Master of Education (M.Ed.)

Title of the course: S.Sc 4(e) Competency Based Education and Science Education: Perspectives and Possibilities

(Semester: I, II, III & IV)

Credits: 4
MM: 100 (External: 70 Internal: 30)
Contact Week: 15

Introduction of the Course

The course aims to develop an understanding about the emerging new perspectives, issues and debates surrounding the role and place of science education in society and the challenges in the field of research in science education. The course studies the shift in the educational paradigm in the form of the re-emergence of the competency based education system and its impact on science education. The course is designed as an attempt to establish the link between science education at a local level (microcontext) with the emerging perspectives in science education at global level (macro context). The course is deeply rooted into the issues in science education per se and the contemporary contexts. So it's more towards making science more inclusive and relevant to the 21st century goals.

Learning Outcomes

After completion of the course, students will be able to:

- Critically analyze the issues, concerns and debates that arise at the interface of science, technology, society and environment.
- Critically analyze the developments at macro level in the field of science education.
- Develop relevant skills and understanding about field of science education.
- Explore the possibilities of making science education more inclusive and be more socially and culturally responsive.
- Appreciate the role and contribution of diverse knowledge systems and science education.

Number of Units (4) **Weeks 15 = 60 hours**

Unit 1: Science Education: Issues and challenges **(4 weeks = 16 hours)**

- Nature of science - science as process, body of knowledge and social enterprise
- Science education for all - issues of equity and diversity in science, multicultural science education, role of Indigenous knowledge system (IKS) and Traditional environmental knowledge (TEK) in science
- Language of science education
- Humanistic perspective, Feminist perspective in science, Interface of science, technology, society and environment (STSE)
- Challenges in current context - gap between theory and praxis, content of science education, role of teachers in changing scenario.

Unit 2: Evolving Perspective of Science Education **(6 weeks = 24 hours)**

- Introduction to Competency based education - deconstructing 'competency', learning about re-emergence of competency based education - shift from behaviouristic

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undertone to constructive nature, capability approach to competency based education - Amartya Sen - Nassbaum model (disability)

- Competency based education and NEP 2020 - shift in vision - from objectives to learning outcome, curricular goals and competencies at different levels of schooling
- Competency based education and science education - look at some international science curriculum, inclusive pedagogy and assessment in science education, development of competencies of science teachers.

Unit 3: Science Education and societal concerns (3 weeks = 12 hours)

- Rootedness of science education in culture and environment - values and dispositions related to science in Indian knowledge system, role of families and communities, local environment as source of knowledge and resources - HSTP
- Inclusion in science education - Diversity as human characteristic, addressing linguistic, socio-economic, cultural and special educational needs diversity in science classrooms.

Unit 4: Research trends in science education (2 weeks = 8 hours)

- Study of current research trends in science education and critical review of the evolving perspectives in the field.

Practicum/ Suggested Project/ Assignments

1. Study of any international curriculum based on CBE
2. Study of research trends in science education
3. Project based on science and society interface.

Note: On the basis of the above, the teacher may design his/her own relevant projects/ assignments.

Essential/ Recommended Readings

- Aikenhead, G.S. and Solomon, J. (Eds.) (1994) STS Education: International Perspectives on Reform. New York: Teachers College Press. Chapter II
- Aikenhead, W. W. (1998). Cultural aspects of learning science. Part one , pp 39-52. (B. F. Tobin, Ed.) Netherlands: Kluwer academic Publisher.
- Barba, H.R. (1997).Science in Multi-Cultural Classroom: A guide to Teaching and Learning. USA: Allyn and Bacon.
- Bergsmann et al. (2015). Evaluation of competence-based teaching in higher education: From theory to practice, *Evaluation and Program Planning* , 52, 1–9
- Deo, M.G. & Pawar, P.V. (2011), General Article: Nurturing Science Talent in Villages, In Current Science, Vol. 101, No. 12, pp1538-1543.
- Gervais, J. (2016). The operational definition of competency-based education. *The Journal of Competency-Based Education,* 1(2):98–106. https://doi.org/10.1002/cbe2.1011
- Holmes, A. G. (2019). Learning Outcomes – A Good Idea, Yet with Problems and Lost Opportunities. *Educational Process: International Journal, 8*(3), 159-169.
- Holmes, A.G.D., Tuin, M.P., & Turner, S.L. (2021). Competence and competency in higher education, simple terms yet with complex meanings: Theoretical and practical issues for university teachers and assessors implementing Competency-Based Education (CBE). *Educational Process: international journal*, 10(3): 39-52.

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- Judith Glaesser (2019) Competence in educational theory and practice: a critical discussion, Oxford Review of Education, 45:1, 70-85, DOI: 10.1080/03054985.2018.1493987
- Jakavonytė-Staškuvienė & Ponomariovienė . (2023). Competency-based practice in conducting natural science research and presenting its results in primary classes: A case study, *Cogent Education*, 10 (2) https://doi.org/10.1080/2331186X.2023.2267962
- Klieme, E., Hartig, J., & Rauch, D. (2008). The concept of competence in educational contexts. In J. Hartig, E. Klieme, & D. Leutner (Eds.), *Assessment of competencies in educational contexts* (pp. 3–22). Gottingen: Hogrefe.
- Lee, O. (2003). Equity for Linguistically and Culturally Diverse Students in Science Education. Teachers College Record , 105 (3), pp 465-489.
- Lee, O. and Buxton, C. (2010) Diversity and Equity in Science Education.Teachers College Press. p23-35 (chapter 2- Conceptual grounding and policy context)
- Lopez-Martín et al. (2023). Why Do Teachers Matter? A Meta-Analytic Review of how Teacher Characteristics and Competencies Affect Students' Academic Achievement. *International Journal of Educational Research*
- McGinnis, J.R. (2013). Teaching science to learners with special needs. *Theory Into Practice*, 52(1), 43-50.
- Meyer, X., & Crawford, B.A. (2011). Teaching science as a cultural way of knowing: Merging authentic inquiry, nature of science, and multicultural strategies. *Cultural Studies of Science Education*, 6(3), 525-547.
- Morten Timmermann Korsgaard & Stig Skov Mortensen (2017) Towards a shift in perspective for inclusive education research – a continental approach, *International Journal of Inclusive Education*, 21:12, 1245-1260, DOI: 10.1080/13603116.2017.1335356
- Murray, R. (2024). The Capability Approach, Pedagogic Rights and Course Design: Developing Autonomy and Reflection through Student-Led, Individually Created Courses, Journal of Human Development and Capabilities, 25 (1), 131-150. https://doi.org/10.1080/19452829.2023.2261856
- Negi, V.S. et al (2021). Scoping the Need of Mainstreaming Indigenous Knowledge for Sustainable Use of Bioresources in the Indian Himalayan Region, *Environmental Management*. https://doi.org/10.1007/s00267-021-01510-w
- Oded Ben-Horin, Menelaos Sotiriou, Magne Espeland & Giedrė Strakšienė (2023) Towards transdisciplinarity in global integrated science-arts practices in education? A Janus approach, Cogent Education, 10:2, DOI: 10.1080/2331186X.2023.2287895
- Pit-ten Cate, I.M. et al (2018). Promoting Inclusive Education: The Role of Teachers' Competence and Attitudes, *Insights into Learning Disabilities*, 15(1), 49-63, 2018
- Quigley, C. (2009). Globalization and Science Education: The Implications for Indigenous knowledge systems. International Educational Studies , 2 (1), pp 76-88.
- Rampal, Anita, & Mander, H. (2013) Lessons on Food and Hunger: Pedagogy of Empathy for Democracy. Economic & Political Weekly, 48(28), 51–57.
- Schneider, K. (2019). What Does Competence Mean? Psychology, 10, 1938-1958. https://doi.org/10.4236/psych.2019.1014125
- Shashidhar Belbase, Bhesh Raj Mainali, Wandee Kasemsukpipat, Hassan Tairab, MunkhjargalGochoo & Adeeb Jarrah (2022) At the dawn of science, technology, engineering, arts, and mathematics (STEAM) education: prospects, priorities, processes, and problems, *International Journal of Mathematical Education in Science and Technology*, 53:11, 2919-2955, DOI: 10.1080/0020739X.2021.1922943

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- Stinken-Rösner, L., Rott, L., Hundertmark, S., Baumann, Th., Menthe, J., Hoffmann, Th., Nehring, A. & Abels, S. (2020). Thinking Inclusive Science Education from two Perspectives: inclusive Pedagogy and Science Education. *RISTAL*, 3, 30–45.
- Tarmo, A., & Kimaro, A. (2021). The teacher education curriculum and its competency-based education attributes. *The Journal of Competency-Based Education*, 6, e01255. https://doi.org/10.1002/cbe2.1255
- Vitello, S., Greatorex, J., & Shaw, S. (2021). *What is competence? A shared interpretation of competence to support teaching, learning and assessment.* Cambridge University Press & Assessment.
- Wallace J. and Louden W. (eds.). Dilemmas of Science Teaching: Perspectives on Problems of Practice. London: Routledge Falmer. pp. 191-204.
- Zidny, R. et al. (2020). A Multi-Perspective Reflection on How Indigenous Knowledge and Related Ideas Can Improve Science Education for Sustainability, *Science & Education*, 29, pp 145–185.

Teaching Learning Process

The course will be taught through interactive pedagogic methods such as classroom discussion, debates, film discussions, critical media analysis, collaborative learning tasks which enhance reading comprehension of core writings in the area and innovative projects. Reflective expression and learning will be encouraged.

Assessment Method

The assessment will be formative in nature and will factor in student participation. Individual and group tasks and assignments will be given. Summative evaluation will be done through end-semester examination.

Key words: Science, Education, Policy Perspective

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