

N716: Doctoral Seminar on Mathematical Learning
Syllabus: Fall Semester 2017

Instructor

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A little about me: I taught middle and high school students for 9 years in L.A. and outside of Chicago. Then I did graduate work at the University of Georgia; Les Steffe was my dissertation advisor. I have taught doctoral courses on mathematical learning at Portland State University and here at IU. I love thinking about students' mathematical thinking and learning and how to orchestrate it, and I look forward to working on that with all of you this term!

Class Time and Location

Mondays 4:30-7:15 pm, Wright 2101

Office Hours

I will hold office hours by appointment. Please feel free to email at any time to arrange a time to meet.

Required Texts

Von Glasersfeld, E. (1995). *Radical constructivism: A way of knowing and learning* (Vol. 6 of Studies in Mathematics Education Series). London: Falmer. ISBN # 0 7507 0572 9

Vygotsky, L. S. (1934/1986). *Thought and language* (A. Kozulin, Trans. & Ed.). Cambridge, MA: MIT Press. ISBN #0 262 72010 6

Supplementary Texts

Piaget, J. (1970). *Genetic epistemology* (E. Duckworth, Trans.). New York: W. W. Norton.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

There will also be many other required readings (journal articles and book chapters) posted to Canvas.

Email and Canvas

I post assignments, documents shown in class, urls, readings, questions about the readings, and other important information regularly to Canvas. In addition, we will use Pages and other features of Canvas to engage in electronic discussion to wrestle with and digest ideas in the course. *You are expected to check email and Canvas regularly.*

Important Dates (note that most due dates are tentative)

August	September	October	November	December
21 First class meeting	4 Labor Day — <i>no class</i> 25 Short paper due	30 Pair presentations begin	6 Pair presentation; Submit final paper topic 13 Pair presentation 20 Thanksgiving break — <i>no class</i> 27 Pair presentation	4 Pair presentation (?) 11 Final paper due & individual paper presentations

Course Overview and Goals

This course focuses on helping you develop your understanding of mathematical learning, as well as research on mathematical learning. In doing so, the goal is to balance breadth with depth. What that means is that we will aim to investigate common approaches to characterizing and understanding learning in mathematics education (e.g., behaviorism, constructivism, situated learning). However, to characterize and understand learning requires going *deeply* into a particular theory. In just one course we won't have time to go to the same level of depth with all of the approaches that we will investigate. Your pair presentations on theories of learning outside of constructivism will allow us to achieve greater breadth, and your final course papers are one way to visit (or revisit) a particular theory in more depth, if that is of interest to you.

The approach that we will spend the most time on is constructivism. However, this is not a course to “convert” you to being a constructivist, whatever that may mean to you now or 15 weeks from now. This IS a course in which you will grapple with significant issues regarding what it means to learn and know mathematics, and to do research on learning and knowing mathematics.

Throughout this course, you are expected to deeply examine your ideas about the nature of mathematics and of what it means to learn and know mathematics. This process includes making explicit how you regard others in mathematical interactions, what you take to be mathematical knowledge, and how you might assess and account for changes in someone's mathematical knowledge. The bulk of the course will consist of readings and discussions, and we will also examine data excerpts in the context of the readings. This course is *not* a course on teaching mathematics, but we will necessarily be considering the role of teaching in understanding learning, since learning and the orchestration of learning (teaching) are very closely linked!

We will explore and discuss questions such as: Is “five” in nature? What does it mean to know or understand a particular area of mathematics—for example, to know or understand fractions? How does a person go from a state of “lesser” knowledge to a state of “greater” knowledge—for example, from knowing “just” whole number multiplication to knowing fraction multiplication? How are our own mathematical concepts involved in understanding the mathematical ideas of others, especially students? Are our own mathematical concepts sufficient to understand students' mathematical ideas? What is the role of interaction with other people in mathematical learning? What is the role of socio-historical contexts in understanding mathematical learning?

Developing your ideas about learning in mathematics education involves the following sub-goals. In my experience, progress toward all of the sub-goals evolves through reading, discussing, questioning, interacting with children/students, writing, exploring, revising, feeling frustrated (at times), feeling stumped (at times), having breakthroughs (at times), and then reading and discussing and questioning and interacting and writing and exploring and revising some more... The sub-goals include:

- To develop an internally consistent orientation to how you regard mathematical knowing and learning.
- To develop an internally consistent orientation to how you regard learners and interaction in mathematical contexts.
- To explore your developing ideas about doing research in mathematics education, which includes considering what kinds of contributions you aim to make to the field.

Description of Course Assignments

1. **Active Participation** (40 points): Prepare for each class by *thoroughly* reading articles and by completing writing assignments on time; actively contribute to class discussions by being *both* a good talker and a good listener. *If you have not done so already in your graduate program, I highly recommend starting and faithfully keeping an Endnote (or other bibliographic) file of all readings.* You should expect to read chapters and articles more than once in preparing them for class. You should also expect to submit questions for discussion for one class reading (you may work with a partner on this task), and participate once each week in wiki discussions on Canvas (for a minimum of 10 postings during the term).

2. **Short Paper** (24 points): I will assign a short paper (4-5 pages max) relatively early in the term (see calendar on page 1 for planned due dates). This assignment will be one of the following: an analysis of a reading; an interpretation of a data excerpt; a discussion of and reflection on an issue or question based on our readings and discussion. This assignment is intended to be useful to you as you grapple with ideas, and useful for me in getting to know your thinking, your interests, and your writing. The following rubric gives you a sense of what I will attend to in reading and commenting on your paper.

	Weak	Avg.	Good	Strong	
	1-2	3-4	5-6	7-8	
Quality and accuracy of connection to ideas from N716					
Depth of analysis/interpretation of ideas					
Quality of writing and paper preparation					
TOTAL					/24

3. **Pair Presentations on Other Learning Theories** (50 points): During class meetings #10-13/14 I will ask you and a partner to make a presentation on a theory of learning other than Piagetian or Vygotskian constructivism. Some theories to consider are: Behaviorism, Enactivism, Situated Learning, Distributed Cognition, and Symbolic Interactionism. Some authors to consider reading (respectively) are Edward Thorndike and E. R. Guthrie (Behaviorism); Tom Kieren, Brent Davis, and Elaine Simmt (Enactivism); Jean Lave and Etienne Wenger (Situated Learning); Roy Pea (Distributive Cognition); and Paul Cobb and Koeno Gravemeijer (Symbolic Interactionism/Cobb’s emergent perspective). Other theorists on learning in mathematics education include Richard Skemp and Jerome Bruner. More information and an evaluation rubric will be distributed later in the term. You should plan a 30-minute presentation on key ideas and important points of your selected theory of learning, followed by a 30-minute group activity to develop and discuss the main points of the theory. To help classmates prepare for your presentation, in consultation with Amy you should assign at least one reading to the class.
4. **Final Paper and Presentation** (86 points): Your final paper should (1) focus on developing your understanding of and ability to characterize mathematical learning, as well as theories of mathematical learning; and (2) help you define and explore your interests in mathematics education—that is, the paper should be something you find useful in your work during your program and beyond. You should expect to do some extra reading for this paper to deepen your understanding of issues discussed in the course and/or to broaden your understanding. For example, you could explore a theory of learning that we have not discussed, extending your assignment in #3 above; you could compare and contrast two theories of learning; you could delve deeper into a theory we have discussed by examining a couple of other studies and/or data. By November 6, each student should select a topic of interest and submit a paragraph about it. Develop the topic in about 15 pages, double-spaced, and prepare a 30-minute presentation of the topic for the class to be given during exam week. The presentation should be modeled on professional presentations that you may have already given, or will give in the future, at academic conferences (e.g., the annual conference of the Psychology of Mathematics Education-North America [PME-NA], the Research Conference of the National Council of Teachers of Mathematics, etc.). Details about this assignment, including topic suggestions and evaluation criteria, will be discussed during the term.

Calculation of Final Grades

As outlined above, the points for the course total to 200 points as follows:

Wiki postings: 3 pts each, x 10 = 30 pts		Pair Presentations on another theory of learning: 50 pts
Discussion questions (once per term): 10 pts		Final Course Paper and Presentation: 86 pts
Short paper: 24 pts		

Course grades are assigned on a typical 90-80-70-60% scale except that the cut-off for an A is 95%. Cut-offs for “+” grades are at 87-77-67%, and cut-offs for “-” grades below A- are at 83-73-63%.

Tentative Reading List and Schedule

Date	Reading due	Broad Topic
Aug 21	Von G, ch. 1 Piaget, J. (1970). <i>Genetic epistemology</i> (E. Duckworth, Trans.). New York: W. W. Norton. <i>Excerpt</i> : ch. 1, pp. 1-19.	Constructivism, both Piagetian and Vygotskian (thru Oct 23)
Aug 28	*Von G, ch. 3 Steffe, L. P. & Olive, J. (2010). Perspectives on children's fractional knowledge. In L. P. Steffe & J. Olive (Eds.), <i>Children's Fractional Knowledge</i> (pp. 13-25). New York: Springer. [This is ch. 2]	
Sept 4	LABOR DAY—NO CLASS !	
Sept 11	Piaget, J. (1964). Development and learning. In R. E. Ripple & V. N. Rockcastle (Eds.), <i>Piaget rediscovered: A report of the conference on cognitive studies and curriculum development</i> (pp. 7-20). Ithaca, NY: School of Education, Cornell University. *Steffe, L. P. (1994). Children's construction of meaning for arithmetical words: A curriculum problem. In D. Tirosh (Ed.), <i>Implicit and explicit knowledge: An educational approach</i> (pp. 131-168). Norwood, NJ: Ablex.	
Sept 18	Continue with Steffe (1994) Steffe, L. P. & Olive, J. (2010). Perspectives on children's fractional knowledge. In L. P. Steffe & J. Olive (Eds.), <i>Children's Fractional Knowledge</i> (pp. 27-47). New York: Springer. [This is ch. 3] ← we will read only pp. 42-47 Von G, ch. 5	
Sept 25	*Von G, ch. 6 Vygotsky, chs. 1 (all, pp. 1-11) & 5, parts I-III, pp. 96-110 Vygotsky-Piaget timeline	
Oct 2	*Vygotsky, ch. 6, parts I and II, pp. 146-174 Hackenberg, A. J., & Tillema, E. S. (2009). Students' whole number multiplicative concepts: A critical constructive resource for fraction composition schemes. <i>Journal of Mathematical Behavior</i> , 28, 1-18.	
Oct 9	Continue discussion of Hackenberg and Tillema (2009). *Vygotsky, ch. 6, parts III-V, pp. 174-209 Piaget's comments on Vygotsky's critique: http://www.marxists.org/archive/vygotsky/works/comment/piaget.htm Lambdin, D. V., & Walcott, C. (2007). Changes through the years: Connections between psychological learning theories and the school mathematics curriculum. In Strutchens, M. E., & Martin, W. G. (Eds.), <i>The learning of mathematics (69th yearbook)</i> (pp. 3-25). Reston, VA: National Council of Teachers of Mathematics.	
Oct 16	Cobb, P., Perlwitz, M., & Underwood, D. (1996). Constructivism and activity theory: A consideration of their similarities and differences as they relate to mathematics education. In H. Mansfield, N. A. Pateman & N. Bednarz (Eds.), <i>Mathematics for tomorrow's young children</i> (pp. 10-58). Dordrecht, The Netherlands: Kluwer. Davydov, V. V. (1995). The influence of L. S. Vygotsky on education theory, research, and practice. <i>Educational Researcher</i> , 24(3), 12-21.	
Oct 23	Van Oers, B. (1996). Learning mathematics as a meaningful activity. In L. P. Steffe, P. Nesher, P. Cobb, G. A. Goldin & B. Greer (Eds.), <i>Theories of mathematical learning</i> (pp. 91-113). Mahwah, NJ: Erlbaum. Steffe, L. P. (1996). Social-cultural approaches in early childhood mathematics education: A discussion. In H. Mansfield, N. A. Pateman & N. Bednarz (Eds.), <i>Mathematics for tomorrow's young children</i> (pp. 79-99). Dordrecht, The Netherlands: Kluwer. Thompson, P. W. (1999). Some remarks on conventions and	

	representations. Paper presented at the <i>Twenty-first Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education</i> . Cuernavaca, Mexico.	
Oct 30	Pair presentation 1 *Cobb, P. (2007). Putting philosophy to work. In F. K. J. Lester (Ed.), <i>Second Handbook of Research on Mathematics Teaching and Learning</i> (pp. 3-38). Charlotte, NC: Information Age. Supporting readings TBA	Other Theories of Learning (starts on Oct 30)
Nov 6	Pair Presentation 2 Supporting readings TBA	
Nov 13	Pair presentation 3 Supporting readings TBA Von G, ch. 7	
Nov 20	THANKSGIVING – NO CLASS	
Nov 27	Pair Presentation 4 Supporting readings TBA Von G, ch. 10	
Dec 4	Pair Presentation 5 (?) Supporting readings TBA Follow-up on selected prior readings	
Dec 11	Our class meeting during finals week will be <u>extended</u> to accommodate paper presentations.	Paper Presentations

Policies

- *Attendance (including promptness) and Participation:* Attendance and active participation are essential in this discussion-based class, both for you to learn and so that others may benefit from your input. The ideas and concepts we work on cannot easily be built up through someone else’s class notes. If circumstances arise that cause you to miss class, you will be responsible for making up all work missed during your absence and for all announcements made in class. Most likely this will mean completing an extra assignment. Absences and tardiness may affect your grade and, more importantly, your understanding.
- *If you do miss a class meeting:*
 - (1) Talk in detail with at least one classmate about what we did during class. Preferably talk with two classmates, so you get more than one perspective.
 - (2) Check Canvas for all new information (wiki posts, announcements, etc.).

You are responsible for any and all information that occurred during your absence.
- *Religious Holidays:* The policy at Indiana University is that instructors must reasonably accommodate students who want to observe their religious holidays at times when academic requirements conflict with those observances. If a conflict with a religious observance exists, a student must make a request to the instructor for a reasonable accommodation for that observance by the end of the second week of the course. Any relevant change to the course calendar affords a new opportunity to make such a request in a timely manner. The request is to be made in writing on a standardized form available at this website: <http://vpfaa.indiana.edu/forms/index.shtml> (scroll down).
- *Academic Misconduct:* All university policies concerning academic misconduct will be strictly followed and can be found at <http://registrar.indiana.edu/policies/academic-misconduct.shtml>. In particular, it is my obligation to report any academic misconduct at the university level. Good information about plagiarism can be found at <http://education.indiana.edu/~frick/plagiarism/>. **It is your responsibility to be familiar with these policies.**
- *Policy on Late Assignments:* I expect that assignments will be turned in by the announced due dates and times. Assignments are to be submitted online using Canvas, unless otherwise noted. I will accept

assignments after the due date, but your grade will decrease by up to 10% of the allocated points for each day the assignment is late.

- *Policy on Computer Accidents:* Please make sure you save your work frequently and keep backup copies of all or your files; I recommend having at least one external hard drive for this purpose! **Computer accidents, while very unfortunate, are not an acceptable excuse to avoid penalties for late work.**
- *Cell phones:* **Please turn cell phones off during class.** If you have an unusual circumstance, please inform me.
- *Policy on Sexual Misconduct:* As your instructor, one of my responsibilities is to create a positive learning environment for all students. Title IX and IU's Sexual Misconduct Policy prohibit sexual misconduct in any form, including sexual harassment, sexual assault, stalking, and dating and domestic violence. If you have experienced sexual misconduct, or know someone who has, the University can help. If you are seeking help and would like to speak to someone confidentially, you can make an appointment with:
 - The Sexual Assault Crisis Services (SACS) at (812) 855-8900 (counseling services)
 - Confidential Victim Advocates (CVA) at (812) 856-2469 (advocacy and advice services)
 - IU Health Center at (812) 855-4011 (health and medical services)

It is also important that you know that Title IX and University policy require me to share any information brought to my attention about potential sexual misconduct, with the campus Deputy Title IX Coordinator or IU's Title IX Coordinator. In that event, those individuals will work to ensure that appropriate measures are taken and resources are made available. Protecting student privacy is of utmost concern, and information will only be shared with those that need to know to ensure the University can respond and assist. I encourage you to visit stopsexualviolence.iu.edu to learn more.

Some On-Line Resources

Constructivist Foundations: <http://www.univie.ac.at/constructivism/journal/>

Ernst von Glasersfeld: <http://www.vonglasersfeld.com/>

Ernst von Glasersfeld on youtube: <http://www.youtube.com/watch?v=zTsY3TosVX0>

<http://www.youtube.com/watch?v=YozoZxblQx8> (this one is about constructivism and teaching)

Piaget's 1962 comments on Vygotsky's criticism of Piaget's work:

<http://www.marxists.org/archive/vygotsky/works/comment/piaget.htm>

What is activity theory? http://carbon.cudenver.edu/~mryder/itc_data/act_dff.html

An overview of behaviorism: <http://plato.stanford.edu/entries/behaviorism/>

...let's compile some more...