NEP 2020 on Technological Integration in Pedagogy

Abdul Basith Anikkaden[1], Dr. Jamuna Emani[2]

[1]Research Scholar, English Language Teaching, Lingaya's Vidyapeeth, Faridabad, Haryana, India

Email ID: basithwafy82@gmail.com

[2]HoD, Department of English,Lingaya's Vidyapeeth, Faridabad, Haryana, India

Abstract:

National Education Policy (NEP) 2020 is a paradigm shift in the education system in India. NEP is centered on an integrated strategy to leverage technology for pedagogical purposes. The article critiques provisions of the policy towards technology integration in teaching and learning. NEP 2020 outlines a theoretically well-articulated agenda for building an inclusive, equitable, and personalized learning environment. However, it will mean surmounting India's deep and multi-faceted digital divide and achieving a systemic cultural transformation of pedagogic attitudes in an effort to successfully adopt it. A qualitative examination of the policy report, government documents, and literature, the paper examines the historical context of educational technology in India,. The basic principles of the technology framework of the policy, and the manner in which its vision is aligned with contemporary learning theories such as Constructivism, social constructivism and connectivism are studied in depth. The research uncovers a wide gap between the possibility of improved learning and the daunting barrier of poor infrastructure, digital illiteracy, and poor teacher readiness. The COVID-19 pandemic is presented as an unexpected driver that accelerated technology uptake while laying bare the weakness of the available digital infrastructure. The study concludes with feasible suggestions that seek to treat digital infrastructure as a public utility, adopt a pedagogy-first strategy in teacher training, and state-led, contextualized implementation in order to avoid technology exacerbating current educational disparities.

Keywords: Technology integration, Constructivism, Pedagogy, Equity.

INTRODUCTION

1.1 The Need for Change

India's education situation in the 21st century is at a juncture, driven by accelerating socio-economic change and technological progress. The earlier National Policy on Education (NPE) of 1986 was constructed in the pre-internet times. . A new policy was necessary: to shift the model of education from a content-focused, memorization-focused model to one promoting critical thinking, imagination, and problem-solving ability. The goal was now no longer to convey knowledge but to create well-rounded, responsible, and moral citizens. Signed into law on July 2020, the National Education Policy (NEP) 2020 is India's 21st-century education policy and a complete overhaul of India's philosophy and education system. The policy is established on Indian ethos and tradition but is also forward-looking, with alignment with international education development targets, such as the United Nations' Sustainable Development Goal 4 (SDG4) for quality education. The policy is established on the foundation of Access, Equity, Quality, Affordability, and Accountability. Its mission is to equip India to become a "vibrant knowledge society and global knowledge superpower" by transforming the school and higher education system into more holistic, flexible, and multidisciplinary learning. The driver of this change agenda is the widespread and strategic use of technology, not as an afterthought but as a full-fledged enabler of teaching, learning, testing, and governance.

1.2. Objectives

- 1. To examine the nature of education technology in India underpinning the strategic vision of NEP 2020.
- 2. To critically assess the major technological provisions and institutional aspects of NEP 2020,
- 3. To assess the potential of NEP to revolutionize pedagogy by applying evidence-based learning theories (Constructivism, Connectivism) and technology integration models (SAMR).
- 4. To determine the main opportunities for increasing access and equity in education, as wellas significant challenges, that is hindering implementation.

1.3. Research Questions

- •How does NEP 2020 propose using technology in learning and teaching?
- •What are the main barriers to using technology in Indian education?
- •How does the technology framework of NEP 2020 align with modern learning theories?

2. HISTORICAL BACKGROUND AND POLICY DEVELOPMENT

NEP 2020's vision for harnessing technology for education came about without history as well. It is the culmination of a long and tortuous history of implementing technology into Indian education, which has been one of grand experiments with mixed outcomes and hard-learned lessons. To understand this development is to be able to enjoy the new direction that NEP 2020 embodies.

2.1 Chalkboards to Satellites: A Short History of Indian Education Technology

Indian use of classroom technology originated with the inception of the classroom itself. The first aids in the nature of slate boards were utilized as early as the 12th century as primitive tools for learning. Nevertheless, after independence, the government of India tried more ambitious large-scale attempts at utilizing latest technology for mass education.. The 1975–76 Satellite Instructional Television Experiment, (SITE) was an early experiment with satellite broadcasting to transmit educational television programs to rural society in six states. It was a universally acclaimed test that demonstrated India's initial enthusiasm for using high-end technology to bridge geographical distances and reaches the unreached.

Almost a decade after that, in 1984, the Computer Literacy and Studies in Schools (CLASS) project was initiated. It was a joint venture of the Ministry of Human Resource Development, Department of Electronics, and National Council of Educational Research and Training (NCERT), and had focused on computer literacy by introducing BBC microcomputers in thousands of schools.

The project was not very successful. A project review revealed gaps between training teachers, hardware installation, and class activity. Insufficient hands-on experience by students and inadequate curriculum integration caused the project to be termed a "spectator sport," where computers were frequently available but ineffectively applied for learning.

Learning the lessons of the failures of the SPVs that had come before, the Indian government in the 2010s steered the course of developing digital infrastructure and platforms. These were the foundational pilings on which NEP 2020 is presently attempting to construct an overall and interoperable ecosystem.

2.2 .The Government Initiatives

• *DIKSHA* (Digital Infrastructure for Knowledge Sharing) study: Released on 5 September 2017, *DIKSHA* was a landmark change towards the platform approach. Designed as a national digital school education platform, it is a store of high-quality e-content such as textbooks, videos, and tests that can be accessed by teachers, students, and parents. One of the innovations that closed the print-digital divide was the "Energized Textbooks" feature with QR codes connecting physical books to digital content.

•*SWAYAM* (Study Webs of Active-Learning for Young Aspiring Minds): Being India's national Massive Open Online Course (*MOOC*) platform, S*WAYAM* was set up with the vision of fulfilling the three cardinal principles of educational policy, namely access, equity, and quality. SWAYAM offers free online courses of the best institutions so that the learners can earn credits and access high-quality higher education content anywhere within the country.

• National Digital Literacy Mission (NDLM) and PMGDISHA: The government realized that digital infrastructure and content were pointless if the populace didn't have the capacity to utilize them.

Programs like the National Digital Literacy Mission (launched in 2014) and its successor, the *Pradhan Mantri Gramin Digital Saksharta Abhiyan* (PMGDISHA, launched in 2017), were meant to provide digital literacy to tens of millions of households, particularly rural India.

These missions put in the spotlight the most critical insight that human capability is not second to technological capability. The evolution from the SITE and CLASS projects to the *DIKSHA* and *SWAYAM* portals indicates an unmistakable learning curve. There was a shift from simply offering technology tools to developing accessible content and user capacity building. Yet even such successful portals worked primarily in isolation, and their impact was significantly reduced by the long-standing fact of the digital divide.

2.3 The Pre-Policy Landscape: The State of the Digital Divide

NEP 2020 was written against the backdrop of bleak digital disparity. Statistics from the near pre-policy era present a bleak picture of the gap between digitally connected and disconnected individuals, and supplying a benchmark with which to measure the problem the policy has to address. Overall, a 2017-18 National Sample Survey Office (NSSO) survey of household social consumption in education uncovered the multi-

dimensionality of the gap. just 14.9% of rural homes had access compared to 42% of urban homes .Ownership of computers was even more unequal, with a paltry 4.4% of rural homes owning a computer. This shortage directly translated into a deficit in literacy. Just 13% of people over the age of five in rural counties had access to the internet, a figure that dropped to just 8.5% for rural women. These technology disparities were then compounded by underlying infrastructural issues. A 2017-18 survey conducted by the Ministry of Rural Development indicated that just 47% of Indian homes were getting more than 12 hours of power a day, and more than one-third of India's schools (36%) had zero electricity. This is hardly the vision of a digitally empowered classroom. The numbers put forward in Table 1 aggregate these findings and indicate the depth of challenge with which NEP 2020 was intended to grapple.

Table 1: The Digital Divide in India (Pre-2020 Snapshot based on NSSO 2017-18 Data)

Indicator	Rural (%)	Urban (%)
Households with a Computer	4.4	23.4
Households with Internet Access	14.9	42.0
Persons (age 5+) able to use the Internet	13.0	Not Available
Females (age 5+) able to use the Internet	8.5	Not Available

Source**:** Compiled from Key Indicators of Household Social Consumption on Education in India report.This context illustrates how NEP 2020 technology vision is not revolutionary discontinuity but evolutionary continuity. Policy architecture is a deliberate reaction to the lessons of decades. Failure of hardware-centric CLASS project signified the necessity for pedagogy and teacher training.

The effectiveness of platform-based initiatives such as *DIKSHA* and S*WAYAM* validated the effectiveness of centralized high-quality content.

The consistent and deep evidence of the digital divide had highlighted the insufficiency of any solution that was not solving the elementary issues of access and literacy.

To that end, NEP 2020 suggests a more holistic, ecosystem-driven approach. Institutions such as the NETF offer strategic advice and reports such as the NDEAR to allow interoperability to link the dots between hardware, software, content, pedagogy, and human capital.

3. METHODOLOGY AND THEORETICAL FRAMEWORK

In order to transcend a descriptive overview of NEP 2020 provisions, an analytical methodology based on a firmly grounded learning theory and rigorous research technique is adopted. This enables one to meaningfully study the potential of the policy to change the tools of education and the teaching-learning process.

3.1 Research Method

The research is qualitative and descriptive-analysis in nature. It is grounded in a rigorous secondary data analysis, and the source policy document of NEP 2020 has been taken as the primary text of study. The main document is supported by a study of ancillary government reports, circulars, and government websites related to important initiatives like *DIKSHA, SWAYAM, PM eVidya, NETF*, and *NDEAR*. The analysis is supplemented with a reading of secondary sources such as peer-reviewed articles, industry reports, and established media analyses of the policy context, its practice, opportunities, and challenges. The blending of these sources enables a comprehensive and concentrated understanding of the technological vision of the policy and implications in practice.

3.2 Application of Learning Theory

The true test of every education technology is the extent to which it can support effective learning. NEP 2020's focus on shifting away from rote learning to higher-order thinking reflects, by implication, the newer pedagogical frameworks of learning as an active, constructive process.

3.2.1 Constructivism and Connectivism

NEP 2020's pedagogic culture aligns with two of the most powerful theories of learning: Constructivism and Connectivism. Constructivism would believe that students are not so much passive receivers of information. They are active builders who construct their own meaning and knowledge through experience and interaction with the world around them. The policy's stipulation that education should be made "experiential, holistic, integrated, inquiry-driven, discovery-oriented, [and] learner-centred" is the textbook definition of constructivist principles. In a constructivist classroom, technology is not merely a delivery system; it's an investigation, innovation, and collaboration tool. It allows students to construct mental models, explain what they know, and create their own models of knowing. The policy's vision of virtual labs, for example, is a great expression of employing technology to offer hands-on, inquiry-based learning that would otherwise be inaccessible. Connectivism, a more contemporary theory designed for the information age, asserts that learning involves the creation of connections and networks. In this framework, knowledge lives in an internet of connections and the skills to locate, negotiate, and assess information are more important than remembering.

The fundamental concepts in Connectivism are echoed in NEP 2020's focus on creating massive digital repositories such as *DIKSHA*, encouraging online courses through *SWAYAM*, and facilitating a "free exchange of ideas" through mediums such as the NETF. This paradigm recognizes the fact that knowledge can reside in non-human machinery (such as a database) and that the space to know more is greater than known.

3.2.2 The SAMR Model: While learning theory informs the "why" of pedagogical change, the SAMR model provides an actionable approach to assessing the "how" and "what" of technology integration. Dr. Ruben Puentedura's model categorizes using technology in school to four levels.: substitution, augmentation, modification, and redefinition. The levels are typically believed to be a process of development from augmenting instruction to genuinely changing instruction.

This paper employs SAMR model as an analysis tool to state that although NEP 2020's vision quite clearly targets the transformational levels of Modification and Redefinition—through emphasis on digital platforms. Owing to issues such as the digital divide, inadequate preparation of teachers, and institutional resistance to change, technology use in the majority of classrooms will likely only advance as far as mere substitution (e.g., online lectures versus traditional ones) or augmentation (e.g., animated textbooks).. It inductively incorporates high-end learning theories to its technological imagination, believing that offering emancipator tools will trigger a transformation of pedagogical practices. This is an ambitious and needed goal but one which is also a deep challenge.

There is a prevalent cultural practice of summative, examination-oriented, and memorization-type learning of Indian education today.

Most teachers, faultlessly, are not trained in or at ease with the student-focused, question-led approaches that constructions requires. NEP 2020 thus creates a possible disconnect: it gives the technology "what" (an online laboratory) but takes the pedagogical "how" (how to enable a discovery-orientated experiment in the laboratory) to somehow magically happen by itself. It is looking for technology to bring about a pedagogic revolution, an expectation which will be vastly tested by the ground realities of the Indian education system.

4. INTEGRATION OF TECHNOLOGY IN NEP 2020

NEP 2020 is also very detailed in the integration of technology in education towards the formulation of an integrated national system and not episodic actions (Ministry of Education, 2020). It is founded upon three far-reaching pillars: one at the steering higher level, universalizing access to virtual spaces, and making use of frontier technologies for reimagining learning.

Its organ of thought is the National Educational Technology Forum (NETF), a cost-recoverable research and advisory body whose role is to consult on technology utilization in education (GoI, 2020). The NETF provides professional guidance on pedagogy via internet spaces, recommends curriculum standards, creates actual data for reforming policy, and acts as a stimulant for innovation via a collaborative work arrangement platform that includes researchers, entrepreneurs, and educators.

It will provide digital learning content to all learners via Digital Public Goods such as DIKSHA and PM eVidya (NITI Aayog, 2021). DIKSHA provides education in several languages using QR codes to interlink textbooks with interactive digital learning. PM eVidya utilizes online, television, and radio learning in trying to bridge the gap and reach even remote districts (UNESCO, 2021).

The NEP 2020 also seeks to prioritize not only e-learning, but also the implementation of virtual laboratories, on experience-based and personalized learning platforms (Mehta & Gupta, 2022). This is made possible by the National Academic Digital Infrastructure (NDEAR), where interoperability and open standards in digital platforms are present, necessitated in an integrated education system (Ministry of Education, 2021). All three

processes—NETF, virtual public forums, and NDEAR—blend into each other to create a system not just to computerize education but to re-model India's model of education to the 21st century.

5. DISCUSSION OF FINDINGS

5.1 The Pandemic as a Proving Ground

The NEP 2020 vision of technology is a multi-level dynamic reality now. The COVID-19 pandemic, coinciding with the launch of NEP 2020, was an accidental test bed for its ed-tech presumptions in education (UNICEF, 2022). In a night's time, the lockdown-induced migration to online learning put even recalcitrant institutions into the digitization fold. Admissions via the SWAYAM portal, for instance, gained traction during the lockdown (Ministry of Education, 2021).

But with that realignment, inherent disparities in India's digital preparedness dominated. Lockdown of almost 1.5 million schools nationwide affected almost 320 million students, the majority with no provision for devices, connectivity, and uninterrupted power (Azim Premji University, 2021). The pandemic imparted NEP 2020's technology-for-equity provisions a pointed emphasis and brought technology's dual capacity as lifeline and gatekeeper to the forefront.

5.2 The Great Leveler: Capability for Equality, Access, and Customized Learning

With a successful implementation, NEP 2020 techno infrastructure can be an equalizer and quality education enablement (Joshi & Mishra, 2023).

• Infrastructure and Geographic Borders: DIKSHA, SWAYAM, multi-modal encompassing PM eVidya technology platforms reach high-quality learning to rural and disadvantaged students, closing the urban-rural education divide. Virtual labs provide experiential learning to infrastructure-less schools (NITI Aayog, 2022).

• Facilitating Personalized and Adaptive Learning: AI-driven learning solutions facilitate personalized learning paths based on an individual's ability, speed, and strength of learning—to competency-based learning in NEP (OECD, 2020).

• Facilitating Democratization of Access to Knowledge: Open Educational Resources (OER),digital libraries, and national repositories facilitate learners' and teachers' easy access to learn material to facilitate lifelong learning and ongoing professional development (UNESCO, 20)

6.RECOMMENDATIONS

National Education Policy 2020 has a strong and futuristic policy for India's education system. Its focus on technology as an access facilitator, equity enabler, and quality driver is timely and helpful. But its translation as a concrete fact would depend on a steady, purposeful, and joint effort of all concerned. Based on analysis in this paper, the following are policy recommendations

6.1 Policy Suggestions

A) Treat Digital Infrastructure as an Essential Public Utility: The digital divide cannot be bridged when internet connectivity is realized to be merely a consumer good. The government will have to attempt to make internet access for education an essential utility, as it is with water and electricity. For this, there would be a shift in policy to provide universal access through subsidized targeting of the poor, public-private partnerships for last-mile connectivity in rural and distant areas, and initiatives such as community Wi-Fi hotspots in each village Panchayat.

B).Take a Pedagogy-First Approach to Educator Development: Educator professional development needs to be turned away from tool-oriented training ("how to operate a smartboard") towards pedagogy-oriented up-skilling ("how to deliver an inquiry lesson with a smartboard").

C).National initiatives such as NISHTHA need to be reorganized in a way that pedagogic models such as the SAMR model and the principles of Constructivism are implemented stronger. Training needs to be ongoing, contextualized, and empower teachers with the abilities and skills to successfully support active learning in a digital environment. The state governments should encourage and incentivize states to create, consolidate, and release multilingual and localised content on DIKSHA-like platforms. The federated model will solve the issue of over-centralization, enhance contextualization of the curriculum, and ensure ownership at the state level of educational institutions.

D).Establish and Pilot Sustainable Device Access Models: "one laptop, one student" model is possibly not affordable at a national scale. One of the innovative and sustainable device access models must hence be experimented with. The following are creating community-owned and community-controlled Panchayat level device libraries, implementing "rent-to-own" on low-cost hardware, and employing Direct Benefit Transfers (DBT) for extending device allowance to economically weaker section students.

6.2 Conclusion

National Education Policy 2020 has aptly recognized technology as a strong enabler in the development of an education system for the 21st century in India. Its dream of having an integrated, interoperable, and intelligent digital ecosystem is visionary and consistent with contemporary pedagogic spirit of encouraging active, inquiry-learning. The policy envisages a broad and sweeping agenda for the future when quality education becomes available everywhere and to all.

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