

# SCE605.2: Gender in STEM Education Research

## Syllabus

**Course Title:** “Gender in STEM Education Research”

**Course Code:** SCE605.2

**Course Credits:** 4 credits

**Instructor:** [Ayush Gupta \(ayush.hbcse@gmail.com\)](mailto:ayush.hbcse@gmail.com)

**Institution:** Homi Bhabha Centre for Science Education, Mumbai, India. (HBCSE)

**Course Dates:** January 22, 2024 – May 1, 2024

**Registration:** Please send an email requesting course registration to [hbcdean@hbcse.tifr.res.in](mailto:hbcdean@hbcse.tifr.res.in) and [ayush.hbcse@gmail.com](mailto:ayush.hbcse@gmail.com) (**please copy both emails**). 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 7th, 2024.** That will help us be prepared for the course. **(You can take this course even if you are not affiliated with HBCSE.)**

### Course Modality & Meeting Times:

- One weekly lecture session: *(All participants will need to attend these)*
  - Mondays 11am - 1pm
  - Online (Zoom or [webinar.hbcse.tifr.res.in](https://webinar.hbcse.tifr.res.in))
- One weekly discussion session:
  - Course participants will choose either the in-person or the online section at the start of the course. (Ayush will share a google form with all registered participants.)
  - Online Section:
    - Participants will meet online (Zoom or [webinar.hbcse.tifr.res.in](https://webinar.hbcse.tifr.res.in)).
    - Day/Time: We will decide on the time to meet based on a discussion with those who choose this option.
  - In-Person Section:
    - Participants will meet in-person in one of the HBCSE classrooms.
    - Wednesdays 11am - 1pm

**Prerequisites:** None

### Technology Needs:

- Access to a laptop and a stable internet connection will be essential for participating in online as well as the in-person sessions. Many class activities will involve writing responses and reflections, which is easier to manage on a laptop. Participants will not be asked to switch on their video, but participating via audio would be important.
- 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.

## 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 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 institutional and cultural practices within STEM and STEM learning environments marginalise women and queer/transgender students.
- 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 students within STEM (as students, scientists, and faculty)

In this course, we will get a broad overview of these topics. We will also explore how educational policies & curriculum attend to gender.

### 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.
    - Brotman, J. S., & Moore, F. M. (2008). *Girls and science: A review of four themes in the science education literature*. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 45(9), 971-1002.
- 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.
- Nevatia, S., Raj, Mahajan, S., Shah, C., & *Lesbians and Bisexuals in Action (LABIA)*. (2012). *Bound by norms and out of bounds: Experiences of PAGFB (Persons assigned gender female at birth) within the formal education system: Lesbians and bisexuals in action (LABIA)*. *Contemporary Education Dialogue*, 9(2), 173-196.
- 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.
    - Martin, D. B., Gholson, M. L., & Leonard, J. (2010). Mathematics as gatekeeper: Power and privilege in the production of knowledge. *Journal of Urban Mathematics Education*, 3(2), 12-24.
- 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.
  - Martin, D. B. (2009). Researching race in mathematics education. *Teachers College Record*, 111(2), 295-338.
- 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](https://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.

- Martin, D. B. (2009). *Researching race in mathematics education*. *Teachers College Record*, 111(2), 295-338.
- 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
    - 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.
    - Singh, Y. (2023). *The Exclusion of Bahujan Schoolchildren. An Anti-Caste Critique of the National Education Policy 2020, India*. *CASTE: A Global Journal on Social Exclusion*, 4(1), 54-74.
    - 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.