

Gender in STEM Education Research

Course Logistical Information

Course Title: "Gender in STEM Education Research"

Course Number: SCE605.2

Course Credits: 4 credits

Instructor: [Ayush Gupta \(ayush.hbcse@gmail.com\)](mailto:ayush.hbcse@gmail.com), (Assoc. Prof., Homi Bhabha Centre for Science Education)

Start Date: January 15, 2024 (*tentative*)

End Date: April 30, 2024 (*tentative*)

Potential Course Meeting Times:

- Mon (11am – 1pm) and Wed (11am - 1pm)

Course Modality:

- One weekly lecture session (2 hours): Online
- One weekly discussion session (2 hours). Online as well as in-person.
 - Course participants will have the choice to choose one of these modalities (in-person vs online) at the start. One section would meet online, and another would meet in-person. In-person discussion section would meet in one of the HBCSE classrooms. (For the online section, we will decide on the time to meet based on a discussion with those who choose this option.)
- *NOTE TO SBSE: Several people from outside of HBCSE from peer institutions (IITs, Jadavpur University, TISS) have indicated interest in joining the course. Hence the course modality has been designed to accommodate both online and in-person experiences.*

Prerequisites: None

Technology Needs:

- Access to a laptop and a stable internet connection will be essential for participating in online sessions. Many class activities will involve writing responses and reflections at times, which is easier to manage on a laptop during online sessions. Participants will not be asked to switch on their video, but participating via audio would be important.
- It is advisable that participants attending in-person discussion sessions bring a laptop for taking notes and participating in some exercises and activities.
- We will use the HBCSE webinar platform (Big Blue Button) or Zoom for the online sessions.
- Familiarity with Google Drive/GoogleDocs will be helpful, since I plan on using Google Drive for course slides, readings, and other documents.

Registration: Please send an email requesting course registration to hbcdean@hbcse.tifr.res.in. Please cc ayush.hbcse@gmail.com. Include (i) the course title in your email, and (ii) whether you want to take the course for credit or audit. **Please send this email by January 1st, 2024. That will help us be prepared for the course.**

Course Description

Course Outcomes

The course has been designed with the following outcomes in mind for course participants:

- Develop a more fleshed out sense for the varieties of phenomenon associated under the idea of gender in STEM education
- Understand the landscape of research that draws on the idea of gender (as identity, as experience, as a analytical category or variable, etc.) in research on STEM learning environments
- Gain familiarity with relevant theoretical frameworks/paradigms and methodologies
- Develop integrated understanding of qualitative and quantitative paradigms relevant to gender in STEM education
- Develop practices for attending to gender as a lens when making ethnographic observations

Topics to be included in the course

In research on education in science, technology, engineering, and mathematics (STEM), the idea of gender has been attended to for a variety of purposes:

- To understand how the institutional and cultural practices within STEM and STEM learning environments marginalise women and queer/transgender learners
- To understand how institutional and cultural practices within STEM and STEM learning environments are constructing learners' gender identities
- To segregate data on learners' performance based on their gender
- To understand and address representation of women and queer/transgender people within STEM (as students, scientists, and faculty)

In this course, we will get a broad overview of these topics, and explore some specific aspects in more detail. We will also explore how educational policies attend to gender.

I am using the label “queer/transgender” to broadly include the spectrum of folks who identify as lesbian, gay, bisexual, and transgender, queer, non-binary, gender non-conforming, and in many other ways.

Course Assignments

- Weekly readings:
 - Please expect to read about 2 research articles or book chapters each week. The list of references is quite long for some modules, but you will be assigned to read only a subset of the readings, based on collective interests.
- Weekly written reflection:
 - Please submit a weekly written reflection on the readings or on developing a specific point from the class discussions that week.
- Course Project:
 - Course participants will design and conduct an ethnographic observation aimed at understanding how cultural practices are linked with gender expression and identity. The report is due at the end of the semester. The report should make connections between your ethnographic observations and some of the course readings.

Grading

50% Participation & Effort

10% Weekly Reflections

20% Designing and making ethnographic observations

20% Final Report

Course Schedule (*Tentative*)

- Week 1: Introduction to Gender in STEM education research
- Week 2-3: Frameworks/Paradigms and Methodologies:
 - *Theoretical and methodological orientations within the different lines of research pertaining to gender in STEM learning environments*
 - Beddoes, K., & Borrego, M. (2011). *Feminist theory in three engineering education journals: 1995–2008*. *Journal of Engineering Education*, 100(2), 281-303.
 - Leyva, L. A. (2017). *Unpacking the male superiority myth and masculinization of mathematics at the intersections: A review of research on gender in mathematics education*. *Journal for Research in Mathematics Education*, 48(4), 397-433.
 - Traxler, A. L., Cid, X. C., Blue, J., & Barthelemy, R. (2016). *Enriching gender in physics education research: A binary past and a complex future*. *Physical Review Physics Education Research*, 12(2), 020114.
 - Slaton, A. E., & Pawley, A. L. (2018). *The power and politics of engineering education research design: Saving the 'Small N'*. *Engineering Studies*, 10(2-3), 133-157.
 - McDermott, R., & Varenne, H. (2018). *Adam, Adam, Adam, and Adam: The cultural construction of a learning disability*. In *Successful Failure* (pp. 25-44). Routledge.
- Week 4 - 6: Cultural practices and marginalisation:
 - *Introduction and overview, Research articles in physics, mathematics, and engineering education, Theoretical frameworks and methodological orientations*
 - Secules, S., Gupta, A., Elby, A., & Turpen, C. (2018). *Zooming out from the struggling individual student: An account of the cultural construction of engineering ability in an undergraduate programming class*. *Journal of Engineering Education*, 107(1), 56-86.
 - Tonso, K. L. (1996). *The impact of cultural norms on women*. *Journal of Engineering Education*, 85(3), 217-225.
 - Rosa, K., & Mensah, F. M. (2016). *Educational pathways of Black women physicists: Stories of experiencing and overcoming obstacles in life*. *Physical Review Physics Education Research*, 12(2), 020113.
 - Kondaiah, B. K., Mahadev, S., & Wahlang, M. G. T. (2017). *The production of science: Bearing gender, caste and more*. *Economic and Political Weekly*, 73-79.
 - Leyva, L. A., Quea, R., Weber, K., Battey, D., & López, D. (2021). *Detailing racialized and gendered mechanisms of undergraduate precalculus and calculus classroom instruction*. *Cognition and Instruction*, 39(1), 1-34.
 - Additional References:
 - Atherton, T. J., Barthelemy, R. S., Deconinck, W., Falk, M. L., Garmon, S., Long, E., ... & Reeves, K. (2016). *LGBT climate in*

- physics: Building an inclusive community. American Physical Society, College Park, MD.*
- *Tonso, K. L. (1999). Engineering Gender— Gendering Engineering: a cultural model for belonging. Journal of women and minorities in science and engineering, 5(4).*
 - *Sur, A. (2001). Dispersed radiance: Women scientists in CV Raman's laboratory. Meridians: feminism, race, transnationalism, 1(2), 95-127.*
 - *Foor, C. E., Walden, S. E., & Trytten, D. A. (2007). "I wish that I belonged more in this whole engineering group." Achieving individual diversity. Journal of Engineering Education, 96(2), 103-115.*
 - *Chakraverty, D., & Rishi, M. (2022). Impostor phenomenon and discipline-specific experiences of violence in science, technology, engineering, and mathematics. Violence and Gender, 9(1), 22-29.*
- Week 7 - 8: Cultural Practices and gendered identity construction:
 - *Introduction and overview, Research articles in science, physics, mathematics, and engineering education, Theoretical frameworks and methodological orientations.*
 - *Danielsson, A. T. (2014). In the physics class: University physics students' enactment of class and gender in the context of laboratory work. Cultural Studies of Science Education, 9, 477-494.*
 - *Gonsalves, A. J. "'Physics and the girly girl—There is a contradiction somewhere": Doctoral students' positioning around discourses of gender and competence in physics." Cultural Studies of Science Education 9 (2014): 503-521.*
 - *Archer, L., Dawson, E., Seakins, A., DeWitt, J., Godec, S., & Whitby, C. (2016). "I'm being a man here": Urban boys' performances of masculinity and engagement with science during a science museum visit. Journal of the Learning Sciences, 25(3), 438-485.*
 - *Hughes, G. (2001). Exploring the availability of student scientist identities within curriculum discourse: An anti-essentialist approach to gender-inclusive science. Gender and education, 13(3), 275-290.*
 - *Carlone, H. B., Johnson, A., & Scott, C. M. (2015). Agency amidst formidable structures: How girls perform gender in science class. Journal of Research in Science Teaching, 52(4), 474-488.*
 - Additional References:
 - *Secules, S. (2019). Making the familiar strange: An ethnographic scholarship of integration contextualizing engineering educational culture as masculine and competitive. Engineering Studies, 11(3), 196-216.*
 - Week 9-10: Counter storytelling and resistances:
 - *Persistence, resistance, and changing narratives through counter storytelling*
 - *Leyva, L. A., McNeill, R. T., Balmer, B. R., Marshall, B. L., King, V. E., & Alley, Z. D. (2022). Black queer students' counter-stories of invisibility in undergraduate STEM as a white, cisheteropatriarchal space. American Educational Research Journal, 59(5), 863-904.*
 - *Leyva, L. A. (2021). Black women's counter-stories of resilience and within-group tensions in the white, patriarchal space of mathematics education. Journal for Research in Mathematics Education, 52(2), 117-151.*

- Secules, S., Gupta, A., Elby, A., & Tanu, E. (2018). Supporting the narrative agency of a marginalized engineering student. *Journal of Engineering Education*, 107(2), 186-218.
- Joseph, N. M. (2021). *Black Feminist Mathematics Pedagogies (BlackFMP): A curricular confrontation to gendered antiblackness in the US mathematics education system*. *Curriculum Inquiry*, 51(1), 75-97.
- Week 11: Course Project: Course Participants present initial ideas for course projects
- Week 12: Understanding representation:
 - Meaning making with data on representation of genders in STEM learning environments.
- Week 13: Understanding comparative studies:
 - Meaning making with data comparing genders on conceptual and/or attitudinal surveys, gender as a category for analysis, collecting demographic data responsibly.
 - Miyagi, M. "When and how can you apply sex contextualism in your own research?" GenderSci Lab. 2022 April 11. Retrieved from: genderscilab.org/blog/faq-for-scientists-applying-sex-contextualism
 - Parks, A. N., & Schmeichel, M. (2012). Obstacles to addressing race and ethnicity in the mathematics education literature. *Journal for Research in Mathematics Education*, 43(3), 238-252.
 - Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of experimental social psychology*, 35(1), 4-28.
 - Additional References:
 - Fernandez, T., Godwin, A., Doyle, J., Verdin, D., Boone, H., Kirn, A., ... & Potvin, G. (2016). More comprehensive and inclusive approaches to demographic data collection.
 - Nissen, J. M., Horses, I. H. M., & Van Dusen, B. (2021). Investigating society's educational debts due to racism and sexism in student attitudes about physics using quantitative critical race theory. *Physical Review Physics Education Research*, 17(1), 010116.
 - Blue, J., Traxler, A., & Cochran, G. (2019). Resource letter: GP-1: Gender and physics. *American Journal of Physics*, 87(8), 616-626.
- Week 14 - 15: Policy & Curriculum
 - "Gender" in the National Education Policy 2020; Policies relevant to inclusion of transgender students in higher education in India; illustrative analysis of HS biology curriculum
 - National Education Policy 2020, of the Govt. of India
 - Datta, S., Mukherjee, D., & Gaikwad, P. (2022). *(Trans)forming Science: Towards a Transgender-Inclusive Science Higher Education in India*. Bengaluru: TESF India, IIHS.
 - NCERT Class X and XII chapters on reproduction and hormones