JRIIE Journal of Research Innovation and Implications in Education
Center for Research Implications & Practice

Website: www.jriiejournal.com ISSN 2520-7504 (Online) Vol.9, Iss.4, 2025 (pp. 110 - 115)

Pedagogical Shifts in Mathematics Education: The Role of NEP 2020 in Shaping Curriculum Practices

Tej Bahadur & Hemendra Kumar Singh
Department of Education
University of Lucknow, Lucknow, UP
https://orcid.org/0009-0009-5097-0375
Email: bahadurtej347@gmail.com/hemendra0013@gmail.com

Abstract: *The National Education Policy (NEP) 2020 marks a transformative shift in India's Education System, stressing the necessity of innovative pedagogical shifts, particularly in Mathematics Education. Pedagogical shifts in Mathematics Education outlined by NEP 2020 are required to align India's Educational System with global trends in teaching-learning environment. This paper studies how the NEP 2020 is reshaping Mathematics curriculum practices by stepping back from parrot learning and towards 21st century skills like analytical reasoning, creativity and collaboration. By dissecting the evolving role of technology, problem- solving skills, critical thinking, interdisciplinary learning and holistic development, this paper aims to highlight the implications of these innovative reforms in reshaping the pedagogical shifts and curriculum designs in Mathematics Education. Additionally, the policy advocates the amalgamation of technology, enabling dynamic learning experiences and enhancing mathematical visualization. This study investigates how the NEP 2020 can potentially upgrade the quality of Mathematics Teaching, promote student involvement, and cater to diversified learning needs. Furthermore, it also outlines the challenges and its opportunities in implementing these types of changes, providing valuable insights into the practical aspects of curriculum development under the new policy framework.*

Keywords: *Mathematics Education*, *Pedagogical Shifts, NEP 2020, Curriculum Practices, Holistic Development*

How to cite this work (APA):

Bahadur, T. & Singh, H. K. (2025). Pedagogical Shifts in Mathematics Education: The Role of NEP 2020 in Shaping Curriculum Practices. *Journal of Research Innovation and Implications in Education, 9*(4), 110 – 115. **https://doi.org/10.59765/pyrk62n.**

1. Introduction

In India, Mathematics Pedagogy has been dominated by mechanical learning, where students often memorize formulas and methods without truly understanding underlying concepts. The changing landscape of education demands that students acquire not just academic as well as bookish knowledge but also skills like critical thinking, problem-solving, creativity and the ability to apply knowledge in real-world situations. The National Education Policy (NEP) 2020 endeavors to match education with the needs of a rapidly evolving world. This policy emphasizes a shift towards holistic and integrated learning, fostering creativity and inquiry-based learning over rote memorization. In the framework of Mathematics Education, NEP 2020 presents an opportunity to step back from traditional methods, transforming how mathematical concepts are taught, learned, and applied. Through a idealized framework, this paper explores how NEP 2020 reshapes Mathematics Education, focusing on pedagogical

shifts, role of technology and 21st Century Skills and challenges in implementing these pedagogical practices in existing curriculum. These shifts not only align with the global demands for critical thinking and innovation but also position Mathematics Education as a key driver in the overall development of students. To achieve the full potential of these reforms, however, sustained efforts in teacher training, resource allocation, and curriculum redesign are essential.

Research Questions

1) What are the key pedagogical shifts in Mathematics Education outlined by NEP 2020?
2) What are the roles of 21st Century Skills and curriculum practices in reshaping the pedagogical shifts in Mathematics Education?
3) What is the significant role of technology in reshaping Mathematics Pedagogy as per NEP 2020, and how can it enhance conceptual understanding?
4) What challenges and hurdles do educators face in implementing the pedagogical shifts in Mathematics Education outlined in NEP 2020?
5) What are the opportunities and Future Directions for Mathematics Education under NEP 2020?

2. Literature Review

Grigaliūnienė et al. (2025) emphasized pedagogical content knowledge (PCK): how teachers understand specific mathematics content and how to teach it. NEP's shifts toward stronger PCK makes this highly relevant. Mustafa Cevikbas, & Stanislaw Schukajlow (2024) provided meta-trends in mathematics education research. Useful to see what topics (teacher education, curriculum, assessment) are being focused on globally, which helps in identifying where NEP aligns/ diverges. Svane et al. (2023). Covers interventions in mathematics education across age groups; shows what types of pedagogical practices lead to improved outcomes. NEP's emphasis on foundational numeracy and early grades is resonant here. Bansal & Sharma (2022) found the proposed changes in the Mathematics Curriculum as per NEP 2020, discussing the shift towards competency-based education, inquiry learning, and interdisciplinary approaches in the curriculum. Brown & Stacey (2022) explored how constructivist principles are applied to Mathematics Education, supporting NEP 2020's aim to encourage active problem-solving and the development of mathematical thinking through collaborative learning. Kumar & Gupta (2021) discussed the pedagogical reforms introduced by NEP 2020, specifically in Mathematics Education, and examines how they aim to step back from parrot learning to concept - based learning. Rao (2020) explored an overview of the common challenges in implementing educational reforms in India, including resistance to change, lack of infrastructure, and teacher preparedness, which could directly affect the successful execution of NEP 2020. Kaur & Singh (2020) examined the pedagogical challenges in Mathematics Education as defined by NEP 2020, such as the shift towards constructivist approaches, and the lack of professional development programs to help teachers transition to new methodologies. Chaudhary & Gupta (2021) focused on the importance of inclusivity in Mathematics Education and discuss how the advancement of 21st century skills, such as communication and collaboration, can help assist with equity issues under NEP 2020. Saavedra & Opfer (2012) explored the core competencies of 21st century skills, including critical thinking, problem-solving, and digital literacy, and analyze how such skills are integrated into curricula worldwide. Ghosh & Kumar (2021) explored the opportunities for transforming assessment practices in mathematics education under NEP 2020, highlighting a shift from traditional examinations to competency-based assessments, project work, and continuous evaluation.

3. Methodology

This study is qualitative and concept-based, relying on theoretical analysis**,** literature review, and comparative evaluation of educational models rather than experimental or statistical data. The preliminary search for literature was conducted using Academic journals, books, and white papers from organizations such as OECD, UNESCO, NCTM, and educational institutions. Thematic analysis focuses on identifying recurring patterns and themes such as 21st century skills, Mathematics Pedagogy, integration of technology, and real-world problem solving. Several document analyses such as National curricula (e.g., Singapore Math, Common Core Standards, Finnish National Core Curriculum) and Reports of NEP 2020, NCFSE 2023 and NCF 2005 are thoroughly explored.

4. Results and Discussion

4.1 Pedagogical Shifts in Mathematics Education under NEP 2020

By emphasizing conceptual understanding**,** inquiry-based learning**,** technology integration, and problem-solving**,** NEP 2020 aims to generate a more dynamic, student-centered, and relevant Mathematics Education system. The final goal is to prepare students not only to succeed academically but also to become critical thinkers**,** problem-solvers, and creative thinkers who can apply logical and

critical knowledge in the rereal-worldituations. The successful execution of these pedagogical shifts will specially require concerted efforts from educators, policymakers, and institutions to generate a supportive environment for all learners. From rote learning to conceptual understanding is major pedagogical shift in Mathematics Education. Historically, Mathematics Education has been based on rote learning, where students memorize formulas, algorithms, and procedures without deeply understanding the concepts behind them. NEP 2020 appeals for a move toward developing a deep conceptualization of the concepts that underlie mathematical procedures. It inspires students to understand the "why" and "how" of Mathematical or other critical concepts, rather than just the "what."

NEP 2020 emphasizes inquiry-based and pragmatic approaches to learning which encourage learners to explore mathematical concepts through questions, problem-solving, and active participation, rather than simply retain information passively. In modern era, the assimilation of technology into Mathematics teaching is a cornerstone of NEP 2020. The policy inspires the use of digital tools and platforms to enhance learning experiences, offering students the chance to visualize and interact with mathematical concepts in ways that were previously impossible. It enables the use of dynamic visualizations, simulations, and mathematical software to bring abstract concepts to life. It emphasizes the development of computational thinking and prepares students for the digital age. One of the key pedagogical shifts advocated by NEP 2020 is the focus on developing critical thinking and problem-solving ability across all subjects, including Mathematics. It helps students become independent thinkers, capable of analyzing and solving complex problems. It also promotes the application of mathematics not only in Education discipline but also other fields, such as Economics, Technology, and Engineering.

4.2 Role of 21st Century Skills and Shaping Curriculum Practices: NEP 2020 and Mathematics Education

NEP 2020 advocates for an interdisciplinary curriculum that breaks down the silos between subjects. In Mathematics, this means integrating mathematical concepts with other disciplines, such as Physics, Economics, and Computer Science, to show students how Mathematics applies across various fields. It encourages the application of mathematical thinking and logical reasoning to solve problems in other fields, fostering a wider understanding. The NEP 2020 envisages flexibility in curriculum design, offering students the chance to choose subjects based on their interests and pace. This flexibility enables learners to explore Mathematics in more depth and specialize in areas of their choice, such as statistics, algebra, or geometry. NEP 2020 calls for a transformation from summative assessments (e.g., exams) to formative assessments, which emphasis on continuous evaluation and feedback. This shift in assessment practices encourages a more holistic approach to evaluating student learning. It encourages regular feedback, which assists students identify areas of improvement and build on their strengths. It moves away from high-stakes exams, reducing pressure and offering more comprehensive assessment of student progress.

Critical thinking and problem-solving are foundational 21st-century skills. The NEP 2020's emphasis on these skills in mathematics aligns with the broader educational goals of encouraging active and inquiry-based learning. Collaboration and teamwork are fundamental to 21st century education, reflecting the real-world need for individuals to work together to solve complex problems. NEP 2020 promotes creativity and innovation in education, encouraging students to explore mathematical ideas in new and innovative ways. In Mathematics Education, this can involve fostering an environment where students approach problems creatively, explore multiple methods of solving problems, and apply mathematics in novel contexts. The inclusion of 21st century skills into Mathematics Education, as envisioned by NEP 2020, is pivotal in reshaping how Mathematics is taught and learned. By emphasizing skills like critical thinking, digital literacy, collaboration, and adaptability, NEP 2020 aims to prepare students not just for exams, but for real-world challenges. These skills empower students to think deeply, work together, use technology responsibly, and contribute meaningfully to society.

4.3 Role of Technology in Reshaping Mathematics Pedagogy as per NEP 2020

NEP 2020 recognizes the necessity of integrating technology into education to enable students to meet the demands of the 21st century. Specifically, in Mathematics Education, technology provides the tools and opportunities to assemble learning more engaging, accessible, and effective. Technology, through graphing tools, dynamic software (e.g., Geo Gebra, Mathematica), and interactive platforms, allows students to visualize abstract mathematical concepts. For example, learners are able to understand geometric shapes, algebraic graphs, and calculus concepts through interactive visualizations, improving their conceptual grasp and retention. Technology can simulate real-world scenarios, such as modeling population growth, financial calculations, or

engineering problems, demonstrating how mathematical theories apply outside the classroom. Technology enables students to collaborate in real-time on digital platforms, such as Google Classroom**,** Microsoft Teams and Learning Management Systems (LMS)**,** where they can share different ideas, collect data, solve problems together, and access online resources.

Technology facilitates this through tools like online quizzes, digital assessments, and instant feedback mechanisms that help teachers assess students' learning continuously. Adaptive learning platforms use Artificial Intelligence (AI) to assess students' strengths and weaknesses and provide customized learning experiences. Technology facilitates the continuous professional growth of teachers by providing access to online workshops, webinars, and courses on new pedagogical strategies, digital tools, and Mathematics content. Platforms like NPTEL (National Programme on Technology Enhanced Learning) offer high-quality professional and vocational development courses for mathematics educators. NEP 2020 supports the flipped classroom model, due to which students learn theoretical content at home via video lessons or online readings and engage in problem-solving activities in the classroom.

4.4 Challenges and Hurdles in Implementing NEP 2020 in Mathematics Education

One of the big challenges in implementing NEP 2020 in Mathematics Education is Teacher Training and Professional Development. Teachers must be equipped with the necessary skills to implement inquiry-based, technology-integrated, and student-centered teaching methods. Socio-Cultural Factors and Parental Expectations are another major challenge in this field. The emphasis on understanding concepts rather than focusing solely on grades might not align with societal expectations, creating tension between traditional practices and the reforms envisioned in NEP 2020. In some parts of India, there is a deeply ingrained belief that mathematics is about memorizing procedures and formulas. Overcoming these attitudes and encouraging students to appreciate mathematics as a subject for exploration, problem-solving, and creativity is a more significant challenge. The successful execution of NEP 2020 requires substantial economic investment in developing and distributing new curriculum materials, providing technology infrastructure, training teachers, and making schools ready for pedagogical shifts. Shifting from a traditional, content-heavy curriculum to one that insists on conceptual understanding, critical thinking, and interdisciplinary learning requires significant changes in curriculum design and delivery. This shift may face resistance from traditional education systems. NEP 2020 advocates for multilingual education, but the large linguistic diversity in India can pose challenges for implementing curriculum reforms that are accessible to students in different regions. NEP 2020 insists on the importance of technology in education, but many schools, especially in rural areas, suffer from inadequate technological infrastructure.

4.5 Opportunities and Future Directions for Mathematics Education under NEP 2020

The future of Mathematics Education under NEP 2020 is poised for significant transformation. By integrating technology, focusing on conceptual understanding, encouraging interdisciplinary learning, and promoting critical 21st century skills, NEP 2020 provides numerous opportunities for reshaping Mathematics Education in India. It stresses the significance of making education relevant to real life**.** Mathematics Education has the decisive opportunity to become more connected to the practical applications of mathematical concepts in daily life**,** business**,** technology, and science**.** It stresses the development of higher-order skills like critical thinking**,** problem-solving**,** and creativity**.** It stresses the credibility of digital literacy and making students for the future workforce**.** It aims to make Indian Education globally relevant, competitive and foster international collaboration**.** Mathematics Education will have the opportunity to align with global standards by including best practices from leading educational systems worldwide.

Future Mathematics Curricula will likely integrate interdisciplinary projects and real-life challenges where students use mathematics to address problems and hurdles from other fields, such as sustainability**,** healthcare, and technology**.** The assimilation of computational thinking and coding into mathematics education will help students to develop essential skills for the 21st century. Mathematical modeling, game-based learning, data analysis, and coding for mathematical problems will stand to become specific components of the curriculum, helping students to develop problem-solving skills and creativity. Future Mathematics curricula may incorporate international benchmarks and collaboration with global educational institutions, facilitating cross-border educational exchanges**,** online global Mathematics competitions**,** and exposure to international research and practices in Mathematics Education

5. Conclusion and Recommendations

The NEP 2020 represents a transformative approach to education in India, and its impact on Mathematics Education is both profound and far-reaching. By emphasizing conceptual understanding, critical thinking, problem-solving, and interdisciplinary learning, the policy aims to equip students with the skills essential for navigating an increasingly complex and technology-driven world. The pedagogical shifts advocated by NEP 2020 stepping back from parrot learning and embracing inquiry-based, student-centered teaching, constructive approach, making it more relevant, engaging, and effective. However, the successful execution of these changes will require careful attention to teacher training, technology integration, and curriculum redesign to certain that all students can benefit from the opportunities provided by NEP 2020.

NEP 2020 offers a transformative vision for mathematics education grounded in conceptual clarity, learner engagement, and pedagogical innovation. Realizing this vision requires coordinated efforts across policy, curriculum, teacher education, and assessment systems. These recommendations provide a blueprint for bridging the gap between policy intent and classroom reality, ensuring that mathematics learning is inclusive, meaningful, and future-ready for all learners. Based on the policy's vision and educational theory, it is necessary to redesign Mathematics curricula to focus on conceptual understanding, problem-solving, and real-life applications, encourage experiential, activity-based, and inquiry-driven teaching methods and Promote constructivist approaches where students build knowledge through exploration and collaboration. Besides of these, it is recommended that strengthening pre-service and in-service teacher education programs to include pedagogical content knowledge (PCK) in Mathematics, implement competency-based assessments that evaluate students' understanding, reasoning, and application of mathematical ideas and translate NEP 2020 goals into clear implementation guidelines at state and school levels with monitoring progress through data-driven evaluations and feedback from stakeholders.

References

Banerjee, P., & Kumar, R. (2022). The Role of 21st Century Skills in Transforming Education: Implications for Mathematics Curriculum. *Journal of Education and Practice*, *13*(7), 41-50.

Banerjee, P., & Kumar, R. (2022). The Role of Technology in Transforming Mathematics Education: Implications of NEP 2020. *Journal of Educational Technology*, *14*(3), 75-85.

Bansal, S., & Sharma, R. (2022). Transforming the Mathematics Curriculum in India: The NEP 2020 Approach. *Educational Studies, 21(4), 98-112.*

Brown, L., & Stacey, K. (2022). A Shift in Mathematics Pedagogy: Constructivism in the Classroom. *Mathematics Education Research Journal, 17(2), 10-30.*

Doolan, L. (2021). NEP 2020 and Shaping Mathematical Pedagogy: Innovations and Challenges. *International Journal of Mathematics Education*, 9(2), 123-137.

Grigaliūnienė, M., Lehtinen, E., Verschaffel, L., et al. (2025*)*. Systematic Review of Research on Pedagogical Content Knowledge in Mathematics: Insights from a Topic-Specific Approach. *ZDM – Mathematics Education, 57*(1) 777-794.

Heid, M. K. (2006). The Role of Technology in Shaping Mathematics Education. *Educational Studies in Mathematics, 61(1), 99-110.*

Jha, S., & Singh, M. (2021). Leveraging Technology in Mathematics Education Under NEP 2020: A Vision for the Future. *Educational Research Review*, *32*(3), 205-220.

Kumar, A., & Bhattacharya, S. (2021). *Mathematics Education in the 21st Century: Challenges and Opportunities*. Springer.

Kumar, V., & Gupta, R. (2021). Pedagogical Shifts in Mathematics Education under the National Education Policy 2020: A Case Study of India's Reforms.
Indian Journal of Educational Research, 39(3), 45-60.

Ministry of Education, Government of India. (2020). *National Education Policy 2020*.

Mishra, S., & Kumari, R. (2022). Transforming Pedagogy in Mathematics: Integrating 21st Century Skills as per NEP 2020. In *International Conference on Education Reforms*, (pp. 118-123). Hyderabad: Educational Research Forum.

Mustafa Cevikbas, Gabriele Kaiser & Stanislaw Schukajlow (2024). Trends in mathematics education and insights from a meta-review and

bibliometric analysis of review studies. *ZDM – Mathematics Education, 56*(1)165-188

Nardi, P. (2014). *Research in Mathematics Education:* A Handbook.
Routledge.

National Council of Educational Research and Training (NCERT). (2021). *Pedagogical Shifts and Curriculum Innovations in Mathematics Education*.

National Council of Teachers of Mathematics (NCTM). (2018). *Principles and Standards for School Mathematics*.

Parker, J., & Thomas, A. (2023). Pedagogical Shifts in Mathematics: Leveraging Technology for 21st Century Learning. *Educational Research Review*, *35*(4), 456-468.

Pimm, D. (2006). *Teaching Mathematics: A Handbook for Primary and Secondary School Teachers*. Routledge.

Prasad, R., & Singh, M. (2020). The Role of NEP 2020 in Shaping Curriculum Practices in Mathematics Education. *Indian Journal of Curriculum and Instruction*, *12*(3), 78-92.

Rao, C. P., & Kiran, S. (2021). Bridging the Gap: NEP 2020 and its Implication for Mathematics Pedagogy in India. *Journal of Education and Pedagogy*, *5*(8), 340-355.

Rao, C. P., & Kiran, S. (2021). Opportunities in Mathematics Education: Reforms and Directions Post NEP 2020. *Educational Innovations Journal*, *12*(2), 87-102.

Robinson, L., & Wright, M. (2021). Redesigning Mathematics Pedagogy with Technology: The Impact of NEP 2020. *Educational Technology Research and Development*, *69*(6), 1141-1157.

Saavedra, A. R., & Opfer, V. D. (2012). Learning 21st-Century Skills: A Global Perspective. *OECD Education Working Papers, No. 72*.

Sardana, P., & Sharma, D. (2020). Empowering Mathematics Teachers through Professional Development. *Journal of Mathematics Teacher Education, 23(3), 405-420.*

Singh, M., & Verma, P. (2023). Reforms in Mathematics Education and NEP 2020: Challenges and Opportunities. *Mathematics Education Review, 16(1), 22-35.*

Svane, R. P., Willemsen, M. M., Bleses, D., Nielsen, H. S., & Krøjgaard, P. (2023). *A systematic literature review of math interventions across educational settings from early childhood education to high school. Frontiers in Education.*

Treffers, A., & Goffree, F. (2011). Inquiry-Based Learning in Mathematics: Current Approaches. *Educational Studies in Mathematics, 49(2), 127-141.*

Watson, A., & Mason, J. (2005). The Role of Critical Thinking in Mathematics Education. *Educational Studies in Mathematics, 58(1), 45-60.*

https://www.researchgate.net/publication/382398351_Problems_Challenges_And_Suggestions_For_The_Implementation_Of_NEP_2020

https://www.academia.edu/103680055/Challenges_and_Opportunities_in_New_Education_Policy_in_India_A_Study

https://www.weforum.org/reports/the-future-of-jobs-report-2020

https://en.unesco.org/themes/ict-education

https://www.khanacademy.org

https://education.microsoft.com

https://www.ijfmr.com/papers/2023/4/5448.pdf