Introduction to Science, Technology and Mathematics Education (STME) Research

Instructors: Shubhangi Bhide, Aniket Sule

Credits: 2

Duration: 13 weeks, with one contact session of 2 h per week

Schedule: Starting August 10, 2016, every Wednesday 11:30 -13 :30 hrs

Summary:

The reading course introduces participants to examples of STME research literature related to the five themes given below. The objective is to provide opportunity for study of acknowledged writings in the area and facilitate understanding about the needs, motivations, issues and contexts in STME research. There will be two sessions per theme. In the first session, participants will collectively share responsibility of leading group discussions through different parts of a research publication. The second session for each theme will include individual presentations by participants, giving overview and highlights, on a research publication selected by them from the readings list. Participants will also write and submit a critical summary on the research presented by them within two days of the presentation.

(Further details and any queries regarding the two sessions will be explained at the first meeting for this course).

Assessment**:**
Students will be assessed based on their (i) participation in / leading group discussions (40 %), (ii) presentations (40 %) and (iii) written summaries (20 %). Scores of (i) and (ii) above will comprise of self-, peer- and instructor assessments.

Introductory session

1. Anderson, C. (2007). Perspectives on science learning. In S. K. Abell & N. G. Lederman (Eds.). *Handbook of Research on Science Education*, pp.3-30. London: Taylor & Francis.

Themes and Reading list

I. Education and Society

2. Krishna, K. (2010, April 24). Culture, state and girls: An educational perspective. *Economic and Political Weekly,* 45 (17), pp. 75-84.
3. Fennema, E. H., & Sherman, J. A. (1978). Sex-related differences in mathematics achievement and related factors: A further study. *Journal for Research in Mathematics Education*, 9 (3), 189-203.
4. Reiss, M. (2008). Should science educators deal with the science/religion issue? *Studies in Science Education*, 44 (2), 157-186.
5. Greer, B. (2011). What is Mathematics Education for? In K. Subramaniam & A. Majumdar (Eds.) epiSTEME 3 – *International Conference to Review Research in Science, Technology and Mathematics Education*. India: MacMillan.
6. George, A. (2013). Illustrating social studies in textbooks. *Contemporary Education Dialogue.* 10 (1), 147–153.
7. Mohite, S. (2014, May 31). Critical thinking on caste among school children in Maharashtra: Case study of two schools in Chiplun. *Economic and Political Weekly*. 49 (22), pp. 139-144.
8. Aikenhead, G. & Jegede, O. (1999). Cross-cultural science education: A cognitive explanation of a Cultural Phenomenon. *Journal of Research in Science Teaching*, 36 (3), 269–287.
9. Hodson, D. (2003). Time for action: Science education for an alternative future. *International Journal of Science Education,* 25 (6), 645-670.

II. Out-of-school and connections to the real world

10. Rennie, L. (2007). Learning science outside of school. In S. K. Abell & N. G. Lederman (Eds.). *Handbook of Research on Science Education*, pp. 125-167. London:Taylor & Francis.
11. Bose, A. & Kantha, V. (2014). Influence of socio-economic background and cultural practices on mathematics education in India: A contemporary overview in historical perspective. *ZDM Mathematics Education*, 46 (7), 1073-1083.
12. Tunnicliffe, S. D., Lucas, A. M. and Osborne, J. F. (1997). School visits to zoos and museums: a missed educational opportunity? *International Journal of Science Education,* 19 (9), 1039-1056.
13. Braund, M. & Reiss, M. (2006). Towards a more authentic science curriculum: The contribution of out-of-school learning. *International Journal of Science Education*, 28 (12), 1373-1388.
14. Milne, C. (1998). Philosophically correct science stories? Examining the implications of heroic science stories for school science. *Journal of Research in Science Teaching*, 35 (2), 175-187.
15. Falk, J. & Dierking, L. (2012). Lifelong science learning for adults: The role of free-choice experiences, In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second International Handbook of Science Education*, Part 1, pp. 1063-1079. Germany: Springer.

16. Allchin, D. (1999). Values in Science: An educational perspective. *Science & Education*, 8 (1), 1-12.
17. Raveendran, A., & Chunawala, S. (2015). Reproducing Values: A Feminist Critique of a Higher Secondary Biology Textbook Chapter on Reproductive Health. *Indian Journal of Gender Studies***,** 22 (2), 194-218.

III. Teacher Education

18. Wallace, J. & Loughran, J. (2012). Science Teacher Learning, In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second International Handbook of Science Education*, Part 1, pp. 295-306. Germany: Springer.
19. Batra, P. (2013). Teacher Education and Classroom Practice in India: A Critique and Propositions. In S. Chunawala & Kharatmal M. Eds.). *The epiSTEME Reviews - Research Trends in Science, Technology and Mathematics Education*, Volume 4, pp. 137-158 India: Narosa.
20. Brown, P., Friedrichsen, P. & Abell, S. (2013). The development of prospective secondary biology teachers PCK. *Journal of Science Teacher Education*, 24 (1), 133-155.
21. Kang, E., Bianchini, J. & Kelly, G. (2013). Crossing the border from science student to science teacher: Preservice teachers' views and experiences learning to teach inquiry. *Journal of Science Teacher Education*, 24 (3), 427-227.
22. Crippen, K. (2012). Argument as professional development: Impacting teacher knowledge and beliefs about science. *Journal of Science Teacher Education*, 23 (8), 847-866.
23. Lumpe, A., Czerniak, C., Haney, J., & Beltyukova, S. (2012). Beliefs about teaching science: The relationship between elementary teachers' participation in professional development and student achievement. *International Journal of Science Education*, 34 (2), 153-166.
24. Stigler, J. & Hiebert. J. (2009). Images of teaching, In *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: Simon and Schuster Inc.

IV. Student Conceptions

25. Mahajan, B. S. & Chunawala, S. (1999). Indian secondary students' understanding of different aspects of health. *International Journal of Science Education*, 21 (11), 1155-1168.
26. Rowell, P. (2004). Developing technological stance: Children's learning in technology education, *International Journal of Technology and Design Education*, 14 (1), 45–59.
27. Duit R. & Treagust D. (2012). How can conceptual change contribute to theory and practice in science education ?, In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second International Handbook of Science Education*, Part 1, pp. 107-118. Germany: Springer.
28. Mintzes, J., Wandersee, J. & Novak, J. (2001) Assessing understanding in biology. *Journal of Biological Education*, 35 (3), 118-124

29. Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education*, 66 (2), 211-227.
30. Eilks, I., Moellering, J., Valanides, N. (2007) Seventh-grade students' understanding of chemical reactions: Reflections from an action research interview study. *Eurasia Journal of Mathematics, Science & Technology Education*. 3 (4), 271-286.
31. Vosniadou, S. (2012). Reframing the Classical Approach to Conceptual Change: Preconceptions, Misconceptions and Synthetic Models, In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second International Handbook of Science Education*, Part 1, pp. 119-130. Germany: Springer.

V. Classroom interaction and assessment

32. Ramadas, J. & Kulkarni, V. (1982). Pupil participation and curriculum relevance. *Journal of Research in Science Teaching*, 19 (5), 357-365.
33. Jones, A. (2012). Technology in science education: context, contestation and connection, In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second International Handbook of Science Education*, Part 1, pp. 811-822. Germany: Springer.
34. Spendlove, D. (2005). Creativity in education: a review. *Design and Technology Education: An International Journal*, 10 (2), 9-18.
35. Larson, J. O (1995). Fatima's rules and other elements of an unintended chemistry curriculum. Paper presented at American Education Research Association (AERA), San Francisco. Retrieved from: http://files.eric.ed.gov/fulltext/ED387318.pdf.
36. Kawalkar, A. & Vijapurkar J. (2013). Scaffolding science talk: The role of teachers' questions in the inquiry classroom. *International Journal of Science Education*, 35 (12) 2004-2027.
37. Osborne, J. (2012). The role of argument: learning how to learn in school science. In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second International Handbook of Science Education*, Part 1, pp. 933-949. Germany: Springer.
38. Sadler, T. & Dawson, V. (2012). Socio-scientific issues in science education: contexts for the promotion of key learning outcomes, In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second International Handbook of Science Education*, Part 1, pp. 799-810. Germany: Springer.