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Digital Pedagogy And The Future Of Higher Education: Innovations Through Ict Tools

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Abstract

The integration of Information and Communication Technology (ICT) tools into higher education represents a pivotal shift in pedagogical practice, promising enhanced engagement and learning outcomes. This study investigates the relationship between digital pedagogy adoption and the perceived future trajectory of higher education, specifically examining the role of ICT innovations. A quantitative survey was administered to a sample of 267 faculty members and teaching staff across institutions in Pune City, Maharashtra, India. Using a five-point Likert scale, the instrument captured perceptions on the effectiveness and necessity of digital tools in contemporary teaching. Data analysis employed one-sample t-tests to assess the significance of mean responses and Pearson correlations to examine the strength of associations between key constructs. The findings robustly support both proposed hypotheses (H1 and H2). The aggregate mean for the primary hypothesis was approximately 3.66, indicating a generally positive disposition toward ICT integration. Furthermore, correlation coefficients ranging from 0.592 to 0.701 revealed significant, positive relationships between variables such as perceived usefulness, ease of integration, and institutional support, underscoring their interconnected influence on pedagogical innovation. These results affirm that faculty perceive ICT tools as essential for modernizing curricula and fostering interactive learning environments. The study concludes that strategic investment in digital infrastructure and continuous professional development is critical for realizing the transformative potential of digital pedagogy. This research contributes to the discourse on educational technology by providing empirical evidence from the Indian higher education context, suggesting that a deliberate focus on digital competencies is indispensable for future-ready academic institutions.

Keywords: digital pedagogy; higher education; ICT tools; blended learning; e-learning; faculty development; learning management systems; India; instructional innovation; online teaching.

1. Introduction

The global landscape of higher education has undergone a profound transformation, driven by the rapid integration of digital pedagogy and Information and Communication Technology (ICT) tools. This shift, accelerated by the post-pandemic pivot to online and blended teaching models, has fundamentally altered the traditional dynamics of instruction and learning. Universities worldwide are now compelled to move beyond mere digitization of content, embracing interactive platforms, learning management systems, and collaborative technologies to enhance student engagement and outcomes. The emphasis has shifted from static knowledge delivery to dynamic, learner-centered environments where technology serves as a catalyst for pedagogical innovation. This evolution necessitates a

critical examination of how faculty members adapt their teaching philosophies and practices to harness the full potential of these digital resources, ensuring that the quality of education is not only maintained but also enriched in a rapidly changing academic ecosystem (Tsiuniak et al., 2025). The challenge lies in integrating these tools seamlessly into curricula to foster critical thinking and digital literacy among students, preparing them for a future where technological fluency is paramount. Consequently, the role of the educator is being redefined, requiring continuous professional development and a willingness to experiment with novel instructional strategies (Sultan, 2025).

Within the Indian context, the digitalization of higher education has gained significant momentum, propelled by national policies aimed at fostering a technology-driven knowledge economy. The country has witnessed a substantial expansion in the adoption of Learning Management Systems (LMS) and hybrid teaching methodologies, particularly in metropolitan centers that serve as hubs for both education and technological innovation. Pune, a major educational and industrial hub of Maharashtra, stands out as a prime example of this convergence, hosting a dense concentration of premier academic institutions and a thriving IT industry. This unique ecosystem creates an ideal environment for exploring the practical implementation of digital pedagogy, as faculty members in the city are often at the forefront of experimenting with new tools and platforms. The city's academic culture is increasingly characterized by a push towards integrating ICT not just as an auxiliary aid but as a core component of the instructional design process. This policy-driven push, combined with the local technological infrastructure, provides a rich backdrop for investigating the real-world challenges and successes of digital transformation in teaching practices (Atdani et al., 2023). The focus on Pune offers valuable insights into how macro-level digital initiatives are translated into micro-level classroom realities.

Despite the widespread acknowledgment of ICT's importance, a significant gap persists in the literature concerning the nuanced relationship between technological tools, pedagogical strategies, and faculty readiness. Much of the existing research tends to focus either on the capabilities of specific software or on student perceptions, often overlooking the critical perspective of the teaching staff themselves. Furthermore, there is a scarcity of city-level empirical evidence from the Indian subcontinent that specifically examines the faculty experience with a robust sample size. While national surveys provide a broad overview, they often fail to capture the localized challenges related to infrastructure, training, and institutional support that are unique to specific urban ecosystems. The existing discourse frequently assumes a linear progression from tool adoption to pedagogical improvement, without adequately addressing the complex interplay of faculty attitudes, digital competence, and institutional culture that determines successful integration. This oversight is particularly pronounced in rapidly developing urban centers where the pace of technological change may outstrip the pedagogical training provided to educators (Zapana et al., 2024). Therefore, a focused investigation is required to bridge this gap, offering a granular analysis of the factors that either facilitate or hinder the effective use of ICT in higher education teaching.

The purpose of this study is to critically examine the adoption and impact of digital pedagogy and ICT tools among faculty members in higher education institutions within Pune City, Maharashtra, India. Specifically, this research aims to assess the current level of digital tool integration in teaching practices, identify the primary drivers and barriers to their effective use, and evaluate the perceived readiness of faculty to engage with advanced pedagogical technologies. The scope of this investigation is deliberately confined to the perspectives of teaching staff, with a sample of N=267 faculty members drawn from various colleges and universities across the city. By focusing exclusively on this demographic, the study seeks to provide a comprehensive understanding of the human element in the digital transformation process, moving beyond infrastructural assessments to explore the professional experiences and attitudes of educators. The findings are intended to offer actionable insights for policymakers, institutional leaders, and academic developers, contributing to the formulation of targeted training programs and support systems that can enhance the quality of technology-mediated instruction. Ultimately, this research endeavors to contribute to the broader discourse on the future of higher education by presenting a localized, evidence-based perspective on the challenges and opportunities inherent in the digital pedagogical shift.

2. Literature Review

Tsiuniak et al. (2025) examine the integration of digital pedagogy into the professional training of future primary school teachers. The study identifies key challenges, including the need to update educational programs, enhance digital literacy among educators and students, ensure access to modern technologies, and balance traditional methods with innovative approaches. The authors analyze contemporary training models and propose recommendations for the effective deployment of digital tools in higher education. Their findings position digital pedagogy as an essential component of contemporary educational practice, necessary for preparing teachers for

the digital age. This work holds relevance for digital pedagogy and ICT integration in higher education, offering guidance for faculty navigating online and blended teaching environments.

Sultan (2025) reviews the edited volume *Language Education in Saudi Arabia: Integrating Technology in the Classroom*, highlighting its compilation of corpus analyses, case studies, systematic reviews, and practitioner reflections. The review notes that the collected studies offer context-sensitive insights into technology-enhanced language education, specifically addressing tools such as, flipped learning, and virtual writing platforms. A central theme identified is that technology's effectiveness relies on teacher support, critical reflection, and contextual awareness. The review also observes that while the editors intend to cover both teaching and learning, the chapters predominantly emphasize teacher experiences and instructional practices. This focus underscores the relevance of faculty development and reflective implementation for effective ICT integration in online and blended higher education settings.

Adtani et al. (2023) examined the adoption and adaptation of information and communication technology (ICT) within academia, framing this shift as the new normal pedagogy. The paper's purpose was to gain insights into the current literature, identify critical contributing authors, countries, and research areas, and outline overall trends and future directions. Methodologically, the study collected bibliometric data from Scopus and Web of Science, utilizing tools such as VOSviewer for analysis. Additionally, short empirical evidence was incorporated to understand faculty members' current adoption of new pedagogical approaches. This work is relevant to digital pedagogy and ICT tools in higher education, as it addresses the ongoing transformation of online and blended teaching practices for faculty.

Zapana et al. (2024) examine in-person and hybrid learning within higher education through an information and communication technology (ICT) centric approach. The study employs a qualitative methodology based on documentary research, analyzing scholarly work published between 2018 and 2024 from databases including Scielo, Redalyc, Dialnet, Google Scholar, and Scopus. The authors focus on integrating virtual inquiry into classroom instruction as a meaningful process for university students, with inclusion criteria emphasizing virtual reality, teaching, and university education. A documentary review matrix was used to analyze the contributions of fifteen prominent authors in this field. This work holds relevance for digital pedagogy by informing how ICT tools can support adaptive and student-centered learning environments in online or blended teaching contexts.

Appianing et al. (2025) investigated instructor presence in Ghanaian higher education within the post-COVID-19 online teaching environment. Grounded in the Community of Inquiry framework, the study examined how instructors establish teaching, cognitive, social, and emotional presences to foster student engagement. Data were collected from 404 postgraduate students via a self-administered online questionnaire. Using Latent Profile Analysis, the authors classified instructors into four distinct groups: novice, intermediate, promising, and ideal, based on their capacity to create these presences. The findings indicated that teaching presence was dominant, while cognitive and social presences were less evident due to barriers such as low technological readiness and limited digital literacy. This research offers valuable insights for digital pedagogy, highlighting the need for targeted faculty development in online and blended teaching contexts.

Kondoro et al. (2025) investigated the adoption of technology-enhanced learning (TEL) methods among higher education faculty in Tanzania, specifically at the University of Dar es Salaam. The study examined faculty digital competencies, known as eSkills, alongside current technology use and barriers to integration. Employing a quantitative survey, the research assessed faculty familiarity with TEL, self-reported eSkills, and willingness to adopt these methods, while also identifying common challenges. The findings indicated varied digital literacy levels among faculty, coupled with a strong willingness to adopt TEL. However, limited institutional support and insufficient training were identified as significant obstacles hindering widespread adoption. This research underscores the critical need for structured institutional frameworks to support faculty development, thereby informing digital pedagogy and the effective integration of ICT tools in higher education and blended teaching environments.

Dewanti et al. (2021) aimed to design a Learning Management System (LMS) model tailored to the characteristics of higher education students, seeking to establish a learning ecosystem that is simple, interesting, and interactive while utilizing multidimensional learning resources within a Cyber Pedagogy framework. The research employed both quantitative and qualitative methods. The study involved 53 respondents from the Institute of Technology and Business (ITB) STIKOM Bali, Faculty of Information Systems, comprising three lecturers who participated in expert testing and 50 student respondents. The resulting LMS model, named SMILE, stands for a Simple, Multidimensional, and Interactive Learning Ecosystem. This design holds relevance for digital pedagogy by offering a structured approach to developing ICT tools that support interactive and multidimensional learning experiences in higher education settings.

Abellán (2025) explores the pedagogical implications of student-led course design by comparing two freemium learning management systems, MoodleCloud and Google Classroom. In a university-level ICT module at Complutense University of Madrid, students designed parallel virtual classrooms using both platforms. Thematic analysis of structured group reflections revealed key contrasts in usability, customisation, collaborative tools, and instructional design flexibility. Findings indicate that Google Classroom is perceived as intuitive and efficient, whereas MoodleCloud is favoured for its pedagogical depth and modular customisation, despite a steeper learning curve. By positioning students as novice instructional designers, the study demonstrates how LMS affordances shape digital pedagogy and learner agency, offering relevant insights for faculty practice in online and blended higher education settings.

Bastidas (2024) analyzes face-to-face and blended learning approaches in higher education, focusing on their impact on professional competency development amid digital transformation and increased use of information and communication technologies. Through a documentary review of scientific literature, the study examines characteristics, benefits, challenges, and trends of both educational models, highlighting their complementary role in teaching and learning. Findings indicate that face-to-face learning remains essential for practical, communicative, and socio-emotional skills, while blended learning offers flexibility, autonomy, and personalization through integrating virtual and in-person environments. The effectiveness of these models depends on instructional design and pedagogical strategies. This work informs digital pedagogy by underscoring how faculty can strategically combine ICT tools and in-person instruction to enhance professional preparation in higher education.

Madani et al. (2023) investigated faculty acceptance of online teaching at a major Saudi Arabian university during the COVID-19 pandemic. Drawing on the Unified Theory of Acceptance and Use of Technology, the authors surveyed business school faculty and employed partial least square structural equation modeling to examine determinants of satisfaction and behavioral intention to continue online instruction. The findings indicated that performance expectancy, or the perception that e-learning enhances teaching effectiveness, and perceived ease of use of online tools positively influenced faculty acceptance. This study offers relevant insights for digital pedagogy and institutional support strategies in higher education, particularly for sustaining online and blended teaching practices beyond emergency contexts.

Yang et al. (2024) evaluated the adoption of blended teaching models among faculty and students at Hubei University of Medicine. The study distributed questionnaires to 235 faculty members and 1501 students to assess preferences for various teaching models. Results indicated that 34.5% of teachers and 33.7% of students preferred the hybrid teaching model. Multiple logistic regression analysis identified influential factors for teachers, including the quality of online teaching and teacher-student interaction. For students, significant factors included online learning experiences. These findings offer a theoretical foundation for reforming teaching models and hold relevance for digital pedagogy, suggesting that institutions should consider both faculty and student preferences when integrating ICT tools in higher education and designing online or blended teaching practices.

Axmedjanova et al. (2023) examined the integration of Information and Communication Technologies in online Academic English instruction within higher education in Uzbekistan. The study, prompted by the COVID-19 pandemic's forced shift to distance education, analyzed case studies from three international universities in Tashkent. As these institutions lacked prior experience with online delivery, they adopted distinct approaches, employing both synchronous and asynchronous sessions through various videoconferencing tools and learning management systems. The authors utilized the Technological, Pedagogical, and Content Knowledge (TPACK) framework to reflect on educator experiences. This investigation offers relevant insights for digital pedagogy, particularly regarding the strategic selection of ICT tools and the importance of faculty adaptability in blended and online teaching environments.

Masripah et al. (2025) present a narrative review of digital pedagogy and technology-enhanced learning, focusing on how emerging tools and pedagogical strategies influence higher education. The study analyzes both opportunities and challenges of integrating digital technologies into teaching and learning, applying a systematic methodology to peer-reviewed literature indexed in Scopus, Web of Science, and Google Scholar. The inclusion criteria covered empirical studies, reviews, and case studies published between 2015 and 2025. Results indicate that artificial intelligence supports personalization and predictive learning outcomes, while augmented and virtual reality enhance student motivation and comprehension through immersive experiences. This review offers relevant insights for faculty practice regarding the integration of ICT tools in online and blended higher education settings.

Bora and Yadav (2024) propose a framework for performance management and ICT-based digitalization within a higher education institution. The authors note that digital technology has transformed academic landscapes by enhancing teaching, learning, research, and governance. They emphasize the critical need for adequate

infrastructure, improved internet access, modern digital tools, secure platforms, and digitally competent professionals. The abstract highlights the growing use of ICT, cloud computing, AI, robotics, and virtual reality in Indian institutions, which improves competencies and aligns skills with industry knowledge. The paper argues that traditional classroom teaching is becoming obsolete, as technology enables students to access learning anytime and anywhere. This framework holds relevance for digital pedagogy and faculty practice in online and blended teaching environments.

3. Research Objectives and Hypotheses

The accelerated digitalization of higher education has transformed instructional design, delivery, and assessment across Indian universities and colleges. Faculty members and teaching staff now confront an expanded repertoire of ICT tools, including learning management systems, interactive digital content, blended and hybrid formats, online assessment platforms, and collaborative technologies. Pune City, Maharashtra, as a major educational and technological hub, offers a concentrated setting in which digital pedagogy innovations are actively negotiated in everyday teaching practice. Despite widespread adoption discourse, empirical evidence remains limited regarding how faculty perceive ICT-enabled pedagogical innovations and how competence, infrastructure, training, student engagement, and policy support relate to the future readiness of higher education. This study therefore examines these relationships among faculty and teaching staff in Pune City, Maharashtra, India.

Objectives

Objective 1: To examine whether ICT-enabled digital pedagogy innovations correlate with improved instructional practices among faculty members and teaching staff in Pune City, Maharashtra, India.

Objective 2: To examine whether faculty ICT competence, institutional digital infrastructure, training, student engagement outcomes, and policy support are significantly associated with the future readiness of higher education among faculty members and teaching staff in Pune City, Maharashtra, India.

Hypotheses

H1o: ICT-enabled digital pedagogy innovations exhibit no statistically significant association with improved instructional practices among faculty members and teaching staff in Pune City, Maharashtra, India.

H1a: ICT-enabled digital pedagogy innovations demonstrate a statistically significant positive association with improved instructional practices among faculty members and teaching staff in Pune City, Maharashtra, India.

H2o: Faculty ICT competence, institutional digital infrastructure, training, student engagement outcomes, and policy support show no statistically significant correlations with the future readiness of higher education among faculty members and teaching staff in Pune City, Maharashtra, India.

H2a: Faculty ICT competence, institutional digital infrastructure, training, student engagement outcomes, and policy support are significantly and positively correlated with the future readiness of higher education among faculty members and teaching staff in Pune City, Maharashtra, India.

4. Research Methodology

The present study adopted a quantitative research design to examine the perceptions of faculty members regarding the integration of ICT tools in higher education pedagogy. A cross-sectional survey approach was deemed appropriate as it enables the systematic collection of numerical data from a defined population at a single point in time, thereby facilitating the identification of patterns and relationships among variables. This design aligns with the study's objective of measuring attitudes, usage patterns, and perceived effectiveness of digital pedagogy. Furthermore, the quantitative framework permits the application of inferential statistical techniques, which are essential for testing hypotheses concerning faculty perceptions against a neutral benchmark. The choice of this design was also guided by its efficiency in reaching a geographically dispersed sample within Pune City while maintaining methodological rigor and objectivity in data interpretation.

The respondent class for this investigation was exclusively confined to faculty members and teaching staff employed in higher education institutions within Pune City, Maharashtra, India. This category included assistant professors, associate professors, professors, lecturers or teaching associates, and heads of department or academic coordinators. Students, non-teaching administrative personnel, and industry professionals were deliberately excluded from the sampling frame. This singular focus was justified by the study's central concern with pedagogical practices and instructional innovation, which are primarily enacted and observed by those directly engaged in

teaching. Faculty members possess firsthand experience with curriculum delivery, classroom technology integration, and student assessment, making them the most credible informants regarding the operational realities of digital pedagogy. Their perspectives are indispensable for evaluating the transformative potential of ICT tools in shaping the future of higher education.

Purposive stratified sampling was employed to select the study participants, ensuring representation across various teaching cadres within the faculty class. This sampling strategy was chosen to capture the diversity of experiences and hierarchical positions that may influence perceptions of digital pedagogy. The strata corresponded to the five designated teaching roles, and respondents were purposively selected within each stratum based on their active teaching engagement and institutional affiliation. The final sample comprised 267 respondents, a size deemed adequate for the statistical analyses planned, including correlation and t-tests. This sample size exceeds the minimum threshold recommended for achieving statistical power in social science research, thereby enhancing the generalizability of findings to the broader faculty population in Pune's higher education sector. The stratification also mitigated selection bias by ensuring that no single teaching cadre dominated the sample.

Data were collected using a structured questionnaire designed specifically for this study, which comprised items measuring faculty perceptions of ICT integration, digital infrastructure, pedagogical effectiveness, and institutional support. Responses were recorded on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was developed based on a review of relevant literature on digital pedagogy and ICT adoption in higher education, and it was pilot-tested with a small group of faculty members to ensure clarity, relevance, and internal consistency. The Likert format was selected for its ease of administration and its capacity to capture nuanced degrees of agreement or disagreement. The structured nature of the questionnaire facilitated standardized data collection across all respondents, thereby minimizing interviewer bias and enabling direct comparability of responses for subsequent quantitative analysis.

The data collection process spanned six months, from July 2023 to December 2023, during which responses were gathered through face-to-face interactions, online surveys, and telephone interviews to maximize participation and accommodate respondent preferences. Informed consent was obtained from all participants prior to their involvement, and confidentiality was assured through anonymization of responses. The collected data were coded and entered into SPSS version 26 for statistical analysis. Descriptive statistics, including means and standard deviations, were computed to summarize faculty perceptions. Inferential analyses comprised one-sample t-tests with a test value of 3 to determine whether mean perceptions significantly deviated from the neutral midpoint of the Likert scale. Additionally, Pearson correlation coefficients were calculated to examine the relationships between various dimensions of digital pedagogy and perceived institutional readiness, thereby addressing the study's research objectives.

5. Data Analysis and Interpretation

Table 1: Age Profile of Respondents

Particulars	Frequency	Percentage	Cumulative Percentage
25-34 years	61	22.85	22.85
35-44 years	78	29.21	52.06
45-54 years	67	25.09	77.15
55-64 years	39	14.61	91.76
65 years and above	22	8.24	100.00
Total	267	100.00	100.00

The age distribution of the 267 faculty respondents reveals a concentration in the middle career brackets, with the largest cohort being those aged 35 to 44 years at 29.21 percent, closely followed by the 45 to 54 years group at 25.09 percent. This pattern indicates a predominantly mid-career teaching workforce in Pune's higher education institutions, a demographic that is likely to possess substantial classroom experience while remaining receptive to professional development in digital tools. The relatively smaller proportions at the extremes, with only 8.24 percent aged 65 and above and 22.85 percent under 35, suggest a potential generational divide in digital fluency. Institutions may need to design targeted capacity building programs that leverage the experience of senior faculty while addressing the distinct pedagogical expectations of younger and older cohorts.

Table 2: Gender Distribution of Respondents

Particulars	Frequency	Percentage	Cumulative Percentage
Male	139	52.06	52.06
Female	128	47.94	100.00
Total	267	100.00	100.00

The gender composition of the surveyed faculty is nearly balanced, with male respondents comprising 52.06 percent and female respondents 47.94 percent. This near parity reflects a notable achievement in faculty representation within Pune's higher education landscape, although it does not necessarily indicate equal access to digital leadership roles or technology integration responsibilities. The balanced distribution strengthens the generalizability of the study's findings on digital pedagogy, as perceptions are unlikely to be skewed by a dominant gender perspective. However, future research should examine whether male and female faculty experience differential access to ICT training, institutional support, or opportunities to lead digital initiatives, as such disparities could influence the effectiveness of technology adoption across departments and disciplines.

Table 3: Teaching Cadre Profile of Faculty Respondents

Particulars	Frequency	Percentage	Cumulative Percentage
Assistant Professors	71	26.59	26.59
Associate Professors	58	21.72	48.31
Professors	47	17.60	65.92
Lecturers and Teaching Associates	53	19.85	85.77
Heads of Department and Academic Coordinators	38	14.23	100.00
Total	267	100.00	100.00

The occupational profile of the sample shows that Assistant Professors constitute the largest cadre at 26.59 percent, followed by Lecturers and Teaching Associates at 19.85 percent, Associate Professors at 21.72 percent, Professors at 17.60 percent, and Heads of Department and Academic Coordinators at 14.23 percent. This distribution indicates that early and mid-career faculty, who are often at the forefront of classroom instruction, form the majority of respondents. Their perspectives on digital pedagogy are particularly valuable because they are likely to be the primary users of learning management systems and interactive content in daily teaching. The substantial representation of administrative roles, such as Heads of Department, also provides insight into institutional decision making regarding ICT infrastructure and training priorities, thereby offering a comprehensive view of digital adoption from both operational and strategic levels.

Table 4: Learning Management Systems Enhancing Instructional Delivery (Statement 1)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	91	34.08	34.08
Agree	79	29.59	63.67
Neutral	48	17.98	81.65
Disagree	31	11.61	93.26
Strongly Disagree	18	6.74	100.00
Total	267	100.00	100.00

The first statement on learning management systems enhancing instructional delivery received a combined agreement of 63.67 percent, with 34.08 percent strongly agreeing and 29.59 percent agreeing. This majority endorsement suggests that faculty in Pune recognize the utility of platforms for organizing course materials, assignments, and communication. However, the presence of 48 neutral respondents and 49 who disagreed or strongly disagreed indicates that a considerable minority remains unconvinced or faces implementation challenges. Such skepticism may stem from inadequate training, unreliable internet connectivity, or concerns about increased workload. For Indian higher education institutions, these findings imply that merely providing LMS access is insufficient; sustained technical support and pedagogical mentoring are necessary to translate platform availability into improved instructional delivery.

Table 5: Interactive Digital Content Improving Learner Engagement (Statement 2)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	94	35.21	35.21
Agree	81	30.34	65.54
Neutral	43	16.10	81.65
Disagree	29	10.86	92.51
Strongly Disagree	20	7.49	100.00
Total	267	100.00	100.00

Interactive digital content for improving learner engagement received the highest combined agreement among the first hypothesis statements at 65.54 percent, with 35.21 percent strongly agreeing. This robust endorsement suggests that faculty perceive multimedia elements, simulations, and gamified content as effective means to capture student attention and foster active participation. The relatively lower neutral and disagreement proportions, with only 20 strongly disagreeing, indicate a generally favorable disposition toward interactive materials. Nevertheless, the 43 neutral responses highlight a segment of faculty who may lack exposure to well-designed digital content or who question its alignment with prescribed curricula. Institutions should therefore invest in developing locally relevant interactive resources and in demonstrating evidence of engagement gains, particularly in large undergraduate classrooms common in Pune's colleges.

Table 6: Blended and Hybrid Teaching Expanding Access to Higher Education (Statement 3)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	87	32.58	32.58
Agree	83	31.09	63.67
Neutral	49	18.35	82.02
Disagree	28	10.49	92.51
Strongly Disagree	20	7.49	100.00
Total	267	100.00	100.00

The statement on blended and hybrid teaching expanding access to higher education elicited a combined agreement of 63.67 percent, mirroring the response to learning management systems. With 32.58 percent strongly agreeing and 31.09 percent agreeing, faculty appear to value the flexibility that hybrid models offer to diverse student populations, including working learners and those from remote areas. Yet, 49 neutral responses and 48 combined disagreement responses reveal that a substantial portion of the sample is cautious about the scalability and quality of blended formats. Concerns may relate to digital divides among students, assessment integrity, or the erosion of campus-based social learning. For policy makers, these findings suggest that expanding access through hybrid teaching requires concurrent investments in student device access, faculty training in synchronous and asynchronous methods, and clear institutional guidelines on quality assurance.

Table 7: Online Assessment Tools Strengthening Feedback and Evaluation (Statement 4)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	76	28.46	28.46
Agree	84	31.46	59.93
Neutral	52	19.48	79.40
Disagree	34	12.73	92.13
Strongly Disagree	21	7.87	100.00
Total	267	100.00	100.00

Online assessment tools for strengthening feedback and evaluation received a combined agreement of 59.93 percent, which is lower than the previous statements. With 28.46 percent strongly agreeing and 31.46 percent agreeing, faculty acknowledge the potential of automated quizzes, e-portfolios, and analytics to provide timely feedback. However, the higher neutral count of 52 and the 55 combined disagreement responses indicate notable

reservations. These concerns likely arise from issues such as plagiarism detection limitations, the difficulty of assessing higher-order skills online, and the reliability of technology during high-stakes examinations. In the Indian context, where examinations are traditionally centralized and summative, faculty may require more robust training in formative online assessment design. Institutions should also address infrastructure reliability to build confidence in digital evaluation methods.

Table 8: Collaborative ICT Tools Supporting Active Learning Practices (Statement 5)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	72	26.97	26.97
Agree	78	29.21	56.18
Neutral	57	21.35	77.53
Disagree	37	13.86	91.39
Strongly Disagree	23	8.61	100.00
Total	267	100.00	100.00

Collaborative ICT tools supporting active learning practices received the lowest combined agreement among the first hypothesis statements at 56.18 percent, with 26.97 percent strongly agreeing. This comparatively weaker endorsement suggests that faculty are less convinced about the effectiveness of tools such as discussion forums, shared documents, and virtual whiteboards for promoting active learning. The 57 neutral responses and 60 combined disagreement responses point to significant barriers, possibly including large class sizes, limited time for collaborative activities, and unfamiliarity with facilitation techniques. In Pune's higher education institutions, where student-to-faculty ratios can be high, implementing collaborative digital pedagogy may require smaller tutorial groups and dedicated training in online facilitation. Without such support, the potential of collaborative ICT tools to transform passive lecture-based instruction into interactive learning experiences remains underutilized.

Table 9: Faculty ICT Competence and Teaching Effectiveness (Statement 1 for H2)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	89	33.33	33.33
Agree	82	30.71	64.04
Neutral	46	17.23	81.27
Disagree	31	11.61	92.88
Strongly Disagree	19	7.12	100.00
Total	267	100.00	100.00

The statement linking faculty ICT competence to teaching effectiveness received a combined agreement of 64.04 percent, with 33.33 percent strongly agreeing. This relatively high endorsement indicates that faculty perceive their own digital skills as a critical determinant of successful technology integration. The 46 neutral responses and 50 combined disagreement responses, however, suggest that some faculty either underestimate the role of competence or feel that their current skills are insufficient to enhance effectiveness. This finding has direct implications for professional development in Indian higher education. Institutions should move beyond one-time workshops and instead offer continuous, discipline-specific training that builds both technical proficiency and pedagogical strategies. Moreover, self-efficacy beliefs may need to be strengthened through peer mentoring and recognition of digital teaching achievements.

Table 10: Institutional Digital Infrastructure and Pedagogy Innovation (Statement 2 for H2)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	74	27.72	27.72
Agree	86	32.21	59.93
Neutral	51	19.10	79.03
Disagree	34	12.73	91.76

Strongly Disagree	22	8.24	100.00
Total	267	100.00	100.00

Institutional digital infrastructure and pedagogy innovation received a combined agreement of 59.93 percent, with 27.72 percent strongly agreeing. This moderate endorsement suggests that while faculty see infrastructure as important, they do not uniformly believe that current facilities enable innovation. The 51 neutral responses and 56 combined disagreement responses indicate that a significant proportion of respondents experience limitations such as outdated hardware, unreliable Wi-Fi, or insufficient software licenses. In Pune, a city known for its technology sector, such infrastructure gaps within educational institutions are particularly striking. The findings imply that investments in hardware and connectivity must be accompanied by a clear institutional vision for how technology can enable pedagogical experimentation. Without reliable infrastructure, even highly motivated faculty cannot translate innovative ideas into sustained classroom practice.

Table 11: Faculty Training and Adoption of Digital Teaching Tools (Statement 3 for H2)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	68	25.47	25.47
Agree	81	30.34	55.81
Neutral	56	20.97	76.78
Disagree	38	14.23	91.01
Strongly Disagree	24	8.99	100.00
Total	267	100.00	100.00

Faculty training and adoption of digital teaching tools received the lowest combined agreement among the second hypothesis statements at 55.81 percent, with only 25.47 percent strongly agreeing. This result indicates that training programs are perceived as a weak link in the digital pedagogy ecosystem. The 56 neutral responses and 62 combined disagreement responses suggest that many faculty find existing training irrelevant, too generic, or poorly timed. This is a critical finding for Indian higher education, where large-scale faculty development initiatives are often mandated but may lack customization. Institutions should conduct needs assessments to identify skill gaps specific to disciplines and teaching levels. Furthermore, training should incorporate hands-on practice with the actual tools used in classrooms, follow-up support, and incentives for participation, as mere exposure to digital tools without structured adoption support appears insufficient to change teaching practices.

Table 12: Student Engagement Outcomes and ICT-Mediated Instruction (Statement 4 for H2)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	79	29.59	29.59
Agree	84	31.46	61.05
Neutral	47	17.60	78.65
Disagree	33	12.36	91.01
Strongly Disagree	24	8.99	100.00
Total	267	100.00	100.00

Student engagement outcomes and ICT-mediated instruction received a combined agreement of 61.05 percent, with 29.59 percent strongly agreeing. This moderate endorsement suggests that faculty observe some positive effects of digital tools on student participation and motivation, but they do not perceive these outcomes as uniformly strong. The 47 neutral responses and 57 combined disagreement responses indicate that engagement gains may be uneven across student groups, courses, or types of technology. Faculty may find that while digital tools attract initial interest, sustaining engagement over a semester is challenging. For Indian institutions, this implies that ICT-mediated instruction should be designed with explicit engagement strategies, such as regular feedback loops, interactive assessments, and collaborative projects. Simply digitizing existing lectures is unlikely to yield meaningful improvements in student engagement without corresponding changes in pedagogical design.

Table 13: Policy Support and Future Readiness of Higher Education (Statement 5 for H2)

Particulars	Frequency	Percentage	Cumulative Percentage
Strongly Agree	83	31.09	31.09
Agree	77	28.84	59.93
Neutral	51	19.10	79.03
Disagree	32	11.99	91.01
Strongly Disagree	24	8.99	100.00
Total	267	100.00	100.00

Policy support and future readiness of higher education received a combined agreement of 59.93 percent, with 31.09 percent strongly agreeing. This result suggests that faculty perceive policy frameworks as moderately supportive of digital transformation, but not overwhelmingly so. The 51 neutral responses and 56 combined disagreement responses reflect uncertainty about the coherence and implementation of digital education policies at institutional, state, and national levels. In India, policies such as the National Education Policy emphasize technology integration, yet faculty may experience a gap between policy rhetoric and on-ground support. The findings indicate that future readiness requires not only policy pronouncements but also clear operational guidelines, funding allocations, and accountability mechanisms. Institutions should communicate policy goals effectively and involve faculty in strategic planning to ensure that digital pedagogy initiatives are aligned with actual classroom realities.

Table 14: One-Sample t-Test Results for H1

Particulars	Test Value	t-Statistic	df	Sig. (2-tailed)	Mean	Std. Deviation
LMS Enhancing Instructional Delivery	3	12.284	266	0.000	3.73	0.971
Interactive Digital Content Improving Learner Engagement	3	12.781	266	0.000	3.75	0.958
Blended and Hybrid Teaching Expanding Access	3	12.031	266	0.000	3.71	0.964
Online Assessment Tools Strengthening Feedback	3	9.627	266	0.000	3.6	1.018
Collaborative ICT Tools Supporting Active Learning	3	7.928	266	0.000	3.52	1.071
H1 Summary (Aggregate Mean Across Statements)	3	13.614	266	0.000	3.66	0.792

The one-sample t-test conducted on the first hypothesis statements yielded an aggregate mean of 3.66, with a t-value of 13.614 at 266 degrees of freedom and all p-values below .001. This statistically significant result provides strong evidence that faculty perceptions of digital pedagogy benefits are significantly above the neutral midpoint of the scale. The magnitude of the t-value indicates that the positive orientation toward ICT tools is not a chance occurrence but a consistent pattern across the sample. For Indian higher education, this finding validates the premise that faculty are generally receptive to digital transformation, thereby providing a favorable foundation for policy interventions. However, the aggregate mean also suggests that while perceptions are positive, they are not overwhelmingly enthusiastic, leaving room for improvement through targeted training and infrastructure enhancements.

Table 15: Correlation Analysis Results for H2

Particulars	Pearson r	Sig. (2-tailed)	N	Result
ICT Competence and Teaching Effectiveness	0.671	0.000	267	Significant
Institutional Infrastructure and Pedagogy Innovation	0.634	0.000	267	Significant
Faculty Training and Digital Tool Adoption	0.592	0.000	267	Significant
Student Engagement and ICT-Mediated Instruction	0.658	0.000	267	Significant
Policy Support and Future Readiness of HE	0.701	0.000	267	Significant

H2 Summary (Mean Correlation Across Relationships)	0.651	0.000	267	Significant
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The Pearson correlation analysis for the second hypothesis revealed correlation coefficients ranging from 0.592 to 0.701, with a mean correlation of 0.651, all significant at the sample size of 267. These moderate to strong positive correlations indicate that faculty perceptions of institutional support, training, infrastructure, and student engagement outcomes are closely interrelated. The strength of these associations suggests that improvements in one area, such as training, are likely to be accompanied by positive perceptions in other areas, such as infrastructure adequacy and student engagement. For Indian higher education institutions, this interconnectedness implies that a holistic approach to digital pedagogy is necessary. Isolated investments in technology without corresponding attention to faculty development or policy support may yield limited results, as the components of digital readiness are mutually reinforcing.

6. Key Findings

The demographic profile of the sampled faculty (N=267) in Pune City revealed a predominantly mid-career cohort, with the largest age group being 35-44 years (29.21%). Gender distribution was nearly balanced, with males comprising 52.06% and females 47.94%. In terms of academic rank, assistant professors constituted the largest cadre at 26.59%, followed by other designations. Regarding perceptions of digital pedagogy, a substantial majority of respondents expressed high agreement with statements concerning the utility of Learning Management Systems (LMS), the effectiveness of interactive digital content, and the value of blended teaching approaches. Combined agreement levels for these core constructs frequently exceeded 60%, indicating a strong baseline receptivity towards technology integration among the teaching staff surveyed. Hypothesis testing yielded significant results that affirm the study's core propositions. One-sample t-tests rejected the null hypothesis (H1o) regarding low overall perception, with an aggregate t-value of 13.614 ($p=0.000$) and a mean score of 3.66, indicating significantly positive attitudes. Furthermore, Pearson correlation analyses supported the alternative hypothesis (H2a), revealing strong positive relationships between key digital pedagogy variables, with correlation coefficients ranging from 0.592 to 0.701 (mean $r=0.651$); all correlations were statistically significant. These findings carry substantial implications for Indian higher education, suggesting that faculty in metropolitan contexts are not only receptive to but also perceive coherent interconnections among ICT tools, which should inform strategic investments in infrastructure and targeted professional development programs.

7. Conclusion

The study established that ICT-enabled digital pedagogy innovations, particularly the integration of learning management systems, interactive multimedia tools, and collaborative platforms, are significantly associated with enhanced instructional practices among faculty in Pune. Faculty who actively adopted these digital tools reported more student-centric teaching approaches, including real-time feedback mechanisms and blended learning strategies. However, the findings also revealed persistent challenges, such as variable digital infrastructure quality and uneven faculty proficiency, which moderate the extent to which these innovations translate into sustained pedagogical transformation. The results underscore that technological adoption alone does not guarantee improved instruction; rather, it requires deliberate alignment with pedagogical goals and institutional support. For universities, faculty development cells, and edtech integrators, the implications are actionable and urgent. Institutions must prioritize continuous, hands-on training programs that move beyond basic tool literacy to advanced instructional design using ICT. Faculty development cells should serve as hubs for peer mentoring and discipline-specific digital pedagogy workshops. For policymakers, the findings reinforce the need for NEP-aligned digitalization strategies that invest in robust and equitable LMS infrastructure across public and private institutions. Edtech integrators must collaborate with faculty to co-create contextually relevant tools, ensuring that technology addresses real classroom constraints rather than adding administrative burden. Such coordinated efforts are essential to bridge the digital divide and ensure quality enhancement in Indian higher education. Future research should extend this investigation to other Indian cities and diverse institutional types to test the generalizability of these findings. Longitudinal designs are necessary to examine how faculty digital competencies evolve over time and how sustained ICT use impacts student learning outcomes. Additionally, discipline-wise comparisons could reveal whether pedagogical innovations vary across STEM, humanities, and professional programs. While this study relied on faculty-only respondents, future work should employ paired student-faculty

designs to triangulate perceptions of instructional effectiveness. Such methodological expansion would provide a more comprehensive understanding of digital pedagogy's transformative potential in Indian higher education.

8. Suggestions

1. Adopt a faculty digital competence framework aligned with national policy, such as the National Education Policy 2020 and UGC guidelines, to assess and certify teaching staff in Pune. Institutions should map competencies across pedagogical, technological, and ethical domains, using self-assessment tools and observed practice. This framework must inform recruitment, promotion, and annual review criteria, ensuring digital readiness is a measurable, valued attribute.
2. Establish institution-wide LMS instructional design standards that mandate structured course shells, consistent navigation, accessible multimedia, and clear learning outcomes for every blended or online module. Pune colleges should develop a common template reviewed by academic councils, reducing fragmentation across departments. These standards must include rubrics for interaction, feedback timeliness, and content currency, enabling systematic quality audits and improving learner experience across diverse programmes.
3. Integrate blended programme quality assurance into existing internal quality assurance cell processes, with specific benchmarks for digital components. Institutions must define thresholds for synchronous sessions, discussion forum participation, and assessment integrity. Annual programme reviews should evaluate digital pedagogies against learning analytics, student satisfaction, and completion rates. This approach embeds continuous improvement, aligning Pune institutions with national accreditation expectations and global comparability.
4. Implement continuous, role-specific ICT training cycles every semester for all teaching staff, covering tools, accessibility, and data privacy. Training must move beyond one-time workshops to include micro-modules, hands-on labs, and follow-up coaching. Institutions in Pune should allocate protected time for practice and certify completion through demonstrable projects. This ensures faculty remain current with evolving platforms while addressing varied proficiency levels across departments and experience cohorts.
5. Address infrastructure equity across colleges by creating a shared digital resource pool, including loanable devices, campus Wi-Fi hotspots, and cloud-based software licenses. Institutions must audit connectivity and hardware gaps among students and faculty, then prioritise investment in underserved disciplines and evening programmes. Establish helpdesk support and offline-capable materials to mitigate disruptions. This systemic approach reduces digital divides within Pune's higher education landscape and supports inclusive participation.
6. Redesign assessment protocols to leverage ICT for authentic, secure, and formative evaluation. Replace high-stakes, memory-based exams with project-based tasks, peer-reviewed submissions, and adaptive quizzes using learning management system analytics. Institutions must develop clear policies for proctoring, plagiarism detection, and feedback loops. Pilot these changes in select courses, then scale based on evidence. This shift enhances academic integrity and measures higher-order skills relevant to Pune's knowledge economy.
7. Foster peer mentoring communities of practice across departments and colleges, pairing digitally skilled faculty with novices for sustained collaboration. Institutions should convene monthly forums, shared repositories of effective practices, and co-teaching opportunities. Recognise mentors through workload adjustments or certificates. These communities build local expertise, reduce isolation, and promote contextual problem-solving. Over time, they create a self-sustaining culture of digital pedagogy innovation within Pune's higher education institutions.
8. Create policy incentives for digital teaching innovation, including seed grants, teaching excellence awards, and reduced teaching loads for pilot projects. Institutions should align these incentives with national schemes like SWAYAM and NPTEL, encouraging faculty to develop open educational resources and publish pedagogical research. Document and disseminate successful innovations through institutional newsletters and conferences. This recognition system motivates sustained engagement, elevates institutional reputation, and contributes to state and national digital education goals.

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