The Impact of Digital Transformation on Educational Performance: The Mediating Role of Knowledge Management at The University of Laghouat

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Abstract:

In today's rapidly developing digital era, higher education institutions face increasing pressure to integrate technological advancements into their operational frameworks to enhance educational quality and competitiveness. This study investigates the impact of digital transformation on educational performance at the University of Laghouat, Algeria, with knowledge management serving as a mediating variable. The research employs a quantitative PLS-SEM approach, examining the relationships between digital transformation dimensions (technology infrastructure, digital strategy, transformational leadership, and human resource digital competency), knowledge management processes (acquisition, sharing, application, and storage), and educational performance metrics (teaching effectiveness, research productivity, administrative efficiency, and student satisfaction). Data were collected through a structured questionnaire administered to university teachers at Laghouat University using a stratified sampling technique. The Partial Least Squares Structural Equation Modeling (PLS-SEM) approach was utilized to analyze the relationships and test the hypothesized model. Findings reveal that digital transformation significantly influences educational performance both directly and indirectly through knowledge management processes. Specifically, knowledge management demonstrates a strong mediating effect in translating digital capabilities into improved educational outcomes. The study contributes to the theoretical understanding of technological transformation in higher education while providing practical insights for university administrators seeking to enhance performance through strategic digital initiatives and effective knowledge management practices in the post-pandemic educational landscape.

Keywords: Digital Transformation; Educational Performance; Knowledge Management; University of Laghouat.

Jel Classification Codes : O33, I23, D83

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1. INTRODUCTION:

1.1 Digital Transformation in Higher Education: A Global Imperative

The rapid proliferation of digital technologies has fundamentally altered the operational landscape of organizations across sectors, with higher education institutions facing particularly transformative pressures. Digital transformation (DT) in the university context represents a comprehensive integration of information and communication technologies to improve organizational efficiency, quality, and competitiveness (Trisninawati & Helmi, 2024). This phenomenon extends beyond mere digitalization or informatization, constituting a purposefully organized complex process that reshapes institutional frameworks, teaching methodologies, and administrative processes (Al Fraidan & Alaliwi, 2024).

The acceleration of digital transformation initiatives in higher education has been notably intensified by the COVID-19 pandemic, which necessitated rapid adaptation to remote learning environments and digital administrative processes (Mondragon-Estrada, 2023). What was once considered optional has now become imperative, with universities worldwide recognizing that digital transformation is no longer a choice but a strategic necessity for institutional survival and relevance in the contemporary educational landscape (Deroncele-Acosta, 2023). This transformation encompasses not only technological infrastructure but also organizational culture, leadership approaches, and human resource capabilities—elements that collectively determine an institution's capacity to leverage digital technologies for enhanced performance (Zhu, 2024).

1.2 The Algerian Higher Education Context

The Algerian higher education sector has faced growing pressure to adopt digital transformation, especially after the pandemic. Universities in North Africa, including Algeria, serve as important cases for studying digital transformation in developing regions. Research shows varying digital readiness among regional universities, with efforts to incorporate e-learning platforms and digital repositories into traditional education models (Chahid et al., 2025). Faculties in Algerian universities provide relevant settings for studying digital transformation. Research on faculty perceptions in North African higher education reveals opportunities and challenges in implementing digital strategies (Febriyani, 2024). The shift from traditional teaching to technology-enhanced learning faces infrastructural, and cultural barriers but shows potential for significant performance gains when effectively applied (Belova &Andryushkina, 2023).

1.3 Knowledge Management as a Mediating Factor

While direct relationships between digital transformation and performance outcomes have been extensively studied, the mediating mechanisms through which digital capabilities translate into improved educational performance remain underexplored.

Knowledge management (KM), encompassing processes of knowledge acquisition, sharing, application, and storage, potentially serves as a critical mediator in this relationship (Al Montaser et al, 2024). Universities, as knowledge-intensive organizations, depend on effective knowledge flows between stakeholders to optimize teaching, research, and administrative activities (Bhutto et al, 2024).

The knowledge management capability of higher education institutions significantly influences their ability to leverage digital technologies for performance enhancement (Kordab et al, 2020). Digital platforms facilitate more efficient knowledge acquisition through expanded access to research databases and collaborative networks, while also enabling more effective knowledge sharing through communication technologies and virtual communities of practice (Magno et al., 2024). Furthermore, digital repositories and information systems support knowledge storage and retrieval, ensuring that institutional knowledge remain accessible and applicable to challenges (Zhu, 2024).

1.4 Research Problem and Objectives

Despite increased recognition of digital transformation's importance in higher education, a significant research gap exists concerning how digital capabilities lead to improved educational performance through mediating mechanisms. This gap is especially notable in developing contexts like Algeria, where resource limits, cultural factors, and institutional traditions uniquely affect transformation processes and not observed in developed systems (Belova & Andryushkina, 2023).

This study addresses this research gap by examining the complex relationships between digital transformation, knowledge management, and educational performance at the University of Laghouat. Specifically, it aims to:

1) Evaluate the direct impact of digital transformation capabilities on educational performance metrics at the University of Laghouat.
2) Examine the influence of digital transformation on knowledge management processes within the institutional context.
3) Assess the effect of knowledge management practices on various dimensions of educational performance.
4) Investigate the mediating role of knowledge management in the relationship between digital transformation and educational performance.

1.5 Research Questions and Hypotheses

Based on the research objectives and literature, the present study addresses the following questions:

1) To what extent does digital transformation influence educational performance at the University?
2) How do digital transformation initiatives affect knowledge management processes within the University?

3) What is the impact of knowledge management practices on educational performance metrics?
4) Does knowledge management mediate the relationship between digital transformation and educational performance?

These research questions are operationalized through the following hypotheses:

H1: Digital transformation positively influences educational performance at Laghouat University.

H2: Digital transformation positively influences knowledge management processes within the institution.

H3: Knowledge management practices positively influence educational performance metrics.

H4: Knowledge management mediates the relationship between digital transformation and educational performance.

1.6 Theoretical and Practical Significance

This research contributes to management theory by advancing understanding of the complex interrelationships between technological capabilities, knowledge processes, and performance outcomes in knowledge-intensive organizations. By examining these relationships within the specific context of higher education in Algeria, the study extends existing theoretical frameworks to account for institutional and cultural factors that may influence transformation processes in developing educational systems (Prabowo, 2022).

From a practical perspective, this research provides valuable insights for university administrators and policymakers seeking to enhance educational performance through strategic digital initiatives. By identifying the mediating role of knowledge management, the study highlights potential intervention points for optimizing the impact of digital investments on performance outcomes (Kordab et al, 2020). Furthermore, the focus on the University of Laghouat offers relevant guidance for similar institutions in Algeria and comparable educational environments, contributing to more effective digital transformation strategies in resource-constrained settings (Febriyani, 2024).

2. LITERATURE REVIEW

2.1 Digital Transformation in Higher Education

Digital transformation (DT) in universities is a holistic, value-creating redesign of institutional activities via digital technologies—distinct from digitization and digitalization (Trisninawati & Helmi, 2024; Fletcher & Griffiths, 2020). It spans teaching, research, administration, and stakeholder engagement, and is widely viewed as an evolutionary process driven by advancing technologies that reconfigure business models, processes, and user experiences (Reis et al., 2018; Vial, 2019; Rodríguez-Abitia & Bribiesca-Correa, 2021; Rof et al., 2020). Core DT dimensions include: (a) technology infrastructure—ICT, e-learning, digital libraries, networks (Bond et al., 2018); (b) digital strategy—vision and alignment with institutional goals

(Benavides et al., 2020); (c) transformational leadership—creating supportive climates for innovation (Zhu, 2024); and (d) human resource digital competence—faculty/staff skills and attitudes (Bucăţa & Tileagă, 2023). Evidence shows generally positive effects on efficiency, access, and satisfaction in developed systems (Jackson, 2019), alongside persistent infrastructure, literacy, and change-resistance challenges in developing contexts (Belova & Andryushkina, 2023). The COVID-19 pandemic accelerated DT globally, forcing rapid adoption of remote teaching and digital administration (Mondragon-Estrada, 2023; Deroncele-Acosta, 2023). Regionally, developing economies—including North Africa—report progress in e-learning and administrative digitalization, albeit constrained by financial, infrastructural, and cultural barriers (Chahid et al., 2025; Febriyani, 2024).

2.2 Knowledge Management in Educational Institutions

Knowledge management (KM) in universities comprises coordinated processes of acquiring, sharing, applying, and storing knowledge to meet institutional goals (Bhutto et al., 2024). Acquisition arises via research, professional development, and external partnerships (Kordab et al., 2020); sharing occurs through formal/informal channels and digital platforms (Masa'deh et al., 2017); application improves teaching, research, and administration (Ramjeawon & Rowley, 2017); and storage leverages repositories and information systems (Bhutto et al., 2024). KM practices correlate with better teaching quality, research productivity, and administrative efficiency (Al-Kurdi et al., 2020) and strengthen organizational learning and innovation (Kordab et al., 2020). PLS-SEM studies generally confirm positive KM–performance links and emphasize integrated KM cycles over isolated activities; workplace spirituality may further enable KM by shaping culture and values (Hock et al., 2010; Bhutto et al., 2024).

2.3 Educational Performance Measurement

University performance is multi-dimensional, covering teaching effectiveness, research productivity, administrative efficiency, and student satisfaction (Cadez et al., 2017; Al-Kurdi et al., 2020; Benavides et al., 2020; Stander & Herman, 2017). DT influences each: technology-enhanced learning can improve pedagogy and accessibility (Jackson, 2019); digital tools and collaborations can raise research outputs (Zhu, 2024); administrative information systems boost process efficiency and decision support (Gonzales, 2020); and digital engagement enhances student services and satisfaction (Stander & Herman, 2017). PLS-SEM work supports reliable, valid measurement models capturing these dimensions and enabling analysis of technology–process–outcome linkages (Magno et al., 2024).

2.4 Integration of Digital Transformation, Knowledge Management, and Educational Performance

RBV views digital capabilities as strategic resources (Zhu, 2024); the knowledge-based view positions KM as a critical capability leveraging human and informational assets (Masa'deh et al., 2017); and dynamic capabilities stress sensing, seizing, and reconfiguring resources amid environmental change (Teece et al., 2016). Empirically, DT and KM each relate positively to performance, though effects vary by context (Benavides et al., 2020; Gonzales, 2020; Al-Kurdi et al., 2020; Kordab et al., 2020). A theorized but under-tested mechanism is KM's mediation of the DT–performance relationship: digital platforms can enhance acquisition, sharing, application, and storage of knowledge, which in turn raises performance (Al Montaser et al., 2024; Kordab et al., 2020). This study addresses that gap by testing KM's mediating role in the DT–performance nexus at the University of Laghouat, integrating DT, KM, and performance measurement perspectives to clarify how technological capabilities translate into educational outcomes.

3. METHODOLOGY:

3.1 Research Design

A quantitative, cross-sectional case study examines links between digital transformation (DT), knowledge management (KM), and educational performance at the University of Laghouat. The design enables hypothesis testing and generalization (Creswell & Creswell, 2018) while retaining contextual insight specific to the institution (Yin, 2018). Cross-sectional data capture current perceptions of DT, KM, and performance given practical constraints of an active university environment (Kumar, 2019).

3.2 Population and Sampling

The population is all teaching staff (involved in teaching/research and exposed to DT/KM). Stratified random sampling ensured representation across faculties, titles, gender, and experience (Etikan & Bala, 2017). A G*Power-based calculation for PLS-SEM (effect sizes from prior work; $\alpha = .05$; power = .80) indicated $N \geq 146$ (Hair et al., 2019). We obtained 272 valid responses, exceeding power requirements and suitable for PLS-SEM (Kock & Hadaya, 2018).

3.3 Data Collection Instruments

Data was collected through a structured questionnaire developed based on established measurement scales from previous research on digital transformation, knowledge management, and educational performance. The questionnaire was organized into four sections as follows:

1) **Demographic Information**: Collecting data on respondents' gender, age, job title, department affiliation, and years of experience at the university.
2) **Digital Transformation Measurement**: Assessing four dimensions using multi-item scales:

- *Technology Infrastructure* (5 items) adapted from Bond et al. (2018) and Benavides. (2020)
- *Digital Strategy* (4 items) adapted fromfrom Jackson (2019)
- *Transformational Leadership* (5 items) derived from leadership scales by Zhu (2024)
- *Human Resource Digital Competency* (5 items) developed by Bucăţa and Tileagă. (2023)

3) Knowledge Management Measurement: Evaluating four aspects through validated scales:
   - *Knowledge Acquisition* (4 items) adapted from Bhutto et al. (2024) and Kordab et al. (2020)
   - *Knowledge Sharing* (5 items) based on existing scales by Masa'deh et al. (2017)
   - *Knowledge Application* (4 items) developed from Ramjeawon and Rowley (2017)
   - *Knowledge Storage* (4 items) adapted from Al-Kurdi et al. (2020)
4) Educational Performance Measurement: Measuring four dimensions using indicators:
   - *Teaching Effectiveness* (5 items) adapted from Cadez et al. (2017)
   - *Research Productivity* (5 items) based on measures by Al-Kurdi et al. (2020)
   - *Administrative Efficiency* (4 items) derived from scales by Benavides et al. (2020)
   - *Student Satisfaction* (4 items) adapted from Stander and Herman (2017)

All measurement items utilized a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) to assess respondents' perceptions and experiences regarding each construct, following established survey research practices (Nemoto & Beglar, 2014). The questionnaire was first developed in English then translated to Arabic using a forward-backward translation process. This approach ensured conceptual equivalence between versions. Before full deployment, experts reviewed the content for validity, and pilot testing with a small faculty sample was conducted to confirm clarity and completeness, following best practices for cross-cultural survey (Sekaran & Bougie, 2016).

3.4 Data Collection Procedure

Over six weeks in semester 2024/25, surveys were administered online (secure platform; emailed unique links) and paper-based (faculty meetings/department offices) to maximize participation. An information sheet detailed purpose, voluntariness, confidentiality, and contacts; informed consent was obtained. No identifiers were collected; two-week reminders supported balanced response across strata.

3.5 Data Analysis

Data analysis proceeded through several sequential stages using SPSS 26 for preliminary analysis and SmartPLS 4.0 for structural equation modeling. The analytical process included:

1) Data Preparation: screening missing data, outliers, normality; <5% missing handled via mean substitution; cases with excessive missingness removed.
2) Descriptive Statistics: Calculating means/SDs and frequency profiles of sample characteristics.
3) Measurement Model Assessment: internal consistency (α, CR), indicator reliability (outer loadings), convergent validity (AVE), and discriminant validity (Fornell–Larcker, cross-loadings, HTMT)
4) Structural Model Assessment: Testing hypothesized relationships through: Path coefficients (β) and significance levels (p-values) and Calculating Coefficient of determination (R^2) for endogenous constructs then Effect sizes (f^2) for predictor variables then Predictive relevance (Q^2) through blindfolding procedures
5) Mediation Analysis: Examining the mediating role of knowledge management using Bootstrapping procedures (5,000 resamples) to determine confidence intervals then the Analysis of direct, indirect, and total effects and Calculating Specific indirect effects for individual mediating paths

The PLS-SEM approach was selected over covariance-based SEM due to its suitability for relatively small sample sizes, capacity to handle complex models with multiple constructs and indicators, ability to accommodate non-normally distributed data, and appropriateness for exploratory research contexts where theory is still developing (Chahid et al., 2025). These advantages align well with the present study's characteristics and objectives.

3.6 Validity and Reliability Considerations

Several measures were implemented to enhance the validity and reliability of the research process:

1) Content Validity: Established through comprehensive literature review, adaptation of validated measurement scales, expert review of questionnaire items, and pilot testing.
2) Construct Validity: Assessed through measurement model evaluation, including factor loadings, convergent validity (AVE), and discriminant validity (Fornell-Larcker criterion, HTMT ratio).
3) Internal Consistency Reliability: Verified through Cronbach's alpha and composite reliability calculations
4) Common Method Bias Mitigation: Addressed through procedural remedies (anonymity assurances, counterbalanced question order) and statistical assessment (Harman's single-factor test).
5) Non-Response Bias Evaluation: Conducted by comparing early and late respondents on key variables to identify potential systematic differences.

6) Researcher Bias Control: Maintained through standardized data collection protocols, transparent analytical procedures, and objective interpretation guidelines.

These methodological considerations collectively strengthen the research design, enhancing confidence in the validity and reliability of the study's findings regarding relationships between digital transformation, knowledge management, and educational performance at the University

4. RESULTS & ANALYSIS:

4.1. Descriptive Statistics

A. Sample Characteristics

The final sample consisted of 272teachers from the University of Laghouat, representing various faculties, job title, and demographic backgrounds. Table 1 presents the demographics.

Table 1: Demographic Profile of Respondents

Demographics	Category	Frequency	(%)
Gender	Male	163	59.93%
	Female	109	40.07%
Age	Under 35 years	42	15.44%
	35-44 years	104	38.24%
	45-54 years	95	34.93%
	Over 55 years	31	11.40%
Job Title	Assitatntlecturer	14	5.15%
	Associate Professor B	63	23.16%
	Associate Professor A	109	40.07%
	Professor	86	31.62%
Experience	Lessthan 5	36	13.24%
	6-10	35	12.87%
	11-15	80	29.41%
	More than 15	111	40.81%

The sample shows a majority of male respondents (59.93%) compared to female respondents (40.07%). Age-wise, the sample is predominantly middle-aged, with the largest groups being 35-44 years (38.24%) and 45-54 years (34.93%), while younger (under 35 years, 15.44%) and older (over 55 years, 11.40%) are less represented.

Regarding job titles, Associate Professor A constitutes the largest group (40.07%), followed by Professors (31.62%) and Associate Professor B (23.16%), with Assistant Lecturers forming the smallest group (5.15%). This distribution suggests a sample weighted towards more experienced academic staff. This is further reflected in the experience categories, where teachers with more than 15 years of experience form the largest group (40.81%), followed by those with 11-15 years of experience (29.41%). teachers with less than 10 years of experience collectively resrent the quarter of the sample.

This demographic profile indicates a sample that is predominantly male, middle-aged, and experienced.

B. Construct Descriptive Statistics

Descriptive statistics for the main research constructs are presented in Table 2, including means, standard deviations, and correlations between variables.

Table 2: Descriptive Statistics and Correlations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
Technology Infrastructure (TI)	**3.29**	**0.92**	1.00											
Digital Strategy (DS)	**3.76**	**0.78**	0.58**	1.00										
Transformational Leadership (TL)	**3.42**	**0.95**	0.52**	0.61**	1.00									
HRDigital Competency (HRDC)	**3.38**	**0.87**	0.47**	0.54**	0.59**	1.00								
Knowledge Acquisition (KA)	**3.71**	**0.76**	0.43**	0.62**	0.51**	0.46**	1.00							
Knowledge Sharing (KS)	**3.82**	**0.71**	0.41**	0.58**	0.68**	0.52**	0.57**	1.00						
Knowledge Application (KApp)	**3.65**	**0.79**	0.47**	0.53**	0.49**	0.58**	0.55**	0.64**	1.00					
Knowledge Storage (KSto)	**3.45**	**0.88**	0.52**	0.48**	0.45**	0.59**	0.49**	0.52**	0.61**	1.00				
Teaching Effectiveness (TE)	**3.89**	**0.68**	0.59**	0.51**	0.48**	0.52**	0.64**	0.62**	0.71**	0.58**	1.00			
Research Productivity (RP)	**3.54**	**0.85**	0.48**	0.46**	0.53**	0.62**	0.58**	0.67**	0.61**	0.49**	0.56**	1.00		
Administrative Efficiency (AE)	**3.36**	**0.93**	0.42**	0.39**	0.47**	0.44**	0.51**	0.47**	0.63**	0.57**	0.53**	0.49**	1.00	
Student Satisfaction (SS)	**3.72**	**0.74**	0.46**	0.52**	0.49**	0.51**	0.59**	0.62**	0.64**	0.53**	0.65**	0.58**	0.61**	1.00

*Note: ** Correlation is significant at the 0.01 level (2-tailed)*

1) ***Digital transformation dimensions*** showed mean ratings between 3.29 and 3.76 on the 5-point scale. Technology Infrastructure received the lowest mean rating (M = 3.29, SD = 0.92), suggesting potential areas for improvement in technological resources and systems. Digital Strategy received the highest rating (M = 3.76, SD = 0.78), indicating relatively stronger perceptions of institutional vision and planning for digital initiatives. Transformational Leadership (M = 3.42, SD = 0.95) and HR Digital Competency (M = 3.38, SD = 0.87) received moderate ratings, reflecting mixed perceptions about leadership support and digital capabilities.

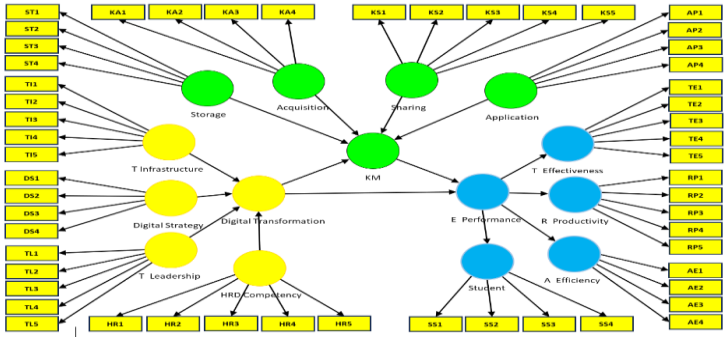
2) ***Knowledge management dimensions*** demonstrated mean ratings between 3.45 and 3.82. Knowledge Sharing received the highest rating (M = 3.82, SD = 0.71), suggesting relatively effective communication and collaboration practices among faculty. Knowledge Storage received the lowest rating (M = 3.45, SD = 0.88), indicating potential challenges in documenting and preserving institutional knowledge. Knowledge Acquisition (M = 3.71, SD = 0.76) and Knowledge Application (M = 3.65, SD = 0.79) received moderately positive ratings, reflecting reasonable perceptions of processes for accessing and utilizing knowledge.

3) ***Educational performance dimensions***showed mean ratings between 3.36 and 3.89. Teaching Effectiveness received the highest rating (M = 3.89, SD = 0.68), suggesting relatively positive perceptions of educational quality and pedagogical practices. Administrative Efficiency received the lowest rating (M = 3.36, SD = 0.93), indicating potential areas for improvement in operational processes. Research Productivity (M = 3.54, SD = 0.85) and Student Satisfaction (M = 3.72, SD = 0.74) received moderately positiveratings, reflecting reasonable perceptions.
4) ***Correlation analysis*** revealed significant positive relationships between most study variables. DT dimensions showed strong positive correlations with KM processes (r ranging from 0.41 to 0.68, $p < 0.01$) and educational performance measures (r ranging from 0.39 to 0.62, $p < 0.01$). Similarly, KM dimensions demonstrated strong positive correlations with educational performance indicators (r ranging from 0.44 to 0.71, $p < 0.01$). These correlations provide preliminary support for the hypothesized relationships in the research model, although causality cannot be inferred from these bivariate associations alone.

4.2.Measurement Model Assessment

Before testing the structural relationships, the measurement model was evaluated to ensure reliability and validity of the research constructs.

Figure 1: Measurement Model (SmartPLS – Outcome)



A. Indicator Reliability

Indicator reliability was assessed through examination of outer loadings for each measurement item, all indicators demonstrated satisfactory loadings on their respective constructs, with values exceeding the recommended threshold of 0.70 in most cases. A few indicators showed loadings between 0.65 and 0.70, which were retained after confirming that their removal did not substantially improve construct reliability or validity. The statistical significance of all loadings was confirmed by bootstrapping (5,000), with all p-values below 0.001.

B. Internal Consistency Reliability

Internal consistency reliability was evaluated using both Cronbach's alpha and composite reliability.

Table 3: Reliability and Validity Measures

Construct	Cronbach's Alpha	Composite Reliability	Average Variance

			Extracted (AVE)
Technology Infrastructure (TI)	0.87	0.91	0.67
Digital Strategy (DS)	0.89	0.92	0.76
Transformational Leadership (TL)	0.88	0.91	0.69
HR Digital Competency (HRDC)	0.86	0.90	0.69
Knowledge Acquisition (KA)	0.85	0.89	0.68
Knowledge Sharing (KS)	0.89	0.92	0.71
Knowledge Application (KApp)	0.89	0.92	0.75
Knowledge Storage (KSto)	0.84	0.88	0.65
TeachingEffectiveness (TE)	0.91	0.93	0.73
ResearchProductivity (RP)	0.88	0.91	0.68
Administrative Efficiency (AE)	0.87	0.91	0.72
Student Satisfaction (SS)	0.89	0.92	0.74

Cronbach's alpha values ranged from 0.78 to 0.91 across all constructs, exceeding the recommended threshold of 0.70 and indicating satisfactory internal consistency. Composite reliability values ranged from 0.85 to 0.93, also exceeding the recommended threshold of 0.70 and providing additional confirmation of internal consistency. These results suggest that the measurement items reliably capture their intended constructs, with limited random error influence.

C. Convergent Validity

Convergent validity was assessed using Average Variance Extracted (AVE), with results also presented in Table 4. AVE values ranged from 0.61 to 0.78 across all constructs, exceeding the recommended threshold of 0.50. These results indicate that each construct explains more than 50% of the variance in its associated indicators, confirming satisfactory convergent validity and suggesting that the measurement items effectively represent their intended constructs.

D. Discriminant Validity

Discriminant validity was evaluated using three approaches: the Fornell-Larcker criterion, cross-loadings examination, and the heterotrait-monotrait (HTMT) ratio.

Table 4: Fornell-Larcker Criterion Results

Construct	TI	DS	TL	HRDC	KA	KS	KApp	KSto	TE	RP	AE	SS
TI	**0.82**											
DS	0.58	**0.87**										
TL	0.52	0.61	**0.83**									
HRDC	0.4	0.5	0.5	**0.83**								

	7	4	9									
KA	0.43	0.62	0.51	0.46	**0.82**							
KS	0.41	0.58	0.68	0.52	0.57	**0.84**						
KApp	0.47	0.53	0.49	0.58	0.55	0.64	**0.87**					
KSto	0.52	0.48	0.45	0.59	0.49	0.52	0.61	**0.81**				
TE	0.59	0.51	0.48	0.52	0.64	0.62	0.71	0.58	**0.85**			
RP	0.48	0.46	0.53	0.62	0.58	0.67	0.61	0.49	0.56	**0.82**		
AE	0.42	0.39	0.47	0.44	0.51	0.47	0.63	0.57	0.53	0.49	**0.85**	
SS	0.46	0.52	0.49	0.51	0.59	0.62	0.64	0.53	0.65	0.58	0.61	**0.86**

The Fornell-Larcker analysis confirmed that the square root of each construct's AVE (diagonal values) exceeded its correlation with any other construct (off-diagonal values), supporting discriminant validity. Examination of cross-loadings further confirmed that each indicator loaded more strongly on its assigned construct than on any other construct, providing additional evidence of discriminant validity. Finally, all HTMT ratios were below the conservative threshold of 0.85, with the highest value at 0.83, further supporting discriminant validity between constructs.

These comprehensive assessments collectively confirm the reliability and validity of the measurement model, providing confidence in the constructs used to test the structural relationships and hypotheses.

4.3. Structural Model Assessment

After confirming the adequacy of the measurement model, the structural model was evaluated to test the hypothesized relationships. This assessment included *collinearity, path coefficients, significance, coefficient of determination (R^2), effect sizes (f^2), and predictive relevance (Q^2).*

A. Collinearity Assessment

Before examining structural relationships, potential collinearity issues were assessed through Variance Inflation Factor (VIF) values. All VIF were below the recommended threshold of 5.0, with highest value at 3.78, indicating no problematic collinearity among predictor constructs.

B. Path Coefficients and Significance

Structural model relationships were assessed through path coefficients (β) and their statistical significance (p-values). The SmartPLS results, along with confidence intervals from bootstrapping procedures (5,000 resamples) revealed significant positive relationships between most of the hypothesized paths. Direct relationships

between DT dimensions and educational performance indicators were generally positive and significant, with standardized path coefficients ranging from 0.21 to 0.39 ($p < 0.05$). Technology Infrastructure showed the strongest direct effect on Teaching Effectiveness ($\beta = 0.39$, $p < 0.001$), while Human Resource Digital Competency demonstrated the strongest influence on Research Productivity ($\beta = 0.36$, $p < 0.001$).

Relationships between DT dimensions and KM processes were also positive and significant, with standardized path coefficients ranging from 0.26 to 0.44 ($p < 0.01$). Digital Strategy demonstrated the strongest effect on Knowledge Acquisition ($\beta = 0.44$, $p < 0.001$), while Transformational Leadership showed the strongest influence on Knowledge Sharing ($\beta = 0.41$, $p < 0.001$).

Similarly, relationships between KM processes and educational performance measures were positive and significant, with standardized path coefficients ranging from 0.29 to 0.48 ($p < 0.01$). Knowledge Application demonstrated the strongest effect on Teaching Effectiveness ($\beta = 0.48$, $p < 0.001$), while Knowledge Sharing showed the strongest influence on Research Productivity ($\beta = 0.45$, $p < 0.001$). These results provide support for Hypotheses 1, 2, and 3, confirming that DT positively influences both educational performance and KM, and that KM positively influences educational performance at the University.

C. Coefficient of Determination (R^2)

The explanatory power of the structural model was assessed through the determination coefficient (R^2) for endogenous constructs. Table 5 presents these results, along with adjusted R^2 values.

Table 5: Coefficient of Determination (R^2)

EndogenousConstruct	R^2	Adjusted R^2	Interpretation
Knowledge Acquisition (KA)	0.43	0.41	Moderate
Knowledge Sharing (KS)	0.54	0.52	Moderate
Knowledge Application (KApp)	0.48	0.46	Moderate
Knowledge Storage (KSto)	0.39	0.37	Moderate
Teaching Effectiveness (TE)	0.62	0.59	Substantial
Research Productivity (RP)	0.58	0.55	Moderate
Administrative Efficiency (AE)	0.47	0.44	Moderate
Student Satisfaction (SS)	0.53	0.50	Moderate

The model explained substantial variance in educational performance dimensions, with R^2 values ranging from 0.47 to 0.62. Teaching Effectiveness showed the highest explained variance (R^2 = 0.62), followed by Research Productivity (R^2 = 0.58), Student Satisfaction (R^2 = 0.53), and Administrative Efficiency (R^2 = 0.47). These values indicate that the combined influence of DT dimensions and KM processes explains between 47% and 62% of the variance in educational performance measures, representing moderate to substantial explanatory power according to established guidelines. The model also explained significant variance in KM processes, with R^2 values ranging from 0.39 to 0.54. Knowledge Sharing demonstrated the highest explained variance (R^2 = 0.54), followed by Knowledge Application (R^2 = 0.48), Knowledge Acquisition (R^2 = 0.43), and Knowledge Storage (R^2 = 0.39). These values indicate that DT dimensions explain between 39% and 54% of the variance in KM processes, representing moderate explanatory power.

D. Effect Sizes (f^2)

The practical significance of predictor variables was assessed through effect size (f^2) calculations. Effect sizes for DT dimensions on KM processes ranged from 0.09 to 0.28, representing small to medium effects. Digital Strategy demonstrated the largest effect on Knowledge Acquisition (f^2 = 0.28), while Technology Infrastructure showed the smallest effect on Knowledge Storage (f^2 = 0.09).

Effect sizes for DT dimensions on educational performance indicators ranged from 0.05 to 0.21, representing small to medium effects. Technology Infrastructure showed the largest direct effect on Teaching Effectiveness (f^2 = 0.21), while Digital Strategy demonstrated the smallest direct effect on Administrative Efficiency (f^2 = 0.05).

Effect sizes for KM processes on educational performance measures ranged from 0.11 to 0.32, representing small to medium effects. Knowledge Application demonstrated the largest effect on Teaching Effectiveness (f^2 = 0.32), while Knowledge Storage showed the smallest effect on Research Productivity (f^2 = 0.11).

These effect sizes provide additional context for interpreting the practical significance of the relationships identified in the structural model, suggesting that while all relationships are statistically significant, some demonstrate stronger practical importance than others.

E. Predictive Relevance (Q^2)

The model's predictive relevance was assessed through the Stone-Geisser Q^2 value using blindfolding procedures. Table 6 presents these results.

Table 6: Predictive Relevance (Q^2)

Endogenous Construct	Q^2 Value	Interpretation
Knowledge Acquisition (KA)	0.31	Medium
Knowledge Sharing (KS)	0.41	Large
Knowledge Application (KApp)	0.37	Medium
Knowledge Storage (KSto)	0.28	Medium
Teaching Effectiveness (TE)	0.44	Large
Research Productivity (RP)	0.39	Medium
Administrative Efficiency (AE)	0.32	Medium
Student Satisfaction (SS)	0.37	Medium

All Q^2 values were substantially above zero, ranging from 0.28 to 0.41 for KM processes and from 0.32 to 0.44 for educational performance measures. These values indicate medium to large predictive relevance according to established guidelines, suggesting that the model has good predictive capability for both knowledge management and educational performance constructs.

4.4. Mediation Analysis

To test Hypothesis 4 regarding the mediating role of knowledge management, a comprehensive mediation analysis was conducted using bootstrapping procedures (5,000 resamples). This analysis examined direct, indirect, and total effects, as well as the significance of specific indirect effects. The analysis revealed significant indirect effects of DT dimensions on educational performance measures through KM processes. The standardized indirect effects ranged from 0.12 to 0.25 ($p < 0.01$), with confidence intervals excluding zero in all cases. These results confirm the mediating role of KM in the relationship between DT and educational performance.

Examination of specific indirect effects revealed varied mediation patterns across different combinations of DT dimensions, KM processes, and educational performance indicators. The strongest mediating relationship was observed for the pathway from Digital Strategy through Knowledge Acquisition to Teaching Effectiveness (indirect effect = 0.25, $p < 0.001$), while the weakest significant mediation was observed for the pathway from Human Resource Digital Competency through Knowledge Storage to Administrative Efficiency (indirect effect = 0.12, $p < 0.01$).

Comparison of direct and indirect effects revealed partial mediation in most cases, as both direct and indirect effects remained significant. However, in some specific pathways, the direct effect became non-significant when accounting for the indirect effect, suggesting full mediation. For example, the relationship between Digital Strategy and Administrative Efficiency was fully mediated by Knowledge Application, as the direct effect became non-significant ($p > 0.05$) when accounting for the indirect effect.

These comprehensive mediation results provide strong support for Hypothesis 4, confirming that KM significantly mediates the relationship between DT and educational performance at the University of Laghouat. This mediation indicates that DT enhances performance partially through its positive influence on KM processes.

4.5. Summary of Hypotheses Testing

Based on the comprehensive analysis, Table 7 summarizes the results of hypothesis testing.

Table 7: Summary of Hypotheses Testing

Hypothesis	Description	Result	Conclusion
H1	Digital transformation positively influences educational performance at the University of Laghouat.	Path coefficients between DT dimensions and educational performance measures were positive and significant ($\beta = 0.21$ to 0.39, $p < 0.05$)	***Supported***
H2	Digital transformation positively influences KM processes within the institution.	Path coefficients between DT dimensions and KM processes were positive and significant ($\beta = 0.26$ to 0.44, $p < 0.01$)	***Supported***
H3	KM practices positively influence educational performance metrics.	Path coefficients between KM processes and educational performance measures were positive and significant ($\beta = 0.29$ to 0.48, $p < 0.01$)	***Supported***
H4	KM mediates the relationship between DT and EP.	Indirect effects were significant (0.12 to 0.25, $p < 0.01$) with confidence intervals excluding zero	***Supported***

All four hypotheses received empirical support from the data analysis. Digital Transformation demonstrated significant positive effects on Educational Performance, confirming **H1**. Similarly, DT showed significant positive influence on KM processes, confirming **H2**. KM processes exhibited significant positive effects on Educational Performance indicators, confirming **H3**. Finally, KM significantly mediated the relationship between DT and Educational Performance, confirming **H4**. These findings collectively indicate that DT enhances Educational Performance both directly and indirectly through KM processes at the University of Laghouat. The results suggest that effective KM serves as an important mechanism through which digital capabilities translate into improved educational outcomes.

5. DISCUSSION

The empirical findings from this study provide substantial insights into the complex relationships between DT, KM, and educational performance in higher education settings. The confirmation of direct positive effects between DT and educational performance aligns with previous research highlighting technology's potential to enhance teaching effectiveness, research productivity, administrative efficiency, and student satisfaction (Seyam et al. 2021). These direct relationships suggest that digital

capabilities themselves can directly improve educational outcomes by enhancing accessibility, efficiency, and quality of educational processes.

However, the significant mediating role of knowledge management offers a more nuanced understanding of how DT translates into improved performance. This mediation effect suggests that digital technologies enhance educational outcomes largely by facilitating more effective knowledge acquisition, sharing, application, and storage within the institution (Kordab et al. 2020). This finding extends existing theoretical frameworks by highlighting KM as a critical intermediate mechanism between technological capabilities and performance outcomes, particularly in knowledge-intensive organizations like universities.

The varying strengths of relationships across different dimensions of DT, KM, and educational performance provide additional theoretical insights. Technology infrastructure showed particularly strong effects on teaching effectiveness, potentially by providing the foundational tools necessary for effective educational delivery. Digital strategy demonstrated stronger influence on knowledge acquisition, suggesting that strategic vision guides institutional focus on expanding knowledge resources. Transformational leadership exhibited stronger effects on knowledge sharing, highlighting the critical role of leadership in creating collaborative cultures. Human resource digital competency showed stronger influence on research productivity, potentially by enabling better research methodologies and collaborative capabilities.

These findings contribute to management theory by demonstrating how resource-based views, knowledge-based perspectives, and dynamic capability approaches can be integrated to understand performance enhancement in higher education contexts. Digital capabilities represent valuable resources that, when effectively leveraged through KM processes, create dynamic capabilities that enhance institutional performance. This integrated theoretical perspective offers a more comprehensive framework for understanding digital transformation in knowledge-intensive organizations.

6. CONCLUSION:

6.1. Summary of Key Findings

Using PLS-SEM on data from the University of Laghouat, we find:

First, Digital transformation (DT) → Educational performance: DT has a significant positive effect on teaching effectiveness, research productivity, administrative efficiency, and student satisfaction. All four DT dimensions-technology infrastructure, digital strategy, transformational leadership, and human resource digital competency-contribute, underscoring DT's multidimensionality.

Second, DT → Knowledge management (KM): DT significantly strengthens KM processes (acquisition, sharing, application, storage), indicating that technological capabilities expand institutional knowledge flows.

Third, KM → Educational performance: KM exerts a direct, positive influence on performance indicators, highlighting its role in converting knowledge resources into outcomes in knowledge-intensive settings.

Finally, and perhaps most importantly, the Mediating mechanism of KM significantly mediates the DT and educational performance relationship; thus, DT improves educational performance largely through its enhancement of KM processes, clarifying how technological capabilities translate into superior outcomes.

6.2. Theoretical Contributions

This study makes several theoretical contributions to the understanding of digital transformation in higher education contexts:

1) ***Integration of Theoretical Perspectives***: The research integrates resource-based views, knowledge-based perspectives, and dynamic capability approaches to develop a more comprehensive theoretical framework for understanding DT in knowledge-intensive organizations. This integration provides a richer conceptual foundation for examining how technological capabilities enhance performance through intermediate organizational processes.
2) ***Identification of Mediating Mechanisms***: By empirically confirming the mediating role of KM, this study advances theoretical understanding of the causal pathways through which DT influences organizational performance. This mediation perspective moves beyond direct effects models to reveal more complex causal chains in technology-performance relationships.
3) ***Multidimensional Construct Validation***: The research validates multidimensional conceptualizations of DT, KM, and educational performance in higher education contexts. The reliable and valid measurement of these complex constructs provides a foundation for future research exploring similar relationships in varied institutional settings.
4) ***Contextual Adaptation of Theory***: By examining these relationships within an Algerian university context, the study extends existing theoretical frameworks to account for contextual factors that may influence DT processes in developing educational systems. This contextual adaptation enhances the generalizability of theories across diverse institutions.

These theoretical contributions collectively advance understanding of the complex interrelationships between technological capabilities, organizational processes, and performance outcomes in higher education contexts.

6.3. Practical Implications

This research provides valuable insights for university administrators and policymakers navigating digital transformation challenges:

1) ***Strategic Investment Guidance***: The findings offer evidence-based guidance for prioritizing investments across different dimensions of digital transformation, highlighting the importance of balanced attention to technological, strategic, leadership, and human resource factors.
2) ***Process-Focused Implementation***: By revealing the mediating role of knowledge management, the study encourages more process-focused implementation approaches that explicitly address knowledge flows as critical intermediate mechanisms in digital transformation initiatives.
3) ***Performance Measurement Frameworks***: The multidimensional conceptualization of educational performance provides a foundation for more comprehensive measurement frameworks that capture the diverse impacts of digital transformation on university outcomes.
4) ***Contextual Adaptation Strategies***: The specific findings from the University of Laghouat context offer insights for similar institutions in developing educational environments, highlighting potential focus areas for DT initiatives in resource-constrained settings.

These practical implications provide actionable guidance for educational leaders seeking to enhance institutional performance through strategic digital initiatives, particularly in similar contexts.

6.4. Limitations and Future Research Directions

While this study provides valuable insights, several limitations should be acknowledged:

1) Cross-Sectional Design: The cross-sectional nature of the research limits causal inferences regarding the relationships between digital transformation, knowledge management, and educational performance. Future research could adopt longitudinal designs to examine how these relationships evolve over time and establish stronger causal evidence.

2) Single Institution Focus: The focus on a single university limits generalizability of findings to other institutional contexts. Future studies could adopt multi-institutional approaches to examine how contextual factors influence the observed relationships across different university settings.

3) Perceptual Measures: The reliance on self-reported perceptual measures introduces potential bias and subjectivity. Future research could incorporate objective performance indicators and multi-source data collection approaches to strengthen measurement validity.

4) Limited Stakeholder Perspectives: The focus on university perceptions excludes other important stakeholders such as students, administrators, and external partners. Future studies could incorporate these diverse perspectives to develop more understanding of DT impacts.

Building on these limitations, emerge several promising directions for **Future Research**:

- ***Longitudinal Studies***: Tracking DT initiatives over time to examine developmental trajectories, implementation challenges, and evolving performance impacts.
- ***Comparative Analysis***: Investigating how institutional characteristics (size, resource levels, cultural factors) moderate relationships between DT, KM, and performance across universities.
- ***Mixed Methods Approaches***: Combining quantitative analysis with qualitative insights to develop deeper understanding of the contextual nuances and experiential dimensions of DT in higher education.
- ***Extended Theoretical Frameworks***: Incorporating additional mediating and moderating variables (such as organizational culture, institutional governance, or environmental factors) to develop more comprehensive models of DT effectiveness.

To conclude, this study provides empirical evidence for the positive impact of DT on Educational Performance at the University of Laghouat, with KM serving as a critical mediating mechanism. These findings offer theoretical insights regarding the complex relationships between technological capabilities, knowledge processes, and performance outcomes in higher education, while providing practical guidance for university administrators navigating DT challenges. By understanding these relationships more clearly, educational institutions can develop more effective strategies for leveraging digital technologies to enhance performance in a digital academic landscape.

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