DIGITAL TECHNOLOGY IN EDUCATIONAL DISCOURSES AND TRANSACTIONS: APPLICATION, NEEDS AND CHALLENGES

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Abstract

Technology in education refers to the use of digital devices, tools, online learning platforms and software to enhance the teaching-learning experiences by making learning more interactive and engaging. This research paper attempts to study the comparison between traditional education and today's education system, the application of technology in education, the technological needs of modern classrooms (21st-century) in the vision of NEP 2020, the importance of technology and the challenges faced in its application. The finding revealed that traditional education is more teacher-centred, rigid and today's education is student-centred, more flexible and technology-driven. The advancements in technology have brought an evolution in education by increasing accessibility through e-learning platforms, reducing cost, providing vast access to information, personalized learning, and global collaboration. By integrating various technological tools and devices such as e-learning platforms, Google classrooms, Kahoot! assistive and adaptive technologies, virtual reality, augmented reality, educators can enhance engagement, improve learning outcomes, and equip students with skills needed to succeed in a technology-driven world. The National Education Policy 2020 also stressed including technology in modern classrooms (21st century) to foster an innovative and inclusive learning environment. By integrating digital infrastructure, AI-powered tools, learning analytics, OER, Internet of Things (IoT), seminars and webinars for teachers' professional development, institutions can enhance student engagement, personalized learning, skill development and prepare students for the demands of the 21st century by instilling creativity, innovation and making them aware of ethical use of technology. While technology has immense potential, its implementation faces several challenges, ranging from digital inequity, resistance to change, quality and reliability of the educational content, teacher preparedness, privacy concerns. To overcome these problems, governments, educational institutions, educators, and technology suppliers must work together to ensure that the benefits of technology are realized and that it is used to promote equity, inclusivity, and increased learning experiences.

Keywords: *Technology in Education, Traditional Education system, Today's Education system, Modern classrooms (21st century),National Education Policy (NEP 2020).*

Introduction:

The 21st century has witnessed a rapid evolution in technology, reshaping every facet of human life, including education. As the world becomes increasingly interconnected and reliant on digital innovation, the role of technology in education has emerged as a pivotal driver of transformative

experiences(Kalyani, 2024). While technology evolves rapidly in the 21st century, educational institutions sometimes struggle to align with the changing requirements of the labor market (Karakolis et al., 2022). This research articlesheds light on a comparison between traditional education and today's education and explores the application of technology in education, the profound impact of technology integration in educational settings, the technological needs and the importance of the application of technology in education focusing on how it enhances learning outcomes and fosters essential 21st-century skills and the challenges faced in application of technology.

Objectives of the study:

1. To draw a comparison between conventional education and today's technology-based digital education system.
2. To study the application of technology in educational discourses and transactions.
3. To understand the technological needs of modern classrooms (21st-century) management per the vision and fundamental principles of NEP 2020.
4. To study the importance of technology in 21st-century education.
5. To study the challenges in the application of technology in education.

Comparison of Conventional Education and Today's Digital Education:

Traditional Education and Today's Education differ in their pedagogical approaches, assessment methods, role of teachers, learning materials, methodologies, etc.

The comparison is as follows-

Aspects	ConventionalEducation	Today's Digital Education
Mode of delivery	• Face-to-face classroom instructions • focus on lecture method, more teacher-centered • less flexibility in education	• Hybrid (both online and face-to-face instructions) • Learning through games, digital classrooms, video-lectures, more student-centered • More flexible schedule
Role of technology	• Limited use of technology • More emphasis on traditional materials for learning (books, paper-based assessments)	• Use of technology in every aspect • Online tools for assessment, assignments, and tests are available • Use of Artificial Intelligence and Gamification in education
Pedagogical approach	• Teacher-centered approach • More emphasis on rote-learning	• Student-centered approach • Emphasis on critical thinking, collaboration, creativity and problem-solving

Aspects	ConventionalEducation	Today's Digital Education
Assessment methods	• No continuous feedback given • Feedback given at the end of the course	• Continuous feedback is given through quizzes, peer review, teacher-learner interaction • More focus on formative assessment (during the course)
Access to information	• Limited access to information • Information confined to textbooks, libraries	• Vast information can be gathered • Online platforms (Google, educational websites, MOOCs) can be accessed
Learning environment	• Fixed schedule in the classrooms • Less interaction between teacher and learner beyond the classroom	• Flexible schedule • To enhance interaction between the teacher-learner, collaborative tools are there
Cost	• Can be expensive	• Online learning platforms like MOOCs (SWAYAM, COURSERA, etc.) have cut down the cost
Role of teacher	• Teacher: the primary source of knowledge	• Teacher: facilitator, guide
Social interaction	• Limited social interaction • Mainly face-to-face	• Global interaction is possible because of technology
Lifelong learning	• Learning limited to childhood and adulthood	• Continuous education • Education throughout life
Democratising education	• Less emphasis on students' autonomy • Students are passive in the educational system	• Learner autonomy is given the utmost priority • The entire education system seems transparent

Application of Technology in Education:

Technology in education refers to using digital resources, tools, and techniques to enhance the teaching-learning process. The application of technology in education has brought transformation in the learning of the students and the way teachers teach.

1. E-learning Platforms-

E-learning platforms like MOOCs (SWAYAM, COURSERA, edX) and KhanAcademyoffer online courses for learners. They focus on afford ability and accessibility in education, by making learning flexible.

Benefits:

- Accessibility to high-quality content from top institutions and universities.
- Life-long learning.
- Students can learn at their own pace i.e., flexible learning.
- A multidisciplinary approach is followed.
- Adaptive learning pathways.
- Cost-effective.

Interactive and engaging content.

MOOCs and their learners in 2021:

MOOCs	Learners
SWAYAM	22 million
Coursera	97 million
Future Learn	17 million

Source: Class Central, 2021

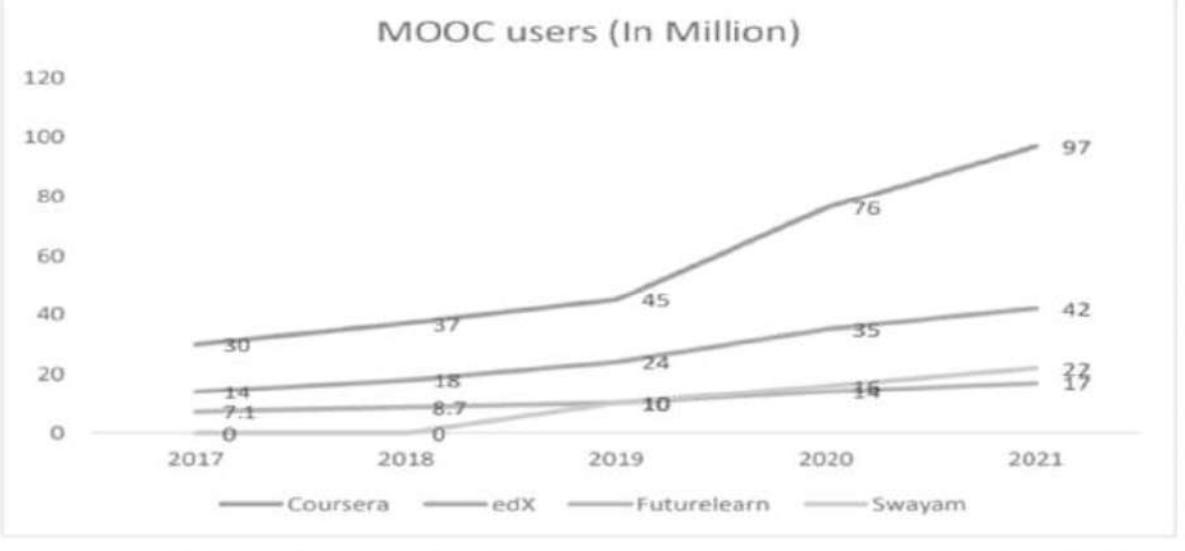


Figure1: MOOCs provider-wise number of users *source: Class Central, 2021*

MOOCs and their learners in 2024:

MOOCs	Learners
SWAYAM	48 million
Coursera	142 million
Future Learn	46 million

2. Learning management systems (LMS):

Universities or institutions use LMSs like Google Classroom, Canvas, and Moodle to help with the planning, implementation, and assessment of the learning process.

Benefits:

- Track student progress and manage the courses.
- Help with course administration, analytics and delivery.
- Enhances communication and collaboration
- Customised content according to the needs of the learners
- Improves students' engagement through games, quizzes, simulations, etc.

3. Gamification:

Use of games to make learning more engaging. Platforms like Kahoot! and Classcraftmake learning more fun.

Benefits:

- Motivates the students and increases their participation.
- Learning becomes more enjoyable.
- Friendly competition among students through leaderboards.
- Fosters collaboration.
- Development of problem-solving skills and critical thinking.
- Help students develop real-world skills.

4. Virtual and Augmented Reality:

Virtual reality and augmented reality allow the students to explore the stimulations or environments that would not be possible in the physical world.

Benefits:

- Virtual field trips, science excursions, or experiments are possible.
- Provides interactive experiences.
- Enhances engagement by providing hands-on experiences.

5. Mobile learning:

The use of smartphones and tablets made it easier to access learning materials. Apps like Quizlet, Google Classroom are helping learners by making learning more effective.

Benefits:

- Flexibility in learning.
- Allows learners to learn anytime and from anywhere.

6. Artificial intelligence and adaptive learning:

AI tools like Dream Box, Smart Sparrow offer personalized content according to the needs and experiences of the learners.

Benefits:

- Identifies gaps in knowledge and areas that require improvement.
- Tailored educational content and learning experiences based on the needs of the students.

7. Cloud computing:

Google Drive, One Drive allows teachers and students to store, and share learning materials online.

Benefits:

- Organizing and managing the educational content is much easier.
- Supports collaborative learning.

8. Social media learning:

Social platforms like Twitter, Facebook, Linked in provide wide access to information and allow teachers, students, and institutions to share educational content online.

Benefits:

- Fosters collaborative and global learning.
- Access to vast educational content.

9. Open educational resources (OER):

OER includes course materials, textbooks, and modules that are available for free. These materials can be used by anyone. OER like NPTEL, khan Academy, MERLOT, and Commonwealth of Learning provide access to quality educational content.

Benefits:

- Access tohigh-quality educational content.
- Helps students to become more active participants and supports lifelong learning.

10. Video-based learning:

Video tutorials and lectures are provided by platforms like YouTube, Vimeo on a wide variety of topics.

Benefits:

- Allows students to learn at their own pace.
- Video content clearly explains complex things.

11. Assistive technology:

Assistive technology like hearing aids, adaptive keyboards, screen readers (VoiceOver, JAWS)help students with special needsby providing them access to education according to their needs. The goal is to provide equal educational opportunities to them.

Benefits:

- Remove barriers by allowing students with special needs to get access to the same educational content as their peers.
- Reduces dependence on others and improves learning outcomes.

12. Flipped classrooms:

In flipped classrooms, students first learn about a new subject at home, especially online, and then have discussions on it in class.

Benefits:

- Active engagement of students.
- Enhancing teamwork and communication.
- Students can learn at their own pace i.e., personalized learning.
- More interactive class time.
- Teacher as a facilitator (NEP2020)

Summarising the key aspects of technology in education:

Category	Description	Technology
E-learning	E-learning platforms provide affordable and accessible education to all.	MOOCs (SWAYAM, COURSERA, edX) and Khan Academy
Learning management systems (LMS)	Platforms for planning, implementation and assessment of learning progress.	Google Classroom, Canvas, and Moodle
Gamification	Learning through games more engagingly.	Kahoot! and Classcraft
Virtual and Augmented reality	Technologies create immersive learning experiences via simulations, allowing students to interact with their environment.	Google expeditions, Oculus for education
Mobile learning	Learning through smartphones and tablets.	Quizlet, Google Classroom
Artificial Intelligence and Adaptive learning	Technology that tailors the educational content according to the needs of the students.	Dream Box, Smart Sparrow

Category	Description	Technology
Cloud computing	Technology that allows students and teachers to store, share learning materials online.	Google Drive, One Drive
Social media learning	Social media platforms provide wide access to information and allow sharing of educational content.	Twitter, Facebook, LinkedIn
Open Educational Resources	Resources that provide access to quality educational content.	NPTEL, khan Academy, MERLOT, and Commonwealth of Learning
Video-based learning	Video content that allows learners to learn at their own pace.	YouTube, Vimeo
Assistive technology	Tools supporting the students with special needs.	Hearing aids, adaptive keyboards, and screen readers (VoiceOver, JAWS, NVDA)
Flipped classrooms	A type of instructional strategy and blended learning	Schoology, Moodle, Google Classroom, Canvas

Technological needs of modern classrooms (21st century) in the vision of NEP 2020:

The National Education Policy (NEP 2020) has strongly emphasized integrating technology with education to meet the technological needs of modern classrooms (21st century).

The key technological needs are:

1. Online Learning platforms:

NEP emphasizes the use of digital platforms like SWAYAM for learning and providing access to quality content in the form of videos, quizzes, etc. In addition, the schools should also utilize the open educational resources (OER)available.

SWAYAM (initiative by the Government of India)-



Figure 2: SWAYAM logo *source: swayam.gov.in*

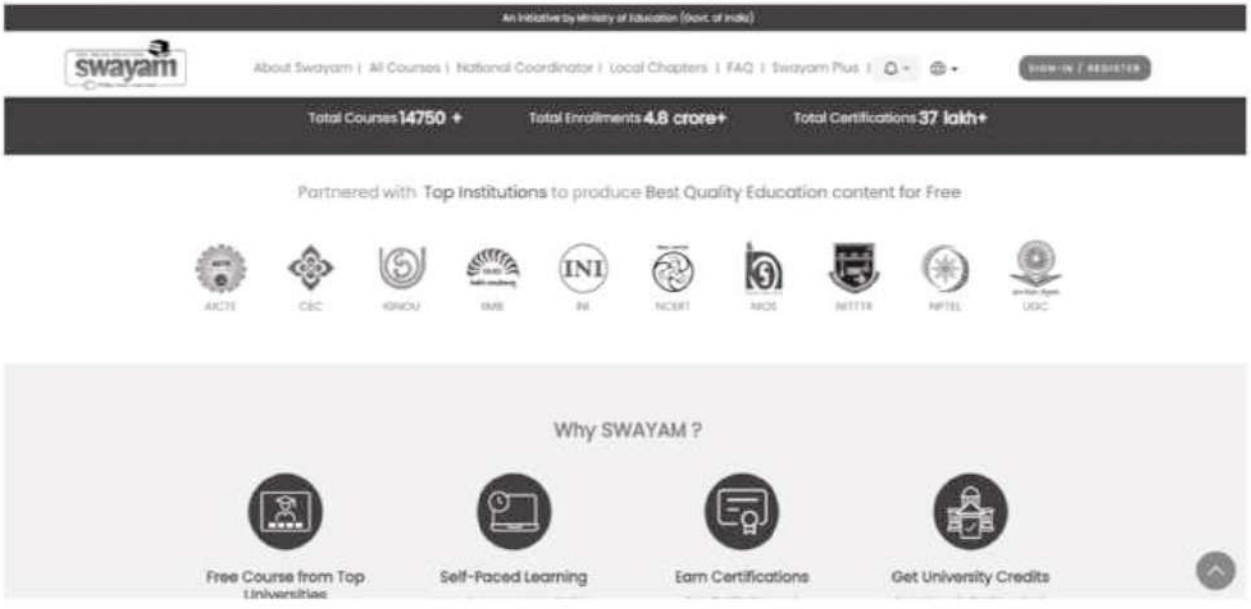


figure 3: SWAYAM Portal *source: swayam.gov.in*

Multi-dimensionalemployment focused approach-

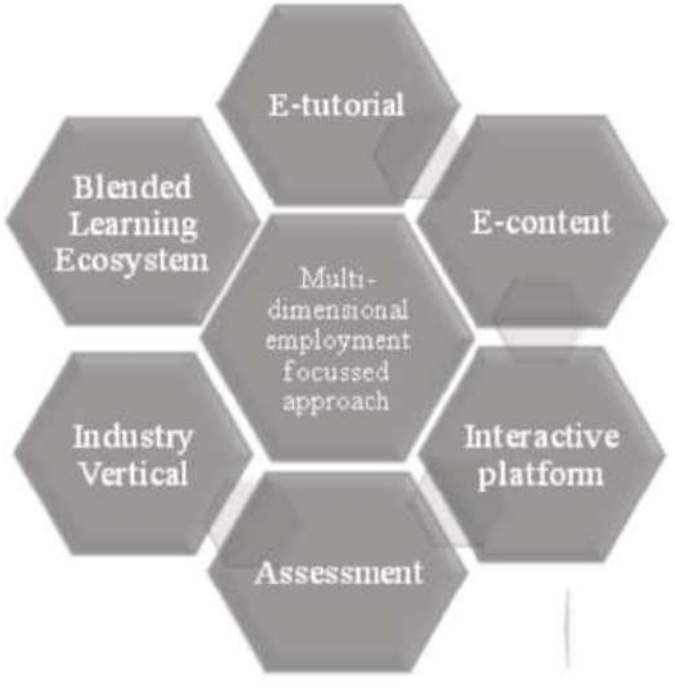


Figure 4 Multi-dimensional employment focused approach

2. Teacher professional development:

Continuous professional development programs such as webinars, online courses for the teachers to keep them updated on new educational strategies. Teachers should be trained to develop their digital literacy and use various tools to encourage more interactive and engaging learning. Many initiatives are taken by the Government for the professional development of the teachers. One such technology professional development programmes by UGCis:

UGC-HRDC (UGC-Human Resource Development Centres) now known as UGC-MMTTC (UGC- Malaviya Mission Teacher Training Centres) to ensure the holistic development of the teachers through different programmes and refresher courses.



figure 5: programs under MMTTC *source: mmc.ugc.ac.in*

Programmes and refresher courses under UGC-MMTTC:

- NEP Orientation Programme
- Nurturing Future Leadership Programme
- Short Term Programme/Faculty Development
- Academic Leadership Program- ABHYUTHANAM
- Guru Dakshta (Faculty Induction Programme)
- Capacity Building Programme on Specific Learning Disabilities

3. Enhancing Access and Equity for diverse learners:

The policy focuses on the digital divide reduction and the distribution of assistive technologies such as screen readers, and speech-to-text software to students with special needs so that no student is left behind.

4. Collaborative learning:

The use of cloud-based tools for collaboration and sharing of resources among students, teachers, peers and even globally results in more interactive and engaging learning. Online collaboration tools like Google Classroom, Microsoft Teamshelp in communication and collaboration.

5. Fostering creativity and innovation:

Fostering creativity and innovation is important to prepare the students for the technology-driven world. This can be developed through project-based learning, using technology as a creative tool, and the teacher as a facilitator of creativity.

6. **Ethical use of technology:**

Students must be encouraged to become responsible digital citizens respecting others' work and understanding digital ethics. NEP 2020 also stresses the need fora balance between traditional and digital learning methods so that technology in education does not replace face-to-face interactions.

7. **Open Educational Resources (OER):**

NEP 2020 emphasizes the use of OER for creating and sharing educational content that is easily accessible and can be downloaded and used for free but under some licenses.

8. **Internet of Things (IoT):**

- **Smart Classrooms:** Use of devices such as smart boards, smart tables to encourage student engagement, to enhance classroom interaction.
- **Learning Analytics:** Use of IoT devices for tracking the students' behaviour, activity, and monitoring performances of the students.

Importance of technology in 21st century education:

Area	Importance of Technology
Learning experiences	Technology provides personalized learning experiences that can be tailored according to the needs of the students so that they can progress.
Collaboration & Communication	Google Classrooms, Microsoft Teams, Zoom allowreal-timecollaboration and communication among the learning groups.
Teacher efficiency &Productivity	Technology-enabled tools allow teachers to do tasks like grading, lesson planning, and tracking attendance.
Access to vast Information	Vast information, resources, materials can be accessed through technology.
Preparation for future academics	Knowledge of the right tools must be given in the school so that the students are prepared for their future academics.
Skill development	Through the integration of digital tools with education, students develop critical skills like problem-solving, creativity, digital literacy, etc.
Distance learning	Through e-learning platforms, education is easily accessible to even those who are geographically distant or cannot afford formal education.
Engagement &Interactivity	Through Virtual Reality, Gamification, Augmented Reality engagement and interactivity are increased in education.
Global learning opportunities	Breaking down the geographical barriers, the learners can interact with peers, teachers, communities all around the world through technology.
Differentiated instruction	Through technology, differentiated instructions can be delivered in the classroom according to the needs of the students.
Cost effectiveness	With technology comes effectiveness. Multiple platforms, materials, sources, websites have made education cost-effective.

Challenges in the application of technology in education:

1. The digital divide is one of the challenges in the application of technology in education. Some students because of geographical location, infrastructure remain deprived of educational technologies.
2. There is resistance to change, many educators, students often resist the adoption of new technologies because they are too comfortable with traditional practices.
3. Online content is in abundance but not all are resources, materials are pedagogically sound. This questions the quality and reliability of the educational content.
4. There is a lack of sufficient training among teachers. Without proper training, they may struggle to use digital tools.
5. No doubt, technology makes learning more engaging and interactive but technology can often lead to distractions. Ensuring the engagement of students is a challenge.
6. Many schools, universities, educational institutions face connectivity issues, technical failures, and maintaining technology infrastructure. This hinders the effective use of technology.
7. Over-reliance on technology can lead to a diminished emphasis on problem-solving, critical thinking, creativity. Avalanched approach is necessary to avoid over-dependency on technological tools.
8. With the integration of technology, a shift in traditional pedagogical approaches is a must. The educators may rethink designing and delivering the content aligning with the digital tools.
9. The use of learning analytics, AI, and gamification, in education often raises ethical questions regarding biases, data privacy, security of the students.
10. Students with special needs may face challenges in accessing online materials or digital tools that are not inclusive or accessible.

Conclusion:

While traditional education is more teacher-centered and emphasizes face-to-face interactions, a fixed schedule in education, and limited social interaction, today's education is student-centered, more flexible allowing students to learn at their own paceand technology-driven. The advancements in technology have brought an evolution in education by increasing accessibility through e-learning platforms, reducing cost, providing vast access to information, personalized learning, and global collaboration. From providing access to global resources through e-learning platforms, technology makes education more interactive, engaging and flexible. By integrating various technological tools such as SWAYAM which is an e-learning platform, canvas or Google classrooms, Kahoot!, assistive and adaptive technologies, virtual reality, augmented reality, educators can enhance engagement, improve learning outcomes, and equip students with skills needed to succeed in a technology-driven world. The National Education Policy 2020 also stressed including technology in modern classrooms (21st century) to foster an innovative and inclusive learning environment. By integrating digital

infrastructure, AI-powered tools, learning analytics, OER, Internet of Things (IoT), seminars, and webinars institutions can enhance student engagement, this will help in the professional development of the teachers, personalized learning, skill development and prepare students for demands of the 21st century by instilling creativity, innovation and making them aware of ethical use of technology.

While technology has immense potential, its implementation faces several challenges, ranging from digital inequity, resistance to change, quality and reliability of the educational content, and teacher preparedness to concerns over privacy. To overcome these problems, governments, educational institutions, educators, and technology suppliers must work together to ensure that the benefits of technology are realized and that it is used to promote equity, inclusivity, and increased learning.

Recommendations and future research:

Technology in education can be an outstanding tool for collaboration, communication, engagement, and personalized learning. However, it is equally important to use it morethoughtfullyso that it does not overshadow the traditional methods of teaching encouraging skills like problem-solving, creativity, and critical thinking.

Future research can be done on integrating Artificial Intelligence in education and studying the impact of AI-based learning tools on student performance, adoption of technology by students and teachers in classroom teaching, comparative analysis of traditional and digital learning environments, etc. can be done.

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