IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Technological Advancements In The Field Of Education After Pandemic

AUTHOR DETAILS:

***AKANKSHA SINGH**
RESEARCH SCHOLAR
DAYALBAGH EDUCATIONAL INSTITUTE, DAYALBAGH, AGRA

**** Prof. CHHAVI LAL SINGH**
ASSOCIATE PROFESSOR
DAYALBAGH EDUCATIONAL INSTITUTE, DAYALBAGH, AGRA

*****Dr. JYOTIKA KHARBANDA**
ASSISTANT PROFESSOR
DAYALBAGH EDUCATIONAL INSTITUTE, DAYALBAGH, AGRA

Abstract:

The COVID-19 pandemic marked a paradigm shift in education, as it catalyzed the use of technology to overcome challenges in traditional teaching methods. This paper explores emerging trends in educational technology, focusing on Artificial Intelligence (AI), Virtual Reality (VR), Learning Management Systems (LMS), and their integration into blended and hybrid learning models. AI-based learning tools have revolutionized education through customized learning, auto-assessment, and real-time data analytics that help refine the teaching strategies. VR has provided immersive learning; students are exposed to interactive simulations of complex ideas, making learning more efficient and productive.

Learning management systems have been at the forefront of online learning as they manage all content, facilitate communication, and provide an opportunity for assessment. Such progressions have allowed a smooth shift toward blended learning: a mixture of face-to-face and digital instructions. Success with Ed-Tech in post-pandemic learning indicates a likelihood of access, engagement, and better outcomes in diverse populations. The National Education Policy 2020 is the backbone in integrating technology in education, digital infrastructure, and skill development through learner-centric approaches. AI tools, VR, and LMS solutions have therefore bridged the gaps in education, making it more inclusive, equitable, and relevant to current needs by aligning with NEP 2020. This paper points out how these innovations address post-pandemic challenges and transform education, preparing students for a technology-driven future in alignment with policy objectives and global trends.

Keywords: Online Learning, AI & VR in learning, Collaborative learning, Educational Technology in NEP2020

Introduction:

Education is the acquisition of knowledge, skills, values, and attitudes to foster both personal and societal growth. Schools and universities, among others, are formal place settings; however, educational experiences also come through informal experiences and self-learning. Generally, education is the foundation of intellectual development, critical thinking, and problem-solving. These enable people to work and contribute positively in society as responsible citizens. It also fosters social cohesion, cultural understanding, and innovation. Education evolves with the world; it is updated in line with technology and the prevailing societal needs. Educating people empowers them to build up to their full potential to make meaningful contributions to a community and the global world at large.

Pre-Pandemic Education was mainly classroom-based and depended on face-to-face contact, timetable-based learning, and traditional pedagogical approaches. Digital tools were supplementary to these traditional approaches, but not at the forefront of the teaching process. The pandemic and the shift towards remote learning drove this shift suddenly, thus making online platforms, virtual classrooms, and digital resources instrumental and bringing out the gaps in technology access and digital literacy. Post-pandemic, and going forward, is mostly a hybrid model-blending in-person and online. This shift has brought about the greater recognition of the need for flexibility, personalised learning, and integration of technology into pedagogy, but it has also drawn attention to equality, mental health, better teacher training, and the development of proper digital infrastructure.

The COVID-19 pandemic has had a profound impact on education, driving rapid technological advancements that have reshaped how learning is delivered and accessed. The sudden shift to online and remote learning during the pandemic led to widespread adoption of digital tools, fostering innovation in virtual classrooms, online assessment methods, and digital resources. Technologies such as artificial intelligence (AI), virtual reality (VR), learning management systems (LMS), and mobile applications have gained prominence, offering new ways to engage students and facilitate interactive learning. As education systems worldwide continue to adapt, these technological advancements are transforming the traditional educational landscape, making learning more accessible, flexible, and personalised, thus paving the way for a more resilient and future-ready education system.(Zhoujing Zhang,2023).

The COVID-19 pandemic served as a catalyst for unprecedented technological advancements in the field of education, fundamentally altering traditional learning paradigms. As educational institutions faced the urgent need to transition to remote learning, the integration of digital technologies became essential to ensure continuity in teaching and learning. This shift accelerated the adoption of tools such as Learning Management Systems (LMS), video conferencing platforms, artificial intelligence (AI), and virtual and augmented reality (VR/AR), transforming how educators deliver content and how students engage with it. These advancements have not only addressed the immediate challenges posed by the pandemic but have also laid the groundwork for a more flexible, accessible, and technology-driven future in education. This research paper examines the impact of these technological innovations, exploring their implications for teaching methodologies, student engagement, and the overall quality of education in a post-pandemic world.

Technology has impacted education dramatically. It changes the face of teaching methodologies, accessibility, and student engagement. It works with adaptive software to provide personalised learning, diverse techniques to accommodate different learning styles, and vast online resources. Online classrooms and distance learning websites facilitate virtual learning free from geographical barriers. Interactive instruments like simulations, gamification, and augmentative reality break the complexity of understanding it to make it more entertaining and comprehensible. Technology, however, also poses challenges like digital divide, overreliance on devices, and potential distractions. Appropriately integrated, it fosters cooperation, reflective thinking, and lifetime learning that equips students in the modern world while redefining how knowledge is delivered and assessed.

Emerging trends from a global perspectives:

From a global perspective, the pandemic has triggered several emerging trends in the field of education, driven by technological advancements. One of the most significant trends is the rise of hybrid and blended learning models, combining online and in-person instruction to offer greater flexibility and accessibility for students. Learning analytics, powered by artificial intelligence, is increasingly being used to personalise education, track student progress, and optimise teaching methods. Another notable trend is the growth of Massive Open Online Courses (MOOCs) and other e-learning platforms, providing learners across the world with access to high-quality education from leading institutions. Virtual and augmented reality (VR/AR) technologies are enhancing experiential learning by enabling immersive simulations and practical experiences in fields like medicine, engineering, and the sciences.

Additionally, mobile learning has gained momentum, particularly in developing regions where access to traditional educational resources may be limited. Digital equity, as a global concern, has also come to the forefront, prompting efforts to bridge the digital divide and ensure that all students, regardless of socio-economic status, have access to the necessary technology and resources for learning (Anna hurajova, 2022). Finally, lifelong learning and continuous upskilling, supported by micro-credentials and digital certifications, are becoming increasingly important in a rapidly changing job market. These trends highlight the growing intersection between technology and education, signalling a transformative shift in how knowledge is delivered and consumed globally. Plenty of research has been done into university Teachers and students having the perception of online learning during the COVID -19.(Durak, and cankaya,2020, polakova, and klimova, 2021).

In addition to the emerging trends already mentioned, several other key developments are shaping the global education landscape in the wake of the pandemic:

1. ***Artificial Intelligence (AI) and Automation in Education:*** AI is playing a transformative role in education through adaptive learning systems, automated grading, and AI-driven tutoring platforms. These tools are allowing for more personalised learning experiences by adjusting to individual student needs, providing real-time feedback, and automating administrative tasks, freeing up educators to focus on interactive teaching.

2. *Gamification and Edutainment:* The incorporation of gaming elements into educational platforms has gained significant traction. Gamification helps increase student motivation and engagement by using point systems, leaderboards, and challenges that make learning more interactive and enjoyable. This approach has proven especially effective in younger age groups and for subjects that benefit from visual and hands-on learning.

3. *Cloud-Based Education and Collaboration Tools:* Cloud technology has enabled seamless collaboration between students and teachers regardless of geographic location. Platforms like Google Classroom, Microsoft Teams, and other cloud-based Learning Management Systems (LMS) have become essential in maintaining the continuity of learning, fostering collaborative projects, and allowing teachers to manage coursework efficiently.

4. *EdTech Startups and Innovation:* The pandemic has fueled the rise of educational technology (EdTech) startups that are developing innovative solutions to meet the growing demand for online and remote learning. These startups are experimenting with AI, VR, blockchain (for credentialing and academic records), and other emerging technologies to enhance the learning experience.

5. *Focus on Social-Emotional Learning (SEL):* With the increased isolation and stress associated with remote learning, there has been a renewed emphasis on the mental health and well-being of students. Social-emotional learning programs, delivered through digital platforms, are helping students develop critical life skills such as resilience, empathy, and emotional regulation, which are increasingly recognized as essential for academic and personal success.

Research Questions of the Study:

1. What is the impact of Technology on education after a pandemic?
2. What challenges do educators face in using technology for teaching?
3. How does teacher training influence the integration of technology in classrooms?
4. What is the role of AI,VR,AR in shaping post -pandemic education?

Objectives of the Study:

1. To study the impact of technology on education after pandemic
2. To study the challenges faced by the Educators in using technology for teaching.
3. To study the importance of teacher training in technology integration.
4. To study the role of AI, VR, AR in post -pandemic education.

Future directions in Educational Technology:

The future of educational technology is poised to evolve rapidly, with several key directions shaping the way learning will be delivered and experienced globally. As technology continues to intersect with education, the following trends and advancements are expected to define the next generation of educational innovation:

1. Artificial Intelligence and Machine Learning:

***AI-driven Personalization*:** AI will continue to advance adaptive learning platforms, offering even more refined, personalised learning experiences tailored to individual student needs, abilities, and learning styles. AI-based systems will analyse vast amounts of student data to provide customised curricula, helping educators to address learning gaps more effectively.

AI Tutors and Chatbots: Intelligent tutoring systems and AI-powered chatbots will become more sophisticated, offering real-time assistance and support to students, answering queries, and guiding them through complex problems with minimal human intervention.

2. Immersive Learning with AR/VR and Mixed Reality:

Augmented and Virtual Reality: Immersive learning environments will see greater integration of AR/VR, allowing students to experience historical events, scientific simulations, and real-world environments in virtual spaces. These technologies will make experiential learning more accessible, particularly in subjects that require practical skills like medicine, engineering, and architecture.

***Mixed Reality Classrooms*:** Combining the best of physical and digital worlds, mixed reality will allow for highly interactive and collaborative learning environments. Students and educators will be able to interact with both physical materials and virtual content simultaneously.

3. Gamification and Game-Based Learning:

***Enhanced Gamification*:** The use of game design elements in educational contexts will grow, incorporating advanced scoring systems, real-time feedback loops, and interactive problem-solving tasks to increase student motivation and retention of knowledge.

***Serious Games*:** Game-based learning with a focus on real-world problem-solving and critical thinking will become a more prevalent method of teaching complex topics, engaging students through narrative-based simulations and competitive educational games.

4. Blockchain and Digital Credentials:

***Blockchain for Academic Records*:** The use of blockchain technology will expand to create secure, immutable records of student achievements, certifications, and diplomas. This technology will offer a more transparent, tamper-proof way of tracking academic credentials, easing the process of transferability across institutions and countries.

***Micro-Credentials and Digital Badges*:** Digital certifications and micro-credentials will gain further traction, enabling students to acquire specific skills in a shorter time frame. These credentials will be stored on blockchain systems, allowing for easy verification by employers and educational institutions.

5. The Rise of EdTech Ecosystems:

Interoperability and Integration: The future will likely see the development of interconnected EdTech ecosystems, where various platforms—such as learning management systems, assessment tools, and analytics systems—are seamlessly integrated. This will allow for smoother workflows for educators and students, facilitating data-driven decision-making.

***Collaborative Learning Platforms*:** Cloud-based collaboration tools will evolve, enabling students from around the world to work together in virtual teams, share resources, and co-create content, regardless of geographic barriers.

Integrating technology in education with Ed tech and AI tools:

Integrating technology in education, particularly with the use of EdTech and AI tools, is reshaping the learning landscape by making education more accessible, personalised, and efficient. This integration leverages digital tools and platforms to enhance the teaching and learning experience, foster collaboration, and provide real-time insights into student performance. Here are key ways in which technology is being integrated into education through EdTech and AI tools:

1. Personalized Learning through AI-Powered Platforms:

Adaptive Learning Systems: AI-driven platforms such as DreamBox or Smart Sparrow analyse student behaviour and learning patterns to create individualised learning paths. These systems adjust the content's difficulty based on a student's performance, ensuring that students can learn at their own pace, mastering concepts before moving forward.

Intelligent Tutoring Systems: AI-based tutoring tools like Socratic or Content Technologies, Inc. (CTI) assists students in real-time by providing personalised explanations, guiding them through problems, and offering customised study materials. These systems act as virtual tutors, reducing the dependency on human instructors for immediate support.

2. Automating Administrative Tasks and Grading:

***Automated Grading Tools*:** AI-based grading systems like Gradescope help automate the grading of multiple-choice, short-answer, and even complex assignments like essays. These tools free up teachers' time, allowing them to focus more on interactive teaching and providing qualitative feedback where necessary.

Learning Management Systems (LMS): Cloud-based platforms such as Canvas, Google Classroom, or Blackboard integrate AI to streamline administrative tasks, such as assignment submissions, attendance tracking, and resource sharing. AI also helps in scheduling and sending personalised notifications to students about deadlines and upcoming tasks.

3. Enhancing Student Engagement through Gamification and Interactive Tools:

***Gamified Learning*:** Tools like Kahoot! and Classcraft incorporate gamification in the learning process by adding competitive elements such as points, badges, and leaderboards. These tools engage students in a fun and interactive way, promoting active learning and making difficult concepts more approachable.

Interactive AI Tools: AI tools such as Nearpod and Pear Deck allow teachers to create interactive lessons, quizzes, and polls, making the learning process more engaging. These platforms provide real-time insights into student understanding, allowing teachers to adjust their teaching strategies on the go.

4. Virtual Reality (VR), Augmented Reality (AR), and Immersive Learning:

***VR in Education*:** Tools like Google Expeditions and zSpace allow students to explore virtual environments, conduct scientific experiments, or experience historical events in a fully immersive way. This enhances experiential learning, especially in subjects like history, geography, and biology.

***AR in Classrooms*:** Augmented reality tools such as Merge Cube or Augment allow students to visualise and interact with 3D objects. In subjects like engineering or anatomy, AR helps students gain a deeper understanding by overlaying virtual content onto real-world environments.

5. Data Analytics for Tracking Student Performance:

Learning Analytics Platforms: Tools like Brightspace Insights and Edmodo use data analytics to track students' learning progress, identify patterns, and predict potential learning gaps. These insights enable teachers to personalise learning materials, target interventions, and offer additional support where necessary.

***Predictive Analytics*:** AI-driven analytics tools use historical data to predict student outcomes and identify at-risk students early on. By analysing attendance, participation, and assessment scores, these tools help educators intervene before students fall behind.

Integrating technology in education through AI and EdTech tools is fundamentally transforming the way education is delivered. It enables personalised, data-driven learning experiences that improve student engagement, efficiency, and accessibility. As these tools continue to evolve, they offer the potential to bridge educational gaps, foster global collaboration, and ensure that students are equipped with the skills needed for the future. The ethical use of these technologies, along with an emphasis on inclusivity and equity, will be critical in shaping the educational landscape in the years to come.

Incorporating AI tools and online learning:

Incorporating AI tools into online learning represents a significant theoretical shift in educational practices, grounded in personalised learning and data-driven methodologies. The integration of adaptive learning platforms tailors educational experiences to individual student needs, enabling a customised approach that fosters engagement and mastery of content. Intelligent tutoring systems act as virtual educators, providing real-time feedback and support, while learning analytics empower educators to make informed decisions based on data insights regarding student performance and engagement.(Laxmi Tulsi, 2023). Moreover, AI facilitates collaboration through enhanced communication tools and peer interaction, promoting a sense of community in virtual environments. Assistive technologies improve accessibility for diverse learners, ensuring inclusivity. As these AI-driven innovations evolve, they present opportunities for continuous improvement in teaching strategies and professional development. This theoretical framework emphasises the transformative potential of AI in creating dynamic, responsive, and inclusive online learning experiences that meet the diverse needs of today's learners.(Tira Nur Fitria, 2021).

The incorporation of AI tools into online learning is revolutionising education by providing personalised, engaging, and data-driven experiences for students. These technologies enhance accessibility, streamline administrative processes, and improve teaching effectiveness, ultimately leading to better educational outcomes. As AI continues to evolve, its role in online education will expand, paving the way for more innovative and inclusive learning environments. The key to maximising the benefits of these technologies lies in their thoughtful and ethical implementation, ensuring that they serve the diverse needs of all learners. Incorporating AI tools into online learning has significantly transformed educational practices, emphasizing personalized, engaging, and data-driven experiences. AI-powered platforms increasingly provide tailored learning experiences based on individual students' needs, learning styles, and abilities. **OpenAI launched an education-focused edition of ChatGPT to approximately 500,000 students and teachers at California State University last year to further learning through individualized tutoring and study guides. Likewise, AI-facilitated intelligent tutoring systems have shown significant gains in learning outcomes, and studies indicate that students taking AI-enabled personalized learning software achieve 2 to 2.5 times more learning compared to students on standard MOOC platforms. Second, AI increases**

inclusivity and access, as demonstrated by sites such as QANDA, that utilize AI to provide step-by-step solutions and learning materials in order to equate education. As AI continues to evolve, its role in education is expanding, offering innovative and inclusive learning environments. However, the key to maximizing these benefits lies in their thoughtful and ethical implementation, ensuring AI serves the diverse needs of all learners while addressing challenges like data privacy and algorithmic bias. Ultimately, AI tools are revolutionizing education by improving accessibility, streamlining administrative processes, and enhancing teaching effectiveness, leading to better educational outcomes.

Roadmap of technology in use: It's challenges & implementation -

The roadmap for technology integration in education involves a structured approach comprising assessment, planning, implementation, and evaluation phases. It begins with analysing needs and engaging stakeholders to establish a strategic vision. The next phase focuses on selecting and piloting technologies, followed by comprehensive training for educators and aligning tools with the curriculum. Implementation is monitored, and continuous data analysis informs ongoing improvements. Challenges such as resistance to change, equity issues, data privacy concerns, training deficiencies, and technical challenges can hinder success. To address these, institutions should adopt collaborative, phased implementations with a focus on pedagogical goals, ensuring ongoing feedback and community engagement. Overall, this roadmap emphasises that effective technology integration can enhance learning experiences and outcomes for all students when approached thoughtfully and strategically.

Integrating technology into education presents several challenges that institutions must address for successful implementation. One major issue is resistance to change, as educators and administrators may feel comfortable with traditional teaching methods or sceptical about new technologies. To combat this, fostering a culture of innovation through showcasing successful use cases and providing incentives for early adopters can encourage acceptance. Additionally, equity and access issues arise when disparities in technology and internet availability hinder students in under-resourced communities. Investing in infrastructure and forming partnerships to supply devices can help bridge this gap. Data privacy and security concerns are also significant, necessitating the implementation of strict data governance policies and transparency regarding data usage, alongside selecting tools with strong security measures. Furthermore, insufficient training and support for educators can impede effective technology integration, making comprehensive professional development programs essential. Technical challenges may arise if existing systems are incompatible with new technologies, highlighting the need for thorough assessments prior to implementation. Lastly, a lack of clear pedagogical focus can lead to technology being used without educational purpose, so it is crucial to emphasise its role as a tool for achieving specific learning goals. By addressing these challenges with strategic solutions, educational institutions can effectively harness technology to enhance learning outcomes and experiences for all students. (Mircae Muresan, 2023).

The implementation of technology in education requires a systematic approach to ensure that it enhances learning outcomes effectively. The process begins with a thorough assessment of needs and stakeholder engagement to establish a strategic vision aligned with educational goals. Once the appropriate technologies

are selected, pilot programs are essential for testing their effectiveness in a controlled environment, gathering feedback to make necessary adjustments. Comprehensive professional development is critical for educators, as it equips them with the skills and confidence to integrate technology into their teaching practices seamlessly. Aligning technology with curriculum development ensures that digital tools enhance, rather than detract from, educational objectives. (Aftab Alam, et al., 2022).

Ensuring the security and privacy of student data when using Technology:

Ensuring the security and privacy of student data in educational technology involves a multifaceted approach encompassing several critical components. First, establishing comprehensive data governance policies is essential for outlining how student information is collected, processed, stored, and shared, promoting transparency and trust among stakeholders. Compliance with relevant regulations, such as the Family Educational Rights and Privacy Act (FERPA) in the United States and the General Data Protection Regulation (GDPR) in the European Union, is crucial to uphold student rights and ensure legal protection, including obtaining consent for data collection (Deetya, 2023). Implementing strong data security measures, such as encryption for data in transit and at rest, role-based access controls, and regular security audits, helps safeguard sensitive information from unauthorized access and breaches.

The significance of these steps is highlighted by the growing number of cyberattacks on educational institutions. In 2023, the education sector witnessed a 105% rise in known ransomware attacks, from 129 in 2022 to 265 in 2023. Higher education institutions alone witnessed a 70% rise, with attacks rising from 68 in 2022 to 116 in 2023 (Wired, 2023). In choosing educational technology providers, institutions should thoroughly review their data privacy and security policies, giving priority to those that have shown transparency and regulatory compliance. Educators and staff should be trained on data privacy practices to ensure responsible data handling and establish a culture of awareness of possible risks. In addition, with a sound incident response plan, institutions are in a better position to promptly tackle possible data breaches, thus curbing losses and regaining student and parent confidence. Encouraging dialogue involving students and parents regarding data privacy also reminds stakeholders of the imperative to protect information, finally developing a secure academic environment.

The economic consequences of data breaches in schools are considerable. The cost to institutions to contain and recover from a cyber incident is estimated at $3.79 million, including technology, manpower, legal costs, and possible fines (Varonis, 2023). By using these integrated approaches, schools can more effectively safeguard student information, meet legal mandates, and retain the confidence of their communities.

Changes in the management and teaching learning methods after pandemic :

After the pandemic, significant changes emerged in management and teaching-learning methods in education. Schools and universities quickly shifted to online platforms, using digital tools like Zoom, Google Classroom, and Learning Management Systems (LMS) to facilitate remote learning. **A Statista report in 2024 indicated that 93% of educators from the United States utilized LMS post-pandemic, up from 70% pre-pandemic. The trend required the transition of blended and hybrid models through in-class**

and online instruction, always prioritizing flexibility. Additionally, 87% of instructors adopted collaborative tools such as Google Docs and Microsoft Teams since they enhance collaboration and interaction among students (Statista, 2024).

Student-centered paradigms became rampant in weaving active learning, collaborative resources, and self-guided materials into their fold. Virtual classrooms as well as usage of asynchronous material increased, including recorded lectures as well as utilization of self-guided modules to the tune of 120% growth. The asynchronous model increased flexibility for learning at one's own pace by students. It also became well-liked among educators to do the flipped model of the classroom where students master content on their own and apply active learning for live sessions**. A study in August 2024 found that 76% of the students were engaged and content with their hybrid learning spaces (ResearchGate, 2024).**

The pandemic also unveiled the mental health side of both teaching and management. Reading and math attainment fell after the pandemic by significant percentages based on the 2024 National Assessment of Educational Progress (NAEP). For instance, 33% of the students were not able to demonstrate basic reading ability, up from 20% prior to the pandemic (Parents, 2024). Institutions have made interventions such as high-dosage tutoring programs to overcome these challenges. Louisiana's efforts have been in phonics, phonemic awareness, and conventional math practice, which have begun to demonstrate improved changes in student performance (NYP Post, 2025).

The pandemic has reshaped the educational landscape, emphasizing the need for continuous innovation, robust digital infrastructure, and a return to foundational skills to address emerging learning deficits. With these strategies, educators hope to balance the increased use of technology with the critical need for personalized, flexible learning approaches that support both academic and emotional well-being.

Evaluating the instructors effectiveness in e-learning :

Evaluating instructor effectiveness in e-learning involves assessing their ability to deliver clear and well-organized content, engage students through interactive tools, and provide timely, constructive feedback. Instructors must also demonstrate technical proficiency in using digital platforms, troubleshoot issues, and adapt teaching methods to meet student needs. Recent studies emphasize the critical role of instructors' technical skills and engagement strategies in determining effectiveness. A research paper in Frontiers in Psychology concluded that teachers' satisfaction with online instruction had a major influence on their performance, highlighting the significance of perceived ease of use and usefulness of online platforms (Frontiersin.org, 2023). **Student engagement is a strong predictor of instructional effectiveness, and e-learning has recorded incredible gains in retention rates, performing better than conventional classroom environments by up to 60%, as concluded by Magnetaba.com (2023).** Alongside, there comes a time of increased adaptation of teaching techniques along with innovations by flipped classrooms, collaborative tools. It emphasizes instructors' performance along with the proficient use of digital tools, creativity, and effective development of attractive, engaging material to promote active learning in learners. This is further supported by the fact that a study revealed a major impact of the usage of digital tools on teacher satisfaction and also on the performance of students during the pandemic (Frontiersin.org, 2023). By

focusing on these factors, educators can enhance their effectiveness in online settings with improved learning outcomes and satisfaction among students.

Bridging the gap of digital divide :

Bridging the digital divide in India involves addressing disparities in access to technology, internet connectivity, and digital skills. Key strategies include providing affordable internet access, distributing devices like laptops or tablets to underserved communities, and ensuring digital literacy through education and training programs. Governments, schools, and private organizations collaborate to implement infrastructure in rural or low-income areas, while policymakers work to reduce the costs of technology and internet services. Additionally, fostering partnerships with tech companies and offering community-based digital skills training can empower individuals to fully participate in the digital economy. **Recent statistics indicate the persisting challenges and developments in this sector: India had 751.5 million internet users as of January 2024, which accounted for 52.4% of the population, thus leaving 47.6% of the population without access (Datareportal, 2024). Concerning digital literacy, over four million individuals were trained under India's digital literacy initiatives during the financial year 2024 (Statista, 2024). Nevertheless, there is a vast rural-urban digital divide in India, and internet penetration in rural areas is 58% less than that in urban areas, a disparity higher than the world average of 49% (IASSCORE, 2024).** These statistics underscore the critical need for targeted initiatives to enhance digital infrastructure, promote digital literacy, and make technology more affordable, ensuring equitable access to digital resources and opportunities for all.

Emphasis on use and integration of educational technology in NEP 2020:

NEP 2020 places significant emphasis on the integration of educational technology to modernise and democratise education in India. It envisions the creation of a comprehensive National Educational Technology Forum (NETF), which will serve as a platform for the exchange of ideas on the use of technology to improve learning, assessment, and governance. The policy highlights the role of AI-driven personalised learning and adaptive assessments to cater to individual student needs, making education more learner-centric. In essence, NEP 2020 aims to leverage technology to reduce inequities, promote innovation, and ensure the education system is agile and responsive to the demands of the 21st-century digital economy.

The National Education Policy (NEP) 2020 emphasises the crucial role of technology use and integration in enhancing India's education system. It advocates for the establishment of a robust digital infrastructure to facilitate online and blended learning, ensuring that all students have access to quality educational resources, especially in remote areas. The policy promotes the use of educational technology for personalised learning experiences, leveraging Artificial Intelligence and data analytics to tailor education to individual needs. NEP 2020 also calls for the creation of the National Educational Technology Forum (NETF) to guide and support the integration of technology across all levels of education. Additionally, it emphasises digital literacy for both students and educators to ensure effective technology use. By fostering innovation and adaptability,

NEP 2020 aims to create an inclusive and responsive education system that prepares learners for the challenges of the 21st century.

NEP 2020 places significant emphasis on the integration of technology across all levels of education, recognizing its potential to transform teaching and learning processes. The policy aims to develop a comprehensive digital infrastructure that facilitates not only online and blended learning but also the creation of open educational resources. It encourages the use of Massive Open Online Courses (MOOCs) and other digital platforms to provide learners with access to diverse learning materials and high-quality content. Furthermore, NEP 2020 highlights the importance of enhancing digital literacy among students and teachers, ensuring they possess the necessary skills to navigate and utilise technology effectively. It promotes innovative teaching practices, including personalised and adaptive learning, which leverage data analytics and artificial intelligence to tailor educational experiences to individual students. The establishment of the National Educational Technology Forum (NETF) is a pivotal aspect of the policy, providing a platform for stakeholders to collaborate, share best practices, and develop guidelines for the effective use of technology in education. Overall, NEP 2020 aims to create an equitable, inclusive, and technology-driven education system that prepares students for the demands of a rapidly evolving digital landscape.

In summary, NEP 2020 envisions a transformative approach to education through the effective use of technology. By fostering innovation, improving infrastructure, and promoting digital literacy, the policy aims to create an inclusive and responsive education system that prepares students for the demands of the digital age.

The success of educational technology in post covid:

The success of educational technology in the post-COVID era has been characterized by the widespread adoption and integration of digital tools in teaching and learning. The pandemic acted as a catalyst, accelerating the shift from traditional classroom-based education to online and hybrid learning models. As schools and universities rushed to ensure continuity in education, they rapidly turned to digital platforms such as Zoom, Google Classroom, Microsoft Teams, and Learning Management Systems (LMS), which became indispensable in facilitating remote learning. This transition led to the development of more robust online platforms, interactive learning resources, and collaborative tools designed to engage students in ways that traditional methods could not. These tools have provided the avenue to learn more on a person-to-person basis. It provides experience tailored to a student's individual needs (Zhang, 2021).

In addition, educational technology has contributed much to increasing access. Students with various backgrounds-from those from rural communities or otherwise marginalized communities-are now accessing quality educational resources previously unavailable. The adoption of technologies has enabled educational institutions to reach a wider audience, thereby breaking geographical and socio-economic barriers. With the expansion of online learning resources, students no longer have to rely on physical classrooms or limited library resources to further their education, making learning more inclusive (Zhao et al., 2021).

As the usage of digital tools became more institutionalized in the education sector, educators learned effective online teaching strategies. Teachers and instructors, most of whom were not familiar with digital tools prior

to the pandemic, had to learn new technologies on the go. This shift prompted educators to embrace a variety of teaching methods that leverage digital resources, such as gamification, multimedia presentations, virtual simulations, and interactive assignments, all of which have enhanced student engagement and learning outcomes. The pandemic also highlighted the importance of teacher professional development, with institutions dedicating more resources to training educators in the use of technology and fostering digital literacy. As a result, educators have become more skilled in delivering online courses, troubleshooting technical issues, and using data analytics to better track student performance (Leung, 2003).

Current statistical evidence reinforces the extent of the digital revolution in learning. For example, about 60% of educators utilizing digital planning tools learned them during the pandemic, while there was an upsurge from 28% pre-pandemic to 52% daily use of digital teaching materials in 2024 (Brookings, 2024). Hybrid learning models, which combine online and face-to-face instruction, have become widely adopted, with studies showing that they foster independent learning and provide flexibility for students (Zhang, 2021). Moreover, educational technology has facilitated greater student engagement. Online learning environments, equipped with collaborative tools like discussion forums, virtual breakout rooms, and interactive content, have encouraged more active participation from students. This shift has been particularly beneficial for those who may have been less engaged in traditional classroom settings, as the digital tools offer more opportunities for interaction and feedback (PMC, 2024).

Overall, the post-COVID educational landscape reflects a more resilient and adaptable education system that leverages technology to enhance learning outcomes. The ongoing investment in digital infrastructure, coupled with a focus on professional development for educators, ensures that technology continues to serve as an effective tool for achieving educational goals. Such further integration of AI, data analytics, and interactivity into learning will further be a promise to more personalized learning in the future. With the embedding of technology into the school system, this has now created a focus for the equitable exploitation of these advantages to ensure every student has the opportunity to achieve success regardless of their background or circumstances (Zhao et al., 2021).

Conclusion :

The COVID-19 pandemic strongly pushed forward education's transformation into something that makes use of technological adoption. Some of the online learning trends now in use with AI integration, and adaptive technology, change old methods of traditional teaching and learning, which, at present, is becoming highly flexible and individualized. Education systems are starting to use AI tools for augmenting teaching efficiency, automating administrative workloads, and allowing educators and learners to make informed data-driven decisions. But in this digital world, there is also a necessity to ensure safety and privacy for users. The pandemic exposed a hardware divide and an internet divide as well as a lack of digital literacy programs. Technology adoption in India resonates with the National Education Policy (NEP) 2020, which forms a philosophy guiding an education system that is inclusive and student-centric. The emphasis of NEP is to utilize digital mechanisms for multilingual learning, development of skills, and outreach that has given the foundation for continuous learning. **From the numerous goals, GER of higher education has been aimed**

at being raised to 50% by 2035, the push for e-learning and other digital empowerment is key drivers towards the achievement of this goal. The National Digital Library of India (NDLI), which has established more than 5,800 clubs and has almost 1.7 million members, is crucial in fostering digital literacy and sharing resources. Educational technology in the post-pandemic world has proven successful when it fosters collaboration, accessibility, and innovation. While challenges persist, such as bridging the digital divide and ensuring data security, the advancements made in integrating technology into education during the pandemic have demonstrated its potential to reshape education. **Halfway across the globe, 5.4 billion individuals, or 67% of the world's population, are connected to the internet, but 2.6 billion individuals still do not have internet access, which highlights the urgency of efforts to close these gaps.** Up to this point, the gains so far have vindicated the transformatory character of technology as an evolving, resilient, and future-proofed learning environment.

References:

Agarwal, P., & Kaushik, J. S. (2021). Role of digital learning during the COVID-19 pandemic: A case study of India. Educational Technology & Society, 24(3), 42–48.

Anderson, T., & Dron, J. (2020). Online learning: Impacts of the pandemic and future trends. Journal of Learning Design, 13(4), 1–15.

Brown, M. T., & Green, T. D. (2022). Integrating artificial intelligence in education: Opportunities and challenges. Computers & Education, 180, 104423. https://doi.org/10.1016/j.compedu.2022.104423

Choudhury, B., & Pattnaik, S. (2021). Bridging the digital divide: Strategies for inclusive education post-COVID-19. International Journal of Educational Development, 85, 102440. https://doi.org/10.1016/j.ijedudev.2021.102440

DataReportal. (2024, January). Digital 2024: India. Retrieved February 15, 2025, from https://datareportal.com/reports/digital-2024-india

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. Journal of Educational Technology Systems, 49(1), 5–22. https://doi.org/10.1177/0047239520934018

GS SCORE. (2024, March). Digital Divide and India. Retrieved February 15, 2025, from https://iasscore.in/current-affairs/digital-divide-and-india

Gutierrez, K. (n.d.). Facts and stats that reveal the power of eLearning. SHIFT eLearning. Retrieved February 15, 2025, from https://www.shiftelearning.com/blog/bid/301248/15-facts-and-stats-that-reveal-the-power-of-elearning

Indian Ministry of Education. (2020). National Education Policy 2020: Transforming education in India. Retrieved from https://www.education.gov.in/nep2020/

Ingabire, H. (2024, August). Hybrid Learning Models: Combining In-Person and Online Education Effectively. Retrieved from https://www.researchgate.net/publication/383556427_Hybrid_Learning_Models_Combining_In-Person_and_Online_Education_Effectively

Jacob, B. A., & Stanojevich, C. (2024). The lasting effects of the COVID-19 pandemic on K-12 schooling. EdWorkingPapers. https://edworkingpapers.com/sites/default/files/ai24-1020.pdf

Koehler, M. J., & Mishra, P. (2009). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017–1054.

Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during lockdown: Students' perspective. International Journal of Educational Research Open, 1, 100012. https://doi.org/10.1016/j.ijedro.2020.100012

National Digital Library of India. (2024). National Digital Library of India (NDLI). Wikipedia. Retrieved February 15, 2025, from https://en.wikipedia.org/wiki/National_Digital_Library_of_India

OECD. (2021). Education at a glance 2021: OECD indicators. OECD Publishing. https://doi.org/10.1787/b35a14e5-en

OpenAI. (2025, February 4). OpenAI and the CSU system bring AI to 500,000 students & faculty. OpenAI. https://openai.com/index/openai-and-the-csu-system/

Parents. (2024, February 4). Latest National Report Card Says Kids' Reading Scores Have Hit All-Time Lows. Retrieved from https://www.parents.com/new-report-shows-record-low-reading-scores-among-kids-8785080

Selwyn, N. (2021). Education and technology: Key issues and debates. Routledge.

Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning. American Journal of Distance Education, 33(4), 289–306. https://doi.org/10.1080/08923647.2019.1663082

St-Hilaire, F., Vu, D. D., Frau, A., Burns, N., Faraji, F., Potochny, J., Robert, S., Roussel, A., Zheng, S., Glazier, T., Romano, J. V., Belfer, R., Shayan, M., Smofsky, A., Delarosbil, T., Ahn, S., Eden-Walker, S., Sony, K., Ching, A. O., Elkins, S., Stepanyan, A., Matajova, A., Chen, V., Sahraei, H., Larson, R., Markova, N., Barkett, A., Charlin, L., Bengio, Y., Serban, I. V., & Kochmar, E. (2022). A new era: Intelligent tutoring systems will transform online learning for millions. arXiv. https://arxiv.org/abs/2203.03724

Statista Research Department. (2024, August 23). Trained beneficiaries in digital literacy scheme in India FY 2018-2024. Statista. Retrieved February 15, 2025, from https://www.statista.com/statistics/1196927/india-trained-beneficiaries-in-digital-literacy-scheme/

UNESCO. (2020). Education in a post-COVID world: Nine ideas for public action. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000373717

Van Deursen, A. J. A. M., & Van Dijk, J. A. G. M. (2019). The first-level digital divide shifts from inequalities in physical access to inequalities in material access. New Media & Society, 21(2), 354–375. https://doi.org/10.1177/1461444818797082

Wikipedia contributors. (2024, March). QANDA. In Wikipedia, The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/QANDA