Academic Guru

NATIONAL EDUCATION POLICY 2020: THE KEY TO DEVELOPMENT IN INDIA

Volume 1
Year: 2024

AG PH Books

Transforming Education: Optimizing Learning Environments through the Fusion of Signal Processing and IOT

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Abstract

In the Indian context, the New Education Policy (NEP) of 2020 is an innovative blueprint that foresees a fundamental transformation of the educational environment centred around technology. This paper investigates the symbiotic connection between technological integration as well as the NEP 2020, concentrating on IoT and signal processing. By adopting a learner-centric stance, the NEP 2020 considers the changing demands of twenty-first century. The objective is to establish an educational environment that is technologically advanced, flexible, and inclusive, with the capacity to accommodate diverse learning preferences. Furthermore, it promotes the early cultivation of critical thinking, creativity, as well as problem-solving skills.

Keywords: NEP 2020, IoT, Signal Processing, Technology, Higher Education.

1 Introduction

NEP 2020 is widely regarded as a groundbreaking initiative in the pursuit of educational advancement. The policy places significant emphasis on the integration of technology into the pedagogical process. In an effort to eliminate language barriers, policy places particular emphasis on multilingualism. Technology not only facilitates access but also plays a role in the planning and administration of

* ISBN No. - 978-81-973048-8-0

education. The learner-centric National Education Policy endeavors to revolutionize the field of education in order to adequately address the demands of our interconnected global society. (Nidhi, 2022)

The "National Education Policy" 2020 is divided into four sections: part-I addresses school education; part-II pertains to higher education; part-III deals with the promotion of Indian languages, adult education, and online education; and part-IV oversees the policy's implementation. The shared goal is to facilitate a comprehensive development of the students through the assurance of foundational knowledge. It provides a diverse array of insights that will enable the stakeholders to make further creative contributions to society. In pursuit of this constructive metamorphosis, the policy proposes modifications to academic curricula, enhancements to digital infrastructure, development of robust and pertinent foundational competencies, and a departure from the conventional assessment system. Additionally, vocational education is incorporated into the policy at both the secondary and tertiary levels. Virtual learning was enabled by technology to facilitate teaching and learning throughout the pandemic. Under duress, the education system underwent a significant overhaul. The advent of the National Education Policy facilitated the exploration of novel opportunities. Efforts have been made to attain "self-reliance" in India, and it is not inaccurate to state that technology will play a significant role in that regard.

1.1 Technology Integration with Respect NEP2020

The incorporation of technology into the educational system is an essential element of the 2020-approved New Education Policy (NEP) in India. The NEP proposes an all-encompassing and student-focused educational framework that utilizes technology to augment educational accessibility, excellence, and adaptability. In light of the NEP, the following are some essential components of educational technology integration:

Digital Infrastructure: The NEP prioritizes the establishment of high-speed internet connectivity and other digital infrastructure in institutions of higher education and the public sector. The establishment of this infrastructure is critical in facilitating the efficient application of technology within the realm of education.

Online and Blended Learning: The NEP acknowledges the value that integrated and online learning models contribute. The promotion of digital content, e-books, as well as educational resources is encouraged in order to facilitate self-paced learning and supplement classroom instruction. This facilitates the provision of high-quality education to students, irrespective of their geographic placement.

EdTech Platforms: The NEP promotes the advancement and implementation of educational technology (EdTech) platforms and tools that serve to augment the process of teaching and learning. These platforms may provide tracking analytics, personalized learning experiences, and assessment tools.

Teacher Training: The necessity for teacher training within digital literacy and proficient utilization of technology in the classroom is recognized by the policy. The primary objective of training programs is

to provide educators with the necessary competencies to effortlessly incorporate technology into the curriculum.

Multilingual E-content: To guarantee access and inclusivity for students of disparate linguistic backgrounds, the NEP advocates for the creation of digital materials in a number of Indian languages.

AI and Machine Learning: The prospective applications of artificial intelligence (AI) as well as machine learning (ML) in educational decision making, including personalized learning, adaptive assessments, and information analytics, are acknowledged by the NEP. It fosters innovation and research in the aforementioned fields.

Virtual Labs and Simulations: Virtual laboratories and simulations are promoted as pedagogical tools to offer practical learning experiences to students in disciplines such as engineering and science, where access to physical laboratories may be limited.

Open Educational Resources (OER): Notwithstanding their cost, the NEP promotes the development and dissemination of open educational resources. This causes textbooks and other educational materials to become more affordable.

Assessment and Examinations: The promotion of technology-driven assessment methods, including online examinations and computer-based testing, is intended to increase the transparency and efficiency of evaluations.

Data Security and Privacy: In order to safeguard students' information in light of the increased prevalence of technology, the NEP stresses the significance of privacy and security of data in academic institutions.

1.2 Digital Transformation in Higher Education

Digital transformation within higher education pertains to the amalgamation of innovative approaches and digital technologies with the aim of augmenting instructional, learning, and administrative procedures within academic establishments. This entails the implementation of digital tools, platforms, as well as pedagogies in order to cultivate institutional innovation, enhance operational efficiency, and provide students with more engaging as well as personalized learning experiences. The prominence of digital transformation has increased as a result of its capacity to tackle the evolving requirements of students, the dynamic nature of the education sector, and the swift progressions in technology.

Numerous studies have underscored the advantages that digital transformation within higher education has to offer. Favorable consequences that digital transformation has on operational effectiveness, student support, and the educational experience at large. The proponents contend that the implementation of digital technologies as well as e-governance systems empowers institutions of higher education to optimize administrative procedures, augment accessibility, and cultivate innovation.

1.3 How internet of Things is Transforming the Education System

The technological revolution of the last few decades has been on par with the transformation that occurred during the middle Ages and into the present day. Nevertheless, the nascent stage of the most significant technological advancement may be the Internet of Things' convergence of the virtual as well as physical realms. Sectors including customer service and healthcare have been significantly impacted by the Internet of Things. Further reliance on connected devices by colleges is likely to have an ongoing impact on the education sector. An increasing number of students, educators, and administrators are engaging in closer collaboration and utilizing data to extract valuable insights as the Internet of Things further permeates the education sector.

A few instances of how Internet of Things is transforming the education sector are as follows:

Global networking among students and educators: Students can now engage in global interactions with their peers, mentors, and educators from the convenience of their homes or classrooms by utilizing connected devices that include interactive boards and digital highlighters. Digital scanners facilitate learning by transferring text to devices in a digital format. In a similar vein, interactive boards facilitate and expedite the learning process through the exchange, recognition, and reception of information.

Enhancement of textbooks: QR codes, or Quick Responses, have been implemented in textbooks. Students have convenient access to feedback, assignments, and supplementary knowledge resources through the utilization of QR codes scanned with smartphones.

Easier data collection and analysis: Supervising the movements and whereabouts of every single student in a college that contains thousands of them is an impossible undertaking. "Radio Frequency Identification" chips scan and record data stored on a tag affixed to an object. The data can be accessed from a distance of several feet, without the object being in direct line-of-sight with the RFID chipper. The implementation of cloud-based applications for automated data analysis has begun at academic institutions. By obtaining firsthand perspectives on subjects that they would otherwise be limited to studying in textbooks, students enhance their educational journey.

Higher collaboration in group projects: Academic establishments foster a culture of collaboration through the utilization of Internet of Things. The idea is that students may share their data to a shared workspace by using their cellphones to scan a RFID tag or a QR code.

Greater safety in campuses: Wristbands and digitized identification badges are utilized to monitor students, staff, and visitors. A server that stores information regarding the last-known locations ensures that only authorized individuals have access to every area of the campus. Additionally, they function as the digital wallets and facilitate frictionless transactions. Moreover, school buses are equipped with GPS monitoring, which not only ensures a secure commute but also informs parents of the location of their children.

More efficient Institute Management: Using IoT to streamline day-to-day operations enables instructors to devote more time to actual teaching. For instance, devices that detect students' presence in institute automatically obviate the need for attendance records and enable administrators to notify parents via electronic message. By collaborating with IoT sensors, they can employ security measures such as unlocking doors exclusively for verified visitors and notifying management of any unauthorized access.

1.4 Importance of IoT in Transforming Traditional Teaching and Learning Methods

Current teaching and learning methodologies could be fundamentally altered by the implementation of IoT in education. The ability to acquire and analyze data in real time regarding pupil behavior and performance is a notable benefit of the Internet of Things in education. Using this data-driven methodology, instructors are able to adapt their lessons in accordance with students' progress. Using IoT data analytics, educators will customize interventions for students who are falling short in specific subject areas. Moreover, the IoT enables the provision of personalized and flexible learning experiences. Students gain access to personalized learning materials and tools through IoT-enabled platforms and devices, which are tailored to their specific needs and preferences.

By encouraging active student participation, this individualized educational approach enhances student motivation and engagement. Additionally, the IoT facilitates collaborative learning and communication. The utilization of IoT-enabled devices and platforms facilitates enhanced collaboration among students, instructors, and parents. Students utilize IoT technology to collaborate on assignments, exchange resources, and partake in group projects. through the development of communication skills, social interaction, and group collaboration in this collaborative learning environment.

In addition to enhancing the learning environment, the IoT provides access to a multitude of tools and resources. By utilizing devices and platforms that are facilitated by the Internet of Things, students are able to access online educational resources, interactive learning materials,. Students are encouraged to engage in autonomous as well as self-directed learning through their increased access to a variety of learning resources, which facilitates their dynamic and engaging exploration of knowledge.

Signal Processing Impacts on Education in NEP 2020

Development of E-Learning Platforms: The utilisation of signal processing is crucial in the creation of advanced e-learning platforms. It guarantees uninterrupted and crystal-clear online lectures as well as interactive sessions by optimizing data transmission, thereby guaranteeing high-quality audio and video streaming. This technological progression enables active student participation in the learning process and enables instructors to deliver materials in an impactful manner.

Improved Accessibility: Particularly in remote and rural regions, signal processing enhances the quality and efficacy of data transmission across networks, thereby increasing the accessibility of educational content. By optimizing bandwidth utilization and improving signal quality, latency and connectivity challenges are mitigated, thereby ensuring equitable access to educational resources for students across all regions.

Real-Time Communication: Signal processing has facilitated real-time communication, which is among its most significant effects. Ensuring uninterrupted video and auditory interactions is of the utmost importance in virtual classrooms, which aim to replicate the atmosphere of a physical classroom. Active participation from students is possible during live lectures, where they can pose inquiries and engage in discussions without any delay.

Augmented and Virtual Reality: The development of augmented reality (AR) as well as virtual reality (VR) applications is supported by signal processing. By providing students with a virtual environment in which to investigate intricate scientific principles, historical occurrences, and geographic locations, these immersive technologies transform the learning process. Students of history and biology, for instance, can virtually traverse the empires of ancient civilizations and dissect a frog.

Data Analytics and Machine Learning: Sophisticated signal processing techniques enable the acquisition and examination of enormous quantities of educational data. This information facilitates the development of individualized learning experiences that are optimized for each student. For instance, learning management systems may employ this information to suggest particular resources or exercises that could assist a struggling student in enhancing their performance.

Intelligent Tutoring Systems: In development of intelligent instruction systems, signal processing is also mandatory. By utilizing machine learning and natural language processing, these systems are capable of comprehending and answering inquiries from students, thereby delivering prompt and individualized feedback. Students are able to learn at their own tempo and receive assistance when they require it with the aid of this ongoing support.

Professional Development Programs: The utilization of signal processing technologies facilitates the provision of superior professional development initiatives for educators. By utilizing webinars, online courses, as well as virtual seminars, these programs guarantee that instructors are consistently informed about the most recent pedagogical approaches and technological advancements. This continuous training enables educators to proficiently incorporate cutting-edge strategies into their instructional practices.

Collaborative Platforms: Enhanced signal processing facilitates the development of educator collaborative platforms. Educators are able to collaborate on lesson plans, share resources, and engage in the professional learning communities through these platforms. By virtue of being able to gain knowledge and insights from one another, this promotes an environment that values innovation and ongoing refinement.

2 Literature Review

(Meenakshi Sundaram, 2020) The Union Cabinet of India unveiled National Education Policy 2020 on July 29, 2020, with the intention of substituting the previous policy from 1986. Its objective is to modernize and advance the Indian education system to align with the benchmarks of international competition, with a transformation target of 2030. Rapid changes are occurring in the technological and environmental spheres of the world. The competencies and reservoir of knowledge possessed by

contemporary students have undergone substantial transformations in the era of new education. Urgent changes were required to the educational infrastructure so that it could remain current with the requirements of the global education system. Numerous radical modifications were suggested for new education policy.

(K, 2020) Education is currently undergoing a similar transformation to other sectors as a result of the Internet of Things. Historically, learning has been confined to traditional settings such as classrooms, conferencing, and online seminars. However, with the advent of the Internet of Things (IoT), this trajectory began to gradually and consistently improve. Smart boards, digital highlighters, and electronic highlighters enable the digital transfer of printed texts to smartphones or other devices. Subsequently, interactive boards facilitate the reception, acknowledgment, and reciprocation of information, rendering learning not only engaging but also universally accessible.

(Malik et al., 2021) Education stands as a paramount necessity for every developing nation. As of 2020, India's education system is ranked 33rd globally. Similarly, the country places significant emphasis on education. As a result of technological and global developments such as COVID-19 and increased globalization, future of the work in all fields is undergoing a radical transformation. In order to meet the evolving demands of the international community, educational models must also be reevaluated. By 2025, India is projected to have the largest population of students aged 18 to 22 worldwide, according to an estimate.

(Majumdar & Mandal, 2021) In recent decades, the implementation of IoT in the realm of social science has significantly transformed the learning process. In recent times, technology has assumed a significant function within the realm of education. The implementation of this technology within the realm of education may be classified as a paradigm shift in culture. This research endeavors to investigate the functions of the Internet of Things in educational sector. Concurrently, emphasis has been placed on the challenges that Kolkata's educational institutions encounter when implementing this technology. In-depth observations and interviews were employed as research methodologies for the analysis. This study demonstrates that the utilization of this technology is more prevalent in nongovernmental organizations as opposed to governmental organizations.

(Pal & Dhillon, 2021) The primary objective of "National Education Polic"y (NEP) 2020 is to establish a holistic framework and provide a comprehensive outlook on secondary and tertiary education within the nation. In order to construct a new system, this approach suggests reshaping and amending every element of educational structure, such as its governance and regulation. The proposed framework is influenced by Indian cultural practices and value systems, in addition to the desired results of education in the twenty-first century, including the "Sustainable Development Goals" (SDGs). 4. Positive societal contributions, fruitful as well as conscientious public participation, and individual accomplishment as well as edification are all made possible by the availability of a high-quality higher education. Through education, citizens must be capable of leading meaningful and fulfilling lives, working in productive environment, and attaining economic independence. Integrating a well-defined set of values and skills at each stage of education is therefore essential, from the pre-school through higher education.

(Kumar, 2022) For nations all throughout the world, 2020 was a remarkable year. In addition to the Covid-19 pandemic, a significant development in India was the formulation of New Education Policy (NEP) 2020. Consistently, numerous committees have advocated for augmenting the education budget allocation to 6% of GDP; this has piqued the interest of scholars. The objective of this paper is to ascertain the focal points and issues of NEP 2020. NEP-2020 is a forward-thinking and progressive proposal that possesses both favorable and unfavorable characteristics. Its overarching goal is to ensure that all individuals have access to high-quality secondary and tertiary education, with an emphasis on comprehensive and research-driven advancements.

(Abrol & Jain, 2022) The "digital revolution" has significantly influenced numerous industries across the globe, including the realm of higher education. A substantial paradigm shift is occurring within higher education system of India as a result of the incorporation of e-Governance. This study investigates how India's higher education system is becoming digital and how e-Governance might change everything. An effort has been undertaken to confront the obstacles that conventional educational establishments in India encounter. Inefficiencies in the bureaucracy, reliance on manual procedures, and restricted availability of information and resources constitute these obstacles. The subsequent section emphasizes the advantages associated with adopting e-Governance, including heightened levels of transparency, optimized administrative procedures, improved accessibility to educational materials, and enhanced stakeholder collaboration.

(Nidhi, 2022) After a span of 34 years, the nation has obtained its inaugural education policy with the endorsement of the "Union Cabinet for National Education Policy" 2020. Significant importance is attributed to the incorporation of technology within NEP 2020, as it has the potential to facilitate comprehensive development. Additionally, regional languages will receive special attention in NEP 2020, as electronic courses will be created in those languages. Additionally, virtual laboratories will be established. Additionally, the establishment of a "National Educational Technology Forum" (NETF) is pertinent at this time. The NEP-2020 represents a groundbreaking initiative aimed at improving the education system.

(Vishwakarma & Singh, 2023) The purpose of this research is to examine the effects of NEP 2020's digitalization on society and quality of life. The sample size was determined through the use of convenience sampling and causal research methodology. Information for the study was gathered via a structured questionnaire from academics, students, and other participants. In the course of the research, 235 responses were gathered from the participants. Diverse statistical techniques, including exploratory factor analysis, confirmatory factor analysis, and linear regression, were utilized to analyze the responses.

(Kumari & Nigam, 2023) Integration of technology in education has emerged as a crucial component of educational reform worldwide. In the Indian context, the New Education Policy of 2020 is an innovative blueprint that foresees a fundamental transformation of the educational environment centred around technology. This abstract describes the NEP 2020 and its aims, strategies, and anticipated outcomes; it

also delves into the positive link between technology integration and the policy. By adopting a learner-centric stance, the NEP 2020 considers the changing demands of twenty-first century.

(Narzary, 2024) The educational system in India has undergone a significant transformation with the implementation of New Education Policy-2020, which has contributed to the nation's improved economic and social indicators. The augmentation of public expenditure on education led to an increase in the budget allocation to 6% of GDP. The objective of the present study is to elucidate the ways in which the implementation of National Education Policy, 2020 will contribute to the reformation of education across various tiers in the Baksa district of Assam. The primary objective is to ensure that all students have equal and fair access to the highest quality of higher education and instruction through the implementation of a comprehensive and evidence-driven methodology.

(Bhattacharjee, 2024) This article explores the revolutionary potential of India's "National Education Policy NEP" 2020, emphasizing its capacity to reshape the educational domain across all levels of education, from pre-primary to university, by implementing the 5–3–3–4 curricular structure. Through the promotion of interdisciplinary methodologies, incorporation into the "Indian knowledge system"and prioritization of skill enhancement, the NEP2020 endeavors to cultivate human capital that is competitive on an international scale. The culmination of India's growth trajectory will be attained through the integration of her expertise in value-based management and the development of proficient human capital. Commencing in stages since 2020, the implementation of this policy presents substantial obstacles and remedies, including the requirement for comprehensive infrastructure development, teacher professional development, and the integration of digital and environmental literacy.

(Meylani, 2024) Focusing on the IoT's significance in revolutionizing conventional methods of instruction, this analysis delves into its implementation and consequences in the classroom. It analyzes the inception and historical expansion of the Internet of Things, as well as its evolution and pivotal moments in its acceptance. In addition to smart devices, augmented and virtual reality, gamification, as well as collaborative learning, the review investigates IoT platforms, tools, and technologies in education. The paper additionally examines the impact of the Internet of Things (IoT) on enhancing campus administration, encompassing energy-efficient technologies, intelligent campuses equipped with IoT infrastructure, and enhancements to safety and security.

(Banal & Sharma, 2024) The National Education Policy (NEP) comprises a collection of regulations or statutes enacted by a nation's government to guarantee adherence to educational benchmarks and foster holistic student growth within its educational system. It provides a structure for the development of instructional materials that functions as a foundation for the implementation and dissemination of curricula across various fields of study. Each nation has a unique education policy, which encompasses specifics regarding the curriculum, assessment methods, and overarching goals. Comprehensive in scope, NEP 2020 is an all-encompassing policy document that regulates curricular modifications, financing structures, institutional administration, and governance in secondary and tertiary education.

(Sawant & Manerkar, 2024) This research article investigates the potential for Internet of Things (IoT)

as well as blockchain technologies to collaborate in order to enhance the effectiveness of National Education Policy (NEP) initiatives within the education industry. Amidst the paradigm shifts occurring in education, the incorporation of these technologies presents encouraging resolutions to obstacles pertaining to data security, openness, and effectiveness. Utilizing blockchain technology for decentralized learning platforms, secure pupil data administration, and credential verification is a component of the proposed framework. Simultaneously, Internet of Things (IoT) devices are utilized to establish intelligent learning environments, initiate real-time monitoring of attendance, and augment the overall educational experience. Assuring the integrity of resource allocation and examination procedures, blockchain technology is implemented, whereas smart contracts streamline stakeholder agreements.

3 Conclusion

By incorporating new policies, the "digital transformation" of higher education in India has the capacity to significantly transform the sector. This research paper offers significant contributions to the field of education by examining the effects of signal processing and the Internet of Things (IOT) on the education system. It does so by utilizing the NEP 2020 as a catalyst for digital transformation in higher education in India, thereby cultivating a digital ecosystem which allows institutions and advances student achievement.

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