

Research Methodology: Advanced Course on STEM Education Research Course Outline

January-April 2023

Course title:	Research Methodology: Advanced Course on STEM Education Research (Course Code: SCE401.2)
Type of course:	Core course (4 credits)
Course requirement:	Students should have credited the foundational course of education research methods
Course duration:	14 weeks
Meeting time	Weekly 4 hours meeting spanned in two sessions
Course learning goals	<ul style="list-style-type: none"> • Integrating multiple worldviews in the conduct of qualitative education research • Understanding design of quantitative surveys stemmed from theoretical & qualitative foundations • Applying self-reflexivity in the understanding of research methods in science education research • Critically evaluate theoretical/ paradigmatic positions and understand how theoretical positions influence design and data collection and analysis choices • Understand IRB application procedure, ethical concerns, participant and researcher's rights
Course assessment & evaluation	a) A review paper on the choice of methodology (30%) b) A term paper submission on pilot data analysis (30%) c) participation in discussions (instructor review 30%) d) participation in discussions (peer review 10%)
Course start date	11 January 2023 (Wednesday)
Course timings	Wednesday (2 PM to 4 PM) and Friday (11 AM to 1 PM)
Course instructor & contact	Deepa Chari Email: deepa@hbcse.tifr.res.in Office: Rm 209, Main building, HBCSE

Please note that the course credits are given **only** upon successful completion of both assessments and appropriate attendance. Most papers are freely accessible with the provided

DOI, those with limited access will be shared with the course takers through Baadal drive. Course is open for all HBCSE members for auditing purpose.

Work plan (weekly)

Week 1	<p>(Theme: Teacher professional development/curriculum enquiry)</p> <p>Reading 1: Characterizing pedagogical decision points in sense-making conversations motivated by scientific uncertainty (2022) Jessika Watkins and Eva Menz, Science Education Journal DOI: https://doi.org/10.1002/sce.21747</p> <p>Reading 2: Improving Science and Mathematics Instruction: The SINUS Project as an example for reform as teacher professional development, (2010) International Journal of Science Education Christian Ostermeier , Manfred Prenzel & Reinders Duit, 32(3), pp 303-327 Journal DOI: www.tandfonline.com/doi/full/10.1080/09500690802535942</p>
Week 2	<p>(Theme: Intersectionality as a framework):</p> <p>Reading 1: Considerations on Mainstreaming Intersectionality. (2011) Dhamoon, Rita Kaur. Political Research Quarterly 64(1),pp 230–243 Journal DOI: https://www.jstor.org/stable/pdf/41058336.pdf</p> <p>Reading 2: Intersectionality as a framework for understanding diverse young women's commitment to engineering; (2015) Bruning, Bystydzienski, and Eisenhart; Journal of Women and Minorities in Science and Engineering 21(1):1-26 Journal DOI: 10.1615/JWomenMinorScienEng.2014007345 (on Researchgate)</p>
Week 3	<p>(Theme: Science agency/ curriculum enquiry)</p> <p>Reading 1: What is ‘Agency’? Perspectives in Science Education Research (2014) Jenny Arnold & David John Clarke (2014), International Journal of Science Education, 36(5), pp 735-754 Journal DOI: www.tandfonline.com/doi/full/10.1080/09500693.2013.825066</p>
Week 4	<p>(Theme: Interdisciplinarity and associated teaching practices)</p> <p>Reading 1: Designing Interdisciplinary Assessments in Sciences for College Students: An</p>

	<p>example on osmosis (2014) Ji Shen, Ou Lydia Liu & Shannon Sung, International Journal of Science Education, 36(11), pp 1773-1793, Journal DOI: www.tandfonline.com/doi/full/10.1080/09500693.2013.879224</p> <p>Reading 2: Interdisciplinary dialogues as a site for reflexive exploration of conceptual understandings of teaching–learning relationships, (2015) Green et al. Pedagogies: An International Journal, 10(1), pp 86-103. Journal DOI: https://doi.org/10.1080/1554480X.2014.999774</p>
Week 5	<p>(Theme: Out of school science and influences)</p> <p>Reading 1: Leaving the laboratory: Using Field Science to Disrupt and Expand Historically Enduring Narratives of Science Teaching and Learning (2021) Stroupe and Carlone, Science & Education (2022) 31, pp 893–921 Journal DOI: link.springer.com/content/pdf/10.1007/s11191-021-00296-x.pdf</p> <p>Reading 2: Science Aspirations, Capital, and Family Habitus: How families shape children’s engagement and identification with science (2012) Archer et al. Journal DOI: https://doi.org/10.3102/0002831211433290</p>
Week 6	<p>(Theme: Communities of practice)</p> <p>Reading 1: Informal physics programs as communities of practice: How can programs support university students’ identities? (2021) Prefontaine et al. Phys. Rev. Phys. Educ. Res. 17, 020134 Journal DOI: https://doi.org/10.1103/PhysRevPhysEducRes.17.020134</p> <p>Reading 2: Exploring emerging features of communities of practice among teacher participants of online discussion seminars on science and mathematics (2023 working paper by Kamat and Chari, link shared internally)</p>
Week 7	<p>Catching up, assessment I preparation & group work Discussion session on classroom data exploration with multiple theories</p>
Week 8	<p>##### Break #####</p>
Week 9	<p>(Theme: Not so common concept inventories)</p> <p>Reading 1: New instrument for measuring student beliefs about physics and learning</p>

	<p>physics: The Colorado Learning Attitudes about Science Survey, (2006) Adams et al., Phys. Rev. ST Phys. Educ. Res. Journal DOI: https://doi.org/10.1103/PhysRevSTPER.2.010101</p> <p>Reading 2: Best Practices for Administering Attitudes and Beliefs Surveys in Physics; Madsen A. et al (2020) The physics teachers. Journal DOI: https://doi.org/10.1119/1.5144786</p>
Week 10	<p>(Theme: Phenomenology and phenomenography)</p> <p>Reading 1: Using Phenomenography to Tackle Key Challenges in Science Education, (2019) Han and Ellis, Frontiers in Psychology Journal DOI : www.frontiersin.org/articles/10.3389/fpsyg.2019.01414/full</p> <p>Reading 2: Understanding science teachers' implementations of integrated STEM curricular units through a phenomenological multiple case study (2018) Dare et al. International Journal of STEM Education, 5:4 Journal DOI: 10.1186/s40594-018-0101-z</p>
Week 11	<p>(Theme: Change theory & workshop)</p> <p>Workshop: Phenomenology Vs Phenomenography (Tuesday session)</p> <p>Reading on Change theory: Change theory and theory of change: what's the difference anyway? (2020) Reinholz and Andrews International Journal of STEM Education, 7:2 Journal DOI: https://doi.org/10.1186/s40594-020-0202-3</p>
Week 12	<p>(Theme: some refresher reading & workshops)</p> <p>Reading on case studies, grounded theory</p> <p>1. Case studies and generalizability: grounded theory and research in science education, International Journal of Science Education, (2000) Keith S. Taber, 22:5, pp 469-487, Journal DOI: 10.1080/095006900289732</p> <p>2. Doing Grounded Theory Research with Gifted Students; (2003) Peine M. Journal for the Education of the Gifted, 26(3), 184-200. Journal DOI: https://doi.org/10.1177/016235320302600303</p>
Week 13	<p>Catching up & Assessment 2 preparation</p>

Week 14

Workshop: Seeking ethical permission from Institutional review board.
Discussion of cases, guidelines and practice application.