



Technological Strategies for Blended Learning Courses of Distance Education in India

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ABSTRACT

The convergence of distance education and blended learning in India represents a transformative shift in the delivery of higher education, particularly within the framework of the National Education Policy 2020 (NEP 2020). Despite significant infrastructure investments, the effective integration of technological strategies into blended learning courses at distance education institutions (DEIs) remains under-studied. This study investigates the technological strategies employed by Indian DEIs for blended learning course delivery, examining their effectiveness, adoption challenges, and outcomes on learner engagement and academic performance. A mixed-methods sequential explanatory design was adopted. Quantitative data were collected from 412 learners and 87 faculty members across eight DEIs using structured survey instruments (Cronbach's $\alpha = 0.87$), and analysed through descriptive statistics, one-way ANOVA, and structural equation modelling (SEM). Qualitative data from 18 semi-structured faculty interviews enriched the quantitative findings. The study found that Learning Management System (LMS) integration ($\beta = 0.54, p < 0.001$), synchronous video conferencing ($\beta = 0.42, p < 0.001$), and mobile learning platforms ($\beta = 0.38, p < 0.01$) significantly predicted learner engagement. Institutional readiness and digital literacy moderated these relationships. Findings underscore the need for context-sensitive blended learning models, faculty digital capacity building, and policy mandates for technology-enabled open and distance learning (ODL) in India. The study develops and validates an Indigenous Blended Learning Technology Integration (IBLTI) Framework tailored to the socio-technical realities of Indian DEIs, addressing a critical gap in the literature.

Keywords: Blended learning, distance education, technology integration, learning management systems, India, NEP 2020, digital pedagogy, open and distance learning

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Global and Indian Context

The global higher education landscape has witnessed a paradigmatic shift towards blended and hybrid learning, accelerated by the COVID-19 pandemic and the rapid proliferation of digital technologies (Dziuban *et al.* 2018; Means *et al.* 2013). Blended learning, defined as the purposeful integration of face-to-face and online instructional modalities, has emerged as a pedagogically robust approach to enhancing learner-centred education (Graham, 2006; Garrison & Kanuka, 2004). In the Indian context, the magnitude of this transformation is particularly significant given the country's expansive higher education ecosystem, comprising over 1,100 universities and more than 40 million enrolled learners as of 2023 (AISHE, 2023).

Distance education institutions (DEIs) in India, anchored by institutions such as the Indira Gandhi National Open University (IGNOU), Dr. B.R. Ambedkar Open University (BRAOU), and fifteen State Open Universities, collectively enrol approximately 15% of all higher education learners (UGC, 2022). The National Education Policy 2020 (NEP 2020) explicitly advocates for the expansion of online and blended learning modalities within Open and Distance Learning (ODL) frameworks to democratise access, enhance quality, and ensure lifelong learning opportunities (MHRD, 2020). However, the operationalisation of technological strategies within DEIs to support blended learning remains a complex, context-dependent, and insufficiently investigated domain.

Significance of the Problem

Despite substantial governmental investment in digital infrastructure through initiatives such as SWAYAM, DIKSHA, the National Digital Library of India (NDLI), and the e-Pathshala platform, the pedagogical efficacy of technology-enabled blended learning in DEIs continues to be constrained by systemic challenges including digital divides, inadequate faculty training, poor internet connectivity in rural areas, and the absence of standardised technology integration frameworks (Bhushan, 2020; Phutela & Dwivedi, 2020). The UGC ODL Regulations 2020 mandate that institutions offering programmes through distance mode adopt a blended approach, yet empirical evidence on the effectiveness of specific technological strategies remains sparse, fragmented, and largely anecdotal.

Research Gap

Extant literature on blended learning predominantly draws from Western university contexts (Garrison & Vaughan, 2008; Oliver & Trigwell, 2005), with limited empirical studies addressing the unique socio-technical, linguistic, and infrastructural conditions of Indian DEIs (Mishra & Panda, 2007; Panda & Mishra, 2007). While studies such as Sahu (2020) and Phutela and Dwivedi (2020) have examined technology adoption in Indian higher education, systematic investigations into blended learning technology strategies specific to ODL institutions—encompassing their design, implementation, and impact—are conspicuously absent. This study addresses this lacuna by empirically examining technological strategies within Indian DEIs through a theoretically grounded, mixed-methods approach.

Purpose and Research Objectives

This study investigates the nature, scope, and effectiveness of technological strategies deployed for blended learning in Indian DEIs. Specifically, it aims to:

- Identify the technological strategies currently employed for blended learning in Indian DEIs;
- Examine the relationship between technological strategies and learner engagement and academic performance;
- Identify institutional and individual-level factors that moderate technology-mediated blended learning outcomes;
- Develop and validate an Indigenous Blended Learning Technology Integration (IBLTI) Framework for Indian DEIs.

LITERATURE REVIEW

Blended Learning: Conceptual Evolution and Theoretical Underpinnings

Blended learning has evolved from a logistical compromise between face-to-face and online education to a sophisticated pedagogical paradigm that leverages the affordances of both modalities (Dziuban *et al.* 2018). Seminal work by Graham (2006) established blended learning as a convergence of instruction, learning, and communication facilitated by digital technologies. Garrison and Kanuka (2004) further conceptualised it within a community of inquiry framework, emphasising cognitive, social, and teaching presences as core elements. More recently, Halverson and Graham (2019) have repositioned blended learning as a design science requiring systematic and evidence-based approaches to technology integration, arguing that learner engagement is the critical mediating variable between instructional design choices and educational outcomes.

Technological Strategies in Blended Learning

The literature identifies several technological strategies fundamental to effective blended learning implementation. Learning Management Systems (LMS) such as Moodle, Blackboard, and Google Classroom have been identified as central technological scaffolds that organise content delivery, assessment, and communication in blended courses (Bates, 2019). Empirical evidence from Derouin *et al.* (2005) and Means *et al.* (2013) consistently demonstrates that LMS-facilitated learning environments improve learner persistence and engagement when coupled with effective instructional design.

Synchronous video conferencing tools, particularly Zoom, Microsoft Teams, and Google Meet, have gained critical importance in post-pandemic blended learning environments. Research by Garrison and Kanuka (2004) and Garrison *et al.* (2000) establishes that real-time synchronous interaction supports the teaching presence and social presence elements of the Community of Inquiry framework, thereby

deepening cognitive engagement and reducing the psychological distance characteristic of distributed learning environments. Mobile learning (m-learning), another prominent strategy, enables flexible, ubiquitous learning that addresses the connectivity and geographical challenges characteristic of DEIs in India (Traxler, 2009; Kukulska-Hulme *et al.* 2015). Studies by Crompton and Burke (2018) document significant improvements in learner engagement and self-regulated learning through mobile learning applications, with higher education settings showing particularly strong outcomes.

Content technologies including podcasts, educational videos, interactive simulations, and open educational resources (OERs) complement delivery platforms by enhancing content richness and learner autonomy (Anderson, 2008; Weller, 2011). In the Indian ODL context, SWAYAM MOOCs and NPTEL video lectures represent institutionally supported content delivery mechanisms with demonstrable reach, though their pedagogical integration into blended courses remains variable (Garg & Garg, 2019).

Blended Learning in Indian Distance Education

Research on blended learning within Indian DEIs remains nascent. Panda and Mishra (2007) examined the faculty readiness and institutional constraints for technology adoption at IGNOU, identifying attitudinal resistance, inadequate training, and infrastructural deficiencies as primary barriers. Mishra and Panda (2007) complemented this work by developing and validating an instrument to measure student attitudes towards e-learning at open universities, finding that learner digital literacy and perceived institutional support were the strongest attitude predictors. Sahu (2020) evaluated the impact of COVID-19 on higher education technology adoption globally, revealing that the enforced shift to online learning exposed the unpreparedness of both institutions and learners for sustained digital engagement. More recently, Phutela and Dwivedi (2020) conducted a qualitative investigation of Indian students' perspectives on e-learning adoption, identifying critical drivers—including flexibility and content accessibility—alongside persistent inhibitors such as inadequate digital infrastructure and low ICT self-efficacy.

Institutional factors, including leadership commitment, technical support infrastructure, bandwidth availability, and policy alignment with the UGC ODL Regulations 2020, have been identified as crucial enablers or inhibitors of blended learning adoption in Indian DEIs (Garg & Garg, 2019; Bhushan, 2020). Qualitative investigations by Iyer (2021) further reveal that language barriers, particularly the predominance of English-medium digital content in a multilingual learner population, present unique challenges for Indian distance learners.

Identified Theoretical and Empirical Gaps

The foregoing review reveals three major gaps: first, the absence of a validated, India-specific technology integration framework for blended learning in DEIs; second, limited quantitative evidence on the differential impact of specific technological strategies (LMS, video conferencing, mobile learning) on learner engagement in ODL contexts; and third, insufficient attention to moderating variables such as institutional readiness and digital literacy in the technology-outcome relationship. This study addresses all three gaps.

THEORETICAL AND CONCEPTUAL FRAMEWORK

Theoretical Foundations

This study draws upon three complementary theoretical lenses to construct its analytical framework:

(a) Technology Acceptance Model (TAM): Davis's (1989) TAM posits that perceived ease of use and perceived usefulness are primary determinants of technology adoption behaviour. In the context of DEIs, TAM provides a framework for understanding why faculty and learners accept or resist specific blended learning technologies. Extensions of TAM (Venkatesh & Bala, 2008) have incorporated contextual variables such as institutional support and training, which are highly relevant to the Indian DEI context.

(b) Transactional Distance Theory (TDT): Moore's (1989) TDT conceptualises the psychological and communicational space between learners and instructors in distance education, arguing that this space is a function of dialogue, structure, and learner autonomy. Technological strategies in blended learning directly modulate all three TDT dimensions: synchronous video conferencing reduces transactional distance through enhanced dialogue; LMS structuring provides course scaffolding; and mobile learning platforms support learner autonomy.

(c) Community of Inquiry (CoI) Framework: Garrison et al.'s (2000) CoI framework identifies three presences—cognitive, social, and teaching—as necessary for deep and meaningful online learning. This framework informs the design of blended learning courses by emphasising that technological strategies must collectively support all three presences to be pedagogically effective.

Indigenous Blended Learning Technology Integration (IBLTI) Framework

Drawing upon the TAM, TDT, and CoI frameworks, and synthesising empirical findings from the Indian DEI context, this study proposes the Indigenous Blended Learning Technology Integration (IBLTI) Framework. The IBLTI Framework conceptualises technology-mediated blended learning outcomes in Indian DEIs as a function of three interacting dimensions, presented in Table 1 below.

Table 1: IBLTI Framework Dimensions and Indicators

Dimension	Sub-Constructs	Indicators
Technology Input Layer	LMS, Video Conferencing, Mobile Learning, OERs	Platform usability, content richness, accessibility
Pedagogical Process Layer	Instructional Design, Interaction Modes, Assessment	Alignment with learning objectives, feedback quality
Contextual Moderators	Institutional Readiness, Digital Literacy, Connectivity	Infrastructure quality, faculty training, learner ICT self-efficacy
Learning Outcome Layer	Engagement, Academic Performance, Satisfaction	Course completion rates, GPA, learner satisfaction scores

Source: Developed by authors based on Davis (1989), Moore (1989), and Garrison et al. (2000)

The IBLTI Framework posits that the relationship between technology strategy adoption and learner outcomes is neither direct nor linear, but is substantively moderated by institutional readiness and learner digital literacy, and mediated by pedagogical process quality. This positions the framework as a context-sensitive alternative to generalist blended learning models that are inadequately calibrated for the socio-technical realities of Indian DEIs.

METHODOLOGY

Research Paradigm and Design

This study adopts a pragmatic research paradigm (Creswell & Creswell, 2018), which accommodates the integration of quantitative and qualitative methods to investigate a complex social phenomenon. A mixed-methods sequential explanatory design (QUAN → QUAL) was employed, wherein quantitative findings from a large-scale survey were first collected and analysed, followed by qualitative data collection to interpret and contextualise the quantitative results. This design was selected for its capacity to provide both breadth of measurement and depth of explanation, appropriate for investigating multidimensional constructs such as technology-mediated blended learning in a diverse institutional context.

Population, Sampling, and Sample Size

The target population comprised learners enrolled in blended learning-enabled programmes and faculty members teaching such programmes at eight DEIs across India: IGNOU, BRAOU, Vardhman Mahaveer Open University (VMOU), Nalanda Open University, Yashwantrao Chavan Maharashtra Open University (YCMOU), Karnataka State Open University (KSOU), Tamil Nadu Open University (TNOU), and Madhya Pradesh Bhoj Open University (MPBOU). These institutions were purposively selected to ensure geographic diversity, programme diversity, and variation in technological infrastructure.

Learners were selected through stratified random sampling across programme types (undergraduate, postgraduate, and diploma) and academic years. Faculty members were selected through purposive sampling to ensure representation of experienced technology users. Sample size was determined using G*Power 3.1 (Faul *et al.* 2007) for SEM with a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and power = 0.80, yielding a minimum sample of 390 learners. Accounting for a 10% non-response rate, 455 questionnaires were distributed, of which 412 were returned complete and usable (response rate = 90.5%). Additionally, 87 faculty members completed the faculty survey, and 18 participated in semi-structured interviews.

Data Collection Instruments

Three instruments were employed:

(i) Learner Technology Engagement Survey (LTES): A 38-item survey adapted from established instruments (Chickering & Ehrmann, 1996; Islam, 2011) measured learner engagement, perceived

technology usefulness, digital literacy, and academic performance. Items were rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

(ii) Faculty Technology Integration Questionnaire (FTIQ): A 24-item survey examined faculty perceptions of LMS utility, video conferencing effectiveness, mobile learning adoption, and institutional readiness for blended learning.

(iii) Semi-Structured Interview Protocol: Eighteen open-ended questions explored faculty experiences with blended learning technologies, perceived student responses, and institutional support structures.

Data Analysis

Quantitative data were analysed using SPSS 26.0 and AMOS 24.0. Descriptive statistics characterised the sample and technology use patterns. One-way ANOVA examined differences in learner engagement across institution types. Structural equation modelling (SEM) tested the hypothesised relationships among technological strategy constructs, moderating variables, and learning outcomes. Moderation analyses were conducted using PROCESS macro v4.2 (Hayes, 2018). Qualitative interview data were analysed thematically following Braun and Clarke’s (2006) six-phase framework, with NVivo 14.0 facilitating coding and theme development.

RESULTS AND FINDINGS

Sample Characteristics

Of the 412 learner respondents, 58.3% were female and 41.7% were male. The age distribution showed 47.1% in the 21–30 year bracket, 31.8% in 31–40 years, and 21.1% aged above 40. Programme enrolment: undergraduate (42.5%), postgraduate (38.6%), and diploma/certificate (18.9%). Device usage: smartphone (74.2%), laptop/desktop (48.1%), and tablet (18.3%). Internet access: 52.4% accessed institutional networks or broadband, while 47.6% relied on mobile data, reflecting the connectivity heterogeneity characteristic of Indian distance learners.

Technological Strategies Employed

Table 2 presents the frequency and perceived effectiveness of technological strategies across the surveyed DEIs.

Table 2: Technology Strategies in Blended Learning Courses at Surveyed Indian DEIs

Technology Strategy	% Institutions Employing	Learner Perceived Effectiveness (M±SD)	Faculty Adoption Rate (%)
LMS (Moodle/SWAYAM)	100%	3.92 ± 0.71	94.3%
Video Conferencing (Zoom/Teams)	87.5%	3.78 ± 0.83	81.6%
Mobile Learning Apps	75.0%	3.64 ± 0.79	72.4%

OERs / SWAYAM MOOCs	87.5%	3.55 ± 0.87	78.2%
Educational Podcasts/Videos	62.5%	3.47 ± 0.91	64.4%
Interactive Simulations	37.5%	3.21 ± 0.96	39.1%
AI-Assisted Tools	25.0%	3.10 ± 1.02	28.7%

LMS was universally adopted, with SWAYAM and Moodle being the predominant platforms. Synchronous video conferencing was employed in 87.5% of DEIs, though its integration into regular course delivery was inconsistent. Mobile learning apps were deployed in three-quarters of the surveyed institutions, primarily as supplementary resources. Interactive simulations and AI-assisted tools represented nascent adoptions, reflecting the early stage of advanced technology integration in the surveyed DEIs.

Structural Equation Modelling Results

SEM results revealed that the overall model fit was acceptable ($\chi^2/\text{df} = 2.31$, CFI = 0.94, TLI = 0.93, RMSEA = 0.057, 90% CI [0.042, 0.071], SRMR = 0.063). Table 3 presents the standardised path coefficients and significance levels.

Table 3: SEM Path Coefficients — Technological Strategies and Learning Outcomes

Path	Std. β	SE	t-value	p-value
LMS Integration → Learner Engagement	0.54	0.06	9.00	< 0.001
Video Conferencing → Academic Performance	0.42	0.07	6.00	< 0.001
Mobile Learning → Learner Engagement	0.38	0.07	5.43	< 0.01
Institutional Readiness × Technology → Outcomes	0.29	0.08	3.63	< 0.01
Digital Literacy × Technology → Engagement	0.33	0.07	4.71	< 0.001

All four hypotheses were supported. LMS integration emerged as the strongest predictor of learner engagement ($\beta = 0.54$), followed by synchronous video conferencing ($\beta = 0.42$) and mobile learning platforms ($\beta = 0.38$). The moderation analysis confirmed that institutional readiness ($\beta = 0.29$) and digital literacy ($\beta = 0.33$) significantly moderated technology-outcome relationships, with stronger technology effects observed in learners with higher digital literacy and at institutions with stronger technological infrastructure.

ANOVA Results: Institutional Differences in Engagement

One-way ANOVA revealed significant differences in mean learner engagement scores across the eight DEIs [$F(7, 404) = 4.87$, $p < 0.001$, $\eta^2 = 0.078$]. Post-hoc Tukey HSD tests showed that learners at IGNOU and YCMOU reported significantly higher engagement than those at smaller state open universities ($p < 0.05$), consistent with these institutions' more developed digital infrastructure and faculty capacity.

Qualitative Findings

Thematic analysis of faculty interview data yielded four major themes: (1) Technology as a Pedagogical Equaliser; (2) Infrastructure Limitations as Persistent Barriers; (3) Learner Digital Heterogeneity; and (4) Policy Aspiration versus Operational Reality. Faculty consistently identified the absence of adequate technical support, inconsistent internet connectivity, and insufficient training as the principal challenges to effective blended learning. Representative of the first theme, one faculty participant remarked: “When the LMS works well and learners can access content at their own pace, technology truly democratises education for students in remote areas.” Regarding barriers, a second participant noted: “The policy says blended learning, but many students in rural areas cannot attend live sessions. The infrastructure simply isn’t there.”

DISCUSSION

Interpretation of Key Findings

The finding that LMS integration is the strongest predictor of learner engagement ($\beta = 0.54$) corroborates the established literature on learning management systems as central scaffolds in online and blended learning environments (Bates, 2019; Derouin *et al.* 2005). The prominence of LMS in Indian DEIs reflects both the UGC’s regulatory push for technology-enabled ODL and the inherent flexibility of platforms such as Moodle and SWAYAM, which support asynchronous interaction, resource sharing, and formative assessment without demanding synchronous internet access—a critical affordance given India’s variable connectivity landscape.

The significant predictive value of synchronous video conferencing ($\beta = 0.42$) on academic performance aligns with Moore’s (1989) transactional distance theory: synchronous technologies reduce the psychological space between learner and instructor through real-time dialogue, thereby enhancing learning depth and motivation. This finding also resonates with Garrison and Kanuka’s (2004) Community of Inquiry framework, which positions synchronous interaction as a key enabler of teaching presence and social presence in distance education contexts. However, the qualitative data reveal an important caveat: synchronous tools are effective only when institutional infrastructure can support consistent, high-quality connectivity—a condition unequally met across Indian DEIs.

The contribution of mobile learning platforms ($\beta = 0.38$) to learner engagement is particularly significant in the Indian DEI context, where smartphone penetration substantially exceeds laptop or desktop availability. This finding extends Crompton and Burke’s (2018) work by contextualising mobile learning’s impact within a large, linguistically diverse, and geographically dispersed distance education system. The moderation of technology effects by institutional readiness and digital literacy is equally noteworthy, confirming Venkatesh and Bala’s (2008) extended TAM proposition that contextual facilitating conditions substantially shape technology adoption outcomes.

Agreements and Contradictions with Prior Literature

The current findings broadly align with Means *et al.*'s (2013) meta-analytic conclusion that blended learning, when implemented with appropriate technological strategies and pedagogical design, outperforms purely online or purely face-to-face instruction. They also corroborate Phutela and Dwivedi's (2020) qualitative evidence that learner digital literacy and institutional support are decisive factors in Indian e-learning adoption outcomes. However, the findings challenge the optimistic technodeterminism evident in some Indian policy documents, which implicitly assume that technology provision alone drives learning outcomes. The strong moderating effects of institutional readiness and digital literacy suggest that technology is a necessary but insufficient condition for effective blended learning—a nuance underrepresented in current Indian ODL policy discourse.

Theoretical Implications

The validated IBLTI Framework contributes to theoretical scholarship in three ways. First, it provides a context-sensitive extension of the TAM to the ODL domain, incorporating institutional-level moderators often absent in individual-level adoption models. Second, it operationalises Moore's transactional distance theory within a blended learning design framework, providing measurable technology-specific constructs (LMS structuring, synchronous dialogue, mobile autonomy) that map onto TDT dimensions. Third, it validates the CoI framework's applicability to Indian distance education contexts, where teaching presence (via LMS design), social presence (via video conferencing), and cognitive presence (via OER-enriched content) collectively determine learning quality.

Practical and Policy Implications

Practically, DEI course designers should prioritise LMS-centred blended course architectures that are supplemented by mobile-accessible content and periodic synchronous interaction. Institutionally, leadership commitment to digital infrastructure, bandwidth provisioning, and faculty digital capacity building is prerequisite to realising the pedagogical benefits of blended learning. At the policy level, the UGC ODL Regulations must evolve beyond mandating blended learning to specifying minimum technology standards, faculty training requirements, and learner digital support mechanisms, with differentiated provisions for institutions at varying stages of digital maturity.

CONCLUSION

This study has provided a comprehensive empirical examination of technological strategies for blended learning in Indian distance education institutions, grounded in the Technology Acceptance Model, Transactional Distance Theory, and the Community of Inquiry Framework. All four hypotheses were supported: LMS integration, synchronous video conferencing, and mobile learning platforms each significantly predict learner engagement and/or academic performance, while institutional readiness and digital literacy moderate these relationships. The study advances the field by developing and validating

the IBLTI Framework—an indigenous conceptual model calibrated to the socio-technical realities of Indian DEIs—and by providing robust empirical evidence to inform technology investment decisions, faculty development initiatives, and ODL policy reforms under the NEP 2020 paradigm. As India pursues its ambition of becoming a global knowledge leader, the intelligent, equitable, and pedagogically grounded integration of technology in blended distance education will be central to that aspiration.

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