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Digital Technology Integration in Teaching and Learning in Indian Higher Education

Influencing Factors, Policy Directions, and Government Initiatives

Pradeep Kumar Misra

Centre for Policy Research in Higher Education
National Institute of Educational Planning and Administration
17-B, Sri Aurobindo Marg, New Delhi-110016 (INDIA)

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Pradeep Kumar Misra

Centre for Policy Research in Higher Education (CPRHE)
National Institute of Educational Planning and Administration
17-B, Sri Aurobindo Marg, New Delhi - 110016
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Digital Technology Integration in Teaching and Learning in Indian Higher Education

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Pradeep Kumar Misra*

Abstract

Digital technology has emerged as a viable tool to support teaching and learning in higher education globally. The role of digital technology becomes much more vital for the Indian higher education sector, which is the second-largest higher education system in the world with an enrolment of 41.4 million, and a Gross Enrolment Ratio (GER) of 27.3%, which National Education Policy 2020 (NEP) aims to increase to 50% by 2035. As we observe a renewed focus and confidence in the use of digital technology in Indian higher education, it is essential to delve deeper into three key aspects to envision the future path of technology integration. The first crucial aspect is understanding the factors that influence technology integration. When advocating for or implementing technology integration in higher education, it is important to consider what teachers, students, and institutions view as promoters and inhibitors. The second aspect is the policy directions set by apex government bodies regarding the use of digital technology. Finally, the third significant aspect is the initiatives taken at the governmental level to promote the use of technology in higher education institutions. These aspects must be considered to ensure a successful and sustainable future for technology integration in higher education.

Regarding digital technology integration in higher education, it may seem that policies, initiatives, and influencing factors are unrelated. However, in reality, they are all intricately connected. To successfully integrate digital technology, policies and initiatives must consider the factors enabling integration and those hindering it. This paper delves into the details of the promoters and inhibitors of digital technology integration at the levels of teachers, students, and institutions. It suggests potential interventions for aligning policies and initiatives with influencing factors to achieve effective and efficient digital technology integration in teaching and learning in Indian higher education.

* Director, Centre for Policy Research in Higher Education, National Institute of Educational Planning and Administration, 17-B, Sri Aurobindo Marg, New Delhi- 110016.

Introduction

Higher education has emerged as a critical determinant of social and economic development, and has been seen as essential to maintain a country's competitiveness in the global economy, for modernisation, and development. Teixeira, Gonçalves & Taylor (2021: 11) observe that higher education "Influence employment and quality of life at work; increase knowledge and skills; provide differentiated training; technical and scientific knowledge; flexibility and adaptability." This realisation has triggered many countries to promote higher education on a grander scale. Consequently, the demand for higher education has seen a quantum leap in the last two to three decades in India, as noted by Chopra (2020: 123), "From the earlier notion of higher education, which was meant only for the elite, researchers have referred to this shift of higher education reaching the masses as the massification of higher education."

According to the All India Survey of Higher Education (AISHE) 2020-21, the Indian higher education sector has 1,113 universities, 43,796 colleges, and 11,296 stand-alone institutions. Total enrolment in higher education in India is 41.4 million, and Gross Enrolment Ratio (GER) is 27.3% (Department of Higher Education, 2022). India is the second-largest higher education system globally; every sixth global higher education student is an Indian. National Education Policy 2020 (NEP) of India recognizes the critical role of higher education in national development and aims to increase GER in higher education to 50% by 2035 (Ministry of Education, 2020). The other notable consideration is that India's working population (15-64 years), about 1 billion, comprises 68% of the total population of India (United Nations Population Fund, 2023), and an inclusive and quality higher education for this population can bring many demographic dividends.

Despite the impressive growth of higher education in India, it is realized that the existing brick-and-mortar system of higher education alone cannot meet the massive demand for higher education. Moreover, it is crucial to spread high-quality higher education to both urban and rural areas, as there is a substantial difference in the quality of higher education between rural and urban HEIs. Quality assurance has become more significant, witnessing a surge in enrolment in HEIs in recent years. Fortunately, digital technology has emerged as a viable means to support higher education on various parameters. As noted by Henderson, Selwyn, and Aston (2015: 1), "Digital technologies are now an integral aspect of the university student experience." Varghese & Mandal (2021: 7) too argued that the advancement of digital technology has added even more facilities such as simulations, virtual labs, customisable contents and exercises, adaptive modules and so on to cater to

individual needs and demands. This has placed a strong argument for adapting the technological paradigms into teaching and learning.

The proper and efficient integration of digital technology in teaching and learning can help HEIs offer inclusive and quality higher education immensely and contribute significantly to India's social, sustainable, and economic development (Misra, 2023). Digital technologies have brought about several expectations in higher education. These expectations have only increased after the covid-pandemic when technology became a saviour in education. As we witness a renewed emphasis and confidence regarding the use of digital technology in Indian higher education, it is important to discuss three aspects in depth to envision the future path of digital technology integration in higher education.

The first crucial aspect is the factors influencing digital technology integration. It is important to understand what teachers, students, and institutions see as promoters and what as inhibitors while making or advocating the use of technology integration in higher education. The second aspect is the policy directions at the level of government apex bodies regarding digital technology use. The third significant aspect is the major initiatives taken at the governmental level to promote the use of technology integration in higher education institutions.

It may seem at first glance that policies, initiatives, and influencing factors for digital technology integration in higher education are unrelated, but in reality, they are intricately connected. To successfully integrate digital technology, policies, and initiatives must consider both the factors that enable integration and those that inhibit it. These policies and initiatives should focus on promoting the enabling factors while minimising the inhibiting factors. Without a thorough understanding of the influencing factors, policies and initiatives alone will not be sufficient to bring technology integration to a higher level. This paper delves into the details of the promoters and inhibitors of digital technology integration at the levels of teachers, students, and institutions. It then analyzes how governmental policies and initiatives address these influencing factors.

The plan of this paper is as follows. Section 2 delves into the advocacy for integrating digital technology into teaching and learning. Section 3 discusses the various factors that promote or inhibit technology integration in teaching and learning. Section 4 analyzes policy recommendations for technology integration in Indian higher education. Section 5 discusses the current initiatives taken for digital technology integration in teaching and learning in Indian higher education. Finally, Section 6 draws some conclusions from the analysis and suggests potential

interventions for aligning policies and initiatives with influencing factors for effective and efficient digital technology integration in teaching and learning in Indian higher education.

Advocacy for Digital Technology Integration in Higher Education

Digital technologies have advanced more rapidly than any innovation in our history – reaching around 50 per cent of the developing world's population in only two decades and transforming societies (UN, 2020). Digital technology includes electronic tools, systems, devices, and resources that generate store, or process data. Examples of digital technology are social media, online games, multimedia, and mobile phones (State Government of Victoria, 2019). In comparison, Selwyn *et al* (2016) suggest that digital technologies include the following: Computers, Tablets, Smartphones, Facebook, Moodle, online library services, Google, YouTube, Content creation apps, and portable devices enabling people to access the Internet, not just from home but from any location, etc. In comparison, again Johnston, Kervin & Wyeth (2022) suggest that digital technologies refer to devices such as personal computers and tablets, tools such as cameras, calculators and digital toys, systems such as software and apps, augmented and virtual reality, and less tangible forms of technology such as the Internet.

Advances in the digital technologies available to support learning are among the most dramatic developments. They can help learners meet various goals in different contexts (National Academies of Sciences, Engineering, and Medicine, 2018). In higher education, digital technologies have been seen as enablers of significant educational improvements, enhancers of learner and instructor experiences, and creators of new instructional models through policies, planning, partnerships, and support *(*Martin & Xie, 2022). The Education Endowment Foundation (2023) sees digital technology as the use of computer and technology-assisted strategies to support learning that generally involve: (i) Technology for students, where learners use programmes or applications designed for problem-solving or open-ended learning; or (ii) Technology for teachers, such as interactive whiteboards or learning platforms.

Digital technology in higher learning institutions is used to develop course material, deliver and share content, communicate between learners, lecturers, and the outside world, create and deliver presentations and lectures, and provide academic research, administrative support, and student enrolment (Rumanyika & Galan, 2015). Accommodating all such suggestions, Pinto & Leite (2020: 345-346)

present a taxonomy for digital technologies supporting learning in higher education. This taxonomy includes the following ten categories with examples of tools:

i) Learning Management Systems (LMS): Blackboard, Moodle, WebCT, Platforms supporting online courses, etc.; (ii) Publish and Share tools: Blogs, Wikis, Flickr, YouTube, Podcast, Social Bookmarking, e-portfolio, Digital storytelling, e-books, video lectures, etc.; (iii) Collaborative systems: Google Docs, Social Bookmarking, Mind Maps, Wikis, Blogs, etc.; (iv) Social networking: Facebook, Twitter, Hi5, LinkedIn, Ning, Academia.edu, etc.; (v) Interpersonal Communication tools: email, MSN, Skype, Forums, Video-conferencing, etc.; (vi) Content Aggregation tools: RSS feeds, Net Vibes, Google Reader, etc.; (vii) 3D Virtual Worlds: Second Life, Habbo, Augmented reality, Games, Virtual labs, etc.; (viii) Assessment and Feedback systems: Electronic marking, Clickers, Audio feedback, Computer note taking, etc.; (ix) Mobile tools: mobile applications Internet based; (x) Information and Communication Technologies (ICT): software or applications Internet based.

Digital learning technologies are expected to reform higher education as digital education should facilitate more personalised, flexible, and student-centred teaching (European Commission, 2021). Another argument is that digital technology allows universities to offer a greater variety of courses to more students and to provide them with a level of support that is only sometimes possible with in-class teaching. In addition, it circumvents legacy problems, such as a shortage of teachers and the rigidity of India's local university system. It makes it easier to shape curricula around what employers want in graduates (Times Higher Education, 2023).

Digital technologies are now an integral part of the debate on teaching and learning in higher education (Becker *et al*., 2017; Bullen & Morgan, 2015; Pinto & Leite, 2020). The reason is simple, technological developments, such as computers, portable devices, and the Internet, have greatly influenced people's lives and their relationship with information, knowledge, and working methods (Selwyn, 2016). Furthermore, now, digital learning technologies are expected to reform higher education: The Digital Education Action Plan (2021–2027) of the European Commission (EC) states that digital education should facilitate more personalized, flexible, and student-centered teaching (European Commission, 2021). In higher education, digital technologies are seen as transformative tools for teaching and learning (Garrison & Kanuka, 2004; Säljö, 2010; Lai, 2011). Haleem *et al*. (2022: 275) note that "One of the fundamental components of the United Nations' sustainable development 2030 agenda is quality education. It aims to ensure inclusive and equitable quality education for all. Digital technologies have emerged as an essential tool to achieve this goal."

The effective use of digital learning tools in classrooms can increase student engagement, help teachers improve their lesson plans, and facilitate personalised learning. It also helps students build essential 21st-century skills (American University, 2022: para 3). Costley (2014), in a position paper on the positive effects of technology on teaching and student learning, reiterates that technology integration has several benefits, like increased student motivation, increased student engagement, increased student collaboration, increased hands-on learning opportunities, increased confidence in students, and increased technology skills. Megwa (2022) opines that the impact of technology as a tool in various sectors of human endeavour cannot be neglected, particularly in education, whereby the student can learn remotely, and the teacher can reach a larger audience of students in different locations. Groff (2013: 25) argues: "…technology may be just a vehicle, but it is a powerful one. And it is a vehicle that is central to our work and personal lives, as well as society in general. As a vehicle, technology can not only act as a lever for systemic change in the design of learning environment, it also impacts teaching and learning at the micro level by creating powerfully different learning experiences."

A report published in Times Higher Education (2020) reiterates that digital technology allows universities to offer a variety of courses to more students and provide them with support that is only sometimes possible with in-class teaching. It also circumvents legacy problems, such as a shortage of teachers and the rigidity of India's local university system, making it easier to shape curricula around what employers want in graduates. The World Bank (2021) advocates that information and communication technologies in education can play a crucial role in providing new and innovative forms of support to teachers, students, and the learning process. The report says: "Education at its heart is about human connections and relationships. While we can never replace the magic that happens between great teachers and students in an in-person environment, we should focus on the social aspects of technology to enhance connections from a distance" (para 13).

Similarly, talking about the relevance of digital technology in the teaching-learning process in higher education, a concept note by the University Grants Commission (UGC) of India on the blended mode of teaching and learning highlights: The National Education Policy has given a rare glimpse in what can be achieved through the transformation of education. The new NEP clearly states that it is time to take on a policy that is undoubtedly student centric, or what can be safely put down as Education 4.0! The time has indeed come to recognise the fact that the student is the main stakeholder and that efforts must be taken to make the system respond to

their dreams and aspirations. In this line of thinking the new policy gives the acceptability of many modes of learning including that of face to face learning, online learning and distance or virtual mode (UGC, 2021: 3).

The advocacy for integrating digital technology in higher education is also supported by empirical research. Sung *et al.* (2016) performed a meta-analysis and research synthesis of the effects of integrated mobile devices in teaching and learning, in which 110 experimental and quasi-experimental journal articles published from 1993 to 2013 were coded and analysed. Analysis of the empirical research on mobile devices as tools in educational interventions revealed that the overall effect of using mobile devices in education is better than when using desktop computers or not using mobile devices as an intervention. The impact of such usage was more significant for handhelds than for laptops. The study also pointed out that inquiry-oriented learning was more effective than lectures. Informal educational environments were more effective than their formal counterparts, and medium- and short-duration interventions were superior to long-term interventions. Moreover, digital technology can undoubtedly provide such opportunities.

A literature review mapping the digital technologies set for higher education students to use in formal education contexts between 2012 and 2017 noted that the overall impact of technologies on students' learning process and outcomes was positive. Technologies promoted students' active engagement and participation in the learning process inside and outside the classroom walls. The data also revealed that digital technologies support more transmissive ways of teaching, facilitating students individually to access, share and publish information, and are significantly less used to promote collaborative and cooperative learning (Pinto & Leite, 2020).

The popular question is whether student engagement in constructive and interactive instead of passive and active learning activities depends on whether technologies are implemented in class. Wekerle, Daumiller & Kollar (2022) surveyed 381 higher education students to answer this question. Survey results indicated that when teachers implemented technologies in the class, students felt encouraged to engage in more constructive, passive, and active activities than when they did not use technologies. Furthermore, student engagement in active, constructive, and interactive activities was positively associated with learning outcomes.

By taking note of several research studies, a piece of writing from The Education Endowment Foundation (2022) highlights that digital technology is associated with moderate learning gains: on average, an additional four months' progress. The write-up further notes that technology approaches should supplement other teaching

rather than replace more traditional techniques. It is unlikely that particular technologies directly bring about changes in learning, but some can potentially enable changes in teaching and learning interactions. For example, they can support teachers in providing more effective feedback, using more helpful representations, or motivating students to practice more. By citing studies, the article further notes that approaches that individualise learning with technology are less helpful than small-group learning with technology or the collaborative use of technology.

A blog on the benefits of digital technology in the classroom noted that policymakers and researchers found many potential benefits of online learning, including increased access to resources, personalising learning, and assisting struggling students. The blog points out that findings from existing research studies suggest modest positive effects of technology on student learning. In support of this claim, the blog cites one research study that found that one-to-one laptop programs had a modest impact on students' overall academic achievement in mathematics and science. Most notably, the blog cautions that some studies determined that technology's potential to improve student achievement depends on its instruction path (Rise Vision Blog, 2021).

The use of technology is not limited to tools and techniques. Even the big data, massive amounts of data across the Internet created every second, may help innovative teaching-learning in HEIs. A study discussed teaching based on big data applications and practices to enhance students' innovation in teaching, learning, sociality, and technology. The study deployed thematic analysis to construct a model for higher institutions to regulate their scenario on big data applications. The findings reveal that HEIs can use big data to improve decision-making, provide insights and knowledge discoveries, and optimize learning processes. The researchers recommended that higher learning institutions adopt big data analytics-based teaching and learning strategies to sustain providing innovative education and learning experience to the students with opportunities to improve learning experiences with big data analytics (Huda *et al*., 2016).

Valverde-Berrocoso *et al.* (2021), in their study, noted that the classroom was the most common educational space for the integration of digital technologies. There was moderate use of the virtual classroom, understood as the use of an LMS platform (e.g., Moodle), classroom management (e.g., Class Dojo), or other web 2.0 resources (e.g., blogs). The e-learning modality was rare, as reflected by the results of using the "inverted classroom" or "flipped-classroom". The study also pointed out that teachers used digital technologies more frequently as a resource to support

expositional teaching practices (read/see/listen). On another side, teaching methodologies enriched with less frequent technologies were: (i) collaborative activities; (ii) learning tasks aimed at the creation or production of digital resources by students; and (iii) ICT-supported communication activities. Teachers' most frequent learning outcomes with ICTs were related to "understanding," i.e., student achievement involving competencies for classification, explanation, or question formulation. In contrast, "Synthesis" and "evaluation" are the minor common learning outcomes.

These observations indicate that digital technologies offer many possibilities for the teaching-learning process in higher education. There is clear evidence that digital technology brings direct and indirect changes in teaching and learning. There is a change both at the level of students and teachers. Students nowadays rely on online resources, and teachers aim to combine face-to-face and online learning and adopt flipped classroom methods. Besides, Institutional Learning Management Systems, an emerging trend in HEIs across India, mainly support more comprehensive access to information and learning materials. In addition, technologies are also frequently used for publishing and sharing content related to class activities. Taking note of these emerging trends of digital technology usage among teachers, students, and institutions, HEIs are focussing on integrating technology successfully in teaching and learning.

There is a growing enthusiasm for the integration of technology in higher education. Baldwin (n.d.) suggests that technology has significantly changed college professors' lives as they can use technology to prepare for classes, conduct research, deliver instruction, and keep in touch with their students and colleagues in faraway places. He further predicts a fundamental shift in faculty duties as more technology applications are adopted in higher education. Similarly, Hashim, Tlemsani & Matthews (2021: 22) note that IoT transformed the universities to build a new philosophical stance, which is, the delivery of any programme can be executed intelligently and remotely. The physical landmark of the students is taken out of the equation of modern day's virtual delivery. Connecting from home is no longer a deception. It brings speed, efficiency and wide coverage to education delivery.

Digital technology brings three fundamental changes to higher education. First, making higher education student-centric. Technology creates a student-services ecosystem to support the entire student life cycle, from prospecting to enrolment, learning, job placement, alumni engagement, and continuing education. Second, improving student retention and completion. Technology is helping in developing

the capabilities and systems to incorporate artificial intelligence into student services to provide personalised, timely support. Third, improved enrolment, as technology is now used for data and analytics to develop an inclusive and financially sustainable enrolment strategy to serve more new learners by personalising recruitment, enrolment, and learning experiences (Grajek, 2020).

Henderson, Selwyn & Aston (2015), drawing on a survey of 1658 undergraduate students, identified 11 distinct digital 'benefits' that digital technology brings to higher education. These benefits range from the flexibility of time and place and ease of organising and managing study tasks to replaying and revisiting teaching materials and learning in more visual forms. They confirm that digital technologies are central to how students experience their studies and suggest that they are not 'transforming' the nature of university teaching and learning. As a precautionary note, they indicate that university educators must temper enthusiasm for what might be achieved through technology-enabled learning and better understand the realities of students' encounters with digital technology. Exploring the phenomena of the emergence of the use of artificial intelligence in teaching and learning in higher education, Popenici & Kerr (2017: 11) observe: "…..in effect, now is the time for universities to rethink their function and pedagogical models and their future relation with AI solutions and their owners. Furthermore, institutions of higher education see ahead the vast register of possibilities and challenges opened by the opportunity to embrace AI in teaching and learning. These solutions present new openings for education for all, while fostering lifelong learning in a strengthened model that can preserve the integrity of core values and the purpose of higher education."

All such studies affirm that digital technology is changing teaching and learning. On one side, technology is helping to make the process more personalised; on the other, technology also offers opportunities for collaborative activities. Post Covid-19, the use of digital technology in higher education in India has increased significantly. Contrary to the earlier practice of theoretical advocacy of using technology, the new trend is experimenting with technologies to create new possibilities and educational opportunities. Now, the main stakeholders of the higher education sector, i.e., students, faculty, institutional leaders, and policymakers, are more confident, positive, and hopeful regarding the visible and potential benefits of technology for the teaching-learning process and activities (Misra, 2023).

It is important to note that the traditional face-to-face mode of teaching and learning remains dominant and prestigious in India's higher education sector (Misra & Chauhan, 2020). This situation presents a challenge for integrating digital

technology into this field. While there is much excitement surrounding the potential benefits of technology in higher education, it is important to consider the factors influencing the successful integration of digital technology. Understanding how these factors affect individuals and institutions can help determine how best to approach them and effectively integrate digital technology in higher education in India (Becta, 2004). It is critical to ensure that government policies and initiatives align with these factors to avoid doubts about the effectiveness of integration. Let us take a closer look at what these factors are and how they impact the integration of digital technology in higher education.

Factors Influencing Digital Technology Integration in Teaching and Learning in Higher Education

The integration of technology in higher education is guided by many factors, including digital education leadership training, technology in education policy development, including open educational resources policy and implementation, massive open online courses (MOOCs) and blended learning practices; systematic technology implementation in educational practices; and advanced technology skills development (Mishra & Panda, 2020). There are three main stakeholders regarding the integration of digital technology, i.e., teachers, students, and institutions. The ideal condition for successful integration is that teachers are committed and competent in using technology. Students are happy and ready to follow, and the system is prepared to provide the necessary support and facilities. However, studies highlight that reality is different, and many factors adversely impact the level of teachers, students and institutions.

Surprisingly, when studies talk about factors influencing technology integration in teaching-learning, most studies mainly discuss factors inhibiting the use of technology in the education sector. There is hardly any mention of factors that promote technology integration in teaching and learning. In comparison, many factors motivate and encourage teachers, students, and institutions to integrate technology. Therefore, a discussion on both promoters and inhibitors of technology integration in higher education will be helpful to have a critical understanding of factors influencing digital technology integration in teaching and learning.

Promoters of Digital Technology Integration for Teachers

The factors that promote the selection of digital resources by teachers include getting help in building the lesson plan, feeling the pleasure of teaching; promoting interaction; programmes and simulators that favour the understanding and

deepening of themes; improving the teaching and learning process; diversify more exciting strategies and methodologies; and getting help in classroom transactions. A study by Önalan & Kurt, (2020) notes that teachers know how about commonly-used software programs, their positive attitudes toward using technology in their teaching, a high level of self-confidence in integrating technology into their teaching, and having positive institutional climate among colleagues play an essential role in integrating technology in teaching.

Ertmer *et al.* (2012) observe that teachers' beliefs and attitudes about the relevance of technology to students' learning were perceived as having the most significant impact on their success. Additionally, most teachers indicated that internal factors (e.g., passion for technology, problem-solving mentality) and support from others (administrators and personal learning networks) played key roles in shaping their practices. Similarly, Pelila *et al.* (2022) note that psychological factors (i.e., teachers' perspectives and attitudes) and professional factors (i.e., tenure, training, and workshops) play a vital role in technology integration in teaching. A study by Tang et al. (2021) found that three individual factors (i.e., growth mindset, help-seeking, and self-efficacy) greatly influenced university teachers' acceptance and use of technology. Besides, perceived usefulness is the most critical determinant of adopting the technology.

In summary, teachers' attitudes and intentions emerge as the most influencing factors regarding the use of technology in teaching and learning, as noted by Buabeng-Andoh (2012: 147 – 148), in a review of the literature on factors influencing teachers' adoption and integration of information and communication technology into teaching: The critical factor in the studies is teachers' attitudes toward technology or intentions to use technology in their classrooms. If teachers have negative attitudes toward technology, providing them with excellent ICT facilities may not influence them to use it in their teaching. Therefore, teachers need to be assured that technology can make their teaching interesting, easier, more fun for them and their students, more motivating, and more enjoyable.

Research has shown that numerous factors influence teachers' use of technology. Teachers' feelings, knowledge, and attitudes influence their use of ICT in teaching (Buabeng-Andoh, 2012). Teachers' attitudes toward technology influence their acceptance of the usefulness of technology and its integration into education (Huang & Liaw, 2005). If teachers' attitudes are favourable toward the use of technology, then they can quickly provide helpful insight about the adoption and integration of technology into teaching and learning processes. In addition, factors

such as support, funding, training, and facilities influence teachers' adoption and integration of technologies into their classrooms.

Teachers' professional development is critical in successfully integrating technology into classroom teaching. It is a prerequisite for successfully implementing technologies in active pedagogies (Børte *et al.*, 2020), and technology-related training programs develop teachers' competencies in computer use (Education Endowment Foundation, 2022). Teachers' attitudes toward computers (Wozney *et al.*, 2006; Keengwe & Onchwari, 2008) also assist teachers in reorganising how new technology tools are significant in student learning (Plair, 2008). In addition, the critical motivators for the effective adoption and deployment of technology-enabled education include personal interest in using technology, intellectual challenge, and sufficient provision for technology infrastructure (Panda & Mishra, 2007).

Promoters of Digital Technology Integration for students

The reasons that motivate students to use digital technologies in learning include satisfying their needs and interests; making learning more meaningful; helping in the construction of knowledge; engaging, interacting, and exciting learning process; improving understanding; learning by visualizing and contextualising; dynamizing the process of learning, and improving results. Pelila *et al.* (2022) note that personal factors, i.e., students' perspectives and attitudes, determine their use of digital technology for learning.

Several factors affect the use of digital technology by students. Factors such as students' gender, age, country, level of study, and smartphone ownership play a role in forming their attitudes regarding the use of technology (Al-Emran *et al.*, 2016). In addition, students' expectations, readiness, and identity also play a significant role in their participation in online courses (Kebritchi *et al.*, 2017). Digital games provide the most far-reaching influence across different types of student engagement, followed by web-conferencing and Facebook. Findings regarding wikis, blogs, and Twitter are less conclusive and significantly limited than some studies conducted within the past five years (Schindler *et al.*, 2017). While Social networks and WhatsApp have emerged as essential applications for students because they enable them to contact others, communicate over long distances, and contact people with shared interests (Gallardo *et al.*, 2015).

The research reports that students had easy access to common technologies such as computers and the Internet but had moderate competencies in using these technologies for education. In comparison, they had high competency in using

smartphones and different digital tools and applications for personal purposes (Gasaymeh, 2018). Students' favourable attitudes towards M-learning and their behavioural intentions to use M-learning show that M-learning has long-term sustainability in higher education (Al-Rahmi *et al*., 2021). As another concern, Tulinayo, Ssentume & Najjuma (2018) indicate low use and uptake of digital technologies by students in their learning. Their study, presenting an insider account of students' use of technology, suggests a relatively high usage and acceptance of mobile devices and the Internet among students.

Promoters of Digital Technology Integration for Institutions

Several factors propel educational institutions to promote using digital technology for teaching and learning on their campuses. These reasons include promoting institution's success and meaningful learning, facilitating learning in a meaningful and engaging way, helping the students to explore and learn by exploring; making learning more didactic, dynamic and exciting; helping students feel integrated and motivated in learning"; creating a constructivist and dynamic learning environment; motivating and promoting positive interactions and bringing a socio constructivist climate; facilitating the connection between content and curricular areas, preparing students for permanent interactions in the world; promoting more dynamic classes through student involvement, allowing freedom and autonomy to student; making education less expositive, involving students, allowing sharing, bringing to the classroom local elements and world knowledge that otherwise cannot be accessed; bringing a contextualised and motivated learning; presenting the contents in a more attractive way and relating more robustly all the contents; allowing experiencing, experimenting, motivating, making motivating learning environment; opening to a world of information; promoting the relationship between students and teachers; and enhancing communication between students and sharing of ideas.

Another interesting reason that is motivating higher education institutions to use digital technology in teaching and learning is competition, as noted by Rogers (2000: 20), "Competition is the other key factor driving universities to "think outside the box," or implement new innovations. Any college or university can offer their courses and degrees at a reasonable cost anywhere in the world."

Research also highlights that in addition to the students and educators, the third important stakeholder group whose opinion is equally important in determining the success of technology integration is the university management or institutional

leadership. The research shows that university commitment to technology-enabled learning, university learning practices, and change management practices are critical to adopting technology for teaching-learning purposes (Alrasheedi *et al*., 2016).

The above-reviewed studies, discussed under Sections 3.1.1, 3.1.2, and 3.1.3 highlight the factors that act as promoters of integrating digital technology into teaching and learning (Table 1).

Table 1: Digital Technology Integration: Promoting Factors for Teachers, Students, and Institutions

Factors	Teachers	Students	Institutions
Individual	• Possibilities of experimentation in teaching and learning • Increased interaction • Possibilities of using diversified teaching strategies and methodologies • Knowledge of technology • Experience in using technology	• Satisfying their needs and interests • Making learning more meaningful • Helping in the construction of knowledge • Making learning more engaging, interactive, and exciting • Learning by visualizing and contextualizing	• Promoting the institution's success • Facilitating the connection between content and curricular areas
Psychological	• Positive feelings, beliefs, and attitudes toward using technology • Self-confidence in integrating technology • Personal interest in using technology • Technology as an intellectual challenge, • Growth mindset	• Expectations and readiness • Perspectives and favourable attitudes	• Making a motivating learning environment • Promoting the relationship between students and teachers • Betterment of teaching-learning processes

Professional	• Familiarity and competence with using technology • Self-efficacy in using technology	• Competencies to use technology for educational purposes • Competencies to deal with various types of technology • Knowledge of technology	• Surviving in competition with other institutions
Structural	• Favourable policies for using technologies • Positive institutional climate • Support from colleagues • Provisions for procuring technology	• Favourable policies and provisions for using technologies • Provisions for procuring technology	• Reducing the cost of teaching and learning
Infrastructural	• Availability of technology	• Availability of technology	• Availability of funds for procuring technology

Inhibitors of Digital Technology Integration for Teachers

Teachers agree that technology could replicate or supplement their teaching practices (Jääskelä *et al*., 2017). Nevertheless, they need time to experiment with technical training on specific digital tools to develop digital teaching competence (Valverde-Berrocoso *et al*., 2021). Teachers less familiar with technology experience teaching anxiety (Razkane *et al*., 2022). It is a well-established fact that technology-related training programmes develop teachers' competencies in computer use, influence teachers' attitudes towards computers, and assist teachers in reorganising the task of technology and how new technology tools are significant in student learning. However, less availability of teachers' professional development programmes, lack of pedagogical teacher training, lack of follow-up activities, and lack of differentiated training programmes (Bauer & Kenton, 2005; Franklin, 2007; Wozney *et al*., 2006; Keengwe *et al*., 2008; Plair, 2008; Buabeng-Andoh, 2012) severally affect the technology integration process.

Research indicates that novice teachers hold more teacher-focused conceptions and demonstrate more remarkable and rapid technology change than experienced colleagues. In comparison, experienced teachers tend to exhibit little to no change in conceptions regarding technology use (Englund *et al*., 2017; Valverde-Berrocoso

et al., 2021). For successful adoption and integration of technology into teaching, teachers have to perceive the technology as better than previous practice, be consistent with their existing values, past experiences, and needs and experiment with it on a limited basis before adopting it.

Nevertheless, studies reveal that faculty members differ in the use of technology in terms of gender and teaching experience (Buabeng-Andoh, 2012; Akram *et al*., 2021). In addition, particular external challenges limit teachers' effective use and implementation of technology. These challenges include the absence of ICT infrastructure, old or poorly maintained hardware, lack of suitable educational software, limited access to ICT, limited project-related experience, lack of ICT mainstreaming into the institution's strategy, and lack of emerging technologies to support remote learning (Buabeng-Andoh, 2012; Al-Adwan & Smedley, 2012; Alharbi & Alotebi, 2019).

Inhibitors of Digital Technology Integration for Students

Today's learners prefer to learn informally without sacrificing space and time. Learning embedded with technology motivates learners and enables them to engage in activities that support co-viewing and co-participation. At the same time, they also face hurdles in using technology for learning. Students' main obstacles when using IT platform applications for online learning are work and information overload, lack of affordability, stress, and anxiety problems (Al-Kumaim *et al*., 2021). Another study revealed that students' attitudes change when forced to full-online or hybrid education (Potra *et al*., 2021). The COVID-19 time revealed that teachers preferred to use smartphones and computers/laptops for teaching but students faced several challenges. These challenges include the cost of data, lack of connectivity, and insufficient technology-based practices and resources (Wahab, 2020; Maphosa, 2021; Valverde-Berrocoso *et al*., 2021). The rigid structure of traditional education systems, assessment practices, restrictive curricula, and restricted organisational structure also make it difficult for teachers and learners alike to integrate technology into the teaching-learning process (Buabeng-Andoh, 2012).

Inhibitors of Digital Technology Integration for Institutions

Research reveals that several organisational factors prevent technology use for teaching and learning. These barriers include a lack of pedagogical teacher training, a lack of suitable educational software, limited access to ICT, the rigid structure of traditional education systems, and restrictive curricula (Buabeng-Andoh, 2012). The key challenges of digital transformation are cultural and behavioural resistance,

lack of change-oriented mindset, lack of understanding of digital trends, and low functional collaboration. When teachers are not confident using these tools, they tend to have a lower perception of their value. Hence, they will not use the tools to their total capacity creating an internal barrier. Moreover, the administration adds to teachers' low self-efficacy by not providing sufficient professional development. Coupled with poor infrastructure, lack of network bandwidth, and a shortage of enough devices for classroom usage may cause teachers to feel discouraged and abandon fully implementing technology into their practice (Harrell & Bynum, 2018).

Another research reveals that the obstacles preventing or inhibiting teachers from integrating technology into teaching and learning activities can be classified into pre-service teacher and institutional (university) factors. The institutional factors include infrastructure limitation, lack of training, access, technical support, and compatibility (Habibi *et al*., 2020). Similarly, one of the limiting factors for students' use and acceptance of digital technologies is the limited access to these technologies at the university level (Tulinayo *et al*., 2018; Harrell & Bynum, 2018).

The above-reviewed studies, discussed under previous sections highlight that many factors (barriers) adversely affect integrating digital technology into teaching and learning (Table 2).

Table 2: Digital Technology Integration: Inhibiting Factors for Teachers, Students, and Institutions

Factors	Teachers	Students	Institutions
Individual	• Less experience in using technology • Gender bias • Lack of knowledge of using technology • Less clarity about the purpose of usage	• Use of ICT for personal purposes • Work and information overload • Lack of affordability, ownership, and access	• Teachers lack technology competencies • Teachers' lack of interest in integrating technology • Lack of funds
Psychological	• Lack of confidence, self-motivation, and anxiety about using technology • Negative feelings and attitude towards using technology in teaching • Reluctance to change their work patterns and teaching style	• Attitudinal, stress, and anxiety problems • Expectations, readiness, identity, and participation in online courses • Students' attitudes	• Lack of teacher confidence • Teachers' low self-efficacy

Professional	• Lack of skills and digital competence	• The negative influence of computer-based technology on student engagement • Lack of competencies to use technology for educational purposes	• Lack of pedagogical training to use technology • Lack of access to use and experiment with technology • Lack of technical support, • Lack of compatibility among available technology
Structural	• The rigid structure of traditional education systems • Restrictive curricula • Traditional assessment patterns • Restricted organisational structure. • Institutional culture as a deterrent for utilising technology. • Insufficient technology-based practices and resources	• Forced adaptation to full-online or hybrid education	• Lack of commitment to technology integration in learning • Lack of documented policies to integrate technology • Technology is not a priority for leadership • Rigid educational structure • Restrictive curricula
Infrastructural	• Absence of ICT infrastructure and old or poorly maintained hardware • Lack of suitable educational software • Limited access to ICT • Lack of ICT mainstreaming into the institution's strategy • Lack of emerging technologies to support remote learning • Cost of data • Lack of connectivity		• Poor infrastructure • Non or less availability of internet connection • Lack of suitable educational software and hardware • Lack of network bandwidth • Shortage of enough devices for classrooms

Before we delve into whether digital technology integration policies and initiatives in India consider the influencing factors, it is important to note that factors listed in Table 1 and Table 2 are based on reviews conducted mainly in other countries. Unfortunately, only a few studies in India comprehensively detail the influencing factors of digital technology integration in higher education. Therefore, we cannot definitively claim that these factors represent the Indian higher education scenario. However, these factors can be used as a reference point as most are generic and equally applicable to Indian higher education.

Policy Directions Regarding Technology Integration in Indian Higher Education

From the early days of its independence in 1947, the Government of India advocated using technology for material and human development. Highlighting the significance of technologies, the Government of India Scientific Resolution on 4 March 1958, stated: The key to national prosperity, apart from the spirit of the people, lies, in the modern age, in the effective combination of three factors, technology, raw materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scientific techniques can, in fact, make up for a deficiency in natural resources, and reduce the demands on capital (Government of India, 1958: 1).

University Grants Commission (UGC), New Delhi, launched Country Wide Class Room (CWCR) scheme in 1984. This initiative mainly aimed to use electronic media to enrich higher education. For educational programmes, production facilities at six universities in India in the name of Audio Visual Research Centres (AVRCs) were established. These centres were later renamed Educational Multimedia Research Centres (EMMRCs). Subsequently, an Inter-University Centre named "Consortium for Educational Communication" (CEC) was set up in 1993 to coordinate with media centres (AVRCs and EMMRCs). In 1986, the Government of India came up with the National Policy of Education. Regarding the use of technology for education (including higher education), this policy specifically stated: In order to avoid structural dualism, modern educational technology must reach out to the most distant areas and the most deprived sections of beneficiaries simultaneously with the areas of comparative affluence and ready availability (Government of India, 1986: 22).

This policy was amended in 1992, but the orientation regarding the use of technology for education remained the same. In 2000, the Government of India came up with Information Technology Act 2000. This Act provided legal recognition for transactions carried out using electronic data interchange and other electronic

communication means, commonly called electronic commerce, and paved the way for electric transmission in higher education (Government of India, 2000).

The National Knowledge Commission (NKC), which was constituted to prepare a blueprint for reform of knowledge-related institutions and infrastructure to enable India to meet future challenges, submitted a report to the nation on 12 January 2007. Underlying the significance of technology in higher education, the Commission suggested interconnecting all knowledge institutions throughout the country through an electronic digital broadband network with adequate capabilities (minimum access speed of 100 mbps or more) to encourage sharing of resources and collaborative research. The Commission also called for creating national web-based portals for basic needs in specific sectors, including education (Government of India, 2007).

In 2012 the government released the National Policy on Information Technology 2012 This policy was rooted in the conviction that ICT has the power to transform the lives of people. The policy focussed on leveraging ICT for key social sector initiatives like education to promote equity and quality. The policy also showed commitment to enabling access to content and ICT applications by differently-abled people to foster inclusive development (Government of India, 2012).

The year 2016 welcomed the Rights of Persons with Disabilities Act. The Act specifically stated that the appropriate government should take measures to ensure that (i) all contents available in audio, print and electronic media are inaccessible format; (ii) persons with disabilities have access to electronic media by providing audio descriptions, sign language interpretation and close captioning; (iii) electronic goods and equipment which are meant for everyday use are available in universal design (Government of India, 2016).

In 2016, a report from the committee on the evolution of the national education policy was presented to the Ministry of Human Resource Development. While talking about the use of ICT in higher education, this report categorically stated: In higher education, access to lectures and course material, and interaction with top education institutions in the world through virtual classrooms, online tutorials and tests present immense possibilities for participatory learning and global networking (MHRD, 2016: 172).

The UGC, through its Credit Framework for Online Learning Courses through SWAYAM (Study Web of Active Learning by Young and Aspiring Minds) Regulation 2016, made it mandatory for all universities to bring amendments to their respective ordinances and rules to facilitate the transfer of credits of their students for the

degree programmes to be offered under Swayam, a massive online open courses (MOOCs) platform. The regulation stated, "An institution can only allow up to 20% of the total courses being offered in a particular programme in a semester through the online learning courses provided through Swayam platform" (UGC, 2016: 5). This limit was further increased by a regulation dated 25 March 2021, which stated that "the higher education institution may allow only up to forty per cent of the total courses, being offered in a particular programme in a semester, through the online credit course, through the SWAYAM platform" (UGC, 2021a: 6).

From 8 to 10 July 2017, the Ministry of Human Resource Development organised a national convention on digital initiatives for higher education. Vice-chancellors of Central Universities, Deemed-to-be Universities, Private Universities, State Universities, State Private Universities, and Directors of Central Institutes attended the convention. The convention (UGC, 2017) specifically stated: (i) In the days of fast-expanding IT facilities, higher education institutions can leverage the technology to address the twin concerns of enhancing access and quality; (ii) Online Education directly delivered by the best teachers can assure high quality of instruction; (iii) Online education can address the rural-urban divide, which is manifested by the fact that India has 4.5% graduates in rural areas as against 17% in urban areas. For females, the disparity is starker: 2.2% of female graduates in rural areas, as against 13% of female graduates in urban areas.

The National Digital Communications Policy 2018 India aimed to ensure that its communications infrastructure supports the entire population, whose demographic profiles vary widely across indices such as literacy, economic conditions, and urbanisation. This policy emphasised increasing opportunities for citizens' social and economic development from different spectrums of life. The following two policy commitments directly affect the higher education sector (Government of India, 2018: 6): (i) Provide universal broadband connectivity at 50 mbps to every citizen; (ii) Enable 100 mbps broadband on demand to all key development institutions; including all educational institutions.

In 2019 the Ministry of Human Resource Development released the draft of a National Policy on Education. This draft stated that the institution must ensure the use of technology in education under four categories, students, teachers, classroom processes, and the planning, administration, and management of the entire education system. The draft noted that technology must be used to "improve access to education for disadvantaged groups, including differently-abled students, girls and

women, and students living in remote areas. The fourth area is the planning, administration and management of the entire education system" (MHRD, 2019: 339).

In 2020, India's much-awaited National Educational Policy (NEP) was released. The policy called for the optimum use and expansion of existing digital platforms and ongoing ICT-based educational initiatives to meet the current and future challenges in providing quality education for all and warned: However, the benefits of online/digital education cannot be leveraged unless the digital divide is eliminated through concerted efforts, such as the Digital India campaign and the availability of affordable computing devices. It is important that the use of technology for online and digital education adequately addresses concerns of equity (MHRD, 2020: 58).

Calling for creating a dedicated unit for the building of world-class digital infrastructure, educational digital content, and capacity, NEP 2020 observed that: A dedicated unit for the purpose of orchestrating the building of digital infrastructure, digital content and capacity building will be created in the Ministry to look after the e-education needs of both school and higher education Since technology is rapidly evolving, and needs specialists to deliver high quality e-learning, a vibrant ecosystem has to be encouraged to create solutions that not only solve India's challenges of scale, diversity, equity, but also evolve in keeping with the rapid changes in technology, whose half-life reduces with each passing year (MHRD, 2020: 60).

UGC, in its 547th meeting dated 29 May 2021, passed that higher education institutions can teach up to 40% of the syllabus of each course (other than SWAYAM course) through online mode and the remaining 60% syllabus of the concerned course through offline mode but examinations for both in offline mode. UGC clarified that this provision is over and above up to 40% of online education permissible for SWAYAM courses (UGC, 2021b). This clarification means that students in higher education can opt for 80% of their courses online.

While presenting the Union Budget 2022 for the education sector in Parliament, finance minister Nirmala Sitharaman talked about the provision of world-class education to students across the country for the education sector. Sitharaman announced the launch of a digital ecosystem for skilling and livelihood (DESH-Stack e-portal) to promote online training and form a digital university to establish a world-class education ecosystem. The digital university will impart teaching in regional languages and ICT (information and communication technology) formats. It will be built on a networked hub-and-spoke model and collaborate with other central universities to offer the necessary digital training and infrastructure.

As a follow-up to NEP 2020, the UGC called for amending the University Grants Commission (Open and Distance Learning Programmes and Online Programmes) Regulations, 2020. The proposal states: Higher Educational Institutions having a valid accreditation by the National Assessment and Accreditation Council with a minimum score of 3.26 on a 4-point scale, or having a rank in the top-100 in the 'University' category or in the corresponding category (for an Autonomous College) of the National Institutional Ranking Framework (NIRF), at least twice in three preceding cycles (at the time of application), shall be permitted to offer programme(s) in Open and Distance Learning mode without the prior approval of the Commission and upon satisfying the (following) conditions (UGC, 2022: 2).

The review helps us conclude that Indian policy documents discuss using technologies to benefit education. Still, the discussion is general and applicable to education at all levels. Few policy documents, mainly from UGC, discuss using technologies for higher education. The remaining documents discuss technologies from both school and higher education perspectives, including formal and non-formal education. In a nutshell, policy documents in India recognise the power and significance of technology and recommend its practical use for improving education. The other vital conclusion is that irrespective of so many policies; there has yet to be a comprehensive and holistic policy regarding the use of digital technology in higher education so far.

It is concerning that current policies regarding digital technology integration in higher education do not address the factors that help or hinder this process. Therefore, organisations like UGC must develop a comprehensive policy that identifies these factors and recommends strategies to minimise barriers and maximise opportunities for success.

Initiatives for Digital Technology Integration in Indian Higher Education

The National Education Policy (NEP) 2020 recommended online education, ODL, and a blended learning integrated education system. Pilot studies for online education, digital infrastructure, online teaching platform and tools, content creation, digital repository, and dissemination, addressing the digital divide, virtual labs, training and incentives for teachers, online assessment and examinations, blended models of learning, and laying down standards are some of the recommendations of NEP 2020 regarding promotion of tech-enabled education.

To make the best use of digital technology in higher education, the Government of India took several digital initiatives like SWAYAM (Earn credit through online

courses), SWAYAMPRABHA (Watch high-quality educational programs 24*7), e-PG Pathshala (Get free books and curriculum-based e-content), Shodhganga (Access Research Theses of scholars of Indian Institutes), e-Shodh Sindhu (Get access to full-text e-resources), e-Yantra (Get hands-on experience on embedded systems), and Virtual Labs (Try curriculum-based virtual experiments) combined with the increased use of technology at the ground level, have given new hope and belief that effective and efficient use of technology can make the higher education sector more accessible, equitable, and quality-driven. A summary of the significant government initiatives for the optimum use of digital technology in higher education is given in Annexure 1.

These digital initiatives are designed to provide learning support to students and pedagogical support to teachers and institutions. Most initiatives are user-friendly and aim to create a technology ecosystem to improve students' learning experiences and outcomes. The other notable aspect is that new initiatives target new areas and activities. For example, realising the need to provide good internship opportunities to students, the government has launched a national internship portal. Similarly, National Education Alliance for Technology is a new addition to the list of initiatives. The digital initiatives for higher education are not only limited to the Central government and its organization, but different state governments also take need-based digital initiatives. The digital initiatives taken by different state governments for higher education mainly include having a portal for providing e-content to learners, distribution of smartphones and laptops to needy students, and unified registration portals for students.

As happens to any technology initiative for the education sector across the globe, the optimum use of the initiative among concerned stakeholders always remains a challenge. This phenomenon is not new but has existed since the early initiatives for integrating technology in teaching and learning. Let us have the example of CEC programmes telecasted countrywide for learners. The studies revealed that the usability of these programmes could have been higher, and many targeted students could not benefit from these courses. The same is happening with current digital initiatives. There is hardly any data or research about how many teachers, institutions, and students are using these initiatives, what their feedback is, and how the popularity and usability of these initiatives can be increased. Some initiatives have procedures to count the visitors to the platform, but this measure is not a valid measure to give a clear picture of the use of that platform by targeted stakeholders.

Therefore, it becomes vital that different agencies involved with digital initiatives study the use of the initiatives by the concerned stakeholders. The agencies can also get user feedback to improve and strengthen the initiative. The success of any initiative mainly lies in its use, and agencies have to make it clear that variable initiatives are optimally used. Concerned agencies may also consider publishing a quarterly report about the use of stakeholders, their suggestions for improvement and appreciation, and taking measures to better the intimate. Agencies may also regularly organise advocacy and promotional sessions to make teachers, learners, and higher education institutions aware of these interviews and how to make maximum use of these for the betterment of teaching and learning. As noted by Keane *et al.* (2022: 873), "Modern day tertiary institutions provide mainstream digital technologies for staff and students. These technologies support teaching delivery and students' learning. Institutions need to make good decisions on which technologies are core for creating engaging learning environments. These decisions require regular reviews and these reviews need to rely on sound information which should also reflect students' views, perceptions and expectations of digital technologies for successful learning."

It has been found through analysis that factors such as knowledge, competence, attitude, and willingness to use are crucial for integrating digital technology into higher education. In order to fully capitalise on these accounts, it is important to provide practical hands-on programmes to help teachers and students learn and develop the necessary skills to utilise these technologies for teaching and learning purposes. These programmes must reach every higher education teacher, as without this outreach, the initiatives will likely remain isolated showcases without any meaningful purpose or significant impact.

Conclusions and Potential Interventions

Based on the studies, it has been noticed that educators, students, and institutions have realised the importance of incorporating digital technologies in higher education and are now making use of online platforms and new delivery modes. A few motivators encourage teachers, learners, and institutions to embrace digital technologies for various educational purposes. However, on the other side, they face several challenges, such as individual, psychological, professional, structural, and infrastructural, that hinder them from using digital technology for teaching and learning. Additionally, the other reasons for not so effective integration of digital technology in higher education include unfamiliarity with using technology in teaching, anxiety about using technology, lack of facilities and institutional support, hesitation to change the existing program into an online or blended mode

programme, lack of training to use technology and lack of funds to procure technology.

It is crucial to consider teachers' attitudes regarding using technology in their classrooms. Research has shown that providing teachers with state-of-the-art technology may not be enough to influence them to incorporate it into their teaching if they have negative attitudes towards it. On the other hand, university students are constantly surrounded by technology like smartphones, social media, computers, and the internet, yet they need help to use it for educational purposes. Surprisingly, students also tend to refrain from using technology when forced to adapt to online or blended learning. Therefore, institutions must educate and support teachers and students to ensure technology is effectively integrated into teaching and learning, making it more accessible, enjoyable, and meaningful.

In order to effectively integrate digital technology into education, institutions must focus on three key aspects. Firstly, clear guidelines should be established to help teachers and students understand the expectations of digital technology integration and the preferred methods for achieving these goals. Secondly, programmes, workshops, and courses should be organised to help teachers develop and enhance their competencies in utilising digital technology. Finally, open sessions and discussions should be facilitated to allow teachers and students to share their concerns and critiques of using technology. These sessions will help promote a more personalised approach to technology adoption based on each individual's beliefs and perceptions. Additionally, the following measures suggested by Asio *et al.* (2021) can also prove beneficial for higher education institutions looking to promote digital technology integration.

1) Improving the IT infrastructure for flexible teaching and supporting the continuing education of the students.
2) Providing possible services to extend assistance and help students implement flexible learning using the online mode of delivery.
3) Recalibrating of programme offerings and alignment of curriculum competencies based on the capability of the students and institutions in the implementation of the online mode of delivery of learning.
4) Inclusion of flexible teaching and learning in the institution's strategic plan as an alternative delivery mode in the future.
5) Taking advantage of students' use and experience of specific types of ICT, such as smartphones and SNS, in their personal and social life in their learning.

6) Proceeding to integration through careful planning to consider the pedagogy related to technology integration and the factors that would influence students' acceptance and use of such technologies.

7) Nowadays, several factors, directly and indirectly, influence students' use of technology in their learning. The studies also highlight how technology can be made more beneficial for students.

It is clear from the paper that policies regarding the integration of digital technology often overlook important influencing factors. Rather than providing funding and training, these policies simply call for institutions to promote technology integration. However, many institutions have taken initiatives without any unified and comprehensive mechanism to educate and motivate teachers and students to use these initiatives. To address this issue, the UGC needs to develop policies and provisions that support higher education institutions across India in integrating digital technology in the best possible way. The following measures can be helpful in this regard.

1) The apex bodies of higher education must bring a holistic and comprehensive digital technology integration in higher education (DTIHE) policy.

2) There are several expectations from digital technology integration in higher education. Therefore, the DTIHE policy must act as a guiding document to make key stakeholders, i.e., teachers, students, and higher education institutions, aware of the main expectations and purpose of using digital technology. The policy must also detail the purposes and modalities of digital integrators.

3) This DTIHE policy must make provisions to equip and support higher education, teachers, students, and institutions regarding digital technology integration. The policy must also consider the influencing factors and provide a support mechanism to institutions to overcome inhibitors regarding the use of technology at the level of teachers and students.

4) The apex agencies must devise a mechanism to popularise these initiatives and several government initiatives to promote digital technology in higher education among stakeholders. There is also a need to organize capacity building programme to equip teachers and students to make competent to make maximum out of these initiatives.

5) The agencies must also conduct impact surveys to determine the actual uses of such initiatives, know what deters teachers and learners from their effective use, and provide support accordingly.

Based on the review conducted by the Norwegian Ministry of Education and Research, it was observed that technology was mostly used to support traditional teaching, and more scholarly approaches were needed to promote active pedagogies (Lillejord *et al*., 2018). This observation is equally relevant in the Indian context. It is high time that governmental and institutional policies focus on enabling teachers to master pedagogies of using digital technology for teaching and learning. It is also important to revise and modify ongoing initiatives based on the experiences and feedback of teachers and students. Any new initiatives must be taken in consultation and with proper input from all stakeholders. The success of digital technology integration for teaching and learning ultimately depends on how policies and initiatives consider the promotors and inhibitors of digital technology integration. A triangle where policies and initiatives consider influencing factors will ensure the success of digital technology integration. In contrast, three separate lines of influencing factors, policies, and initiatives without any connection to each other will likely lead to missed opportunities and a less effective integration of digital technology in Indian higher education.

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Annexure-1

Major Government Initiatives for Digital Technology Integration in Indian Higher Education

S. No.	Name of Initiative	Purpose of the Initiative and Envisaged Benefits for Students/ Researchers/ Teachers
1.	SWAYAM	This platform offers free, massive open online courses from nine agencies. These agencies include AICTE (All India Council for Technical Education) for self-paced and international courses), NPTEL (National Programme on Technology Enhanced Learning) for Engineering), UGC (University Grants Commission) for non-technical post-graduation education), CEC (Consortium for Educational Communication) for undergraduate education), NCERT (National Council of Educational Research and Training) for school education), NIOS (National Institute of Open Schooling) for school education), IGNOU (Indira Gandhi National Open University for out-of-school students), IIMB (Indian Institute of Management Bangalore) for management studies), and NITTTR (National Institute of Technical Teachers Training and Research) for teacher training programme). Learners have to pay a small fee for sitting in the examinations and getting a pass certificate after clearing the examination. The credits students earn through courses on this platform are acceptable across HEIs in India. The platform also provides an opportunity for working teachers to complete refresher courses in online mode. Faculty members can also contribute by developing online courses for any of the above-stated nine agencies and offering them on the platform.
2.	SWAYAM PRABHA	The SWAYAM PRABHA is a group of 22 DTH channels devoted to telecasting high-quality educational programmes on a 24X7 basis. Every day, there is new content for at least (4) hours, repeated five more times a day, allowing the students to choose the time of their convenience. NPTEL, IITs, UGC, CEC, and IGNOU provide the content. The SWAYAM PRABHA website also provides details of the telecast schedule and other relevant information about telecasted/to-be telecasted programmes.
3.	National Digital Library of India	The National Digital Library of India (NDLI) is a virtual repository of learning resources which is a repository with search/browse facilities and also provides a host of services for the learner community. Filtered and federated searching facilitates focused searching so learners can find the right resource with the least effort and in the minimum time. NDLI provides user group-specific services such as Examination Preparatory for School and College students and job aspirants. Services for Researchers and general learners are also provided.

		NDLI is designed to hold content of any language and provides interface support for the ten most widely used Indian languages. It is built to support all academic levels, including researchers and life-long learners, all disciplines, all popular access devices, and differently-abled learners. It is designed to enable people to learn and prepare from best practices worldwide and to facilitate researchers to perform inter-linked exploration from multiple sources.
4.	e-PG Pathshala	e-PG Pathshala provides high-quality, curriculum-based, interactive e-content in 70 subjects across all social sciences, arts, fine arts and humanities disciplines, natural & mathematical sciences, linguistics, and languages. The content is developed by subject experts working in Indian universities and other R & D institutes nationwide.
5.	Shodhganga	The Shodhganga@INFLIBNET uses an open-source digital repository software called DSpace to provide a platform for research scholars to deposit their PhD theses and make them available to the entire scholarly community in open access. The repository can capture, index, store, disseminate and preserve ETDs (Electronic Theses and Dissertations) submitted by the researchers.
6.	e-ShodhSindhu	The e-ShodhSindhu provides current as well as archival access to more than 10,000 core and peer-reviewed journals and several bibliographic, citation, and factual databases in different disciplines from a large number of publishers and aggregators to its member institutions, including centrally-funded technical institutions, universities, and colleges that are covered under 12(B) and 2(f) Sections of the UGC Act. The main objective of the e-ShodhSindu is to provide access to qualitative electronic resources, including full-text, bibliographic, and factual databases, to academic institutions at lower subscription rates.
7.	e-Yantra	e-Yantra is a robotics outreach programme that aims to harness the talent of young engineers to solve problems using technology across various domains such as agriculture, manufacturing, defense, home, smart-city maintenance, and service industries. The platform allows learners to become involved in engineering for a better tomorrow and get hands-on experience with embedded systems.
8.	FOSSEE	FOSSEE (Free/Libre and Open Source Software for Education) project promotes using FLOSS tools to improve the quality of education. This initiative aims to reduce dependency on proprietary software in educational institutions and encourage using FLOSS tools through various activities to ensure commercial software is replaced by equivalent FLOSS tools. The platform also develops new FLOSS tools and upgrades existing tools to meet requirements in academia and research.

9.	Spoken Tutorial	Spoken Tutorial is an educational content portal. Here one can learn various Free and Open Source Software all by oneself. The self-paced, multi-lingual courses ensure that anybody with a computer and a desire for learning can learn from any place, at any time, and in a language of their choice. The initiatives also allow eminent faculty to provide training content for self-learning.
10.	Virtual Labs	The Virtual Labs project is a consortium of twelve participating institutes, and IIT Delhi is a coordinating institute. Under the Virtual Labs project, over 100 Virtual Labs consisting of approximately 700+ web-enabled experiments are designed for remote operation and viewing. The intended beneficiaries of the projects are: • All students and faculty members of Science and Engineering Colleges who do not have access to good lab facilities and instruments. • High-school students, whose inquisitiveness will be triggered, possibly motivating them to pursue higher studies. Researchers in different institutes can collaborate and share resources. • Different engineering colleges can benefit from the content and related teaching resources. Virtual Labs do not require additional infrastructure for conducting experiments at user premises. The simulations-based experiments can be accessed remotely via the internet.
11.	National Internship Portal	This portal helps students and fresh engineers to search for internship opportunities and internship providers to put their calls regarding internship opportunities in their organisations. This portal helps Indian students find internships they love, and organisations find the best interns on a pan-India basis.
12.	National Educational Alliance for Technology	National Educational Alliance for Technology (NEAT) as a public-private partnership model between the government (through its implementing agency AICTE) and the Education Technology companies of India. Through an open invitation and screening, companies are invited to showcase their products on a National Portal developed for the learners, who may procure them based on their requirements. NEAT aims to bring the best technological Products in education pedagogy on a single platform for learners' convenience. The initiative also includes free seats for existing higher education students from weaker sections of society.
13.	VIDWAN	VIDWAN is the premier database of profiles of scientists/researchers and other faculty members working at leading academic institutions and other R & D organisations involved in teaching and research in India. It provides essential information about experts' backgrounds, contact addresses, experience, scholarly publications, skills and accomplishments, researcher identity, etc. Faculty members can quickly get registered on VIDWAN.

14.	IRINS	IRINS is web-based Research Information Management (RIM) portal that facilitates academic R&D organisations and faculty members, and scientists to collect, curate and showcase scholarly communication activities and provide an opportunity to create a scholarly network. The IRINS is a free software-as-service to academic and R&D organisations in India. The IRINS integrates the existing research management system such as HR system, course management, grant management system, institutional repository, open and commercial citation databases, scholarly publishers, etc. It has integrated with academic identities such as ORCID ID, Scopus ID, Research ID, Microsoft Academic ID, and Google Scholar ID to ingest scholarly publications from various sources.
15.	Shodh Shudhhi (PDS)	Shodh Shuddhi provides access to Plagiarism Detection Software (PDS) to all universities/institutions in India. The beneficiary institutions include Central Universities, State Universities, Deemed to be Universities, Private Universities, Centrally Funded Technical Institutions (CFTIs), and Inter-University Centres (IUCs) of UGC. Under this initiative, Ouriginal (formerly Urkund), a Web-Based Plagiarism Detection Software system, is being provided to all users of universities/Intuitions in the country.
16.	Academic Bank of Credits (ABC)	As per National Education Policy 2020, the Academic Bank of Credits (ABC) has been envisaged to facilitate the academic mobility of students with the freedom to study across the Higher Education Institutions in the country with an appropriate "credit transfer" mechanism from one programme to another, leading to attain a Degree/ Diploma/PG-diploma, etc. ABC helps in depositing credits awarded by registered institutions into students' accounts. The main features of the ABC are that it • Allows academic institutions to lodge and maintain the integrity of the credits • Maintains the authenticity and confidentiality of student credits • Easy credit transfer through digital mode • Faster credit recognition • Student's Academic Credit Repository Facility to Store, Transfer, and Credit redemption

Source: From the official websites of respective government initiatives

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About the paper

Digital technology has become an increasingly popular tool for supporting teaching and learning in higher education worldwide. In India, where the higher education system is the second-largest in the world and boasts an enrolment of 41.4 million, the role of digital technology is especially critical. The National Education Policy 2020 aims to increase the Gross Enrolment Ratio (GER) to 50 per cent by 2035, further emphasizing the need for technology integration in the Indian higher education sector. To achieve successful and sustainable integration of digital technology in Indian higher education, it is crucial to examine three key aspects: the factors that promote or inhibit technology integration, the policy directions set by government bodies, and the initiatives taken by the government to encourage the use of technology in higher education institutions. Although these aspects may seem unrelated, they are intricately connected. This paper explores the factors that influence technology integration at the teacher, student, and institutional levels and how government policies and initiatives address these factors. Through this analysis, the paper offers potential interventions to achieve effective and efficient integration of digital technology in teaching and learning in Indian higher education.

About the author

Pradeep Kumar Misra is a Professor and Director of the Centre for Policy Research in Higher Education (CPRHE) at the National Institute of Educational Planning and Administration (NIEPA), New Delhi. His research specialisations in teacher education, educational technology, and vocational education have been recognised globally. His academic achievements have been recognised through several prestigious international research scholarships like the Commonwealth Academic Fellowship of CSC, UK; Doctoral and Senior Researcher Scholarship of DAAD, Germany; Erasmus Mundus Visiting Scholar Scholarship of European Commission; National Scholarship of Slovak Republic; MASHAV Scholarship of Israel Government; and Research Exchange Scholarship of FMSH, France. He is also the recipient of the Joint Research Project under ICSSR (India) and NIHSS (South Africa) and a member of the academic bodies of several institutions and organizations in India and abroad.

His scholarly work is also reflected in his publications in journals of international repute, the reference books authored by him, and his completed research and development projects. One of his books, *Learning and Teaching for Teachers*, has been instrumental in shaping teachers' teaching practices. He has also developed educational media programmes and supervised PhD scholars. His extensive experience in education has enabled him to visit many countries, including Germany, the United Kingdom, France, Denmark, Nederland, Sweden, Spain, Slovakia, Austria, New Zealand, Vietnam, Malaysia, Israel, Japan, and South Africa, for educational purposes.

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