   b. Sociocultural and Anthropological Perspectives
      i. Vygotsky
      ii. Emergent vs. Sociocultural Perspectives
      iii. Activity theory, symbolic interaction, enactivism, situated cognition (Projects)
   c. Piaget or Vygotsky? Beyond the Individual-social Antimony in Discussions of Piaget and Vygotsky (Cole & Wertsch, 1994).
   d. Other Cognitive Science theories
      i. Information Processing Theory (in Mathematics Education)

4. Revisiting the Issue of Multiple Theories in Mathematics Education

5. Implications for Your Research: (Theoretical) Frameworks for Research Design
PROJECT DESCRIPTIONS

PROJECT #1:
Select a top-tier journal (e.g., *Journal for Research in Mathematics Education, Educational Studies in Mathematics*) and critique the use of constructivist theory in math ed research for the past decade or so. (How has it been used?, What types of research designs does it allow for (not)?, What type of results has it led to?, etc.) Synthesize your findings in a brief report (3-4 pages). Note that this doesn’t mean you need to read every article in your review in detail. However, do identify one specific study to focus on that you find particularly compelling. Prepare a class presentation (e.g., powerpoint) on your findings/synthesis from your literature review and on your highlighted study. In your presentation, be sure to address how the study you selected uses a constructivist theoretical framework and the implications of this framework for the design, analysis, etc. of the study.

You might think of this project as a type of document analysis you would do in qualitative research. As such, what is the story in your data? Additionally, keep in mind that literature reviews are not intended to result in a ‘dump’ of the literature into a report (i.e., a summary of all the studies you’ve considered). Instead, the goal is to use the literature to make an argument, or build a rationale for a particular point or thesis you want to make.

PROJECT #2:
There have been a lot of discussions in the literature (and elsewhere!) regarding whether or not and how theories of learning are connected to practices of teaching. Regardless of where you fit in these arguments, there is a fair amount of research that looks at implications of particular theories of learning in teacher practice. For example, what would ‘constructivist teaching’ look like if you have a constructivist view on learning (although some would argue that the term itself (‘constructivist teaching’) is not an appropriate construct – e.g., Cobb, 2007). Conduct a review of mathematics education research literature to explore what researchers are saying about implications of constructivism for teaching practice. Identify 3 articles that are relevant to this topic. These articles might be research studies that examine practices of teaching in a constructivist framework, or theoretical expositions on the nature of implications of constructivism for teaching.

Type a 3-4 page report that briefly synthesizes your selected studies, that addresses their implications for constructivism and teaching practice/research, and that identifies issues these studies have raised in your own thinking, whether they are theoretical points or possible lines of research. Your report should include a citation list of all the articles you considered, and reasons for why you selected the particular 3 articles as your focus articles. **Make sure I approve your list of articles before you write about your findings.**
**PROJECT #3:**
There are a lot of ‘isms’ associated with theories of learning that we can’t collectively study as a class because of time. But it would be nice for you to know a little more about these. There are four such areas identified within (or close to) sociocultural theory that warrant closer inspection:

1. activity theory
2. enactivism
3. symbolic interactionism
4. situated cognition

Select one of these areas (confirm with me, so we don’t have overlap) and prepare a class presentation (PowerPoint) to ‘teach’ the rest of the class salient points about your theory and how it has been used in mathematics education research. Your presentation should be about 30-40 minutes.

**FINAL PROJECT:**
Part of your preparation as a doctoral student entails preparing you for the professoriate—and that likely will include teaching doctoral classes. Assume you have just been hired as a new faculty member at University X. As part of your duties, you have been asked to teach a doctoral course on Theories of Learning in Mathematics Education. Design the course. The trick (now that you’ve gone through my course!) is that you have to design a course that is ‘uniquely’ yours. It needs to look different than mine (obviously, there will be some overlap). But no course is perfect—maybe there are things I focused on that you would focus on less, and vice versa. Maybe there are projects or assignments that you would have found helpful that I didn’t include—or ones that I did include that you might not. Maybe there are articles that you’ve found—on your own—to be particularly helpful and would be relevant for such a course. While you might want to include readings I’ve selected, these should not dominate your selections. Your final product should include a syllabus, outline of topics for the course, set of learning objectives, selected readings for the course, and a sample set of homework assignments/projects. Additionally, all items need to include a rationale for why you think they should be in the course (and if there is overlap with my course in some way, why you made this choice).
Reading List (in chronological order):

- Introduction, pp. 3-22, in *Theories of Developmental Psychology*

- Chapter 11, “Theories of Mathematics Education: The Role of Cognitive Analyses” (Brian Greer) in *Theories of Mathematical Learning*.


- Read pp. 25-38, 62-90 in Chapter 1, “Piaget’s Cognitive Stage Theory and the Neo-Piagetians” in *Theories of Developmental Psychology*. (If you have never studied Piaget, you should read the full chapter.)


- Chapter 20, “Varieties of constructivism: A framework for comparison” (Paul Ernest) in *Theories of Mathematical Learning*.


• “Learning Mathematics as a Meaningful Activity” – chp 7, *Theories of Mathematical Learning*, pp. 91-113


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• “Emergent and Sociocultural Views on Mathematical Activity” – chp. 1, *Theories of Mathematical Learning*, pp. 3-19.


• Information-Processing Theory, chp. 4, pp. 213-275, *Theories in Developmental Psychology*


