European Economic Letters
ISSN 2323-5233
Vol 15, Issue 2 (2025)
http://eelet.org.uk

Teachers as Digital Facilitators: Analysing ICT Integration Levels and Pedagogical Shifts in Nashik's Colleges

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Abstract
The study analyses the 'acceptance', pedagogical changes, and challenges regarding ICT integration by college teachers in Nashik, Maharashtra. As per India's National Education Policy (NEP), 2020, a digital paradigm shift in learning is a necessity. This study identifies the gaps in ICT adoption in per-urban higher educational institutions. 356 faculty members from various colleges filled out the quantitative surveys while participating in qualitative interviews aiming to understand the complexities of institutional frameworks and the use of innovations in teaching in information technologies. The study adapts the TPACK model and SAMR model of ICT implementation to uncover the impacts of digital technologies on teaching and identify structural barriers to integration.

The importance of ICT integration lies in its impact towards improving inclusivity, equity, and instructional innovation, but will remain a challenge as lack of facilities, semi-urban training, and resistance to change foster the gap in places like Nashik. The study shows how ICT has the potential of transforming didactic teaching approaches to active ones that promote collaborative and student-cantered methods like the flipped classroom model. The goal of the research is to analyse how quality and inclusive education are offered at national and global levels and how the gaps in the digital divide are addressed.

PowerPoint as well as PDF documents are very popular, with around 76% to 82% usage, while modern technologies such as Learning Management Systems (LMS) are used less, at 18% to 38%. Professional and Science faculties integrated ICT more than Commerce and Arts. The level of ICT utilization was closely associated with the type of instructional changes made, particularly in the case of TPACK skilled teachers. Other major constraints included limited resources, a lack of training ($\beta = -.35$), and organizational unwillingness, especially for government colleges. On the other hand, institutional support ($\beta = .39$) and specific targeted aid such as TPACK workshops and infrastructure improvements enhanced the sustainable uptake.

Equitable infrastructure financing coupled with mandated institutional digital roadmaps were suggested in the report alongside the training of educators. As discussed previously, more focus on training, infrastructure, facilitative strategy alignment, and softer frameworks is required for comprehensive digital enablement. Solving these problems would allow colleges in Nashik to contribute to India's digital vision and the NEP 2020. These findings can be improved by conducting additional research in other similar semi-urban areas.

Keywords: ICT integration, digital pedagogy, TPACK framework, higher education, teacher training, Nashik colleges

1. Introduction

1.1 Background of the Study

The 21st century has experienced a global transformation in education due to the digital revolution. The integration of ICT in education shifted from being an optional enhancement to a necessity, especially after the pandemic when hybrid and blended learning models became standard (Dhawan, 2020). The diffusion of digital technologies has changed how educational content is distributed as well as the interactions between educators and learners. In India, this change has been expedited by The National Education Policy (NEP) 2020, which emphasizes the integration of technology into teaching and learning processes, especially concerning access, equity, and quality of educational outcomes. The policy highlights the digitization of educational infrastructure, the training of educators in ICT pedagogy, and the development of responsive sociological frameworks for teaching in higher education.

With the changes in teaching methods comes a shift in practices for educators. Teachers are required to use technology to develop individualized and highly engaging and interactive learning experiences (Howell, 2012). According to Mishra and Koehler (2006), the technical Pedagogical Content Knowledge (TPACK) framework calls for a combination of teaching artistry, technological know-how, and digital sophistication. Digital facilitators select a variety of resources, design teaching activities aided by software, and instruct their learners on rudimentary information handling skills which enable basic participation in work processes that rely on technology. Even with the greater focus on the integration of Information and Communication Technologies (ICT), most teachers, especially in small towns and rural developing countries such as India, do not effectively adopt and apply technology (Selwyn, 2019).

The case of Nashik studying in-depth the ICT integration of digital technologies in higher education serves as a backdrop because of its rapidly evolving educational hub character in the state of Maharashtra. With the increase in the number of colleges and universities in the city, it remains a priori unknown the level to which digital pedagogical practices are embedded. Some preliminary results suggest, for example, that several educators have embraced digital technologies,

while others, because of some infrastructural constraints, insufficient pre-service training, and resistance to change, persist with traditional techniques (Ghavifekr & Rosdy, 2015). This discrepancy raises critical concerns about the readiness of the academic community in Nashik to adopt the role of digital facilitators and the institutional barriers that slow change. The need for pedagogical changes such as from instructor led to student driven, the need for analytics, and customizing instructions for personalized learning aimed at the individual and integration of these advanced technologies necessitate assessing instructional effectiveness, and student outcomes (Bates, 2019).

1.2 Problem Statement

Despite the global shift towards embracing digital education and India's intent-driven thrust for ICT integration through the National Education Policy (NEP) 2020, semi-urban areas like Nashik continue to have higher education institutions which remain intransigent with regard to the adoption of digital teaching technologies. As an educational hub in Maharashtra, Nashik has several colleges and universities with varied academic offerings but, as the research suggests, there is scant and superficial integration of ICT by the staff (Ghavifekr & Rosdy, 2015). Some faculties and colleges appear to have adopted some degree of modern ICT including Learning Management Systems (LMS), multimedia presentations, and online testing, but many continue with traditional, lecture-cantered teaching approaches. This disconnect illustrates the variance in the underlying assumptions behind educational policies and their intended effects in practice, which poses significant questions about the ICT integration challenges facing colleges in Nashik. Major challenges include insufficient digital infrastructure and internet connectivity, inadequate teacher professional advancement opportunities, and lack of institutional investment in educational technology. Selwyn (2019) argues that these constraints hamper the effectiveness of digital education and deepen educational inequalities, especially for disadvantaged learners.

Shift in pedagogy remains the second priority for digital education. ICT tools such as individualized learning, online collaborative environments, and data-driven teaching have the potential to transform the Nashik University teaching and learning paradigm, but most instructors have detuned from fully adopting these technologies (Bates, 2019). Even in schools that have digital resources, traditional pedagogy is still focused on rote and teacher-cantered learning. The gap between the use of technology and pedagogical approaches reveals an instructional design gap aimed at guiding teachers in the transition to digital facilitators (Mishra & Koehler, 2006). Without guidance, integrating ICT will be perceived as a value-added structural change rather than an enticing educational reform. The scant specialized research attending to Nashik's context renders policymakers and institutional leaders devoid of evidence-facing information to design focused interventions. Research on Information and Communication Technology (ICT) in education focuses on metropolitan areas or affluent contexts, overlooking areas such as Nashik which are semi-urban or rural (Dhawan, 2020).

This study seeks to bridge the disconnect by investigating the ICT adoption practices of college teachers in Nashik and how the trends in educational digitalization shape their teaching practices. The research explores the systemic, organizational, and social barriers in the adoption of ICT to understand why some teachers manage to become digital professionals while others do not. It looks at the changing dynamics, or the lack thereof, in teaching practices as technology evolves. The conclusions will provide strategic recommendations for the optimisation of the use of information and communication technologies in teaching and learning in higher educational institutions in Nashik. The research contributes towards promoting equitable and sustainable approaches to digital transformation in Indian higher education.

1.3 Research Questions

1. What are the current levels and patterns of ICT integration among college teachers in Nashik, particularly regarding the use of digital tools (e.g., LMS, multimedia resources, and online assessments) in teaching and administrative practices?
2. How has ICT adoption influenced pedagogical shifts among educators in Nashik's colleges, and to what extent have these shifts embraced student-cantered approaches (e.g., flipped classrooms, collaborative learning) as conceptualized in frameworks like TPACK?
3. What are the primary barriers (e.g., infrastructural, institutional, or socio-cultural) and enablers (e.g., training, support systems) affecting effective ICT integration in Nashik's higher education institutions?
4. How can policymakers, teacher educators, and institutional leaders foster sustainable digital facilitation in Nashik's colleges, based on empirical findings about ICT integration and pedagogical transformation?

1. 4 Research Objectives

1. To assess the current levels of ICT integration among college teachers in Nashik
2. To analyse the pedagogical shifts occurring among educators in Nashik's colleges
3. To identify the key barriers and enablers influencing effective ICT integration
4. To propose evidence-based recommendations for policymakers, teacher educators, and institutional leaders

1.5 Research Hypotheses

1. **H_1**: College teachers in Nashik demonstrate varying levels of ICT integration, with significantly higher adoption of basic digital tools (e.g., presentation software) compared to advanced systems (e.g., LMS and data analytics platforms) in both instructional and administrative functions.
2. **H_2**: Educators who actively integrate ICT tools are more likely to exhibit pedagogical shifts toward student-cantered approaches (e.g., flipped classrooms, collaborative learning) that align with the TPACK framework, compared to those using minimal or no digital tools.
3. **H_3**: Key barriers (e.g., inadequate infrastructure, lack of training) negatively correlate with ICT integration levels, while institutional support (e.g., professional development, technical resources) positively predicts effective adoption among Nashik's college teachers.
4. **H_4**: Evidence-based interventions targeting teacher training, infrastructure improvement, and policy alignment will significantly enhance sustainable digital facilitation practices in Nashik's colleges, as measured by post-intervention adoption rates and pedagogical innovation.

1.6 Significance of the Study

This study holds substantial significance for multiple stakeholders in the educational ecosystem, offering both theoretical and practical contributions to the discourse on ICT integration in higher education.

1.6.1 Contribution to Digital Education Policies

The results of this study will assist in formulating and polishing digital education policies pertinent to institutions, regions, and even nations by providing needed empirical information. The research will help policymakers understand how Nashik's colleges' ICT adoption gaps and challenges work in the context of the NEP 2020 vision and comes in the need to bridge the gap between vision and implementation (Ministry of Education, Government of India, 2020). As an example, the research may point out the need for more institutional funding in digitally marginalized areas of semi-urban regions or the creation of sub-national frameworks for ICT integration to cater to some local variations (Selwyn, 2019). Moreover, the shifts in pedagogical approaches that the study aims to address will help shape policy debates on curriculum restructuring as teaching approaches incorporated must advance and prepare learners for the 21st century (Bates, 2019).

1.6.2 Implications for Teacher Training and Institutional Support

By considering the barriers to ICT integration, the study will illustrate the gaps in training teachers professionally developed for their roles. The outcomes will assist in developing appropriate professional development support for educators within semi-urban contexts (Ghavifekr & Rosdy, 2015). Changes such as the recommendation for TPACK based training on instructional technology for fostering pedagogical knowledge among teachers in training could be implemented because of the findings (Mishra & Koehler, 2006). The professional development needs of instructors, school administrators, and other stakeholders will also be addressed, especially concerning the enhancement of institutional leadership towards nurturing a digital innovative culture within the institution. Such professionals will be assisted much on what to do through proposals such as those on mentorship, rewards for technology use, and mentorship towards teaching staff integration of ICT in teaching (Savale, T. 2024). With these recommendations, colleges in Nashik and other places will be enabled to design functional and robust systems that facilitate effective teaching and positive learning attitude among students.

2. Literature Review

2.1 ICT Integration in Higher Education

Changing demands for technology as well as rapid advancements in technology have made ICT integration in higher education a global necessity. This part analyses the global and Indian ICT integration with special attention to the changing roles of teachers in a digital classroom.

2.1.1 Global Perspectives on ICT Integration

Global use ICT in higher education for teaching, learning and administration. Selwyn (2019) notes how broad access to infrastructure, legislation, and innovative culture of the US and EU often marks integration of digitally advanced ICT systems. In these regions, learning is customized using data analytics, and Moodle and Blackboard Systems, as well as newer virtual and augmented reality technologies (Bates, 2019). The COVID-19 pandemic integrated these changes, necessitating blended and hybrid approaches to sustain education continuity (Dhawan, 2020).

The regions differ massively with respect to the extent and effectiveness of ICT integration. Underdeveloped countries face challenges utilizing digital technology due to insufficient infrastructure, internet availability, and inadequate teacher training (Ghavifekr & Rosdy, 2015). South and sub-Saharan Africa educators experience limited resources and sociocultural make adoption of technology-enhanced pedagogical techniques difficult (Unwin et al., 2020). Regardless of these challenges, there are effective case studies that illustrate how ICT can bridge gaps in education. The

"One Laptop per Child" program in Uruguay showcased the potential improvement in student interest and learning when technology is made accessible (Warschauer & Ames, 2010).

2.1.2 Indian Perspectives on ICT Integration

Policies such as the National Education Policy (NEP) 2020 are foundational for integrating Information and Communication Technologies (ICT) in Indian Higher Education. The Government of India has placed a special focus on advancing Educational Policies to facilitate a digitally inclusive education system (Ministry of Education, Government of India, 2020). The NEP 2020 policy makes a strong case for creating digital teacher infrastructure and training, as well as developing quality e-learning frameworks like SWAYAM and DIKSHA that promote equal opportunities for accessing education. The situation has improved with the advent of these policies; however, the application scope of ICT in Indian higher education remains incomplete, with urban colleges performing comparatively better than those in semi-urban or rural locations (Selwyn, 2019).

Nashik illustrates this imbalance as a semi-urban educational hub. It contains a mixture of students who know about ICT and use LMS and multimedia while others still cling to traditional methods of teaching and learning because of insufficient infrastructure and willingness to change (Ghavifekr & Rosdy, 2015). Research has shown that Indian educators tend to face a unique situation where they lack pedagogical expertise and the requisite technological know-how to praticing teaching in emerging digital environments (Mishra & Koehler, 2006). This points to the need for strategies that provide a regional focus while addressing global gaps.

2.1.3 Role of Teachers in Digital Classrooms

The functions of digital teaching teachers' roles have changed from the instructor to a learning facilitator who integrates technology as teaching tools. In this pedagogy, teachers are expected to nurture appropriate instructional materials, stimulate active learning, foster critical thinking and collaboration among students (Howell, 2012). Equipped with TPACK (Mishra & Koehler, 2006), which combines technological, pedagogical, and content knowledge for effective teaching, a teacher can teach with technology.

As with any change, there are issues that need to be solved. Many teachers, especially from peri-urban and rural areas, face a lack of supportive training ICT policy frameworks (Ghavifekr & Rosdy, 2015). For example, some teachers may present lectures through PowerPoint, but few are able to redesign a course syllabus to create an integrated curriculum that incorporates virtual tours (Puentedura, 2006). To effectively guide teachers through this change, professional development opportunities, active mentoring, and organizational support are necessary (Bates, 2019).

2.2 Pedagogical Shifts Due to ICT

The incorporation of Information and Communication Technologies (ICT) tools in post-secondary education has triggered notable shifts in the educational paradigms applied in classrooms as it has moved away from a teacher-centred to a more active, student-centred approach. This part analyses the shifts in pedagogy with special emphasis on the shift from traditional teaching methods to blended and flipped teaching techniques which seem to be more common in digitally integrated classrooms.

2.2.1 From Traditional to Student-Cantered Learning

Education systems around the world, including those in developing countries like India, have traditionally emphasized rote learning and lectures (Bates, 2019). Still, the development of ICT has stimulated the transformation of these approaches to one which focuses on learners doing and actively engaging with the content and is constructivist in nature (Howell, 2012).

- **Role of ICT in Facilitating Student-Cantered Learning**:

E-technology such as Learning Management Systems (LMS), Google Workspace, Padlet, and discussion forums allow educators to create participatory and interactive learning environments. For example, Dhawan (2020) explains how LMS like Moodle offer resource access, assignment submission, and peer discussion features, which are done asynchronously, promoting self-directed learning and autonomy.

- **Empirical Evidence**: Studies conducted within the Indian higher education context indicate that retention and engagement are positively impacted by self-paced learning and the integration of information and communications technology, ICT. According to Ghavifekr and Rosdy's study from 2015, technology classroom students showed superior motivation and critical thinking skills compared to their non-technology classroom peers.

- **Challenges in Transitioning**:

Despite these benefits, the shift to student-centred learning is often hindered by:

1. **Resistance to Change**: Most teachers, including those from semi-urban regions like Nashik, remain stuck in a passive lecture-based approach due to a lack of training or institutional inertia (Selwyn, 2019).
2. **Infrastructural Barriers**: There is a restriction, both in terms of internet access and devices, which limits the ability to perform collaborative digital tasks (Unwin et al., 2020).

- **Blended and Flipped Learning Approaches**

The advent of ICT is responsible for the emergence of blended and flipped classes. The former is a mixture of traditional face-to-face teaching and online instruction while the latter is when students learn new material at home and actively apply what they learned in class. These models showcase the change in teaching that has been brought about by technology.

- **Blended Learning**:
  - **Global Adoption**: In developed nations, blended learning is common to customize teaching. For instance, in the US and EU, universities implement hybrid models to attend to the varied needs of learners (Bates, 2019).
  - **Indian Context**: Like many other parts of the world, India too faces challenges blended learning such as unequal access to technology. Despite this, the initiative SWAYAM which provides MOOCs (Massive Open Online Courses) accompanied by traditional instructional materials is aimed at tackling these problems (Ministry of Education, 2020).

- **Flipped Classrooms**:
  - **Pedagogical Impact**: Use of pre-recorded lectures, such as those available on YouTube or posted on the institution's Learning Management System, allows students time-shifted instruction; class attendance time is reserved for discussion, collaborative work, problem-solving, and other forms of engagement (Mishra & Koehler, 2006).
  - **Case Studies**: Scholarly work in the colleges of Nashik can address some of the gaps regarding the usage of Google Classroom or Zoom as instructional tools. A case study on Dhawan (2020) spotlighted the positive impacts of flipped classrooms in semi-urban Indian institutions, where student performance improved by 20% with adequate teacher training.

2.3 Challenges in ICT Adoption

Nashik, alongside many other rural and suburban areas, has not yet fully adopted Information and Communication Technology (ICT) its technology and innovation centres, thus missing out on its ICT's potential value to their quality of higher education. We can identify insufficient training and unwillingness to implement new teaching approaches as accompanying factors. Through an international multifactorial approach, we examine the Indian context of ICT adoption in the framework of Nashik's colleges.

2.3.1 Infrastructural Limitations

In more underdeveloped regions such as those in Africa, the inability to provide these services individually or as a combination creates a significant obstacle towards utilizing ICT, especially within late developing countries. Teaching and Learning Technologies in particular, need uninterrupted electricity, access to running water, modern digital equipment, and high-speed Internet (Selwyn, 2019).

- **Global Perspective**: Parts of Southern Asia and Sub Shaaran Africa have long been dealing with access to power and broadband, which undermines their capability of taking advantage of new digital aids (Unwin et al., 2020).
- **Indian Context**: Like most Nashik Colleges, semi-urban and rural colleges face challenges with lacking hardware (computers, projectors) and software (licenses for learning management systems). Beyond these inadequacies, urbanized institutions are in a much better position with respect to having digital infrastructure (Ghavifekr & Rosdy, 2015). There is a need to foster more equitable infrastructure to address the gaps outlined in NEP 2020 (Ministry of Education, 2020).

2.3.2 Insufficient Teacher Training

Integration of ICT comes down to the educator's ability to use technology to enhance learning. In most cases, teachers do not have the knowledge necessary to guide learners through the facilitation of learning (Mishra & Koehler, 2006).

- **TPACK Gap**: As pointed out in the TPACK framework, the fusion of pedagogy, content, and technology is essential to ensure that ICT is fully integrated into the curriculum. Unfortunately, teachers in semi-urban parts of India are known to have scant knowledge of pedagogy and TK, which makes them unable to use sophisticated LMS or data analytics (Voogt et al., 2013).
- **Professional Development Gaps**: Workshops for ICT professional development in Nashik are characterized by a lack of training and sporadic teaching. For example, educators learn about flipped classrooms without any instructions on producing content and administering online assessments (Dhawan, 2020).

2.3.3 Nashik's Context Gaps

Although these issues have been extensively documented globally, studies focusing on Nashik are almost non-existent. This study aims to systematically explain the ways infrastructural gaps, lack of training, and resistance obstructions occur in the colleges of Nashik to provide policymakers with localized perspectives.

3. Research Approach

This specific study is the first of its kind in Nashik; therefore, it utilizes a mixed-methods approach alongside quantitative surveys and qualitative interviews with a purposive sampling technique to encompass the entire spectrum of ICT integration and instructional change amongst college teachers in Nashik (Creswell and Creswell, 2018). The method was designed in a way to achieve the goal of the study which encompasses the objectives, hypotheses, and questions delineated earlier.

3.1 Research Methods

This study adopts a convergent parallel mixed-methods approach, which involves the simultaneous collection and independent analysis of qualitative and quantitative data, integrating them for a comprehensive understanding after analysis (Creswell & Creswell, 2018).

- **Quantitative Component:** Teachers will be sent a structured ICT usage questionnaire designed with Likert scales covering perceived limitations and adaptations to their teaching. This is based on the premise of statistical generalization and hypothesis testing (Cohen et al., 2018).
- **Qualitative Component:** Selected participants will be engaged in semi-structured interviews with the aim of exploring teachers' perceptions, their challenges, and the institutional frameworks aimed at supporting them in greater detail. This approach captures elements of the multifaceted perspectives that should be included but are absent in surveys (Merriam and Tisdell, 2016).

With the incorporation of both datasets, the TPACK and SAMR frameworks will provide adequate consideration to evaluate the level of ICT adoption and pedagogical shift comprehensively.

3.2 Population and Sampling

- **Study Area:** Nashik is a semi-urban educational centre with multi-faceted higher educational institutions.
- **Target Population:** College educators (both full-time and part-time) from the arts, science, commerce, and professional disciplines.
- **Sample Size:** 340 educators (computed using Krejcie and Morgan formula for finite population sample at 95% confidence level and 5% margin of error).
- **Sampling Technique:** Stratified Random Sampling to ensure representation across:
  - Disciplines (Arts, Science, Commerce, Professional Courses)
  - Institution Types (Government, Private, Aided Colleges)
  - Experience Levels (Early-career, Mid-career, Senior faculty)

This method of sampling reduces bias and improves the reliability of the results (Etikan et al., 2016).

3.3 Data Collection Tools

A. Surveys (Quantitative Data)

- **Tool**: A structured **5-point Likert-scale questionnaire** (1 = Strongly Disagree, 5 = Strongly Agree) will assess:
  1. **ICT Integration Levels** (e.g., frequency of LMS usage, multimedia tools, online assessments).
  2. **Pedagogical Shifts** (e.g., adoption of flipped classrooms, collaborative learning).
  3. **Barriers & Enablers** (e.g., infrastructure, training, institutional support).
- **Validation**: The questionnaire will be **pilot tested** with 30 teachers (not part of the final sample) to ensure reliability (Cronbach's $\alpha \geq 0.7$) and face validity (Cohen et al., 2018).
- **Distribution**: Online (Google Forms) and offline (paper-based) modes to accommodate varying digital access.

B. Interviews (Qualitative Data)

- **Tool**: **Semi-structured interviews** with **20–25 purposively selected teachers** (representing different strata).
- **Focus Areas**:
  1. Personal experiences with ICT adoption.
  2. Challenges faced (e.g., training gaps, resistance).
  3. Institutional policies and support systems.
- **Duration**: 30–45 minutes per interview, audio-recorded (with consent) and transcribed for thematic analysis (Braun & Clarke, 2006).

3.4 Data Analysis Techniques

3.4.1 Testing Research Hypothesis H_1

H_1: College teachers in Nashik demonstrate varying levels of ICT integration, with significantly higher adoption of basic digital tools (e.g., presentation software) compared to advanced systems (e.g., LMS and data analytics platforms) in both instructional and administrative functions.

- **Variables Measured:**
  - **Basic ICT Tools:** PowerPoint, PDFs, Word Processors.
  - **Advanced ICT Tools:** LMS (Moodle, Google Classroom), Online Assessments (Quizizz, Kahoot), Data Analytics (Google Analytics, LMS reports).
  -

Table 1: Descriptive Statistics of ICT Tool Usage Among Teachers (N=340)

ICT Tool Category	Mean (M)	Standard Deviation (SD)	Usage Frequency (%) (Often + Always)
Basic Tools			
- PowerPoint	4.21	0.89	82%
- PDFs	3.95	0.92	76%
- Word Processors	4.05	0.87	80%
Advanced Tools			
- LMS (Moodle, Google Classroom)	2.67	1.12	38%
- Online Assessments	2.45	1.20	32%
- Data Analytics	1.89	0.95	18%

Interpretation:

- Basic tools (PowerPoint, PDFs, Word Processors) show high adoption ($M > 3.9$, 76–82% frequent usage).
- Advanced tools (LMS, Online Assessments, Data Analytics) exhibit low adoption ($M < 2.7$, 18–38% frequent usage).
- SD values (0.87–1.20) indicate moderate variability in responses, suggesting inconsistent ICT adoption among teachers.

Table 2: Paired Samples t-test (Basic vs. Advanced ICT Tools)

Comparison	Mean Difference	t-value	df	p-value	Effect Size (Cohen's d)
Basic Tools vs. LMS	1.54	12.76	339	<0.001	0.89 (Large)
Basic Tools vs. Online Assessments	1.60	14.21	339	<0.001	0.92 (Large)
Basic Tools vs. Data Analytics	2.32	18.45	339	<0.001	1.15 (Very Large)

Interpretation:

- Highly significant differences ($p < 0.001$) confirm that basic tools are used more than advanced tools.
- Large effect sizes ($d > 0.8$) indicate practically meaningful differences in adoption levels.
- Supports H_1, showing teachers prefer familiar, low-complexity tools over advanced systems.

Table 3: One-Way ANOVA (ICT Adoption Across Disciplines)

ICT Tool	Arts (n=85)	Science (n=95)	Commerce (n=80)	Professional (n=80)	F-value	p-value
PowerPoint	4.05	4.30	4.10	4.40	3.21	0.023*
LMS	2.20	2.85	2.60	3.10	5.67	0.001**
Data Analytics	1.50	2.00	1.80	2.30	4.89	0.002**

Post-hoc Tukey Test:

- Science & Professional teachers use LMS and data analytics significantly more ($p < 0.05$) than Arts/Commerce teachers.
- No significant differences in basic tool usage ($p > 0.05$).

Interpretation:

- Disciplinary differences exist in advanced ICT adoption, likely due to curriculum demands (e.g., Science/Professional courses require more digital tools).
- Arts/Commerce teachers lag in LMS usage, possibly due to traditional pedagogy reliance (Dhawan, 2020).

The results of the study indicate that there is a stark difference in the use of ICT by college teachers in Nashik, digital tools such as PowerPoint and Post PDF documents are widely used in comparison to advanced systems such as data

analytic tools, LMS, etc. Descriptive statistics (Table 1) indicate that 82% of teachers use PowerPoint regularly, whereas only 18-38% make use of LMS and online assessments which validates H_1. This supports Selwyn (2019) in that educators in peri-urban areas tend to use more basic, well-known tools because those tools are easy to be training and access, as noted earlier. The statistics from the paired t-test (Table 2) strongly support the hypotheses regarding the effect size using Cohen's d > 0.8; these paired differences focus not only on basic and advanced ICT instructions but enhance educational practice, productivity, and innovation. These findings confirm Mishra & Koehler MPU-TPACK (2006) which argue that pedagogical technology gaps impede the utilization of sophisticated instruments along bottom advanced hand tools.
Moreover, a gap was noted with Professional and Science faculty adopting more sophisticated ICT instruments (such as Learning Management Systems and advanced data analytics) than their counterparts in Arts and Commerce (Table 3). This aligns with Ghavifekr & Rosdy's (2015) remarks that STEM fields tend to appreciate the integration of digital technologies owing to their deeply technical curricula, whereas non-STEM fields are more resistant to such shifts. Nashik still has not realized the infrastructure or systematic training integration envisioned by the National Education Policy 2020 (Ministry of Education, 2020) throughout all disciplines. All these factors reinforce the need for effective teacher training, such as TPACK workshops, strategic policy changes, and institutional targeted policies on the socio-economic priorities for Nashik aimed at overcoming the digital divide towards equity and sustainability for higher education.

3.4.2 Testing Research Hypothesis H_2

H_2: Educators who actively integrate ICT tools are more likely to exhibit pedagogical shifts toward student-centred approaches (e.g., flipped classrooms, collaborative learning) that align with the TPACK framework, compared to those using minimal or no digital tools.

Data Collection & Analysis

- **Measures:**
  - **ICT Integration Index:** Composite score (1-5 scale) of LMS usage, multimedia tools, and online assessments
  - **Pedagogical Shift Scale:** Measured adoption of student-centred approaches (flipped classrooms, collaborative learning, inquiry-based methods)
  - **TPACK Alignment:** Self-reported confidence in integrating technology, pedagogy and content knowledge

Table 4: Comparison of Pedagogical Approaches by ICT Usage Level (N=340)

Pedagogical Approach	High ICT Users (n=85) Mean (SD)	Low ICT Users (n=85) Mean (SD)	t-value	p-value	Cohen's d
Flipped Classrooms	4.12 (0.78)	2.45 (1.02)	12.67	<0.001	1.85
Collaborative Learning	4.35 (0.65)	2.89 (0.91)	13.24	<0.001	1.91
Inquiry-Based Methods	3.98 (0.82)	2.67 (0.95)	10.89	<0.001	1.52
TPACK Alignment	4.21 (0.71)	2.78 (0.88)	11.93	<0.001	1.83

Interpretation:

- Significant differences ($p<0.001$) exist across all pedagogical approaches, with large effect sizes ($d>1.5$)
- High ICT users report 1.5-2.0 points higher adoption of student-centred methods
- Supports H_2 that ICT integration correlates with pedagogical shifts

Table 5: Correlation Matrix (ICT Integration and Pedagogical Shifts)

Variable	1	2	3	4	5
1. ICT Integration	1.00				
2. Flipped Classrooms	.68**	1.00			
3. Collaborative Learn	.72**	.65**	1.00		
4. Inquiry-Based	.61**	.58**	.63**	1.00	
5. TPACK Alignment	.75**	.69**	.71**	.66**	1.00

**$p<0.01$

Interpretation:

- Strong positive correlations (r=.61-.75) between ICT integration and all pedagogical measures
- TPACK alignment shows strongest relationship with ICT use (r=.75)

- Consistent with Howell's (2012) findings on digital pedagogies enabling collaborative learning

Table 6: Regression Analysis Predicting Pedagogical Shifts

Predictor	β	t	p	R^2	ΔR^2
Step 1				.18	
Age	-.08	-1.45	.149		
Gender	.05	0.92	.358		
Discipline	.12	2.21	.028		
Step 2				.59	.41**
ICT Integration	.63	11.67	<.001		
TPACK Confidence	.22	4.05	<.001		

Interpretation:

- ICT integration is the strongest predictor (β=.63) of pedagogical shifts
- TPACK confidence adds significant explanatory power
- Model explains 59% of variance in student-centred approaches
- Supports Bates' (2019) argument that both tools and teacher competence drive change

The investigation gives strong empirical evidence for H_2 given that, for those college teachers in Nashik who integrate ICT tools into their teaching, the probability of adopting student-centred pedagogies is much higher. The t-test results (Table 4) show that there were marked differences (with large effect sizes) between high and low ICT users for all pedagogical approaches, including the ICT users' self-appraisal of their teaching. These results are consistent with Mishra and Koehler's (2006) TPACK framework that argues effective technology integration is only possible when there is an overlap of technological knowledge, pedagogical knowledge, and content knowledge. The correlation matrix (Table 5) reveals particularly strong correlations with ICT usage for collaborative learning strategies (r=.72), supporting Howell's (2012) study that digital pedagogies promote collaboration.

The regression analysis (Table 6) offers important nuance as she revealed that ICT integration is the most important factor explaining changes in pedagogical approaches (41% unique variance), but retained TPACK confidence as also having a significant influence. This indicates that there are multiple facets at play: an overriding argument made was that simply providing technological ICT tools is inadequate – there is a need for professional development to build the proper pedagogical reasoning frameworks, as emphasized in Voogt et al.'s (2013) TPACK review. The discipline-based differences (β=.12) made clear that context matters because the Science and Professional Education teachers had greater adoption of innovative approaches, which aligns with Ghavifekr and Rosdy (2015) work on subject area differences in technology use integration.

3.4.3 Testing Research Hypothesis H_3

H_3: Key barriers (e.g., inadequate infrastructure, lack of training) negatively correlate with ICT integration levels, while institutional support (e.g., professional development, technical resources) positively predicts effective adoption among Nashik's college teachers.

Data Collection & Analysis

- **Sample Size:** 340 college teachers from Nashik (stratified sampling)
- **Measures:**
  - **ICT Integration Index:** Composite score of digital tool usage (1-5 scale)
  - **Barriers Scale:** Infrastructure, training gaps, resistance (1-5 scale)
  - **Enablers Scale:** Institutional support, PD programs, resources (1-5 scale)

Table 7: Correlation Matrix of Barriers, Enablers and ICT Integration

Variable	1	2	3	4	5
1. ICT Integration	1.00				
2. Infrastructure	-.54**	1.00			
3. Training Gaps	-.62**	.48**	1.00		
4. Institutional Support	.71**	-.39**	-.52**	1.00	
5. PD Programs	.68**	-.35**	-.58**	.63**	1.00

**p<0.01

Interpretation:

- Strong negative correlations between barriers and ICT integration (r=-.54 to -.62)
- Strong positive correlations between enablers and ICT integration (r=.68 to .71)
- Confirms H_3's directional relationships
- Aligns with Selwyn's (2019) findings on infrastructure as critical determinant
-

Table 8: Multiple Regression Predicting ICT Integration

Predictor	β	t	p	95% CI	VIF
Barriers					
Infrastructure	-.28	-4.12	<.001	[-.38, -.18]	1.32
Training Gaps	-.35	-5.67	<.001	[-.45, -.25]	1.41
Enablers					
Institutional Support	.39	6.45	<.001	[.28, .50]	1.52
PD Programs	.31	4.89	<.001	[.19, .43]	1.47
Model Summary				R^2=.67	
				Adj. R^2=.65	
				F=58.32**	

Interpretation:

- Model explains 67% of ICT integration variance
- Training gaps strongest barrier (β=-.35)
- Institutional support strongest enabler (β=.39)
- Supports Dhawan's (2020) pandemic-era findings on support systems
- VIF<2 indicates no multicollinearity issues
-

Table 9: Mean Scores of Barriers/Enablers by Institution Type

Factor	Govt (n=120)	Private (n=130)	Aided (n=90)	F	p
Infrastructure	3.89 (0.91)	2.45 (0.78)	3.12 (0.85)	28.76	<.001
Training Gaps	4.05 (0.82)	2.89 (0.75)	3.45 (0.80)	31.45	<.001
Institutional Support	2.12 (0.68)	4.25 (0.72)	3.15 (0.70)	42.31	<.001
PD Programs	1.95 (0.65)	4.05 (0.81)	2.89 (0.75)	38.92	<.001

Post-hoc Tukey:

- Private institutions significantly better on all enablers (p<.001)
- Government colleges face most severe barriers

Interpretation:

- Reveals systemic inequities in resource distribution
- Explains variance in ICT adoption patterns
- Supports Ghavifekr & Rosdy's (2015) institutional analysis

The assessment offers solid evidence for H_3 confirming that both barriers and enablers significantly influence ICT integration into colleges in Nashik. The correlation matrix (Table 7) shows especially high negative correlations concerning the training gaps (r=-.62) and ICT adoption which, as aligned with Mishra and Koehler's (2006) TPACK framework, highlights the still greater need for teacher training. The regression analysis (Table 8) illustrates these relationships in further depth, identifying that the closing gaps related to training would, by far, have the most significant effect (β = -.35) on ICT integration improvement, with infrastructure inadequacies coming a distant second (β = -.28). These results support Bates' (2019) assertion that having access to technology resources is irrelevant in the absence of proper training.

The institutional benchmarks (Table 9) reveal the most glaring gaps with private colleges surpassing government and aided colleges in all enabler categories. This institutional stratification aids in the explanation of the uneven ICT adoption tendencies registered in Nashik and supports Selwyn's (2019) critique of digital divides in semi-urban India. The strong predictive value of institutional support (β = .39) especially supports Dhawan's (2020) observations post-pandemic regarding the organizational ecosystems that sustain digital education initiatives.

3.4.4 Testing Research Hypothesis H_4

H_4: Evidence-based interventions targeting teacher training, infrastructure improvement, and policy alignment will significantly enhance sustainable digital facilitation practices in Nashik's colleges, as measured by post-intervention adoption rates and pedagogical innovation.

Intervention Components:

1. Teacher Training: TPACK-based workshops (40 hours)
2. Infrastructure Upgrade: Smart classrooms + LMS access
3. Policy Alignment: Institutional digital integration policies

Table 10: Pre-Post Comparison of ICT Integration (Intervention Group N=170)

Measure	Pre-Intervention M(SD)	Post-Intervention M(SD)	t-value	p-value	Cohen's d
Overall ICT Use	2.45 (0.82)	3.89 (0.75)	14.32	<.001	1.82
LMS Utilization	1.78 (0.65)	3.45 (0.82)	18.56	<.001	2.31
Student-Centred Tech	2.12 (0.71)	3.78 (0.69)	19.23	<.001	2.42
TPACK Confidence	2.89 (0.78)	4.12 (0.65)	15.67	<.001	1.75

Interpretation:

- Significant improvements (p<.001) with very large effect sizes (d>1.7)
- Largest gain in student-centred technology use (d=2.42)
- Supports Voogt et al.'s (2013) findings on TPACK development

Table 11: ANCOVA Results (Post-Intervention Comparison)

Outcome Variable	Group	Adj. Mean	F-value	p-value	Partial η^2
ICT Integration	Intervention	3.85	48.76	<.001	.42
	Control	2.52			
Pedagogical Innovation	Intervention	4.02	52.34	<.001	.45
	Control	2.78			

Covariates: Pre-test scores, teaching experience

Interpretation:

- Significant group differences after controlling for covariates
- Large effect sizes (η^2>.40)
- Aligns with Bates' (2019) intervention studies

Table 12: Sustainability Indicators (6-Month Follow-up)

Indicator	% Achieving Benchmark	χ^2	p-value
Continued LMS Use	82%	35.67	<.001
Regular PD Attendance	75%	28.45	<.001
Policy Implementation	68%	22.31	<.001

Benchmarks:

- LMS Use: ≥2x/week
- PD: ≥1 session/month
- Policy: Documented integration standards

Interpretation:

- High sustainability rates across indicators
- Supports Dhawan's (2020) framework for sustained change

The results serve as strong evidence for H_4 about how targeted approaches can positively impact digital facilitation practices. As seen in Table 10, improvement was remarkable across all domains but was especially high for student-centred technology use (d=2.42), confirming Mishra and Koehler's (2006) claim on TPACK development. The ANCOVA results (Table 11) affirm there was no additional value from gains contrived from chance or baseline differences with markers on pedagogical innovation being highly impacted (partial $\eta^2 = .45$), which was also noted by Bates (2019) and speaks to the power of carefully crafted interventions.

For policymakers, the sustainability metrics (Table 12) are especially insightful. The high rate of continued LMS utilization (82%) indicates that investments in infrastructure, when accompanied with training, yield significant long-term value as cited by Selwyn (2019). The policy implementation rate (68%) shows that institutional buy-in is possible when provided with guideline frameworks backed by evidence, as recommended in NEP 2020. Collectively, these findings indicate that colleges in Nashik have the means to achieve sustained digital transformational through an integrated strategy of training, infrastructure, and policy.

4. Results and Discussion

This part provides an interpretation of the outcomes of the study, organized according to the four research objectives. The outcomes stemmed from a mixed-methods approach which integrated quantitative data from a survey of 340 college teachers from Nashik and qualitative data from interviews. The examination of the results integrates literature related to the use of ICT in higher education and discusses the major impacts of the study on policy, practice or research.

4.1 ICT Integration Levels Among Teachers

The finding indicates that ICT integration by colleges within entrepreneur education has massive divides in Nashik. The use of PowerPoint presentations and documents in PDF format was very high with 82% and 76% absorption or adoption rate respectively, while the utilization of more sophisticated Learning Management Systems (LMS) and data analytic tools were much lower with 38% and 18% absorption respectively. These results corroborate Selwyn's (2019) claim that teachers from peri-urban areas are often overly dependent on standard low-complexity instruments because of infrastructural constraints and inadequate training. The TPACK framework (Mishra & Koehler, 2006) also accounts for these gaps, where most of these teachers have too little pedagogy-technology knowledge to use advanced tools in an appropriate way. After the intervention, there were significantly higher TPACK confidence scores from 2.89 to 4.12 (on a 5-point scale), evidencing the return on investment in some form of systematic professional development (Bates, 2019).

4.2 Pedagogical Shifts Observed

The strong correlation these educators showed with innovation pedagogy was ICT tools adoption. Those who digitally advanced were much more likely to use student-centric methods, with the average for low ICT users being 2.45 for flipped classrooms and 4.12 for collaborative learning and 4.35 for collaborative learning (low ICT users: 2.89). These changes correspond to the SAMR model's (Puentedura, 2006) higher-order levels, where the technology substantially alters rather than merely adds to the teaching practice framework. The qualitative interviews corroborated with what Dhawan (2020) mentioned regarding the effectiveness of hybrid learning; participants discussed how flipped learning and using Google Classroom and other interactive platforms enhanced student participation. Despite these findings, there was an inter-disciplinary difference; the Professional Faculty and the Sciences were much more willing to adopt these methods than the Arts and Commerce disciplines, which demonstrates curriculum and resource equity gaps (Ghavifekr & Rosdy, 2015).

4.3 Barriers to Effective ICT Adoption

Three major barriers emerged:

1. Infrastructure Deficits: Government colleges reported severe shortages (e.g., unreliable internet, outdated hardware), scoring 3.89/5 on barrier scales compared to 2.45 in private institutions.
2. Training Gaps: The strongest negative predictor of ICT integration ($\beta = -.35$), with only 25% of teachers receiving formal TPACK training.
3. Institutional Resistance: Cultural inertia and lack of policy enforcement hindered adoption, particularly in traditional disciplines.

These findings echo Voogt et al. (2013), who identified similar challenges in developing regions. The regression analysis underscored that institutional support ($\beta = .39$) was the most critical enabler, validating Bates' (2019) argument that top-down policy alignment is essential for sustainable change.

5. Conclusion and Recommendations

The focus of the current study is the ICT integration efforts of college professors from Nashik, and it identifies areas of achievement as well as challenges within the scope of digitization. While educators construct PowerPoint presentations and use PDFs, they do not utilize Learning Management Systems or data analytics software. This gap is greater in the Arts and Commerce compared to Science and Professional courses, demonstrating the impact of discipline norms on the rate of technological adoption (Ghavifekr & Rosdy, 2015). Instructors who made active use of ICT resources also opted for more learner-centred approaches, such as the flipped classroom model and cooperative learning, thus validating the TPACK framework (Mishra & Koehler, 2006). Widespread ICT use, particularly in government universities, is still limited due to systemic factors such as inadequate infrastructure, teacher education, and institutional apathy (Selwyn, 2019).

The implications on initial teacher training programs are considerable. The research argues for TPACK-centred professional development policies, claiming educators need pedagogical, technological, and content mastery for digitally mediated teaching (Voogt et al., 2013). Participation should be incentivized with micro-credentials earned through hands-on workshops focused on multimedia, student-centred pedagogy, and LMS's. Other solutions might involve peer-mentoring networks that link early adopters with more hesitant educators to promote collaborative teaching (Dhawan, 2020). The strong correlation between ICT uses and inductive learning suggests these integrated training modules should rewrite the definition of basic 'technical skills and advocate for a more transformational view of technology integration into teaching (Bates, 2019).

Equally as important, digital infrastructure requires an institutional framework. A comparison between private and government universities showed the latter lagged with infrastructure (internet connectivity, outdated equipment, etc). Inadequate infrastructure should be solved by policymakers prioritizing equitable provision for smart classrooms and high-speed internet to all regions (Ministry of Education, 2020). Resource constraints might be alleviated with the purchase of technology through public-private partnerships (PPP). Adherence to the NEP 2020 standards would require colleges to formulate national digital strategies that include an LMS and blended learning. Encouragement of innovation requires that academics who embrace digital pedagogy be strategically sponsored (Selwyn, 2019).

Outcomes of the study's intervention training suggest a sustainable change may be achieved through policy alignment with infrastructure. School level post-intervention participation in the LMS and student-centred teaching showed an 82% uptake and improvement respectively. These findings endorse integrative, evidence-based semi-urban strategies (Dhawan, 2020). Such innovative frameworks warrant longitudinal study in other semi-urban settings to explore the ecologically relevant variance.

Nashik's colleges are adopting ICT in teaching but aim with institutional refinement is to fully integrate with NEP 2020. Sustained and transformational equity in access to higher education in semi-urban India can be achieved by empowering educators as digital facilitators through addressing the training, infrastructure, and policy gaps.

References

1. Bates, A. W. (2019). Teaching in a digital age: Guidelines for designing teaching and learning (2nd ed.). Tony Bates Associates Ltd.
2. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101.
3. Cohen, L., Manion, L., & Morrison, K. (2018). Research methods in education (8th ed.). Routledge.
4. Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approach (5th ed.). Sage.
5. Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. Journal of Educational Technology Systems, 49(1), 5–22.
6. Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1–4.
7. Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. International Journal of Research in Education and Science, 1(2), 175–191.
8. Howell, J. (2012). Teaching with ICT: Digital pedagogies for collaboration and creativity. Oxford University Press.
9. Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30(3), 607–610
10. Merriam, S. B., & Tisdell, E. J. (2016). Qualitative research: A guide to design and implementation (4th ed.). Jossey-Bass.
11. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017–1054.
12. Ministry of Education, Government of India. (2020). National Education Policy 2020.
13. Puentedura, R. R. (2006). Transformation, technology, and education.
14. Selwyn, N. (2019). Education and technology: Key issues and debates (2nd ed.). Bloomsbury Academic.

15. Savale, Tushar (2024). Enhancing Education through Technologies: Assessing e-Learning Effectiveness and Outcomes. Journal of Informatics Education and Research, Vol-4(2),2068-2080
16. Unwin, T., Kleine, D., & Hollow, D. (2020). ICT4D: Information and communication technology for development. Cambridge University Press.
17. Voogt, J., Fisser, P., Roblin, N. P., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge—A review of the literature. Journal of Computer Assisted Learning, 29(2), 109–121.
18. Warschauer, M., & Ames, M. (2010). Can one laptop per child save the world's poor? Journal of International Affairs, 64(1), 33–51.