Education

Digital transformation and educational quality in higher education institutions: evidence from the Rohilkhand region of Uttar Pradesh

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Received 2 Apr 2026; Accepted 06 May 2026; Published 20 May 2026

DOI: https://doi.org/10.64171/JAES.6.3.72-83

Abstract

Digital technologies are reshaping teaching, learning, and student engagement across higher education institutions. In India, policy initiatives such as the National Education Policy (NEP) 2020 and the Digital India programme have accelerated the integration of digital technologies across universities and colleges. Despite these developments, empirical evidence on the contribution of digital transformation to educational quality remains limited, particularly in regional higher education systems. This study examines the relationship between digital transformation and educational quality in higher education institutions located in the Rohilkhand region of Uttar Pradesh.

The study conceptualizes digital transformation through four key dimensions: digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices. Educational quality is assessed through teaching effectiveness, student engagement, learning outcomes, and academic support services. A quantitative research design is employed to investigate the proposed relationships. Data are collected from students and faculty members of selected universities and colleges in the region. Structural Equation Modeling (SEM) is used to validate the measurement model and examine the structural relationships among the study constructs.

The findings indicate that digital transformation plays a significant role in enhancing educational quality. Digital infrastructure provides the technological foundation for effective academic delivery, while faculty digital competence strengthens the integration of digital tools into pedagogical practices. Institutional support facilitates the successful implementation of digital initiatives, and technology-enabled teaching practices contribute to improved learning experiences and academic engagement. Collectively, these dimensions demonstrate a positive influence on educational quality within higher education institutions.

By providing empirical evidence from a region that has received limited scholarly attention, this study extends the literature on digital transformation in higher education and offers a context-specific understanding of how digital capabilities contribute to educational improvement. The findings provide valuable insights for policymakers, institutional leaders, and quality assurance agencies seeking to strengthen educational quality through strategic digital transformation initiatives. The study also highlights the importance of developing digitally capable institutions to support inclusive, effective, and sustainable higher education in India.

Keywords: Digital transformation, Educational quality, Higher education institutions, Digital infrastructure

1. Introduction

Digital technologies are reshaping teaching, learning, and student engagement across higher education institutions. Universities and colleges increasingly rely on learning management systems, virtual classrooms, digital content platforms, cloud-based resources, and data-driven technologies to support academic activities (Mohamed Hashim *et al*., 2022) [33]. As higher education systems respond to changing learner expectations and technological advancements, digital transformation has become a strategic priority for institutional development and educational improvement.

The growing emphasis on digital transformation reflects a broader shift in the way higher education institutions design and deliver educational services. Digital technologies are no longer viewed merely as supplementary tools; they have become integral to teaching processes, student engagement, academic communication, and institutional operations. Consequently, institutions across the world are investing in digital infrastructure, strengthening faculty digital competence, and adopting technology-enabled teaching practices to improve educational quality and enhance academic outcomes (Singh & Dixit, 2025) [46].

In India, the digitalization of higher education has received significant policy attention. The National Education Policy (NEP) 2020 emphasizes the effective integration of technology to enhance teaching, learning, and institutional effectiveness across the higher education system (Singh & Dixit, 2024) [14]. Similarly, initiatives such as the Digital India programme, Swayam, Diksha, and the National Digital Library have accelerated the adoption of digital technologies across universities and colleges. These initiatives have encouraged institutions to invest in digital infrastructure, expand technology-enabled teaching practices, strengthen faculty digital competence, and improve academic support mechanisms. As a result, digital transformation has emerged as an important component of higher education reform in India (Sarkar, 2026) [44].

Despite these developments, important questions remain regarding the extent to which digital transformation contributes to educational quality. Educational quality extends beyond academic achievement and encompasses teaching effectiveness, student engagement, learning outcomes, and academic support services. Although digital technologies offer new opportunities for improving educational delivery and student learning, the successful realization of these benefits depends on several institutional conditions. Digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices may collectively determine whether digital transformation translates into meaningful improvements in educational quality (Martínez-Caro *et al*., 2015) [32].

Existing research has reported positive associations between technology adoption and educational outcomes, including student engagement, learning effectiveness, instructional innovation, and academic performance. However, the literature remains fragmented. A considerable proportion of prior studies has focused on specific technologies, online learning platforms, or individual aspects of technology adoption. Consequently, limited attention has been devoted to understanding digital transformation as a multidimensional institutional phenomenon (Shard *et al*., 2024) [45]. Furthermore, insufficient evidence exists regarding how multiple dimensions of digital transformation collectively influence educational quality within higher education institutions. This limitation restricts a comprehensive understanding of the mechanisms through which institutional digital capabilities contribute to educational improvement (Aquino *et al*., 2025) [6].

Another important limitation concerns the geographical context of existing literature. Much of the available evidence originates from developed countries, technologically advanced institutions, or major metropolitan regions. Within India, studies examining digital transformation in higher education have increased considerably; however, research has largely concentrated on central universities, national institutions, and urban educational settings. Regional higher education systems have received comparatively limited scholarly attention despite their significant contribution to the expansion of higher education (Goarty & Gupta, 2025) [19]. Consequently, there remains a need for context-specific evidence that reflects the realities, opportunities, and challenges associated with digital transformation in regional institutional environments.

The Rohilkhand region of Uttar Pradesh provides an appropriate setting for addressing this gap. The region comprises a diverse network of universities and affiliated colleges serving students from both urban and rural backgrounds. In recent years, these institutions have increasingly adopted digital technologies in response to policy initiatives, technological developments, and changing educational requirements. Nevertheless, variations in digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices may influence the effectiveness of digital transformation initiatives. Understanding these variations is essential for assessing how digital transformation contributes to educational quality within regional higher education institutions.

Against this background, the present study examines the relationship between digital transformation and educational quality in higher education institutions located in the Rohilkhand region of Uttar Pradesh. The study conceptualizes digital transformation through four dimensions: digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices. Educational quality is assessed through teaching effectiveness, student engagement, learning outcomes, and academic support services. By examining the relationships among these dimensions, the study seeks to provide a comprehensive understanding of how institutional digital capabilities contribute to educational quality.

This study addresses these gaps by examining the relationship between digital transformation and educational quality in higher education institutions of the Rohilkhand region of Uttar Pradesh. Specifically, it adopts a multidimensional perspective of digital transformation encompassing digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices. The study further investigates how these dimensions are associated with key indicators of educational quality, including teaching effectiveness, student engagement, learning outcomes, and academic support services. By providing empirical evidence from a regional higher education context, the study contributes to a deeper understanding of the conditions under which digital transformation can enhance educational quality.

Accordingly, the primary objective of this study is to examine the influence of digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices on educational quality in higher education institutions of the Rohilkhand region of Uttar Pradesh. Through this investigation, the study aims to contribute to a deeper understanding of how digital transformation can support quality enhancement and institutional development within contemporary higher education.

2. Literature review

Digital transformation has become increasingly important in higher education as institutions seek to enhance teaching, learning, student engagement, and academic support through digital technologies. Contemporary scholarship views digital transformation as more than the adoption of technological tools; it represents a broader institutional process that integrates technological, organizational, and human capabilities (Benavides *et al*., 2020; Kopp *et al*., 2019) [9, 26]. Previous studies have emphasized its potential to strengthen innovation, institutional development, and educational effectiveness, while also highlighting challenges related to digital competencies, organizational resistance, and institutional support (Abad-Segura *et al*., 2020; Singun, 2025) [1, 47]. Recent evidence points to a growing transition toward integrated digital ecosystems that support both academic and administrative functions (Kayanja *et al*., 2025) [24]. However, existing research has primarily examined technology adoption and implementation processes, providing limited insight into how the core dimensions of digital transformation contribute to educational

quality. Therefore, this study examines digital transformation through four dimensions digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices and investigates their relationship with educational quality.

2.1 Technological infrastructure and institutional digital capability

Digital infrastructure represents a fundamental component of digital transformation in higher education institutions. It includes internet connectivity, digital platforms, learning management systems, software applications, hardware resources, and other technological facilities that support academic and administrative activities. As higher education institutions increasingly adopt digital technologies, the availability and quality of digital infrastructure have become critical determinants of institutional digital capability. Institutional digital capability reflects the ability of institutions to effectively utilize technological resources to support teaching, learning, student engagement, and academic support services (Wei *et al*., 2022) [51].

Existing literature consistently highlights the importance of digital infrastructure in facilitating digital transformation. Institutional digital capacity depends largely on technological resources, digital connectivity, and the effective integration of technology within educational systems (Timotheou *et al*., 2023) [49]. Similarly, accessibility, reliability, and adaptability of digital platforms were found to significantly influence learners' educational experiences and engagement. These findings suggest that digital technologies can contribute to educational improvement only when supported by adequate and reliable infrastructure (Huda, 2024) [21].

Recent studies further demonstrate the contribution of digital infrastructure to educational effectiveness. Digital infrastructure has been found to enhance teaching effectiveness by improving access to educational resources and supporting technology-enabled instructional practices (Rahmat *et al*., 2025) [40]. Furthermore, infrastructure-supported technology integration strengthens institutional capacity to address diverse educational needs and improve learning environments (Anto *et al*., 2026) [5]. From a managerial perspective, effective management of technological facilities contributes positively to the quality of student learning, whereas persistent infrastructure gaps continue to constrain digital transformation efforts in many educational institutions (Rawal, 2024) [41].

Overall, the literature suggests that digital infrastructure provides the technological foundation necessary for the effective implementation of digital transformation initiatives. Robust infrastructure facilitates access to digital resources, supports technology-enabled teaching practices, and strengthens institutional capability to deliver quality educational services. However, existing studies have primarily examined digital infrastructure from technological or operational perspectives, with comparatively limited attention to its influence on broader dimensions of educational quality. In particular, insufficient evidence exists regarding how digital infrastructure contributes to teaching effectiveness, student engagement, learning outcomes, and academic support services within regional higher education contexts. This limitation provides a basis for examining the role of digital infrastructure in enhancing educational quality.

H1: *Digital infrastructure positively influences educational quality in higher education institutions.*

2.2 Faculty digital competence as a strategic educational capability

Faculty digital competence is increasingly recognized as a critical driver of digital transformation in higher education. As digital technologies become embedded in teaching, learning, and academic support processes, the ability of faculty members to effectively utilize these technologies has become essential for achieving meaningful educational outcomes (Falloon, 2020) [15]. Faculty digital competence encompasses the knowledge, skills, and capabilities required to integrate digital tools into instructional design, content delivery, assessment, communication, and student support activities. Consequently, faculty members play a central role in translating institutional digital investments into effective educational practices (P. M. L. Ng *et al*., 2024) [37].

The growing integration of digital technologies in education has increased the importance of faculty digital competence in technology-enabled learning environments. Structured digital learning initiatives have been found to enhance faculty competence and strengthen engagement with digital teaching environments (Afonso *et al*., 2025) [2]. In addition, digital competence plays a crucial role in effective online course delivery by enabling educators to design interactive learning experiences and facilitate active student participation. These findings indicate that faculty digital competence is closely associated with the successful integration of digital technologies into teaching and learning processes (Kocatürk Kapucu *et al*., 2025) [25].

Continuous professional development has been identified as an important factor in strengthening faculty digital competence. Targeted training initiatives have been found to improve educators' confidence and readiness to adopt digital technologies (Trujillo-Juárez *et al*., 2025) [50]. Furthermore, digitally competent educators are more likely to engage in pedagogical innovation and utilize emerging technologies to enhance learning experiences. As higher education institutions increasingly adopt advanced digital tools, educators' ability to adapt to evolving technological environments becomes increasingly important (Basilotta-Gómez-Pablos *et al*., 2022) [8]. In this context, digital competence and AI literacy significantly influence educators' capacity to effectively evaluate and integrate emerging technologies into educational practice (D. T. K. Ng *et al*., 2023) [36].

Collectively, existing evidence suggests that faculty digital competence represents a strategic educational capability that supports technology-enabled teaching practices, strengthens student engagement, and improves instructional effectiveness. Faculty members with higher levels of digital competence are better positioned to create interactive learning environments, respond to diverse learner needs, and utilize digital

technologies to support academic development (Mohammed *et al*., 2025) [34]. However, much of the existing literature focuses on competence development, professional training, or individual technology adoption. Comparatively limited empirical attention has been devoted to examining how faculty digital competence contributes to broader dimensions of educational quality, particularly teaching effectiveness, student engagement, learning outcomes, and academic support services within regional higher education contexts. This limitation highlights the need to investigate faculty digital competence as a key determinant of educational quality in higher education institutions.

H2: *Faculty digital competence positively influences educational quality in higher education institutions.*

2.3 Institutional support for digital transformation

Institutional support plays a crucial role in the successful implementation of digital transformation initiatives in higher education institutions. While digital infrastructure provides the technological foundation for transformation, its effective utilization depends on the extent to which institutions establish supportive policies, leadership commitment, professional development opportunities, technical assistance, and administrative mechanisms (Langseth *et al*., 2023) [29]. As a result, digital transformation is increasingly viewed not only as a technological process but also as an institutional undertaking that requires coordinated support to achieve meaningful educational outcomes.

Institutional support plays a significant role in facilitating technology adoption and enhancing educational experiences. Supportive institutional environments have been found to improve accessibility, participation, and student engagement within learning environments (Munjanja & Hendricks, 2025) [35]. In addition, institutional support promotes knowledge sharing, organizational learning, and capability development, thereby strengthening overall institutional effectiveness. These findings suggest that institutional support creates favorable conditions for the successful integration of digital technologies into academic activities (Fernández *et al*., 2023) [16].

The growing adoption of emerging technologies has increased the importance of institutional support in educational settings. Training opportunities, policy guidance, and administrative encouragement have been found to strongly influence educators' willingness to adopt generative artificial intelligence technologies (Ceallaigh *et al*., 2025) [11]. Furthermore, institutional support plays a crucial role in developing digital skills and competencies among educational professionals through continuous professional development and access to learning resources. Such support enables educators to adapt to evolving technological environments and integrate digital technologies more effectively into teaching and academic activities (Hussain & Abdullah, 2025) [22].

Evidence from higher education institutions further demonstrates the importance of institutional support in promoting faculty engagement with digital transformation initiatives. Leadership commitment, institutional policies, and professional development opportunities have been found to significantly influence faculty adoption of emerging technologies in higher education (Kadam *et al*., 2025) [23]. Institutional support not only facilitates technology utilization but also strengthens educators' confidence in implementing technology-enabled teaching practices. This becomes increasingly important as higher education institutions continue to expand the use of digital technologies across teaching, learning, and academic support functions (Razi-ur-Rahim *et al*., 2026) [42].

Overall, the literature suggests that institutional support represents an important organizational capability that enables higher education institutions to realize the benefits of digital transformation. Supportive institutional environments encourage technology adoption, strengthen faculty development, and facilitate the effective integration of digital technologies into educational processes. However, existing research has primarily examined institutional support in relation to technology adoption and professional development. Comparatively limited empirical evidence exists regarding its contribution to broader dimensions of educational quality, including teaching effectiveness, student engagement, learning outcomes, and academic support services, particularly within regional higher education contexts. This limitation highlights the need to examine the role of institutional support in enhancing educational quality within higher education institutions.

H3: *Institutional support positively influences educational quality in higher education institutions.*

2.4 Pedagogical integration of technology in higher education

The educational value of digital transformation depends not only on the availability of technological resources but also on their effective integration into teaching and learning processes. The pedagogical integration of technology refers to the purposeful use of digital tools and platforms to support instructional delivery, assessment, learner interaction, and academic support (Georgina & Olson, 2008) [18]. In higher education, such integration is reflected through technology-enabled teaching practices that enhance learning experiences and promote active student participation. Consequently, technology-enabled teaching practices have become an important mechanism through which institutions seek to improve educational quality (Chernenko, 2020) [12].

The rapid advancement of educational technologies has created new opportunities for innovative teaching and learning practices. The increasing adoption of artificial intelligence has been found to reshape instructional practices, learner support, and academic interactions in higher education (Gavira Durón & Jiménez-Preciado, 2026) [17]. Likewise, digital learning technologies enhance student participation, facilitate collaboration, and provide greater flexibility in learning when effectively integrated into instructional processes (Salam *et al*., 2026) [43]. These findings suggest that technology can enrich educational experiences when aligned with pedagogical objectives.

Effective integration of technology in education requires changes in teaching practices rather than the mere adoption of digital tools. Educators are increasingly required to redesign learning experiences in ways that encourage interaction, engagement, and deeper learning (Bailey *et al*., 2026) [7]. In addition, continuous pedagogical adaptation has become essential in response to the emergence of new digital technologies. These findings indicate that the educational benefits of technology largely depend on how effectively it is integrated into instructional practices and learning activities (Dogan & Arslan, 2026) [13]. AI-supported learning materials have been found to enhance learner participation, strengthen knowledge retention, and support active learning strategies. These findings suggest that technology-enabled teaching practices can improve teaching effectiveness, encourage student engagement, and facilitate meaningful learning experiences when implemented within pedagogically sound learning environments (Aluko *et al*., 2026) [4].

Overall, existing research supports the educational value of technology integration in higher education. However, most existing studies have primarily focused on specific technologies or isolated instructional innovations. Comparatively limited attention has been given to technology-enabled teaching practices as a broader dimension of digital transformation. In addition, insufficient empirical evidence exists regarding their contribution to teaching effectiveness, student engagement, learning outcomes, and academic support services within regional higher education contexts. This limitation highlights the need to investigate the role of technology-enabled teaching practices in enhancing educational quality within higher education institutions.

H4: *Technology-enabled teaching practices positively influence educational quality in higher education institutions.*

2.5 Dimensions of educational quality in higher education institutions

Educational quality is widely regarded as a key indicator of institutional effectiveness in higher education. Contemporary scholarship views educational quality as a multidimensional construct that extends beyond academic achievement and reflects the overall effectiveness of teaching, learning, and student support processes (Lagrosen *et al*., 2004) [28].

Teaching effectiveness refers to the ability of instructional practices to facilitate meaningful learning experiences, promote critical thinking, and support the achievement of intended learning outcomes. A positive relationship has been identified between perceived teaching quality and student achievement, emphasizing the importance of effective instructional practices in higher education. Student engagement reflects the extent of students' active participation in academic activities and learning processes(Widrick *et al*., 2002) [52]. Higher levels of engagement are often associated with improved motivation, academic performance, and learning satisfaction. With the increasing integration of digital technologies into educational delivery, student engagement has emerged as an important indicator of educational quality (Ping *et al*., 2026) [39].

Learning outcomes reflect the knowledge, skills, and competencies gained through higher education and serve as key indicators of educational effectiveness (Allan, 1996) [3]. Effective institutional practices and collaborative learning environments have been found to enhance student achievement, while academic support services including academic advising, technological assistance, library resources, mentoring, and administrative support contribute to student satisfaction, retention, and academic success (Brooks *et al*., 2014) [10]. Educational quality is increasingly conceptualized as a multidimensional institutional outcome encompassing teaching effectiveness, student engagement, learning outcomes, and academic support services, supported by robust governance and quality-oriented management practices. However, empirical evidence remains limited regarding how digital transformation factors, such as digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices, collectively influence these dimensions of educational quality, particularly within regional higher education institutions (Svanström *et al*., 2008) [48]. This gap underscores the need for a comprehensive examination of the relationship between digital transformation and educational quality.

3. Theoretical foundation

The present study is grounded in the Resource-Based View (RBV), which argues that an organization's success depends on how effectively it utilizes its valuable resources and capabilities. According to RBV, institutions can achieve better performance when they develop and strategically deploy resources that are difficult to imitate and capable of creating value. Although the theory originated in strategic management, it has increasingly been applied in higher education research to explain how institutional resources contribute to improved organizational and educational outcomes (Lynch * & Baines, 2004) [30].

Within the context of higher education, digital transformation is not simply about adopting new technologies; rather, it involves the effective integration of technological, human, and organizational resources to enhance teaching and learning. From an RBV perspective, digital infrastructure represents a key technological resource, while faculty digital competence reflects the institution's human capability to use digital tools effectively (Willie, 2024) [53]. Likewise, institutional support provides the organizational environment necessary for technology adoption, and technology-enabled teaching practices represent the practical application of these resources in educational activities (Nugroho *et al*., 2025) [38].

RBV further suggests that the benefits of digital transformation are determined not only by the availability of digital resources but also by how successfully they are utilized to improve educational processes. Institutions with stronger digital capabilities are better positioned to enhance teaching effectiveness, promote student engagement, improve learning outcomes, and provide more effective academic support services (Yaakub *et al*., 2021) [54]. As a result, educational quality can be viewed as a consequence of an institution's

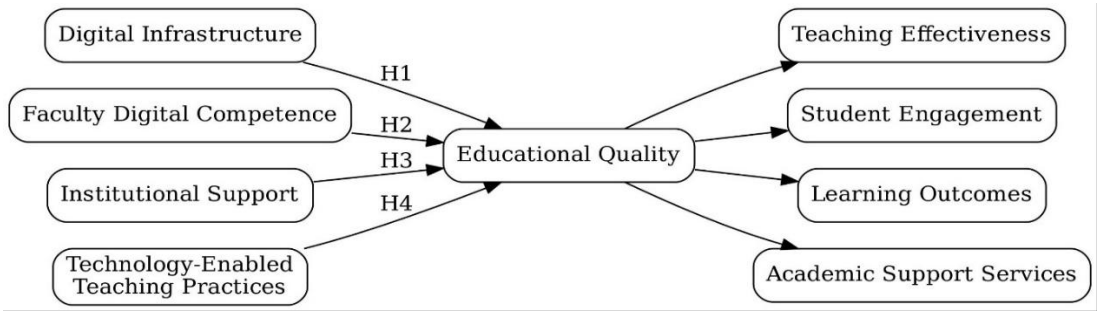
ability to mobilize and utilize its digital resources and capabilities in a purposeful manner.

Therefore, the Resource-Based View offers a strong theoretical foundation for explaining how digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices contribute to educational quality in higher education institutions. The theory highlights the role of institutional digital capabilities in enhancing educational outcomes and supports the conceptual framework developed for this study.

Based on the Resource-Based View (RBV), the proposed framework conceptualizes digital transformation through four dimensions: digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices. These dimensions represent the technological, human, organizational, and pedagogical capabilities that facilitate digital transformation within higher education institutions.

4. Conceptual framework

The framework proposes that these capabilities positively influence educational quality, reflected in teaching effectiveness, student engagement, learning outcomes, and academic support services. Accordingly, the framework proposes four direct relationships between the dimensions of digital transformation and educational quality (H1–H4).



5. Research methodology

5.1 Research design

This study adopts a quantitative, cross-sectional research design to examine the relationship between digital transformation and educational quality in higher education institutions. Digital transformation is conceptualized through four dimensions digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices while educational quality is reflected through teaching effectiveness, student engagement, learning outcomes, and academic support services. Data were collected from students and faculty members at a single point in time using a structured questionnaire. The proposed relationships were examined using Structural Equation Modeling (SEM).

5.2 Study area, population and sampling technique

The study was conducted in the Rohilkhand region of Uttar Pradesh, a major higher education hub served by Mahatma Jyotiba Phule Rohilkhand University and its affiliated institutions. The university oversees a large network of affiliated colleges across multiple districts of the region and serves a substantial student population, making it an appropriate context for examining digital transformation in higher education.

The target population comprised students and faculty members from selected higher education institutions in the region. Universities and colleges were selected purposively to ensure representation of institutions operating under diverse academic and technological conditions. Data were subsequently collected from students and faculty members using convenience sampling. Following the recommendations of Hair *et al*. (2022) [20] and Kline (2023), which emphasize the importance of an adequate sample size in SEM applications, a sample of 400 respondents was considered sufficient for reliable parameter estimation and model evaluation. Given the large and diverse higher education population in the Rohilkhand region, the selected sample size was considered appropriate for capturing variations in perceptions regarding digital transformation and educational quality.

5.3 Measurement instrument and data collection

The study measured digital transformation through four dimensions: digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices. Educational quality was conceptualized as a multidimensional construct comprising teaching effectiveness, student engagement, learning outcomes, and academic support services. Measurement items were adapted from established scales reported in previous studies and modified to suit the higher education context. All items were assessed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

A structured questionnaire was developed for data collection. To ensure content validity and clarity, the instrument was reviewed by academic experts and refined where necessary. Data were collected through both online and offline survey administration. Participation was voluntary, and respondents were assured of the confidentiality and anonymity of their responses.

Table 1 summarizes the study constructs, corresponding dimensions, item codes, and measurement sources used in the development of the survey instrument.

Table 1: Operationalization of study constructs

Higher-order construct	Dimension	Item codes	No. of items	Source
Digital transformation	Digital Infrastructure	DI1–DI5	5	(Nugroho *et al*., 2025; Timotheou *et al*., 2023)
	Faculty Digital Competence	FDC1–FDC5	5	DigCompEdu Framework (Redecker, 2017); (Kocatürk Kapucu *et al*., 2025)
	Institutional Support	IS1–IS5	5	(Munjanja & Hendricks, 2025; Razi-ur-Rahim *et al*., 2026)
	Technology-Enabled Teaching Practices	TETP1–TETP5	5	TPACK Framework Mishra & Koehler, 2006); (Bailey *et al*., 2026)
Educational quality	Teaching Effectiveness	TE1–TE4	4	(MARSH, 1982)
	Student Engagement	SE1–SE4	4	(Kuh, 2003)
	Learning Outcomes	LO1–LO4	4	(Allan, 1996; Brooks *et al*., 2014; Svanström *et al*., 2008)
	Academic Support Services	ASS1–ASS4	4	(Fernández *et al*., 2023; Mohamed Hashim *et al*., 2022; Munjanja & Hendricks, 2025)

Note: Measurement items were adapted from validated scales reported in prior studies and refined to suit the higher education context. All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree)

6. Results

6.1 Respondent profile

Table 2: Demographic profile of respondents (N = 400)

Variable	Category	Frequency	Percentage (%)
Gender	Male	228	57.0
	Female	172	43.0
Age group	Below 20 years	48	12.0
	21–25 years	188	47.0
	26–30 years	82	20.5
	Above 30 years	82	20.5
Respondent category	Students	300	75.0
	Faculty Members	100	25.0
Type of institution	University	150	37.5
	College	250	62.5
Mode of study/teaching	Primarily Offline	168	42.0
	Blended (Offline + Online)	172	43.0
	Primarily Online	60	15.0
District	Bareilly	130	32.5
	Budaun	85	21.3
	Shahjahanpur	70	17.5
	Pilibhit	55	13.7
	Rampur	60	15.0
Total	-	400	100.0

Table 2 presents the demographic profile of the respondents. The sample comprised 400 participants, including both students and faculty members from higher education institutions across the Rohilkhand region. Male respondents represented 57.0% of the sample, while females accounted for 43.0%. The largest proportion of respondents belonged to the 21–25 years age group, indicating strong representation of individuals actively engaged in higher education. Students constituted three-fourths of the sample, whereas faculty members represented one-fourth. Most respondents were affiliated with colleges, while a substantial proportion were drawn from universities. In terms of learning and teaching modes, blended environments were the most common, followed closely by predominantly offline settings, reflecting the growing integration of digital technologies within higher education institutions. The district-wise distribution demonstrates representation from major educational centres across the Rohilkhand region, including Bareilly, Budaun, Shahjahanpur, Pilibhit, and Rampur. Overall, the sample captures diverse institutional and participant perspectives relevant to the study of digital transformation and educational quality.

6.2 Descriptive statistics

Table 3: Descriptive statistics of study constructs

Construct	Mean	SD
Digital infrastructure	3.74	0.76
Faculty digital competence	4.02	0.71
Institutional support	3.68	0.79
Technology-enabled teaching practices	4.08	0.69
Educational quality	3.89	0.73

Table 3 presents the descriptive statistics of the study constructs. The results indicate generally favorable perceptions of digital transformation and educational quality among the respondents. Technology-enabled teaching practices and faculty digital competence emerged as the highest-rated dimensions, highlighting the perceived importance of effective technology integration and digital capabilities in the educational process. Educational quality also received positive evaluations across its constituent dimensions. Although digital infrastructure and institutional support were viewed positively, their comparatively lower mean scores suggest opportunities for further enhancement. Taken together, these findings reflect a generally positive assessment of digital transformation initiatives and their contribution to educational quality within higher education institutions in the Rohilkhand region of Uttar Pradesh.

6.3 Measurement model assessment

Before examining the structural relationships, the measurement model was assessed to establish the reliability and validity of the study constructs.

6.3.1 Reliability and convergent validity

Table 4 presents the results of Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) for all study constructs. The findings indicate that the Cronbach's alpha values ranged from 0.78 to 0.82, while Composite Reliability values varied between 0.83 and 0.87, exceeding the recommended threshold of 0.70. These results demonstrate satisfactory internal consistency across all constructs. Furthermore, the AVE values ranged from 0.60 to 0.70, surpassing the recommended minimum value of 0.50 and indicating adequate convergent validity. Collectively, the results suggest that the measurement items provided a reliable representation of their respective constructs and adequately captured the underlying dimensions of digital transformation and educational quality.

Table 4: Reliability and convergent validity

Construct	Cronbach's α	CR	AVE
Digital Infrastructure	0.80	0.84	0.65
Faculty Digital Competence	0.82	0.87	0.60
Institutional Support	0.79	0.85	0.62
Technology-Enabled Teaching Practices	0.82	0.87	0.70
Teaching Effectiveness	0.79	0.84	0.65
Student Engagement	0.82	0.86	0.63
Learning Outcomes	0.78	0.84	0.62
Academic Support Services	0.78	0.83	0.65

6.3.2 Discriminant validity

To further assess the distinctiveness of the study constructs, discriminant validity was evaluated using the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio. The results are presented in Tables 5 and 6.

Table 5: Fornell–larcker criterion

Construct	DI	FDC	IS	TETP	TE	SE	LO	ASS
DI	0.81							
FDC	0.56	0.77						
IS	0.51	0.58	0.79					
TETP	0.59	0.64	0.57	0.84				
TE	0.49	0.61	0.53	0.68	0.81			
SE	0.46	0.58	0.51	0.65	0.69	0.79		
LO	0.48	0.60	0.54	0.67	0.71	0.68	0.79	
ASS	0.44	0.55	0.57	0.63	0.66	0.64	0.65	0.81

Note: Diagonal values (bold) represent the square root of AVE

Table 6: Heterotrait–Monotrait (HTMT) Ratio

Construct	DI	FDC	IS	TETP	TE	SE	LO	ASS
DI	—							
FDC	0.62	—						
IS	0.58	0.66	—					
TETP	0.71	0.78	0.64	—				
TE	0.57	0.73	0.62	0.80	—			
SE	0.54	0.69	0.59	0.77	0.81	—		
LO	0.56	0.71	0.63	0.79	0.82	0.78	—	
ASS	0.52	0.67	0.65	0.74	0.77	0.73	0.75	—

As shown in Tables 5 and 6, the square root of AVE for each construct exceeded its correlations with the remaining constructs, thereby meeting the requirements of the Fornell–Larcker criterion. Furthermore, all HTMT values were below the recommended threshold of 0.85. These results indicate that the study constructs are empirically distinct and represent different dimensions of digital transformation and educational quality. Accordingly, the measurement model demonstrates satisfactory discriminant validity.

6.4 Structural model assessment and hypothesis testing

Following the establishment of reliability and validity, the structural model was evaluated to test the proposed hypotheses. Path coefficients (β), t-values, and significance levels were examined to assess the influence of the four dimensions of digital transformation on educational quality. The results are presented in Table 7.

Table 7: Structural model results and hypothesis testing

Hypothesis	Path	β	t-value	*p*-value	Decision
H1	DI → EQ	0.21	3.89	<0.001	Supported
H2	FDC → EQ	0.32	5.74	<0.001	Supported
H3	IS → EQ	0.18	3.26	<0.001	Supported
H4	TETP →EQ	0.37	6.42	<0.001	Supported

The results indicate that all four dimensions of digital transformation have a positive and statistically significant influence on educational quality. Among the examined factors, technology-enabled teaching practices emerged as the strongest predictor of educational quality ($\beta = 0.37$, $p < 0.001$), highlighting the importance of integrating digital technologies into teaching and learning processes. Faculty digital competence also demonstrated a substantial positive effect ($\beta = 0.32$, $p < 0.001$), suggesting that educators' ability to effectively utilize digital technologies plays a crucial role in enhancing educational experiences and outcomes.

Digital infrastructure ($\beta = 0.21$, $p < 0.001$) and institutional support ($\beta = 0.18$, $p < 0.001$) were likewise found to exert significant positive influences on educational quality. Although their effects were comparatively smaller, the findings underscore the importance of providing adequate technological resources and supportive institutional mechanisms to facilitate successful digital transformation initiatives. Overall, the results suggest that technological, human, organizational, and pedagogical capabilities collectively contribute to improving educational quality within higher education institutions. Accordingly, H1, H2, H3, and H4 are supported.

6.5 Coefficient of Determination (R^2)

The explanatory power of the structural model was assessed using the coefficient of determination (R^2). The results indicated that the four dimensions of digital transformation explained 64% of the variance in educational quality ($R^2 = 0.64$). According to (Hair & Alamer, 2022) [20], this reflects strong explanatory power, suggesting that the proposed framework provides a meaningful explanation of the factors influencing educational quality in higher education institutions in the Rohilkhand region of Uttar Pradesh.

7. Discussion

The present study examined the influence of digital transformation on educational quality in higher education institutions in the Rohilkhand region of Uttar Pradesh. The findings indicate that all four dimensions of digital transformation digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices have a positive and significant impact on educational quality. Together, these results suggest that improvements in educational quality are not driven by technology alone. Rather, meaningful outcomes emerge when technological resources are supported by digitally competent faculty, supportive institutional environments, and effective technology-enabled teaching practices. The findings therefore reinforce the multidimensional nature of digital transformation and highlight the importance of aligning technological, human, organizational, and pedagogical capabilities to enhance educational quality.

7.1 Digital infrastructure and educational quality

The findings indicate that digital infrastructure positively influences educational quality. Reliable internet connectivity, digital platforms, and technological resources provide the foundation necessary for effective teaching, learning, and academic support. The results suggest that institutions with stronger digital infrastructure are better positioned to support technology-enhanced educational activities and improve access to learning resources. This finding is consistent with previous studies that highlight the importance of technological infrastructure in strengthening institutional effectiveness and educational outcomes (Timotheou *et al*., 2023; Nugroho *et al*., 2025) [49, 38].

7.2 Faculty digital competence and educational quality

Faculty digital competence emerged as one of the strongest predictors of educational quality. The finding suggests that the benefits of digital technologies largely depend on educators' ability to integrate them effectively into teaching and learning processes. Digitally competent faculty members are more likely to create engaging learning experiences and support positive learning outcomes. This result aligns with the work of Redecker (2017) and Kocatürk Kapucu *et al*. (2025) [25], emphasizing the critical role of digital competence in contemporary higher education.

7.3 Institutional support and educational quality

The study also found a significant positive relationship between institutional support and educational quality. Leadership commitment, supportive policies, technical assistance, and professional development opportunities encourage the effective use of digital technologies across institutions. Although its influence was comparatively lower than other dimensions, institutional support remains an important enabler of successful digital transformation. This finding is consistent with previous research highlighting the role of organizational support in facilitating technology adoption and institutional effectiveness (Munjanja & Hendricks, 2025; Razi-ur-Rahim *et al*., 2026) [35, 42].

7.4 Technology-enabled teaching practices and educational quality

Technology-enabled teaching practices emerged as the strongest contributor to educational quality. The findings indicate that the educational value of digital transformation depends not only on the availability of technology but also on its effective integration into teaching and learning activities. The use of digital tools to support interaction, collaboration, feedback, and student engagement contributes significantly to improved educational outcomes. This result supports the TPACK perspective and is consistent with earlier studies demonstrating the benefits of meaningful technology integration in higher education (Mishra & Koehler, 2006; Bailey *et al*., 2026) [7].

8. Conclusion and Implications

8.1 Conclusion

This study examined the relationship between digital transformation and educational quality in higher education institutions in the Rohilkhand region of Uttar Pradesh. Drawing on the Resource-Based View (RBV), digital transformation was conceptualized through four dimensions: digital infrastructure, faculty digital competence, institutional support, and technology-enabled teaching practices. The findings revealed that all four dimensions positively influence educational quality, highlighting the importance of technological, human, organizational, and pedagogical capabilities in contemporary higher education. Overall, the study demonstrates that digital transformation can play a significant role in enhancing teaching effectiveness, student engagement, learning outcomes, and academic support services.

8.2 Theoretical implications

The study contributes to the literature by developing and empirically validating an integrated framework linking digital transformation and educational quality in higher education. It also extends the application of the Resource-Based View by demonstrating that digital transformation capabilities serve as strategic institutional resources that enhance educational quality. The findings provide a more comprehensive understanding of how technological, human, organizational, and pedagogical capabilities contribute to educational quality in higher education institutions.

8.3 Practical implications

The findings suggest that improving educational quality requires more than technological investment alone. Higher education institutions should strengthen digital infrastructure, enhance faculty digital competence, and encourage the adoption of technology-enabled teaching practices. Institutional leaders can further support these efforts through appropriate policies, technical assistance, and professional development opportunities. Together, these initiatives can contribute to more effective teaching, greater student engagement, and improved learning outcomes.

8.4 Policy implications

The findings have important implications for higher education policy. Policymakers should continue to invest in digital infrastructure, strengthen faculty digital development programmes, and support institutions in adopting technology-enabled teaching practices. Greater emphasis should also be placed on building institutional capacity through technical support, training opportunities, and resource allocation. Such measures can help create more inclusive and effective learning environments while supporting the objectives of the National Education Policy (NEP) 2020 and the Digital India programme.

9. Limitations and future research directions

Despite its contributions, the study has certain limitations that should be acknowledged. First, the research was conducted in higher education institutions located in the Rohilkhand region of Uttar Pradesh, which may limit the generalizability of the findings to other geographical and institutional contexts. Second, the cross-sectional nature of the study captures respondents' perceptions at a single point in time and therefore does not reflect how the effects of digital transformation may evolve over time. Third, the analysis focused on four dimensions of digital transformation and did not consider other potentially relevant factors such as digital leadership, organizational culture, technological readiness, student digital competence, or innovation capability. In addition, the study relied on self-reported survey data, which may be influenced by respondents' subjective perceptions. Future research may address these limitations by examining diverse institutional settings, employing longitudinal research designs, and incorporating additional explanatory variables. The use of mixed-method approaches, including interviews, case studies, and institutional performance indicators, may also provide deeper insights into the relationship between digital transformation and educational quality.

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