Course Title: Trends in Science and Mathematics Teacher Education
Course Number: SCE607.2
Credits: 4
Contact hours: 48 hours, 2 hrs. twice a week
Time: 2 pm to 4 pm, every Tuesday and Friday
Course Instructor: Dr Shweta Naik

Course Description

This course examines contemporary and emerging trends in science and mathematics teacher education across national and international contexts. Drawing on research literature, policy documents, and practice-based innovations, the course critically explores how teachers are prepared, supported, and developed across the professional continuum, from pre-service preparation to in-service professional learning. Particular attention is paid to issues of equity, disciplinary practices, curriculum reforms, assessment, technology, and the changing nature of teachers' professional identities.

Additionally, the course includes a customized component in which participating doctoral students will pursue a sub-theme aligned with their individual research questions. In this component, students are expected to engage deeply with and develop mastery over the relevant literature pertaining to pre-service and/or in-service teacher learning and education.

Illustrative sub-themes include, but are not limited to: teachers' facilitation of quantitative reasoning in biology education; teachers' management of uncertainty and inquiry in physics classrooms; teachers' practices related to designing, posing, and using problems in mathematics classrooms; and teachers' pedagogical use of biological understanding of hormonal health through activity-based classroom discourse.

Course Objectives

By the end of the course, students will be able to:

1. Identify and critically analyze major trends in science and mathematics teacher education.
2. Examine theoretical frameworks informing teacher learning and professional development.
3. Engage with research methodologies commonly used in teacher education research.
4. Critically evaluate innovations and interventions in teacher education across contexts.

5. Articulate informed perspectives on future directions in science and mathematics teacher education.

Course Content Outline (Tentative)

Theme 1: Foundations and Historical Perspectives

- Evolution of science and mathematics teacher education
- Shifts from training to professional learning
- Disciplinary versus pedagogical orientations

Theme 2: Theoretical Frameworks for Teacher Learning

- Teacher knowledge: PCK, MKT, and disciplinary practices
- Beliefs, identity, and agency of teachers
- Sociocultural and practice-based perspectives

Theme 3: Trends in Pre-service Teacher Education

- Program designs and clinical models
- Integration of content, pedagogy, and practice
- Role of mentoring and school–university partnerships

This Theme will deal with examples such as BTR, I-TEP, etc.

Theme 4: In-service Teacher Professional Development

- Models of professional development
- Communities of practice and lesson study
- Teacher learning through reflective practice

Theme 6: Technology and Teacher Education

- Digital tools and online professional learning
- AI, simulations, and data-informed teaching
- Challenges and ethical considerations

Theme 7: Equity, Diversity, and Inclusion

- Teacher education for diverse classrooms
- Gender, language, and socio-cultural dimensions
- Culturally responsive and inclusive pedagogies

Theme 8: Research in Teacher Education

- Research designs and methodologies
- Practitioner research and design-based research
- Interpreting and critiquing teacher education studies

Theme 9: Policy, Governance, and Institutional Contexts

- National and international policy perspectives
- Accreditation, standards, and accountability
- Teacher education in Global South contexts

Theme 10: Future Directions in Teacher Education

- Emerging challenges and opportunities
- Sustainability, interdisciplinarity, and lifelong learning
- Student synthesis and course reflections

Teaching - Learning Strategies

- Interactive lectures
- Seminar-style discussions
- Student-led paper presentations
- Critical reading and reflection
- Collaborative group work

Assessment

1. Critical Reading Responses / Reflection Notes (20%):Short written reflections on assigned readings
2. Seminar Presentation (35%): Individual or small-group presentation of a research paper or theme
3. Final Paper / Analytical Essay (45%): Critical analysis of a trend or issue in science or mathematics teacher education (3,000–4,000 words or equivalent) accompanied with a presentation of the paper

Tentative Readings

Core and Cross-cutting Readings (Teacher Education)

- Cochran-Smith, M., Feiman-Nemser, S., McIntyre, D. J., & Demers, K. E. (2008). Handbook of research on teacher education: Enduring questions in changing contexts. Routledge.
- Darling-Hammond, L. (2012). Powerful teacher education: Lessons from exemplary programs. John Wiley & Sons.
- Loughran, J. (2013). Developing a pedagogy of teacher education: Understanding teaching & learning about teaching. Routledge.
- Zeichner, K. (2010). Rethinking the connections between campus courses and field experiences in college-and university-based teacher education. Journal of teacher education, 61(1-2), 89-99.
- Feiman-Nemser, S. (2012). Teachers as learners. Harvard Education Press. 8 Story Street First Floor, Cambridge, MA 02138.

Mathematics Teacher Education

- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special?.
- Jaworski, B. (2006). Theory and practice in mathematics teaching development: Critical inquiry as a mode of learning in teaching. Journal of mathematics teacher education, 9(2), 187-211.
- Adler, J. (2002). Teaching mathematics in multilingual classrooms. Dordrecht: Springer Netherlands.
- Stylianides, G. J., Stylianides, A. J., & Shilling-Traina, L. N. (2013). Prospective Teachers'challenges In Teaching Reasoning-And-Proving. International Journal of Science and Mathematics Education, 11(6), 1463-1490.

Science Teacher Education

- Abell, S. K., & Lederman, N. G. (Eds.). (2013). Handbook of research on science education. Routledge.
- Windschitl, M., Thompson, J., & Braaten, M. (2020). Ambitious science teaching. Harvard Education Press.
- Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In Examining pedagogical content knowledge: The construct and its implications for science education (pp. 95-132). Dordrecht: Springer Netherlands.
- Avraamidou, L. (2016). Studying science teacher identity. In Studying science teacher identity (pp. 1-14). SensePublishers.

Professional Development and Teacher Learning

- Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. Educational Researcher, 38(3), 181–199. https://doi.org/10.3102/0013189X08331140

- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. Educational Researcher, 33(8), 3–15. https://doi.org/10.3102/0013189X033008003
- Loucks-Horsley, S., Stiles, K. E., Mundry, S., & Hewson, P. W. (Eds.). (2010). Designing professional development for teachers of science and mathematics. Corwin press.
- Kumar, R. S., Subramaniam, K., & Naik, S. (2015). Professional development workshops for in-service mathematics teachers in India. The first sourcebook on Asian research in mathematics education: China, Korea, Singapore, Japan, Malaysia and India, 2, 1631-1654.

Policy, Equity, and Contexts

- Tatto, M. T. (2013). The Teacher Education and Development Study in Mathematics (TEDS-M): Policy, Practice, and Readiness to Teach Primary and Secondary Mathematics in 17 Countries. Technical Report. International Association for the Evaluation of Educational Achievement. Herengracht 487, Amsterdam, 1017 BT, The Netherlands.
- Zeichner, K., Payne, K. A., & Brayko, K. (2015). Democratizing teacher education. Journal of teacher education, 66(2), 122-135.
- Settlage, J., & Southerland, S. (2012). Teaching science to every child: Using culture as a starting point. Routledge.

Customised Readings: This section will comprise readings selected and incorporated in alignment with each participating doctoral student's research agenda and areas of relevance.