

Master of Education (M.Ed.)

**Title of the Course: S. Ma.2(a) Mathematics Curriculum: Development and Analysis
(Semester: I, II, III & IV)**

Credits: 4

MM: 100 (External: 70 Internal: 30)

Contact Week 15

Introduction of the Course

The course delineates main assumptions behind a range of theoretical frameworks for conceptualising and analysing learning and teaching of mathematics at the developmental stages of a child and how they contribute towards an intended curriculum. This course is designed for analytic considerations related to the content, organization, presentation and evaluation of school mathematics curricula. Develop a critical perspective towards knowledge that is embedded in and anticipated to be attained in the mathematics curriculum in schools

Learning Outcomes

1. Understand the Issues in curriculum making, power and politics of knowledge.
2. Critical view of curriculum at school level, reviewing the position of mathematics in national education policies and documents of India,
3. Evaluation and critical analyse the research done in the development of core topics in school mathematics curriculum.
4. focus on the contemporary research being done in understanding pedagogical concerns, approaches that promote students' conceptual understanding.
5. Address the anticipated learning difficulties and teaching methods that provoke critical thinking.
6. Foster inquiry-based learning, assessment
7. Understand the needs of diverse learners in mathematics classroom.



Head/Dean

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Number of Units (4)

Weeks 15 = 60 hours

Unit 1: Mathematics Curriculum at School Level: Issues and Emerging Trends (3 weeks = 12 hours)

- Position of Mathematics in School Curriculum in different National and international policies.
- Study of Mathematics curriculum of certain countries such as Singapore, Japan and Us.
- Textbook and content development

Unit 2: Construction and Development of Core Topics

(5 weeks = 20 hours)

- Indepth study of one of the core areas of mathematics will be done to a) evaluate, b) critically analyse the research done in the development of core topics in school mathematics curriculum.
- Focus will be on the contemporary researches being done in understanding pedagogical concerns, approaches that promote students' conceptual understanding and address anticipated learning difficulties; and teaching methods that provoke critical thought and foster inquiry-based learning in that area. Emphasis will on analyzing ways in which students make multiple representations, develop generalizations and give justification while developing understanding of any one the following areas:

- A) Geometry
- B) Number sense and number theory
- C) Algebra
- D) Statistics Probability theory

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- E) Elementary calculus
- F) Language issues in mathematics
- G) History of Mathematics

Unit 3: Assessment in Mathematics

(4 weeks = 16 hours)

- Changing role of assessment in mathematics
- Contemporary issues related to assessing mathematical thinking.
- Assessment methods for linguistically, culturally and mathematically diverse students.

Unit 4: Meeting Diverse Needs in a Mathematics Classroom

(3 weeks = 12 hours)

- Issues of Gender, socioeconomics, language, learning differences in Mathematics classroom
- Role of differentiated assessment, differentiated instruction and adapting curriculum to meet diverse learners.

Practicum/ Suggested Projects / Assignments (Any Two)

1. Critical analyse and compare and two large-scale mathematics tests such as TIMSS, PISA, Olympiads. Make a report of key similarities and differences
2. Reviewing the position of mathematics in national education policies and documents of India. Make a report of similarities and differences
3. Compare and contrast mathematics curriculum across the world. Critically analyse the perspectives and rationale adopted in other countries on goals of teaching mathematics
4. Study the textbooks of any two countries and do a thorough content analysis on any of the key topics.

5. Choose one area of your choice and focus on the contemporary researches being done in understanding pedagogical concerns, approaches that promote students' conceptual understanding and address anticipated learning difficulties in that area.


6. Pick an area of your choice and study at 5 research papers in that area. Do a metaanalysis of the key recommendations made in the papers.

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

Essential/ Recommended Readings

- Boaler, J. (1998). Open and Closed mathematics: Students' experiences and understandings. *Journal for Research in Mathematics Education*. Vol. 29, No. 1, 41–62.
- Cuoco, A., Paul Goldenberg, E., & Mark, J. (1996). Habits of mind: An organizing principle for mathematics curricula. *Journal of Mathematics education*. 15, 375-40
- Frankenstein, M. (1995). Equity in mathematics education: Class in the world outside the class. In W.G. G. Secada, E. Fennema, & L. B. Adajian (Eds.), *New directions for equity in mathematics*.
- Gandhi, H. (2018). kya ek "Achchi Kaksha", "Ganit ki Safak Kaksha" bhi kahi jaa sakti hai? *Pathshala. Bheetar aur Bahar*. Azim Premji Publication. 1(1).
- Gandhi, H. and Popli, M. (2021). Foundational numeracy: a quintessential ingredient for a developing nation. In Pankaj Arora and Haneet Gandhi (Eds). *National Education Policy 2020: Paving for Transformational Reforms*. Shipra Publications. New Delhi
- Gandhi, H. (2021). Embracing Ancient Indian Mathematics in the Indian Curriculum. *Education in India*. Institute of Research in Indian Wisdom (IRIW)
- Gandhi, H. (2018). Searching for Didactical negotiations in Mathematics textbooks *Voices of Teachers and Teacher Educators*. NCERT on behalf of MHRD. VI(II). 50-57

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- Herbel-Eisenmann B., Choppin J., Wagner D., Pimm D. (2012). Equity in Discourse for Mathematics Education: Theories, Practices, and Policies. Springer, New York.
- Herbel-Eisenmann, B. (2007). From intended curriculum to written curriculum: Examining the —voices of a mathematics textbook. Journal for Research in Mathematics Education, 38, 344-369.
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- Kazemi, E., & Stipek, D. (2001). Promoting conceptual thinking in four mathematics classrooms. The Elementary School Journal, 102(1), 59–80.
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- Lampert, M. (1990). When the Problem is Not the Question and the Solution is not the Answer: Mathematical Knowing and Teaching. American Education Research Journal.27(1), 29-63.
- McBride, M. (1994). The theme of individualism in mathematics education: An examination of mathematics textbooks. For the Learning of Mathematics, 14(3), 36-24.
- Tempus Newton, D. P., & Newton, L. D. (2006). Could elementary mathematics textbooks help give attention to reasons in the classroom? Educational Studies in Mathematics, 64, 69-84.
- Polya, G. (1954). Induction in solid geometry. In Mathematics and plausible reasoning (Vol. 1, pp. 35- 41). Princeton: Princeton


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- Schmidt, W. H., Houang, R. T., & Cogan, L. (2002). A coherent curriculum: The case of mathematics. *American Educator*, 26(2), 10-26,47.
- Schoenfeld, A. (1988). When good teaching leads to bad results: The disasters of "well taught" mathematics courses. *Educational Studies in Mathematics*, 56, 255-286
- Schoenfeld, A. H. (2004). The Math Wars. *Educational Policy*, 18(1), 253.
- Steen, L. A. (1998). Core curriculum in context: History, goals, models, challenges. In J. Dossey (Ed.), *Confronting the core curriculum* (Vol. 45, MAA Notes, pp. 3-13). Washington, DC: Mathematical Association of America.
- Stodolsky, S. S. (1989). Is teaching really by the book? In P. W. Jackson & S. Haroutunian-Gordon (Eds.), *From Socrates to software: The teacher as text and the text as teacher*.
- Tarr, J. E., Reys, R. E., Reys, B. J., Chavez, O., Shih, J., & Osterlind, S. J. (2008). The Impact of Middle Grades Mathematics Curricula and the Classroom Learning Environment on Student Achievement. *Journal For Research In Mathematics Education*, 39(3), 247.
- Charalambous, C., Delaney, S., Hsu, A., & Mesa, V. (2010). The addition and subtraction of fractions in the textbooks of three countries: A comparative analysis. *Mathematical Thinking and Learning*, 12(2), 117-151.
- Cogan, L., Houang, R., & Wang, H. C. *The conceptualization and measurement of curriculum*. College Press.
- Gandhi, H. (2018). Understanding children's meanings of randomness in relation to random generators. In Batanero C., Chernoff E. (eds). *Teaching and Learning Stochastics. Advances in Probability Education. ICME 13 Monograph*. 181-200. Springer, Cham
- Herbst, P. (1997). The Number-Line metaphor in the discourse of a textbook series. *For the Learning of Mathematics*, 17(3), 36-45.
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- Mesa, V (2004). Characterizing practices associated with functions in middle school textbooks: An empirical approach. *Educational Studies in Mathematics*, 56, 255-286
- Mesa, V. (2010). Strategies for controlling the work in mathematics textbooks for introductory calculus. *Research in Collegiate Mathematics Education*, 16, 235-265.
- Noddings, N. (1994). Does everybody count? *Journal of Mathematical Behavior* 13(1): 89-106

Additional Readings

- Bharath. S., English, L. (2010). *Theories in Mathematics education. Seeking new frontiers.* Springer.
- Butler, J. (1999). *Gender trouble.* New York: Routledge
- Christensen, O. R., Skovsmose, O., and Yasukawa, K. (2008). The mathematical state of the world Explorations into the characteristics of mathematical descriptions. *ALEXANDRIA Revista de Educação em Ciência e Tecnologia*, 1(1), 77-90.
- Frankenstein, M. (1989). *Relearning mathematics: A different third R—Radical math.* London, UK:Free Association Books.
- Harwell, M. R., Herrick, M. L., Curtis, D., Mundfrom, D., & Gold, K. (1996). Evaluating statistics texts used in education. *Journal of Educational and Behavioral Statistics*, 21(1), 3-34.
- Newman, J. (2003). *The World of Mathematics: A Four-Volume Series.* Washington
- Timothy Gowers (2002). *Mathematics: A Very Short Introduction.* Oxford University Press
- Apple, M. (1992). Do the Standards Go Far Enough? Power, Policy, and Practice in Mathematics Education? *Journal for Research in Mathematics Education.*
- Chapman, A. (1995). Inter-textuality in school mathematics: The case of functions. *Linguistics and Education*, 7, 243-262.
- Ernest P. (1991). *The Philosophy of Mathematics Education.* Ernest, P. (2009). New philosophy of mathematics: Implications for mathematics education. In B. Greer, S. Mukhopadhyay, A. B. Powell, & S. Nelson-Barber (Eds.), *Culturally responsive mathematics education* (pp. 43-64). Routledge.

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- Mewborn, D. S. (2000). Learning to teach elementary mathematics: Ecological elements of a field experience. Journal of Mathematics Teacher Education, 3, 27-46.
- Murrell, Peter C. Jr. (1994). In Search of Responsive Teaching for African American Males: An Investigation of Students' Experiences of Middle School Mathematics Curriculum. The Journal of Negro Education, 63, (4), 556-569

Teaching Learning Resources (Digital and others): Across Units (If any)

- <https://www.youcubed.org/>
- <https://mathvalues.squarespace.com/masterblog/category/Devlin%27s+Angle>
- <https://www.ox.ac.uk/news-and-events/find-an-expert/professor-marcus-du-sautoy>

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: Mathematics curriculum, Assessment in Mathematics, Textbooks and diverse learners