

# Theoretical perspectives on school mathematics

**Credits: 4 (Elective course)**

**Instructors: K. Subramaniam, Tathagata Sengupta, Jayasree Subramanian**

Duration: 15<sup>th</sup> February to 31<sup>st</sup> May 2019

How is mathematics in the school curriculum conceptualized? What is the connection of school mathematics to the discipline of mathematics on the one hand, and to the lived experiences of school students on the other? The course will introduce participants to some influential contemporary theories reflecting three broad approaches: ethnomathematics, critical mathematics education and social-constructivism. School mathematics is thought of as mathematics done up to the higher secondary school level.

## **Unit 1: Ethnomathematics (Led by JS)**

This unit will investigate the notion of “Ethnomathematics” as defined by Ubirathen D’Ambrosia and its relevance to Mathematics Education. It will engage with the range of meanings and use associated with Ethnomathematics, look at a few examples of how Ethnomathematics has been brought into school curriculum and what purpose such inclusion served. Finally, the unit will seek to make sense of the continuing debate between those who see the relevance of Ethnomathematics for teaching and learning of mathematics in schools and those who are skeptical.

## **Readings**

1. d’Ambrosio, Ubiratan. (1985) Ethnomathematics and Its Place in the History and Pedagogy of Mathematics For the Learning of Mathematics, Vol. 5, No. 1 (Feb., 1985), pp. 44-48
2. d’Ambrosio, Ubiratan. (1999) In Focus Mathematics, History, Ethnomathematics and Education: A comprehensive program
3. Ubiratan d’ Ambrosio & Beatriz Silva d’ Ambrosio (2013) The role of Ethnomathematics in Curricular Leadership Mathematics Education, Journal of Mathematics Education at Teachers College Leadership Issue, Spring-Summer Vol 4.
4. David Davison (1989) An Ethnomathematics Approach to teaching Language Minority students
5. Arthur Powel (2001) Seeding Ethnomathematics with Oware : Sankofa NCTM
6. Arthur Powel (2002) Ethnomathematics and the challenges of racism in mathematics education in Proceedings of the third MES conference, pp 1-15
7. Gelsa Knijnik (1998) Ethnomathematics and the Brazilian Landless People Education, First International Conference on Ethnomathematics
8. Gelsa Knijnik (2002) Culture and Politics of Knowledge in Mathematics Education, For the Learning of Mathematics 22, pp11-14
9. Paulus Gerdes (1994) Reflections on Ethnomathematics, For the Learning of Mathematics 14, pp19-22
10. Adam, Alanguli, & Bill Barton comment on Rowland & Carson (2003, 2004) and response ‘Where would formal academic mathematics stand in a curriculum informed by Ethnomathematics’ ESM 6

11. Vithal & Skovsmose (1997) End of Innocence: A critique of 'Ethnomathematics' ESM 34, pp131-157
12. A Pais & M Mesquita (2013) Ethnomathematics in nonformal educational settings: The Urban boundaries Project *Revista Latinoamericana de Etnomatemática*, 6(3), pp 134-144

### **Unit 2: Critical Mathematics Education (Led by TS and JS)**

The main objective of this unit would be to critically engage with the discipline of mathematics focusing on the implication of the disciplinary knowledge for teaching and learning mathematics in school, on the connection between mathematics education and social justice, and on mathematics education for emancipation. Recent critiques of the notion of inclusion or “mathematics for all” will also be discussed.

1. Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. Taylor & Francis.
2. Gutstein, E. (2016). “Our issues, our people—Math as our weapon”: Critical mathematics in a Chicago neighborhood high school. *Journal for Research in Mathematics Education*, 47(5), 454-504.
3. Ole Skovsmose (2007) Students Foregrounds and the politics of Learning Obstacles. In Uwe Gellert & Eva Jablonka (Eds.) *Mathematization and Demathematization*
4. Uwe Gellert & Eva Jablonka (2007) Introduction. In Uwe Gellert & Eva Jablonka (Eds.) *Mathematization and Demathematization*
5. Paola Valero (2007) What has power got to do with Mathematics Education. *Philosophy of Mathematics Education Journal*, 21(13), 1-13.
6. Ole Skovsmose (2011) *An Invitation to Critical Mathematics Education*. Sense Publishers
7. Danny Martin (2013) Race, Racial Projects and Mathematics Education. *JRME* Vol 44. No 1 pp 316-333
8. P Ernest (2002) Empowerment in Mathematics Education
9. R Gutierrez (2012) The Socio political turn in mathematics education *JRME* Vol 44 No.1 pp 37-68
10. B Atweh (2009) Socially Response-able mathematics education: Implications of an Ethical Approach. *Eurasia Journal of Mathematics, Science & Technology Education*, 2009, 5(3), 267-276

### **Unit 3: Social-constructivist Approaches (Led by KS)**

In this unit, we will engage with Anna Sfard’s commognitive framework of mathematics and mathematical learning. The following text will be covered in detail and in full.

- Sfard, A. (2008). *Thinking as communicating: Human development, the growth of discourses, and mathematizing*. Cambridge University Press.

### **Unit 4: Applying the commognitive framework to algebra education (Led by KS)**

This unit will consist of two parts. In the first part, participants will be exposed to theories of algebra education that have been developed by researchers. In the second part, participants will present seminars where they will apply the commognitive framework to understand algebra teaching and learning.

- Sfard, A., & Linchevski, L. (1994). The gains and the pitfalls of reification—the case of algebra. In *Learning mathematics* (pp. 87-124). Springer, Dordrecht.
- Sfard, A. (1995). The development of algebra: Confronting historical and psychological perspectives. *The Journal of Mathematical Behavior*, 14(1), 15-39.
- Sfard, A. (1991). On the dual nature of mathematical conceptions: Reflections on processes and objects as different sides of the same coin. *Educational studies in mathematics*, 22(1), 1-36.
- Mason, J. (1996). Expressing generality and roots of algebra. In *Approaches to algebra* (pp. 65-86). Springer, Dordrecht.
- Mason, J. (1989). Mathematical abstraction as the result of a delicate shift of attention. *For the learning of mathematics*, 9(2), 2-8.
- Arcavi, A., Drijvers, P., & Stacey, K. (2016). *The Learning and Teaching of Algebra: Ideas, Insights and Activities*. Routledge.

#### Notes

- The reading list is provisional and may be modified as the course progresses.
- Units 1 and 2 will run concurrently followed by units 3 and 4.
- There will be two meetings per week, on Mondays and Fridays from 11 am to 1 pm.
- The first session will be on Feb 15, Friday 11 am to 1 pm. (List of readings for this session will be sent by email.)

#### Assessment

- Class discussion
- Seminar presentations
- Term paper