Fostering Scientific Temper and Problem-Solving Skills through Experiential and Interdisciplinary Learning: An NEP 2020 Perspective.

Antaryami Hissaria[1], Dr. Jatinder Grover[2]
[1]*Research ScholarDepartment of Education, Panjab University, Chandigarh*
[2]*ProfessorDepartment of Education, Panjab University, Chandigarh*

***Abstract*—The National Education Policy (NEP) 2020 envisions a transformative framework to revolutionise the Indian education system by emphasising the development of scientific temper, problem-solving skills, and practical efficiency. At its core, the policy seeks to bridge the divide between theoretical knowledge and real-world applications through interdisciplinary learning and experiential approaches. NEP 2020 stresses critical thinking, innovation, and analytical rigor as essential pillars for nurturing well-rounded learners capable of tackling complex challenges. By embedding practical learning in the curriculum, particularly in science and technology, the policy fosters an environment where students actively engage in hands-on activities, experiments, and inquiry-based projects. These experiences equip learners with the tools to address real-world issues and develop solutions that are both creative and impactful. NEP 2020 also focuses on streamlining pedagogy and curriculum design, ensuring they are aligned with the goals of holistic education and sustainable learning. The policy emphasizes efficiency in education delivery by integrating modern technologies and fostering an adaptive learning environment. By promoting critical thinking and creativity, NEP 2020 empowers students to become independent problem-solvers and future-ready global citizens. The cultivation of scientific temper is not merely confined to academic pursuits but extends to decision-making in diverse societal contexts, fostering a culture of inquiry, logic, and evidence-based reasoning. This paper examines how NEP 2020's focus on these dimensions can catalyse educational reform and propel India toward becoming a knowledge-driven economy. With its strategic emphasis on practical knowledge, problem-solving skills, and innovative learning methodologies, NEP 2020 offers a roadmap to redefine education for personal empowerment and societal progress.**

***Index Terms*—Scientific temper, Problem-solving skills, Efficiency, Critical thinking, NEP 2020**

I. INTRODUCTION

The National Education Policy (NEP) 2020 signifies a transformative shift in India's educational paradigm, emphasising the cultivation of scientific temper and enhancement of problem-solving skills among students. Scientific temper, defined as a process of logical and rational thinking, is vital for fostering critical inquiry and evidence-based reasoning (Kankaria & Chakraborty, 2024; Pandey & Biswal, 2022). NEP 2020 integrates this concept into the educational framework, promoting experiential learning and interdisciplinary approaches to bridge the gap between theoretical knowledge and practical application (Ministry of Education, 2020; Govindharaj et al, 2023). Historically, India's educational policies have underscored the importance of scientific temper. The term was first introduced by Jawaharlal Nehru in The Discovery of India, where he described it as a way of life, a process of thinking, and a method of acting (Nehru, 1946). This philosophical foundation has been echoed in subsequent policies, which emphasize critical thinking, rationality, and innovation as central to educational progress (Pandey & Biswal, 2022; Mehta et al. 2024) NEP 2020 builds upon this legacy by advocating for a curriculum that encourages scientific inquiry and problem-solving from an early age. The policy proposes a restructuring of the school curriculum into a 5+3+3+4 design, with discovery-based learning and skill development at each stage (Ministry of Education, 2020; Parmar et al., 2024). This aligns with progressive educational philosophies

that prioritise experiential and skill-based education over rote memorisation (Bhardwaj et al., 2024; Mishra, & Aithal, 2023).

The policy also emphasizes the critical role of teachers in fostering scientific temper among students. Educators are encouraged to adopt pedagogical practices that promote creativity, analytical thinking, and innovation (Kumar & Singh, 2024; Dasgupta, 2023). Integrating technology into classrooms is another key element, facilitating adaptive learning environments that cater to individual needs (Sharma & Gupta, 2022; Ministry of Education, 2020). Such initiatives are anticipated to enhance student engagement and their ability to navigate complex real-world challenges (Sharma & Vashistha, 2024; Raaj, 2024). By embedding scientific temper and problem-solving into the educational framework, NEP 2020 also aims to address broader societal challenges, including sustainable development and economic innovation. The policy's focus on inquiry-driven learning equips students to tackle pressing global issues, contributing to India's transition toward a knowledge-driven economy (Mehta et al., 2024). NEP 2020 promotes interdisciplinary learning by integrating arts, sciences, and vocational education. This approach aligns with global trends, as interdisciplinary methods are increasingly recognized for fostering creativity and adaptability (Mishra & Aithal, 2023; Dasgupta, 2023). Research also underscores the importance of lifelong learning, which the policy addresses by emphasising flexibility and skill acquisition across educational stages (Govindharaj et al, 2023). By promoting critical thinking, experiential learning, and interdisciplinary approaches, the policy seeks to equip learners with skills necessary for personal empowerment and societal progress (Sharma & Gupta, 2022; Sharma & Vashistha, 2024).

II. OBJECTIVES

1. To explore the strategies outlined in NEP 2020 for fostering scientific temper and problem-solving skills among students.
2. To analyse the role of experiential and interdisciplinary learning in bridging the gap between theoretical and practical knowledge.
3. To evaluate the contributions of teachers and technology in promoting critical thinking and preparing students for real-world challenges.

III. RESEARCH QUESTIONS

1. How does NEP 2020 promote the development of scientific temper and problem-solving skills among students?
2. What role does experiential and interdisciplinary learning play in achieving NEP 2020's objectives?
3. How do teachers and technology contribute to fostering critical thinking and preparing students for global challenges?

IV. METHODOLOGY

This paper adopts a qualitative and analytical approach, utilizing a systematic review of secondary data. The methodology includes:

1. Data Collection: An extensive review of policy documents, scholarly articles, books, and credible online sources focusing on NEP 2020 and its objectives. Inclusion of primary sources such as the National Education Policy 2020 document and secondary sources from databases like Google Scholar, Semantic Scholar, and ResearchGate.
2. Selection Criteria: Literature published between 2020 and 2025 to ensure relevance. Studies that specifically address scientific temper, problem-solving, experiential learning, and the role of technology in education.
3. Analysis Framework: Thematic analysis to categorise the literature into key areas such as curriculum design, pedagogy, interdisciplinary learning, and technology integration. Comparative analysis to identify global best practices that align with NEP 2020's objectives.
4. Synthesis: Collation of findings to draw meaningful insights regarding the policy's effectiveness, challenges, and opportunities for enhancement.

V. FINDINGS

1. NEP 2020 and the Development of Scientific Temper and Problem-Solving Skills

Thematic analysis of NEP 2020 reveals that cultivating scientific temper is a core tenet of the policy, aiming

to rational thinking, evidence-based decision-making, and analytical skills in students (Kumar & Singh, 2024). The policy emphasises early exposure to critical thinking and problem-solving through inquiry-based learning approaches and hands-on activities. For instance, coding and computational thinking are introduced from foundational stages to foster analytical abilities and problem-solving capabilities (Sharma & Gupta, 2022). The policy highlights the importance of integrating local knowledge and cultural contexts into scientific inquiry to make learning more relatable and impactful (Mehta et al., 2024). Students are encouraged to address community-specific problems through projects and experiments, bridging the gap between theoretical understanding and practical application (Pandey & Biswal, 2022). Comparative analysis of global best practices highlights similarities with Finland's education model, where problem-based learning and student autonomy are key priorities (Raaj, 2024). Such approaches have been linked to improved student engagement and the development of critical thinking skills, outcomes that NEP 2020 aims to replicate in the Indian context (Govindharaj et al, 2023). However, disparities in resources and teacher readiness pose significant challenges to achieving these objectives. Rural schools often lack access to laboratories and digital tools, which are essential for hands-on learning (Reganti Balakrishna & Padmavathi, 2024). addressing these systemic inequities will be critical for the policy's success (Sharma & Vashistha, 2024).

2. Role of Experiential and Interdisciplinary Learning

Thematic analysis underscores that experiential learning is central to NEP 2020, promoting active student engagement through projects, fieldwork, and problem-solving activities. This approach ensures that students can apply classroom knowledge to real-world scenarios, fostering deeper learning and retention (Mishra & Aithal, 2023). For instance, the integration of vocational education at the secondary school level equips students with practical skills relevant to industry needs (Parmar et al., 2024). Interdisciplinary learning, another key aspect, enables students to draw connections between different domains, such as integrating the arts with STEM subjects (STEAM education). Research indicates that this approach enhances creativity and innovation, equipping students to tackle multifaceted global challenges like climate change or public health crises (Dasgupta, 2023; Raaj, 2024). Global comparisons show that countries like Singapore have successfully implemented interdisciplinary curricula that emphasise both academic rigor and practical skills (Mehta et al., 2024). NEP 2020's emphasis on flexibility in subject choice mirrors these international trends, aiming to foster student agency and adaptability (Bhardwaj et al., 2024). Despite these strengths, effective implementation requires significant investment in teacher training and infrastructure development. Teachers need professional development to design and deliver experiential and interdisciplinary lessons effectively (Kumar & Singh, 2024). The lack of adequate resources in underprivileged areas remains a barrier to equitable implementation, necessitating targeted interventions learning (Reganti Balakrishna & Padmavathi, 2024).

3. Contribution of Teachers and Technology

Thematic analysis identifies teachers and technology as pivotal to the successful implementation of NEP 2020. Teachers are envisioned as facilitators of knowledge, guiding students through inquiry-based and project-driven learning processes. The policy stresses the need for continuous professional development (CPD) to equip teachers with modern pedagogical skills, such as differentiated instruction and formative assessment techniques (Govindharaj et al, 2023). Technology plays a complementary role by personalising learning experiences and ensuring access to quality resources. Initiatives like DIKSHA (Digital Infrastructure for Knowledge Sharing) and SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) are integral to this effort, providing digital content for both teachers and students (Ministry of Education, 2020). Adaptive learning platforms powered by AI can further enhance learning by tailoring content to individual needs (Sharma & Gupta, 2022). Comparative analysis highlights the potential of these technologies, drawing parallels with South Korea's Smart Education initiative, which integrates digital tools into classrooms to foster interactive learning (Sharma & Vashistha, 2024). However, the digital divide in India, particularly in rural areas, poses a significant challenge. Limited access to devices and internet connectivity prevents many students from fully benefiting from these initiatives (Raaj, 2024). Synthesis of findings suggests that a balanced

approach, combining teacher empowerment with technological innovation, is essential for fostering critical thinking and problem-solving skills. Investments in infrastructure, teacher training, and equitable access to technology will be crucial to overcoming existing barriers and achieving NEP 2020's transformative vision learning (Reganti Balakrishna & Padmavathi, 2024; Parmar et al., 2024).

VI. RECOMMENDATIONS AND SUGGESTIONS

Based on the findings, several recommendations and suggestions emerge to enhance the implementation and impact of NEP 2020's focus on scientific temper, problem-solving skills, experiential learning, and interdisciplinary education.

1. Strengthening Teacher Training Programs

To effectively implement NEP 2020, comprehensive teacher training programs must be prioritised. Teachers should be equipped with the skills to foster critical thinking and facilitate inquiry-based learning. Regular professional development workshops focusing on modern pedagogies, such as project-based learning and interdisciplinary approaches, are crucial (Govindharaj et al, 2023). The government can collaborate with international organisations to adopt best practices, as seen in Finland and Singapore, to ensure global standards of teacher training (Raaj, 2024).

2. Ensuring Equitable Resource Allocation

Addressing disparities in educational resources is essential for equitable implementation of NEP 2020. Rural and underprivileged schools must be provided with basic infrastructure, including laboratories, digital devices, and internet connectivity (Sharma & Vashistha, 2024). The government should introduce schemes to subsidise technology for low-income families, ensuring that all students have access to digital learning tools (Mishra & Aithal, 2023).

3. Promoting Interdisciplinary Learning through Policy Guidelines

Clear guidelines for implementing interdisciplinary learning need to be developed. Curricular flexibility should be ensured to allow students to explore combinations of subjects that align with their interests and career goals (Parmar et al., 2024). Additionally, schools should be encouraged to integrate STEAM education and design thinking into their curriculum, fostering creativity and innovation (Dasgupta, 2023).

4. Leveraging Technology for Personalized Learning

Digital tools and AI-driven platforms should be expanded to provide personalised learning experiences tailored to individual student needs. Initiatives like DIKSHA and SWAYAM should be scaled up with multilingual support to cater to diverse learners (Sharma & Gupta, 2022). The government should invest in developing indigenous educational technologies to reduce dependency on foreign platforms and ensure cost-effectiveness (Mehta et al., 2024).

5. Encouraging Collaboration between Schools and Industry

To enhance the practical applicability of education, partnerships between schools and industries should be encouraged. Such collaborations can provide students with hands-on experience and exposure to real-world challenges learning (Reganti Balakrishna & Padmavathi, 2024). Internship programs and vocational training opportunities can bridge the gap between academic learning and industry demands (Bhardwaj et al., 2024).

6. Establishing Monitoring and Evaluation Mechanisms

Robust monitoring and evaluation frameworks should be established to assess the implementation of NEP 2020. Metrics to evaluate the development of scientific temper, critical thinking, and problem-solving skills should be incorporated into assessment systems (Kumar & Singh, 2024). Regular audits and feedback mechanisms involving educators, students, and parents can ensure continuous improvement (Pandey & Biswal, 2022).

VII. CONCLUSION

NEP 2020 offers a transformative vision for the Indian education system, aiming to develop scientific temper, problem-solving skills, and a culture of critical thinking among students. Its emphasis on experiential and interdisciplinary learning, combined with the integration of technology, positions it as a progressive framework for fostering holistic education and preparing students for the complexities of the 21st

century. The policy's innovative approach to curriculum design bridges the gap between theoretical knowledge and real-world applications. By advocating for hands-on learning, coding, and vocational education, NEP 2020 equips students with practical skills that enhance their employability and problem-solving capabilities (Ministry of Education, 2020). Interdisciplinary education further ensures that students develop a well-rounded perspective, essential for addressing multifaceted global challenges (Parmar et al., 2024). The successful implementation of NEP 2020 hinges on addressing significant challenges. Disparities in resource allocation, particularly in rural and underprivileged areas, hinder equitable access to quality education (Sharma & Vashistha, 2024). The digital divide continues to be a major obstacle, limiting the potential of technology-driven learning for marginalised communities (Raaj, 2024). The lack of teacher training in modern pedagogies and the absence of monitoring mechanisms pose additional hurdles (Govindharaj et al, 2023). To overcome these challenges, the government, educators, and stakeholders must collaborate to ensure the effective implementation of the policy. Teacher training programs need to be prioritised, and resources must be allocated equitably to create an inclusive learning environment. Technological innovations should be leveraged to personalise education, while interdisciplinary learning must be institutionalised through clear guidelines and frameworks (Sharma & Gupta, 2022). The policy's success will ultimately depend on the commitment of all stakeholders to its vision and objectives. By fostering a culture of inquiry, innovation, and evidence-based reasoning, NEP 2020 has the potential to redefine education in India, empowering students to become independent thinkers and global citizens capable of driving societal progress (Mishra & Aithal, 2023; Bhardwaj et al., 2024).

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