Essential Readings in Mathematics Education Research
Instructors: K. Subramaniam, Shweta Naik

Credits: 4

Duration: 18 weeks [Total sessions 31]

Time: Monday and Wednesday from 3:30 pm to 5:30 pm

Beginning Date: 17th August 2016

End Date: 14th December 2016

No classes on: 5th September, 12th September, 12th October, 14th November, and 21st November

The aim of the course is to introduce participants to the mathematics education literature, by a close study of some of the writings that have had the highest impact in the field. Participants will carefully read the publications listed, participate in informal discussions and write critical summaries of the articles. Along with this engaging in *doing* mathematics, would be an added aspect of the course. Each participant will also pursue a topic of interest in the research literature and study representative readings to develop and submit a term paper.

Given below is a week-wise schedule of sessions, followed by the detailed list of the readings categorized in themes prominent in mathematics education.

List of Sessions

Date (Day)	Title of the Reading	Instructor and Format of the Session
Week 1		
17th August (Wed)	Mathematics – a very short introduction	Shweta Naik, Advance reading and prompts
Week 2		
22nd August (Mon)	Learning through Geometric Constructions	K. Subramaniam, Working with problems
24th August (Wed)	Problem Solving in Mathematics	Shweta Naik, Working with problems
Week 3		
29th August (Mon)	Benny's Conceptions of Rules and Answers in IPI Mathematics.	Ruchi Kumar, Advance reading and prompts
31st August	Problem Solving in Mathematics	Aniket Sule, Working with

(Wed)		problems
Week 4		
7th September (Wed)	When good teaching leads to bad results: The disasters of 'well-taught' mathematics courses	Shweta Naik, Advance reading and prompts
Week 5		
14th September (Wed)	Using a base-ten blocks learning/teaching approach for first- and second-grade place-value and multi-digit addition and subtraction.	K. Subramaniam, Advance reading and prompts
19th September (Mon)	Learning through Problems: Number Sense	K. Subramaniam, Working with problems
Week 6		
21st September (Wed)	Conceptions of school algebra and uses of variables	K. Subramaniam, Advance reading and prompts
Week 7		
26th September (Mon)	Purposes in school algebra	Shweta Naik, Advance reading and prompts
28th September (Wed)	Children's difficulties in beginning algebra	K. Subramaniam, Advance reading and prompts
Week 8		
3rd October (Mon)	Why is algebra important to learn?	Shweta Naik, Advance reading and prompts
5th October (Wed)	Learning through Problems: Algebra	K. Subramaniam, Working with problems
Week 9		
10th October (Mon)	The arithmetic-algebra connection: A historical-pedagogical perspective.	Shweta Naik, Advance reading and prompts
Week 10		
17th October (Mon)	The learning and teaching of Algebra: Ideas, Insight and Activities	K. Subramaniam, Advance reading and prompts
19th October	Recent Trends in Algebra Research	Rakhi Banerjee, Talk and

(Wed)		discussion
Week 11		
24th October (Mon)	Drawing on a Theoretical Model to Study Students' Understandings of Fractions	Shweta Naik, Advance reading and prompts
26th October (Wed)	Integrating the measure and quotient interpretation of fractions.	Ruchi Kumar, Advance reading and prompts
Week 12		
31st October (Mon)	Ratio and proportion: Connecting content and children's thinking	K. Subramaniam, Advance reading and prompts
2nd November (Wed)	Learning through Problems	Shweta Naik, Working with problems
Week 13		
7th November (Mon)	Fractions: A realistic approach	K. Subramaniam, Advance reading and prompts
9th November (Wed)	Freudenthal, H. (1986). *Didactical phenomenology of mathematical structures* (Vol. 1). Springer Science & Business Media.	Shweta Naik, Advance reading and prompts
Week 14		
14th November (Mon)	Generating Representations: Division By Fractions	Shikha Takker, Advance reading and prompts
16th November (Wed)	Exploring New Knowledge: The Relationship between Perimeter and Area	Ruchi Kumar, Advance reading and prompts
Week 15		
23rd November (Wed)	Teachers' Subject Matter Knowledge: Profound Understanding of Fundamental Mathematics	Shikha Takker, Advance reading and prompts
Week 16		
28th November (Mon)	Those who understand knowledge growth in teaching	Shweta Naik, Advance reading and prompts
30th November	Teaching problems and the problems	Shweta Naik, Advance

(Wed)	of teaching	reading and prompts
Week 17		
5th December (Mon)	The teaching gap	Shikha Takker, Advance reading and prompts
7th December (Wed)	When the rules of discourse change, but nobody tells you: Making sense of mathematics learning from a commognitive standpoint	K. Subramaniam, Advance reading and prompts
Week 18		
12th December (Mon)	Socio-mathematical Norms, Argumentation, and Autonomy in Mathematics	Jeenath Rahaman, Advance reading and prompts
14th December (Dec)	Students' foregrounds and the politics of learning obstacles	Rossi D'Souza, Advance reading and prompts

List of Readings

Doing Mathematics to Understand the Nature of Mathematics

1. Gowers, T. (2002) Mathematics – a very short introduction. OUP. Chapters 1, 2, (17 pages)
2. Learning through Geometric Constructions – *doing* Mathematics session by K. Subramaniam
3. Problem Solving in Mathematics – *doing* Mathematics session by Shweta Naik
4. Mathematics Problem solving session – *doing* Mathematics session by Aniket Sule
5. Mathematics Problem solving session – *doing* Mathematics session by Prithwijit De

Students' Conceptions of and about Mathematics

6. Erlwanger, S.H. (1973) Benny's Conceptions of Rules and Answers in IPI Mathematics. *Journal of Children's Mathematical Behaviour 1*, Autumn 1973. In T.P. Carpenter, J.A. Dossey, & J. Kochler (eds.) *Classics in mathematics education research*, Reston, VA: NCTM.
7. Schoenfeld, A. H. (1988). When good teaching leads to bad results: The disasters of 'well-taught' mathematics courses. *Educational psychologist, 23*(2), 145-166. – SN

Developing Number sense

8. Learning through Problems – *doing* Mathematics session by K. Subramaniam

9. Fuson, K. C., & Briars, D. J. (1990). Using a base-ten blocks learning/teaching approach for first-and second-grade place-value and multidigit addition and subtraction. *Journal for research in mathematics education*, 180-206.

Algebra Education

10. Usiskin, Z. (1988). Conceptions of school algebra and uses of variables. *The ideas of algebra, K-12*, *8*, 19.

11. Bell, A. (1995). Purpose in school algebra. *Journal of Mathematical Behavior*, 14, 41-73.

12. Booth, L. R. (1988). Children's difficulties in beginning algebra. *The ideas of algebra, K-12*, 20-32.

13. Usiskin, Z. (1995). Why is algebra important to learn? *American Educator*, *19*(1), 30-37.

14. Learning through Problems – *doing* Mathematics session by K. Subramaniam

15. Subramaniam, K., & Banerjee, R. (2011). The arithmetic-algebra connection: A historical-pedagogical perspective. In Cai, J. & Knuth, E. (Eds.), *Early Algebraization: A Global Dialogue from Multiple Perspectives*, pp. 87-107. Springer: Berlin Heidelberg.

16. Recent Trends in Education Research, talk by Rakhi Banerjee

17. Arcavi, A., Drijvers, P., & Stacey, K. (2016). *The Learning and Teaching of Algebra: Ideas, Insights and Activities*. Routledge.

Fractions, Ratio and Proportions

18. Charalambous, C.Y. and Pitta-Pantazi, D. (2007) 'Drawing on a Theoretical Model to Study Students' Understandings of Fractions', *Educational Studies in Mathematics*, 64, pp 293-316. – SN

19. Naik, S., & Subramaniam, K. (2008). Integrating the measure and quotient interpretation of fractions. In *International group of the psychology of mathematics education: Proceedings of the Joint Meeting of PME* (Vol. 32, pp. 17-24). – RK

20. Lamon, S. J. (1993). Ratio and proportion: Connecting content and children's thinking. *Journal for research in mathematics education*, 41-61. – KS

21. Learning through Problems – *doing* Mathematics session by Shweta Naik

22. Streefland, L. (1993). Fractions: A realistic approach. *Rational numbers: An integration of research*, 289-325.

23. Freudenthal, H. (1986). *Didactical phenomenology of mathematical structures* (Vol. 1). Springer Science & Business Media.

Mathematics Teaching and Knowledge needed to Teach Mathematics

24. Ma, L. (1999) *Knowing and teaching Elementary mathematics*, London: Lawrence Erlbaum Associates publisher. (Foreword, Introduction, Chapter 3: Generating Representations: Division By Fractions, Chapter 4: Exploring New Knowledge: The Relationship between Perimeter and Area, Chapter 5: Teachers' Subject Matter Knowledge: Profound Understanding of Fundamental Mathematics)

25. Shulman, L. (1986). Those who understand knowledge growth in teaching, *Educational Researcher. V*ol. 15, No. 2, pp. 4-14.

26. Lampert, M. (2001) *Teaching problems and the problems of teaching*. US: Yale University Press. (Chapter 2: An Instance of Teaching Practice)

27. Stigler, J. W. & Hiebert, J. (1999) *The teaching gap*, The Free Press. (Chapter 3: Images of Teaching, Chapter 6: Teaching is a Cultural Activity)

Theoretical Papers

28. Sfard, A. (2007). When the rules of discourse change, but nobody tells you: Making sense of mathematics learning from a commognitive standpoint. *The Journal of the Learning Sciences, 16*(4), 565-613. <<KS to change>>

29. Yackel, E. & Cobb, P. (1996). Sociomathematical Norms, Argumentation, and Autonomy in Mathematics. *Journal for Research in Mathematics Education.* 27(4), 458-477.

30. Skovsmose, O. (2007) Students' foregrounds and the politics of learning obstacles. In E. U. Gellert and E. Jablonka (Eds.) *Mathematization and demathematization – social, philosophical and educational ramifications*. (8 pages)

Assessment:

- Discussion about each of the readings (25%)

- Summary of at least five readings (25%)

- Term paper based on a selected reading exploring selected cited references and forward citations of the paper (30%)

- Summary – opinion (not more than a page) on the Moodle for every reading (20%)