Review Article

Hybrid education in the age of Education 5.0- A study of engagement and innovations in the Indian education system amidst covid-19

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Abstract

Amidst the global pandemic, the landscape of education witnessed a seismic shift, compelling both students and educators to embrace digital platforms for learning. Education 5.0 emerged as a beacon of hope, offering innovative solutions to navigate the challenges posed by the COVID-19 scenario. This paper presents an overview of the educational sector, focusing on the engagement and innovations that shaped hybrid education in the Indian Education System during the pandemic.

Investigating the form and effectiveness of digital platforms, the research explores their benefits as vehicles for exchanging information. Additionally, it highlights the pivotal role of AI in Education 5.0, empowering educators with data-driven insights and personalized support through digital platforms. The study also explores the transformative potential of blended learning, envisioning a paradigm shift in India's educational ecosystem through education 5.0- Faculty-student engagement model with the addition of Blended learning and Artificial Intelligence.

Through this exploration of engaging pedagogies and cutting-edge technologies, the paper underlines the resilience of the Indian Education System amidst adversity.

Keywords: Blended learning, pandemic challenges, faculty and student engagement, innovations in higher education, artificial intelligence

Introduction to Digital Engagement in the Higher Education Sector

Just like social engagement, the word 'digital engagement' is often used for any use of social media by an organization to promote the participation of its stakeholders. For a business organization, its stakeholders are customers, employees, management, shareholders, suppliers, government, etc, and for an educational organization, its main stakeholders are its faculty and its students, along with its management. COVID-19 is considered a 'black swan'. The very first feature of a 'black swan' is the uncertainty in their occurrence, and the second key feature is that the impact of their occurrence is very big, just like any terrorist attack in the past or any global financial recession (Erken et al., 2020).

Digital engagement is a very complex topic, and two modes of engagement, offline and online, are responsible for engaging people on digital platforms (Hecht, 2014). Covid 19 has a great

impact on Global education and its learners. Global statistics by UNESCO show that about 1.38 billion learners are being affected by the pandemic situation (Li and Lalani, 2020).

The hunt for talent will become difficult, and organizations will be compelled to ensure the engagement of existing employees to drive performance and sustain competitive advantage (Mukherjee, 2014). It is not the engagement of people, but the engagement of the digital age, which requires a framework of thoughts, strategies, and innovation. The digital platform has been successful in engaging the faculty as well as students through various tools such as WhatsApp, which is one of the most used messaging apps in the world. Nowadays, it is used mostly by students and staff, acting as a topmost social platform. Presently it has become a successful medium to exchange information, especially in the education sector. On the other hand, Facebook has become a dominating social media app that has just increased its branches in one or the other way. It is not only providing opportunities to marketers or businesspersons but also innovators and educators. The LinkedIn account always acts as a network where professionals can share their thoughts on learning, innovation, and teaching. One can say that Twitter acts as the best place for digital engagement connecting people globally. Today teachers are finding YouTube as the best way to connect with students globally (Stoller, 2019).

Objectives of the Study

1. To study the importance of digital engagement and how it acts as an opportunity or a challenge in the education sector during the Covid-19 period.
2. To study different online innovative modes and platforms that have been successful in the engagement of faculty and students during the pandemic at the global level.
3. To discuss a hybrid education framework adopted by the Indian education system under Education 5.0 after COVID-19 with the inclusion of artificial intelligence (AI) to engage the faculty and students for the long term.

Research Methodology

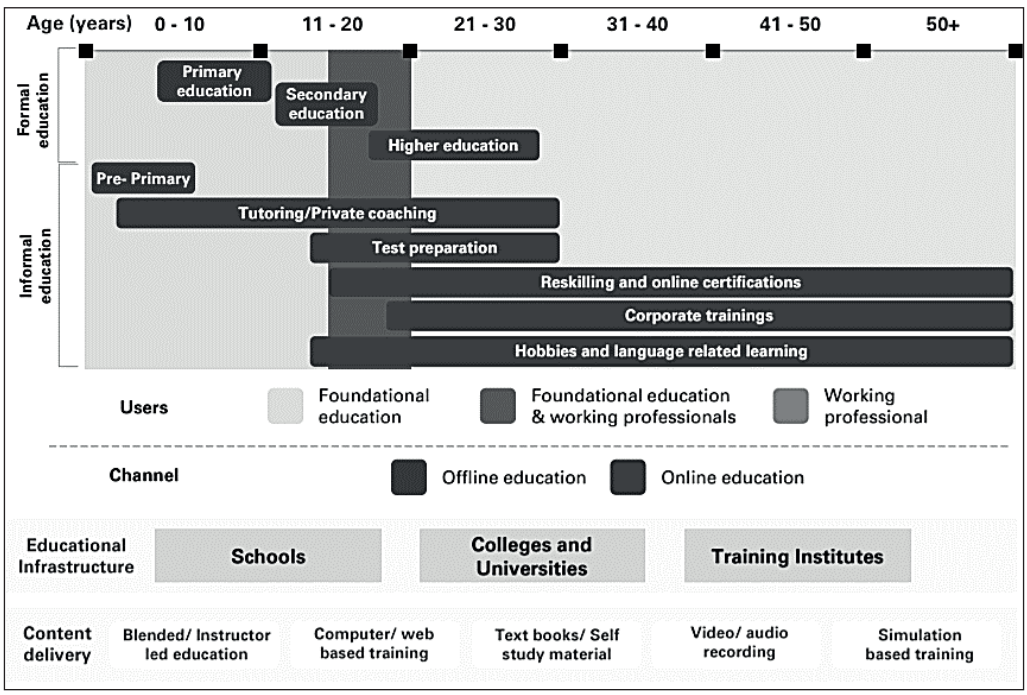
For a deeper understanding of the higher education sector and faculty and student engagement on the digital platform, this paper compiles relevant material with the aid of sixty-three pieces of literature, including book chapters, articles, and research papers. EBSCO, ProQuest, and Web of Science databases were used to search the literature on teacher and student participation. This research adapts a systematic assessment approach suggested by Cerchione and Esposito (2016), Easterby-Smith et al. (2012), Petticrew & Roberts (2006), and Pittaway et al. (2004). Thus, the research is segmented into certain phases such as keyword research, database selection stage, inclusion and exclusion of the literature based on the definitions, analyzing and classifying the selected publications, and lastly the content analysis by examining the publications and categorizing the subjects. A structured review strategy is being adopted by implementing manual filtering and transparency (Tranfield et al., 2003).

Overview of the Education System in India before the Emergence of Covid-19

A study conducted by KPMG in India and Google shows that India has a complex or one can say multiple-

layered structure, where the formal educational structure is placed upon primary schools, secondary schools, graduation, post-graduation, and other degree courses, where the governing bodies are central or state governments. The University Grant Commission plays a very important role in the higher education sector. Informal education includes coaching, private mode of tuition, online certification courses, training programs, etc. It can be seen in Figure 1 that online education was only a part of informal education before Covid-19. The Indian education system has always relied upon only the physical mode rather than the online mode, whether it is a question of physical classes, or examination system, or a student evaluation system. The online channels in India were mostly used either for marketing or business purposes (All India Survey on Higher Education, 2015; Online Education in India, 2017).

Figure-1: Education system in India before Covid-19



(*Source: All India Survey on Higher Education, 2015; Online Education in India, 2017*)

Figure 1 reveals the educational landscape across different age groups and shows the progression in formal education from pre-primary to higher education, along with informal learning opportunities. It also differentiates between the foundational education for children and professional development for adults, thus showcasing the mixture of offline and online educational channels with schools, colleges, and training institutes as different types of infrastructures in education. Content delivery methods from the traditional instructor-led approaches to the modern approaches are also explained here, and thus, Figure 1 focuses on the continuity in the learning process throughout one's life at different stages of learning (All India Survey on Higher Education, 2015; Online Education in India, 2017).

But the emergence of the pandemic has completely transformed the scenario in the education system. In the last hundred years, no one has thought that the world would ever face such a situation where people can't move out for education or work. Now, the education sector is more focused on online teaching and tools than physical teaching. Earlier, virtual teaching was just considered as an option for distance learning or any other training course, but now it has become a compulsion.

Digital Engagement and Its Stakeholders in Higher Education

There are different stakeholders in the higher education sector, such as students, teachers, investors, government, non-government organizations, administration, employers, suppliers, management, and even parents (Speck, 1996). However, keeping in mind the pandemic situation, the most important stakeholders connecting education and digital engagement are management, government, faculty, and students. The most important role is played by a faculty member who connects with the students, motivates them, and makes the best use of different pedagogy tools to teach them (Marshall, 2018). Covid-19 has completely transformed the scenario of teaching at the global level. Today a teacher has become a digital teacher by providing the students with virtual classes, engaging the students on the digital platform, sharing the e-content with them, interfacing with the application-based evaluation system, and much more (Brown, 2021).

Three basic pillars of the education system in India in the pandemic are:

1. **Curriculum (Models Defined By UGC and AICTE)**

   It includes all the immediate guidelines given by the UGC and AICTE to all the colleges and universities at the time of emergency lockdown in the pandemic, which was the need of time. These guidelines included all the instructions regarding online classes, online exam conduction, and e-content sharing.

   The details of some of the UGC letters communicated immediately to the employees and the students after the COVID-19 outbreak:

   a. UGC Letter Dated 25th March 2020 regarding ICT Initiatives of MHRD and UGC. The details of all the platforms mentioned in the letter were shared with both the faculty as well as the students. The various online platforms are Swayam online courses, UG/PG MOOCS, E-Pathshala, Swayam Prabha, UGC YouTube channels, Shodhganga, National Digital Library, E-Shodh Sindhu, Vidwan, etc. (University Grant Commission, 2020)

   b. UGC Letter Dated 28th March 2020 where an appeal was made for a Contribution to COMBAT COVID-19 with one day's salary by the employees to provide financial help for the Nation (University Grant Commission, 2020).

   c. The UGC Letter Dated 28th March 2020 provides the UGC Quality Mandate to suggest various activities be completed within the semester to improve the quality in the Higher education sector and to face the different challenges like employability, quality teaching, ICT Tools, course completion, etc (University Grant Commission, 2020).

3. **Conduction of Classes on the Digital Platform**

   The second most important pillar of the Indian education system in the pandemic was the education regarding the digital platforms available for the conduction of classes such as Skype, GoToMeeting, Zoom, Cisco Webex, WhatsApp, Google Meet, free Conference.com, etc to engage the students as well the teachers which could have otherwise hampered the teaching-learning process. Video lectures and live streaming on YouTube or Facebook are also a part of the online platforms.

4. **Evaluation (Online Assessment Tools For Teachers For The Quiz, Grades, Tutorials, Material Sharing, etc.)**

   The third pillar is the availability of online assessment tools required by teachers to assess the performance of the students without their physical presence for examination. Different online tools such as Google Classroom, Moodle, Microsoft Whiteboard, Hot Potatoes, quizzes, Google Forms, and Microsoft Teams were being introduced to the teachers for online content sharing, examination, and grading system which in turn is acting as a boon for them.

New Opportunities for Faculty and Student Engagement in Higher Education through a Digital Platform at the Global Level

One cannot deny the fact that Higher education is moving from the adoption of old teaching methods to new innovative teaching techniques. Teachers are actively engaged in more sophisticated tools to instruct the students (Soni, 2020). UNESCO just came up with different platforms to help parents, teachers, and students provide a solution for learning and teaching opportunities in the time of social distancing.

Table-1: Online learning management system given by UNICEF

S. No.	Digital Learning Tools	Application
1.	Century-Tech	Teaching and learning platform through artificial intelligence
2.	Class-Dojo	A platform to connect parents, teachers and students through online mode
3.	Ed-modo	A platform to connect parents, teachers and students through online mode and helps in sharing e-content
4.	Google-Class	A learning management system to connect parents, teachers and students through online mode and helps in sharing e-content and managing assessment
5.	LMS-Moodle	A learning management system to connect teachers and students through online mode and helps in sharing e-content and managing assessment
6.	Paper-Airplanes	Offers sessions on English through online platform

S. No.	Digital Learning Tools	Application
7	School-ogy	A learning management system to connect teachers and students through online mode and helps in sharing e-content and managing assessment
8	See-saw	An online tool to connect teachers and students through online mode and helps in sharing e-content and managing assessment.
9	Skooler	A learning management system to connect teachers and students through Microsoft.

Source: UNESCO, 2021

Table-2: Collaboration online platforms for communication and interaction

S. No.	Digital Collaboration Platforms	Application
1.	Ding-Talk	Free online platform for communication
2.	Lark	A communication tool for messaging, conferencing, and data exchange
3.	Google-Hangouts	Video calling, chats, and voice calls
4.	Microsoft-Teams	A communication tool for messaging, conferencing, and data exchange
5.	Skype	Video calling, chats, and voice calls
6.	WeChat-Work	Communication and corporate tool for workplace
7.	WhatsApp	A communication app for messaging, calling and data exchange
8.	Zoom	A platform for messaging, conferencing, and data exchange

Source: UNESCO, 2021

Table-3: Tools for creating e-content

S. No.	Digital Tools For Teachers	Application
1.	Thing-link	A tool or an app to create images, videos, etc
2.	Buncee	e-content sharing through innovative virtual presentations
3.	Ed-Puzzle	e-content sharing through innovative virtual presentations by connecting them with LMS
4.	Kaltura	Video creation tool and connects with LMS
5.	Near-pod	Interactive presentation and video creation tool
6.	Pear-Deck	Interactive presentation and video creation tool
7.	SQUILL	A tool converting the content into interactive presentation through artificial intelligence
8.	Trello	A collaborative tool for designing courses and managing classes.

Source: UNESCO, 2021

"UNESCO is not only guiding about all these tools and applications but also providing mental support to parents, students, and teachers at the global level to eradicate any kind of panic. It is also creating awareness regarding child support and health in the pandemic (UNESCO, 2021). All the above-mentioned tools are being followed by different educational stakeholders worldwide which has somewhat reduced the problem of content sharing as well as communication.

Covid-19 as a Catalyst in Faculty and Student Engagement

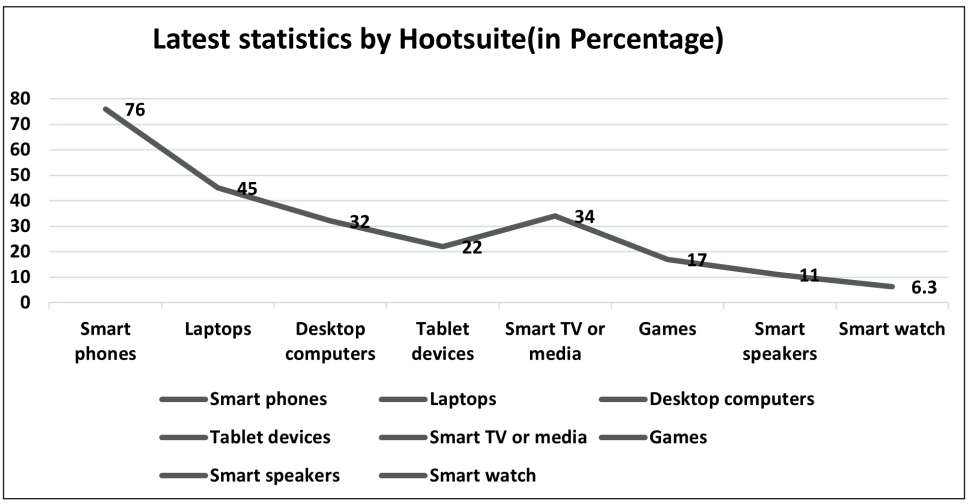
This pandemic has acted as a catalyst in engaging the faculty and students on a digital platform. These online tools and techniques are acting as an omnichannel in the education sector. Digital global reports by Statshot in 2020 show how the digital world has grown at the global level at a very fast pace. Table No. 4 and Figure 2 clearly show how people have increased their usage of the internet, mobile phones, and social media during the pandemic.

Table-4: Global digital growth (During the Pandemic)

Statistics by Hootsuite	Total Population	Mobile phone users	Internet users	Social media users
April 2020 vs. April 2019	+ 82 Million	+128 Million	+301 Million	+304 Million
Digital Growth	1.10%	2.50%	7.10%	8.70%

(Source: Kemp, 2020)

Figure-2: People spending their time with online devices after the emergence of COVID-19



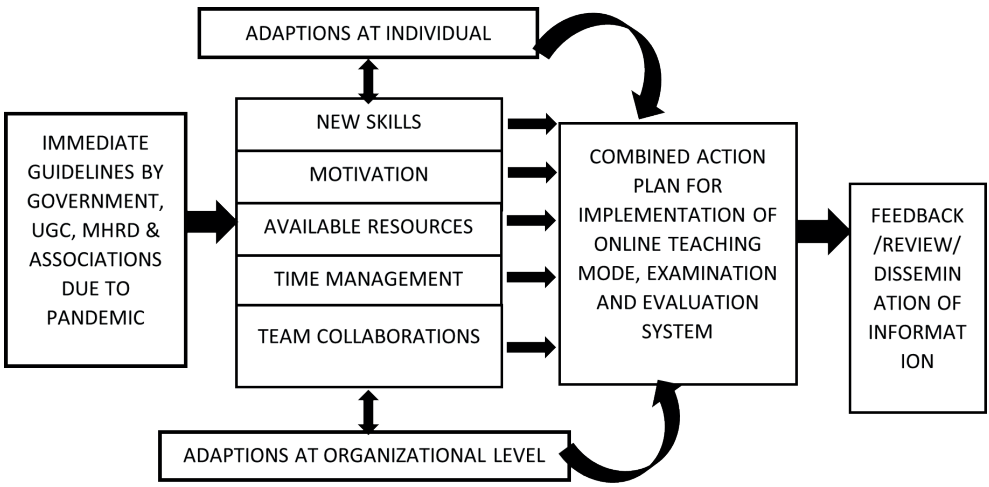
(Source: Kemp, 2020)

In one of the surveys, Figure 2 shows that by April 2020 users aged 16 to 64 years in countries like Australia, Brazil, India, China, France, Canada, Germany, Ireland Italy, New Zealand, Philippines, Singapore, Spain, UK, South Africa, and the USA started spending more and more time on the digital devices like smartphones, laptops, computers, tablets, gamification, smartwatches, etc at the global level (Kemp, 2020).

New Engagement Model Adapted in the Education Sector in Covid-19

The pandemic situation forced everyone to come up with novel ideas, tools, technologies, and technologies to adjust to the changing environment and to face this challenge even if the students and teachers were not computer savvy in most of the areas and cases, and that too in a very short period. The changes are to be implemented in a very short period with high accuracy as it is a question of the education sector that is the future of any country. So, a new education online system is mostly adopted in the current situation as shown in Figure 3 keeping in mind the previous education models suggested by different researchers (Speck, 1996; Mishra et al., 2020).

Figure-3: Adapted Faculty-student engagement model through digital platform in COVID



(Source: Adapted from Speck, 1996 and Mishra et al., 2020)

Figure 3 shows a comprehensive model for adapting educational systems to online platforms during the COVID-19 pandemic, with the outbreak of a pandemic, the education system has to completely rely on the online system (Speck, 1996; Mishra et al., 2020).

1. Initiating Factor

Immediate guidelines were issued by the Indian government, UGC, and MHRD, which pushed the education stakeholders like faculty, administration, leaders, collaborators, students as well as parents to adapt themselves at the individual as well as the organizational levels with novel skills, limited resources keeping in mind the time constraint.

2. Key Components

The key components of this model were:

New Skills: Educators, as well as students, needed to acquire digital literacy in a short time.

Motivation: Maintaining engagement and drive in a novel and potentially **challenged environment.**

Available Resources: Identifying and utilizing accessible digital tools or platforms.

Time Management: Adapting to the new schedules and balancing different responsibilities in remote settings.

Team Collaboration: Fostering virtual teamwork and proper communication among the educational stakeholders.

3. Central Action

The combined action plan included the implementation of online modes of teaching, online examination systems, e-content sharing, online examination modes and methods, effective online evaluation system which can effectively engage the faculty as well as the students at the online platforms. Finally, a regular feedback system that can act as a watchdog.

4. Dual Adaptation Levels

Adaptation at an individual level: The knowledge of the digital platform became a necessity not only in the agriculture sector or IT sector but also in the education sector and thus, an attempt was made to train students as well as teachers so that they may acquire knowledge of ICT Tools and techniques with the already existing resources (Singh, 2012). The situation is just like war after a pandemic, so everyone must work as a team and, most importantly, work according to the time available.

Adaptation at the organizational level: All educational institutions, as well as the universities, must change their mode of instruction, feedback, and collaboration methods to achieve quick goals which are not possible without top-level management support, administrative staff, students as well as teachers' support.

The circular arrows indicate that these adaptations continuously affect and refine the action plan.

Outcome

Due to the lack of face-to-face interaction between educational stakeholders, it became very necessary to take timely feedback to improve the processes on time. The final stage involves data collection in the form of feedback and reviews on the effectiveness of the implemented changes, their analysis, and dissemination of the information for the further improvisation of the system.

Thus, this model provides a holistic approach, recognizing the successful transformation to online education.

The Challenges in Faculty and Student Engagement at Digital Platform

There are different challenges in adopting the online platform for learning as most of the learners are struggling at the global level without internet facilities as well as proper training on online platforms. The usage of the right technology may lead to more effective learning (Li and Lalani, 2020).

In the digital era, everything can be done in the blink of an eye and has become a new rule for everyone. The new generation is living up to the latest gadgets, iPhones, laptops, smartphones, and the internet, which have reduced the need for physical infrastructure. The mode of study of language communication and social interaction has completely changed. In the last few years, universities like Harvard have developed different innovative strategies to connect faculty and students (Hewitt, 2014).

The students at an institute or a university are its assets. Some of the previous studies show that the e-learning methods have not shown consistent results in increasing the productivity of students in Academics. So, the researcher conducted a study on undergraduate students at a Korean University and thus measured student engagement on the digital platform. This study revealed that the students believe that their online assignments completely engaged them during their classes. But this study was also conducted on campus (Kim et al., 2019).

Different barriers act as a challenge in adopting a digital platform for learning. Some of the challenges on the part of

learners and teachers are as follows (Swan, 2017; Singh & Tiwana, 2018; Chen et al., 2022):

1. One of the challenges is to handle the weak students as compared to the average or brilliant students through the online platform.
2. Another challenge is related to the assignments that must be completed in teams or groups with zero defects, where learners may face technical and coordination issues.
3. The complete engagement or attentiveness of the student while attending the class is always questionable, as there is no face-to-face interaction between the learner and the teacher.
4. Another major issue is the promotion of quality writing among students who have become so technology savvy that they may forget writing in academics.
5. If there are no media or devices, then how will a student learn? This can also act as a great challenge.
6. Finally, there are technical issues like the unavailability of internet facilities in remote areas.

Not all the teachers and students are computer savvy, and some of the courses need only physical classroom teaching. Apart from the above challenges, nowadays, everyone is facing security issues related to the internet and devices, and one has to face unethical hackers in this field (UNESCO, 2021). As India is the second most, after China, in the Top 20 nations in having Internet facilities, the challenges faced may be less as more than 95 per cent of users in India have access to mobile phones while 93 per cent of the higher education students use the Internet daily (Internet world stats, 2020).

Is the digital platform successful in engaging the faculty and students?

This question is ironic. In the period of Covid-19, with the adoption of technology, education has completely transformed from teacher-centric to teacher- student-centric education. Virtual classrooms and innovative online tools help to engage faculty as well as students just like a real-time classroom. The only thing that Digital education requires is the coordination between reliable course content, faculty dedication, reliable technology, dedicated students, and, most importantly, an easily available internet connection. Covid-19 brought in a lot of uncertainties. While office-going employees are adapting to the remote work culture, colleges, and universities are embracing online learning modules and discussions. For many, the lockdown has resulted in an uncertain examination schedule, lost internship opportunities, and the pulling back of job offers (Dhawan, 2020). However, the main question of the reliability of digital platforms will always remain unsolved as everyone will agree with the fact that for a successful digital engagement, a learner or an instructor must also be honest.

Shadow of Education 5.0- Blended Mode of Learning

Education 5.0 evolves from Education 4.0 by emphasizing a human-centric approach, focusing on social and emotional skills, and promoting environmental consciousness for a sustainable future. Blended learning is not just the combination of the offline mode and the online mode of learning but also includes all those activities that drive teacher-student engagement with more effective results. The University Grants Commission (UGC) on 20th May 2021 released a concept note for the implementation of a blended mode of learning – a mix of online and offline education – in universities with the

following proposed guidelines (Kalita, 2021):

1. Syllabus Completion

According to this concept note, higher education institutes will be allowed to teach up to 40 per cent of each course, other than SWAYAM courses, online, and the remaining 60 per cent syllabus of the course can be taught offline which can act as a boon in the education sector.

2. SWAYAM Platform

The new provision that may make up to 40 per cent of online education permissible for SWAYAM courses is also very desirable as this change will transform passive learners into active learners.

3. Proper Infrastructure For ICT Preparations

Before implementing blended learning, proper time must be given to prepare educational institutions to prepare for online teaching and learning, as earlier, online teaching was not a part of the curriculum. Blended learning will require proper computer labs and teaching tools. As mentioned in the concept note, proper infrastructure facilities such as LMS, ERP, WIFI, Bandwidth, smart classes, data service centres, and studio facilities are to be taken care of.

4. Proper Planning

Proper planning on the part of a university or a college will be required for the introduction of blended learning as the incremental learning process will reduce the chances of failures.

5. Proper Training

To introduce this learning model in education, the students and teachers will require proper training and education.

6. Assessment and Evaluation

Another important point discussed in the concept note focuses on the online assessment strategies to be followed partially in all the subjects. Rubrics should be developed for the assessment including projects.

7. Effective Feedback

Course-related feedback, 360-degree feedback, and student feedback must be taken regularly (2-3 times a semester) to monitor the flaws or the progress of the learning system.

8. Flexible Course System

A flexible course system will help the students to discover themselves and expand their horizons. This flexible system will also be very helpful in times of lockdown or other emergencies where a complete syllabus is to be taught through online mode.

9. New Room for Innovations

The blended learning model will open new rooms for innovative tools and techniques and more autonomy in teaching and learning processes.

New Era of Artificial Intelligence-Education 5.0

In the realm of Education 5.0, Artificial Intelligence (AI) has emerged as a game-changer, revolutionizing the field of education with its profound contributions. One of the key contributions of AI in Education 5.0 is its ability to analyze vast datasets to identify learning gaps and design targeted interventions. Chen and Liu (2021) conducted a comprehensive survey on AI in education, highlighting how AI-powered algorithms can process massive amounts of student data, including assessment scores, learning behaviors, and preferences. By analyzing this data, AI algorithms can pinpoint areas where students are struggling,

enabling educators to tailor their teaching approaches and resources accordingly. One of the projects, Udaan, launched by IIT Bombay in India, is an AI-based Translation ecosystem designed to translate scientific or technical content from English to different Indian languages by reducing the translation time and efforts (Indian Institute of Technology Bombay, 2021). Even IIT Madras is developing a virtual reality-based education model for rural schools that helps the students learn and conduct experiments. This initiative also includes the mobile application "Memory Bytes" to bridge the digital issues in the future (Indian Institute of Technology Madras, 2023).

Another noteworthy contribution of AI in Education 5.0 is the development of AI-powered chatbots and virtual tutors. Martin et al. (2022) explored the potential of chatbots as virtual tutors and found that these AI-driven tools offer real-time support to students. These chatbots can answer queries, clarify doubts, and provide guidance on various topics, promoting continuous learning beyond the confines of traditional classroom hours. In India, AICTE (All India Council for Technical Education) entered a partnership with Microsoft on 25th September 2024 to enhance skills and employability among students and teachers by providing certifications, mentorship, AI Cloud, hands-on learning through platforms like Microsoft Learn and Azure Developer Community (Ministry of Education, AICTE, & Microsoft, 2023).

Furthermore, AI has streamlined the assessment and feedback mechanisms in Education 5.0. Wang et al. (2023) investigated the integration of AI in assessment practices and reported that AI-powered systems can automatically grade assignments, quizzes, and exams with high accuracy. This automation not only saves valuable time for educators but also provides timely and constructive feedback to learners. Instant feedback is instrumental in helping students understand their mistakes, make improvements, and progress in their learning journey. It also allows educators to track student progress effectively, enabling targeted interventions when needed.

Thus, artificial intelligence has significantly transformed Education 5.0 by empowering educators with data-driven insights, providing real-time support to students, and streamlining assessment processes. The personalized learning experiences facilitated by artificial intelligence-driven educational technologies ensure that each student's needs are met, enhancing overall learning outcomes (D'Mello and Calvo, 2011; Johnson et al., 2016; Siemens and Baker, 2012). As artificial intelligence continues to advance, its role in education is likely to expand further, promising an exciting future for the evolution of Education 5.0.

Additionally, such analytics enable the identification of at-risk students, allowing for timely interventions and support systems (Romero and Ventura, 2010).

In terms of innovation, Education 5.0 can facilitate the development of intelligent tutoring systems that simulate human-like interactions and adapt to students' needs, fostering deeper engagement and improving learning outcomes (VanLehn, 2011). Technologies such as virtual reality (VR) and augmented reality (AR) can also create immersive and interactive learning environments, enabling students to explore complex concepts in a hands-on manner (Chen et al., 2016).

AI Tools and Post-Pandemic Innovations In Shaping Hybrid Education Models (2021-2024)

Table No 5 reveals the key contributions of artificial intelligence in improvising the hybrid education experience during and after the COVID-19 pandemic. Every facet of hybrid education has been transformed by AI tools and post-pandemic pedagogical innovations, more adaptable, personalized, and comprehensive education environment.

Table-5: AI Tools and Post-Pandemic Innovations in Shaping Hybrid Education Models (2021-2024)

Aspect	Researcher	Artificial Intelligence (AI) in Education	Post-Pandemic Pedagogical Innovations	Impact on Hybrid Education	Tools Used
Learning Experience	Chen et al. (2020); Ouyang & Jiao (2021); Holmes & Tuomi (2022); Acosta et al. (2023); Carius (2021); Moorhouse et al. (2023); Pathiranage & Karunaratne (2022).	Personalized learning paths, Intelligent tutoring systems, Adaptive assessments.	Shift towards student-centred learning, Increased emphasis on self-directed learning.	Blended learning models combining online and in-person instruction, Flexible learning environments.	Learning Management Systems (LMS), Virtual Reality (VR) and Augmented Reality (AR) platforms, AI-powered educational apps.
Teaching Methods	Grassini (2023); Mirzaeian et al. (2016); Olszewska (2020); Chin et al. (2019); Sangster et al. (2020); Zhao & Watterston (2021).	AI-assisted content creation, Automated grading and feedback.	Flipped classroom approaches, Project-based and problem-based learning.	Synchronous and asynchr-onous teaching methods, Increased use of multimedia and interactive content.	Video conferencing tools (e.g., Zoom, Microsoft Teams), Interactive whiteboards, AI-powered content recommen-dation systems.
Student Support	Narayanan et al. (2023); Huang (2024); Carius (2021); Grassini (2023); Khedrane (2024); Holmes & Tuomi (2022).	AI chatbots for student queries, Early warning systems for at-risk students.	Virtual office hours and online mentoring, Peer-to-peer online support networks.	24/7 access to learning resources and support, Seamless integration of in-person and online support services.	AI-powered chatbots, Online collaboration platforms, Learning analytics dashboards.
Assessment and Feedback	Ouyang & Jiao (2021); Chen et al. (2020); Acosta et al. (2023); Pathiranage & Karunaratne (2022); Sangster et al. (2020); Moorhouse et al. (2023).	AI-driven formative assessments, Automated essay scoring	Shift towards continuous assessment, Increased use of project portfolios and peer assessments	Combination of online and offline assessment methods, Real-time feedback mechanisms.	Online proctoring software, AI-powered plagiarism detection tools, Digital portfolio platforms.
Curriculum Design	Roy (2020); Roschelle et al. (2020); Zhao & Watterston (2021); Grassini (2023); Carius (2021); Holmes & Tuomi (2022).	AI-assisted curriculum mapping and optimization; Adaptive learning pathways.	Integration of digital literacy and 21st-century skills; Emphasis on interdisciplinary learning.	Modular course designs for flexibility; Integration of online and offline learning experiences.	Curriculum mapping software, Learning design platforms, AI-powered content recommendation engines

Aspect	Researcher	Artificial Intelligence (AI) in Education	Post-Pandemic Pedagogical Innovations	Impact on Hybrid Education	Tools Used
Accessibility and Inclusion	Zawacki-Richter et al. (2019); Huang (2024); Acosta et al. (2023); Zhao & Watterston (2021); Khedrane (2024); Moorhouse et al. (2023).	AI-powered assistive technologies, Language translation for international students.	Universal Design for Learning (UDL) principles in online environments, Increased focus on digital equity.	Combination of synchronous and asynchronous options for diverse learner needs, Adaptive technologies for both online and in-person settings.	Screen readers and text-to-speech software, Closed captioning and transcription tools, Adaptive learning platforms

(Source: Literature Review)

1. Learning Experience

Literature highlights how intelligent tutoring systems and flexible projects and assessments have enhanced personalized learning areas (Chen et al., 2020; Ouyang & Jiao, 2021; Holmes & Tuomi, 2022). Such systems help in a student-centred approach where the students engage with customized educational content. This transition, coupled with hybrid learning methods that combine both online and offline instructions, has completely changed the students' experience with learning. AI platforms such as learning management systems (LMS), virtual reality (VR), and augmented reality (AR) applications have improved learner engagement and made learning interactive (Acosta et al., 2023; Carius, 2021; Moorhouse et al., 2023).

2. Pedagogical Approaches

Artificial intelligence has not only reshaped the teaching pedagogies but also the automated grading systems (Grassini, 2023; Mirzaeian et al., 2016). These technologies assist educators in optimizing their workflows, hence allowing for increased student participation. The use of video conferencing platforms like Zoom and AI-powered content recommendation systems has expanded the horizons for teachers (Sangster et al., 2020; Zhao & Watterston, 2021).

3. Student Support

AI chatbots provide round-the-clock assistance, addressing student inquiries. Virtual office hours, online guidance, and peer-to-peer support networks lead to student engagement. Online meetup platforms and learning analytics dashboards assist educators in keeping track of student's performance (Carius, 2021; Grassini, 2023; Narayanan et al., 2023; Huang, 2024).

4. Evaluation and Feedback

The AI-driven evaluation system has completely transformed the assessment practices (Ouyang & Jiao, 2021; Chen et al., 2020). After the pandemic, there has been a shift towards continuous and peer assessments. This methodology of assessment is the combination of both online and offline methods, supported by real-time feedback mechanisms. Even AI-powered plagiarism detection tools improve the efficacy of these evaluations in the hybrid learning environment (Acosta et al., 2023; Sangster et al., 2020).

5. Curriculum Development

AI tools assist educators in creating

adaptive learning pathways that can be modified as per the student's performance and needs. Curriculum mapping software and learning design platforms help in the creation of flexible course designs appropriate for hybrid education models (Roy, 2020; Roschelle et al., 2020; Zhao & Watterston, 2021; Carius, 2021).

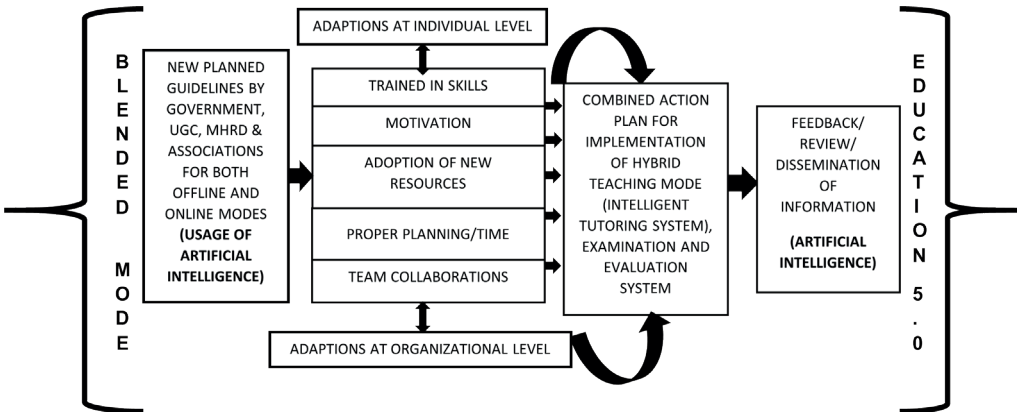
6. Accessibility in Education

The usage of AI assistive technologies has improved accessibility in education by offering language translation, screen readers, and text-to-speech functions for students with disabilities as well as international students. Post-pandemic innovations have prioritized digital equity, enabling students to have equal access to educational materials and support (Acosta et al., 2023; Khedrane, 2024; Moorhouse et al., 2023; Zawacki-Richter et al., 2019; Huang, 2024).

Findings and Discussions

Engaging the faculty as well as the students and that too a single online mode is a very difficult task but one cannot deny the fact that the introduction of the blended learning and teaching model can enhance the engagement levels of faculty as well as the students in future which also impacts the employability in one or the other way (Mandernach et al., 2015). As can be analyzed from Figure 4 below once the element of blended learning is being added in the adapted model, along with the introduction of artificial intelligence, the education model itself becomes flexible irrespective of any crisis (Kalita, 2021).

Figure-4: Education 5.0- Faculty-student engagement model with the addition of Blended learning and Artificial Intelligence



(*Source: Adapted from Speck, 1996 and Mishra et al., 2020; Kalita, 2021; University Grant commission, 2021; VanLehn, 2011; Wang et al., 2023*)

Thus, the blended teaching and learning processes greatly affect the student engagement process (Sahni, 2019). A blended approach has been identified already by various academic institutions and universities in the past but has not been accepted completely in most countries yet (Lars, 2012). It can be summed up that by combining the previous education models (Speck, 1996 and Mishra et al., 2020) along with the current situation of the pandemic and looking forward to the necessity in the future the above-mentioned model has to be followed in any case to upgrade ourselves from the old methodologies of learning and engaging processes (Kalita, 2021; University Grant commission, 2021) especially in the developing nations including India.

However, its practical implementations may face several challenges such as infrastructure disparities when we compare premier institutions like IITs and IISc with rural or semi-urban institutions, faculty readiness with the latest blended teaching methods, resource allocation, cultural adaptation, logistical and technological challenges, and alignment with the new regulations.

Conclusion

Virtual classrooms and innovative online tools help to engage faculty as well as students just like a real-time classroom. Along with some challenges COVID-19 also acted as an opportunity in the education sector to explore more in the form of adoption of a hybrid education model. There is no age constraint in a learning process which may act as a hurdle, and the usage of artificial intelligence and gamification concepts in online learning may lead to a rapid developmental process. The only thing that Digital education requires is the coordination between reliable course content, faculty dedication, reliable technology, dedicated students, and, most importantly, an easily available internet connection. For many, the lockdown has resulted in an uncertain examination schedule, lost internship opportunities, and the pulling back of job offers. However, the main question of the reliability of digital platforms will always remain unsolved as everyone will agree with the fact that for a successful digital engagement, a learner or an instructor must also be honest. This reliability can be achieved by introducing a blended model of teaching and learning, which, once incorporated successfully in the Indian education sector, can do wonders by transforming the quality of the education system in India. Educators must adopt technology and pursue professional development through this Education model. Policymakers must invest in infrastructure and training and foster partnerships with tech companies to raise digital education standards. Together these strategies can create an effective and strong educational framework, transforming India's landscape and preparing the students for future challenges.

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