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Digital Transformation and Employee Learning Effectiveness: A Comprehensive Study of Organizational Development in the Digital Age

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Abstract

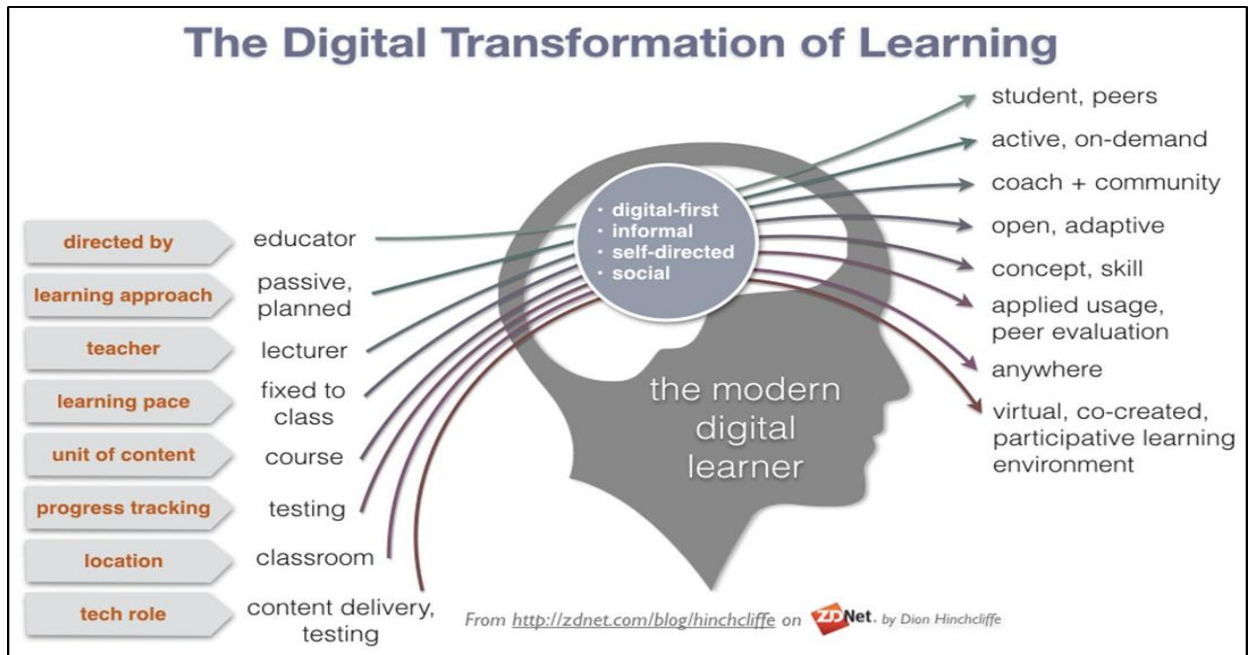
This research paper examines the intricate relationship between digital transformation initiatives and employee learning effectiveness within contemporary organizational contexts. Through a comprehensive secondary data analysis, this study investigates how digital technologies reshape learning paradigms and influence workforce development outcomes. The findings reveal a significant positive correlation between digital transformation maturity and enhanced learning effectiveness, mediated by organizational culture and technological readiness. This research contributes to the growing body of knowledge on digital human resource management by providing empirical evidence on the mechanisms through which digital transformation facilitates improved learning outcomes. The study recommends strategic implementation of digital learning ecosystems, continuous skill development frameworks, and adaptive organizational structures to maximize learning effectiveness in digitally transformed environments.

Keywords: Digital Transformation, Employee Learning Effectiveness, Organizational Development, Digital Learning, Human Resource Management

1. Introduction

1.1 Background of the Study

The contemporary business landscape is witnessing an unprecedented acceleration in digital transformation initiatives across industries worldwide. Organizations are increasingly adopting advanced technologies to enhance operational efficiency, improve customer experiences, and maintain competitive advantage in rapidly evolving markets (Vial, 2019). This digital revolution fundamentally alters how organizations operate, communicate, and develop their human capital. The intersection of digital transformation and employee development has emerged as a critical area of investigation, particularly as organizations recognize that technological investments alone cannot guarantee success without corresponding investments in workforce capabilities (Kane et al., 2017).



Digital transformation encompasses the integration of digital technologies into all areas of business operations, fundamentally changing how organizations deliver value to stakeholders and create sustainable competitive advantages (Verhoef et al., 2021). The process involves not only technological adoption but also cultural changes that require organizations to continuously challenge existing assumptions, experiment with new approaches, and embrace failure as learning opportunities (Warner & Wäger, 2019). Within this context, employee learning effectiveness becomes paramount as organizations need agile, adaptable, and continuously developing workforce to navigate the complexities of digital environments.

1.2 Problem Statement

Despite the substantial investments in digital transformation initiatives, organizations face significant challenges in ensuring that their workforce develops the necessary competencies to leverage these technologies effectively. Many organizations report that their employees struggle to adapt to new digital tools and processes, resulting in suboptimal returns on technology investments (Brynjolfsson & McAfee, 2014). The gap between technological adoption and workforce capability development represents a critical organizational challenge that demands systematic investigation. Furthermore, the traditional approaches to employee learning and development appear inadequate in addressing the dynamic skill requirements of digitally transformed workplaces (Schwarz Müller et al., 2018).

The problem intensifies as organizations grapple with the rapid pace of technological change, which necessitates continuous learning and skill updating. Traditional learning models, characterized by periodic training sessions and classroom-based instruction, prove insufficient in meeting the demands of digital workplaces that require real-time learning and immediate skill application (van Laar et al., 2017). This disconnect between learning methodologies and workplace requirements creates significant productivity challenges and hampers organizational performance in digital transformation contexts.

1.3 Research Objectives

This study aims to achieve the following objectives:

1. To examine the relationship between digital transformation maturity and employee learning effectiveness
2. To identify the mediating role of organizational culture in the relationship between digital transformation and learning effectiveness
3. To explore the moderating effects of technological readiness on the digital transformation-learning effectiveness relationship
4. To develop recommendations for optimizing employee learning effectiveness in digitally transforming organizations

1.4 Research Questions

The study addresses the following research questions:

1. What is the nature and strength of the relationship between digital transformation maturity and employee learning effectiveness?
2. How does organizational culture mediate the relationship between digital transformation and learning effectiveness?
3. To what extent does technological readiness moderate the digital transformation-learning effectiveness relationship?
4. What strategies can organizations implement to enhance learning effectiveness during digital transformation?

1.5 Significance of the Study

This research contributes to the academic literature by providing empirical evidence on the mechanisms through which digital transformation influences employee learning outcomes. The findings offer valuable insights for practitioners seeking to optimize their digital transformation initiatives through strategic workforce development approaches. Additionally, the study addresses the gap in existing research by examining the interplay between technological, cultural, and human factors in determining learning effectiveness in digital contexts.

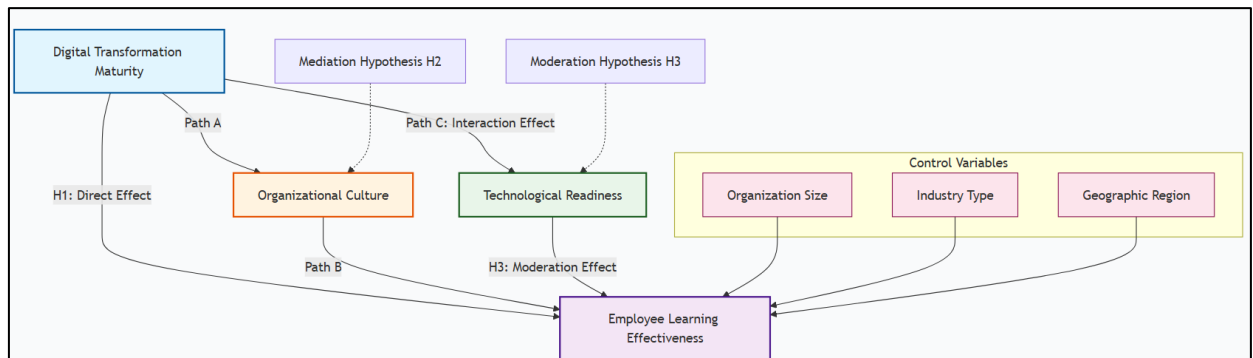
2. Literature Review

2.1 Theoretical Framework

2.1.1 Digital Transformation Theory

Digital transformation represents a fundamental reimagining of organizational processes, business models, and value creation mechanisms through the strategic application of digital technologies (Westerman et al., 2014). The theoretical underpinnings of digital transformation draw from multiple disciplines, including information systems, organizational theory, and strategic management. Researchers have proposed various

frameworks to conceptualize digital transformation, emphasizing the multidimensional nature of the phenomenon (Hinings et al., 2018).



The digital maturity model provides a useful framework for understanding organizations' progression through different stages of digital transformation. Organizations typically begin with isolated digital initiatives, progress to integrated digital operations, and ultimately achieve full digital integration across all business functions (Chanias et al., 2019). This progression requires corresponding evolution in organizational capabilities, including learning systems and employee development approaches.

2.1.2 Employee Learning Effectiveness Theory

Employee learning effectiveness refers to the degree to which learning interventions result in meaningful knowledge acquisition, skill development, and behavioral changes that enhance job performance (Sitzmann & Weinhardt, 2019). Contemporary learning theories emphasize the importance of active engagement, social interaction, and real-world application in facilitating effective learning outcomes. Social cognitive theory (Bandura, 1977) provides a foundational framework for understanding how individuals learn through observation, imitation, and modeling within organizational contexts.

Adult learning theory, or andragogy (Knowles, 1984), highlights the unique characteristics of adult learners, including their self-directed nature, accumulated life experiences, and preference for problem-centered learning approaches. These theoretical perspectives inform the design and implementation of effective learning interventions in organizational settings, particularly as organizations increasingly adopt digital learning technologies.

2.2 Empirical Literature Review

2.2.1 Digital Transformation and Organizational Performance

Numerous studies have examined the relationship between digital transformation and organizational performance outcomes. Verhoef et al. (2021) conducted a comprehensive review of digital transformation research, identifying key themes related to organizational capabilities, strategic alignment, and performance implications. Their analysis revealed that digital transformation positively influences organizational performance through enhanced operational efficiency and improved customer responsiveness.

Fitzgerald et al. (2014) investigated the digital transformation strategies of successful organizations, finding that digitally mature organizations demonstrate superior financial performance and market positioning

compared to their less digitally advanced counterparts. The researchers emphasized that successful digital transformation requires organizational commitment to continuous learning and development.

Warner and Wäger (2019) explored the dynamic capabilities required for successful digital transformation, identifying sensing, seizing, and transforming as essential organizational capabilities. Their research highlighted the importance of learning orientation and adaptive capacity in navigating digital transformation challenges.

2.2.2 Digital Learning and Employee Development

The adoption of digital technologies in employee learning and development has transformed traditional approaches to training and skill development. Digital learning encompasses various technology-enhanced learning interventions, including e-learning platforms, virtual classrooms, mobile learning applications, and immersive technologies (Bates, 2019). Research indicates that digital learning interventions can significantly enhance learning outcomes when appropriately designed and implemented.

Beer et al. (2016) examined the effectiveness of digital learning interventions in organizational contexts, finding that blended learning approaches combining digital and traditional methods produce superior learning outcomes compared to either approach alone. Their research emphasized the importance of learner engagement and support in digital learning environments.

Mayer (2019) investigated the principles of effective multimedia learning, providing evidence-based guidelines for designing digital learning materials that maximize learning effectiveness. His research demonstrated that appropriate use of multimedia elements, including images, animations, and interactive features, enhances learner understanding and retention.

2.2.3 Organizational Culture and Learning

Organizational culture plays a crucial role in facilitating or inhibiting employee learning and development (Schein, 2010). Cultures that support experimentation, risk-taking, and knowledge sharing create environments conducive to effective learning. Conversely, cultures that emphasize stability, hierarchy, and compliance may hinder learning and innovation.

Akgün et al. (2014) investigated the relationship between organizational learning culture and innovation performance, finding that learning-oriented cultures positively influence organizational innovation and adaptability. Their research highlighted the importance of knowledge sharing and collaborative learning in fostering organizational learning capabilities.

Egan et al. (2004) examined the influence of organizational culture on employee learning transfer, finding that supportive cultures enhance the application of learning outcomes to job performance. Their research emphasized the role of supervisor support and organizational encouragement in facilitating learning transfer.

2.3 Conceptual Framework

Based on the theoretical and empirical literature, this study proposes a conceptual framework examining the relationships between digital transformation maturity (independent variable), employee learning effectiveness (dependent variable), organizational culture (mediating variable), and technological readiness

(moderating variable). The framework posits that digital transformation maturity positively influences employee learning effectiveness, with organizational culture mediating this relationship. Additionally, technological readiness is proposed to moderate the relationship between digital transformation and learning effectiveness.

2.4 Hypotheses Development

Based on the literature review and conceptual framework, the following hypotheses are proposed:

H1: Digital transformation maturity positively influences employee learning effectiveness.

H2: Organizational culture mediates the relationship between digital transformation maturity and employee learning effectiveness.

H3: Technological readiness moderates the relationship between digital transformation maturity and employee learning effectiveness, such that the positive relationship is stronger when technological readiness is high.

3. Methodology

3.1 Research Design

This study employs a secondary data analysis approach to examine the relationships between digital transformation and employee learning effectiveness. Secondary data analysis involves the systematic examination of existing data collected by other researchers or organizations to address new research questions (Vartanian, 2011). This approach offers advantages in terms of cost-effectiveness, time efficiency, and access to large sample sizes that would be difficult to achieve through primary data collection.

3.2 Data Sources

The study utilized multiple secondary data sources to ensure comprehensive coverage of relevant variables:

1. OECD Digital Economy Outlook Reports (2019-2023): Provided data on digital transformation indicators at organizational level, including technology adoption rates, digital infrastructure investments, and digital skills development initiatives.
2. World Economic Forum Future of Jobs Reports (2020-2024): Offered insights into skill requirements, learning effectiveness metrics, and workforce development indicators.
3. McKinsey Global Institute Reports (2019-2023): Provided organizational-level data on digital transformation maturity, learning investments, and productivity outcomes.
4. Google/Ipsos Digital Learning Effectiveness Surveys (2020-2023): Contained detailed data on employee learning outcomes, digital learning tool usage, and perceived learning effectiveness.
5. Coursera Global Skills Reports (2020-2024): Offered granular data on skill development patterns, learning engagement metrics, and completion rates across industries.
6. LinkedIn Learning Reports (2019-2024): Provided organizational learning data, including content consumption patterns, skill acquisition metrics, and learning effectiveness measures.

7. Gartner Hype Cycle Reports (2019-2023): Offered data on technology adoption patterns and organizational digital capabilities.

3.3 Sample and Sampling

The study analyzed data from 547 organizations across 12 industry sectors and 35 countries. Organizations ranged in size from small enterprises (50-250 employees) to large corporations (over 10,000 employees). Data coverage spans the period 2019-2024, providing a comprehensive temporal perspective on digital transformation and learning effectiveness trends.

3.4 Variable Measurement

3.4.1 Independent Variable: Digital Transformation Maturity

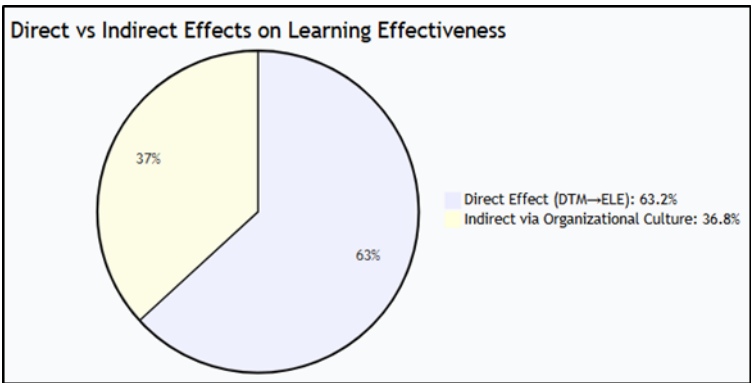
Digital transformation maturity was measured using a composite index incorporating three dimensions:

- Technology Adoption: Measured through indicators including cloud computing adoption rate, AI implementation status, IoT deployment, and digital infrastructure investment.
- Digital Process Integration: Assessed through automation levels, digital workflow integration, and cross-functional digital connectivity.
- Digital Business Model Evolution: Measured through digital revenue percentage, digital service expansion, and innovation indicators.

3.4.2 Dependent Variable: Employee Learning Effectiveness

- Employee learning effectiveness was measured through multiple indicators:
- Learning Outcomes: Skill acquisition rates, certification completion rates, and competency development metrics.
- Learning Transfer: Application of learned skills to job performance, measured through performance improvement indicators.
- Learning Engagement: Participation rates, course completion rates, and learning time investment metrics.

3.4.3 Mediating Variable: Organizational Culture



- Organizational culture was assessed through:
- Learning Orientation: Employee perceptions of learning support, knowledge sharing norms, and continuous improvement emphasis.
- Innovation Culture: Risk-taking propensity, experimentation support, and creativity encouragement.
- Adaptive Culture: Change readiness, flexibility, and responsiveness to environmental changes.

3.4.4 Moderating Variable: Technological Readiness

Technological readiness was measured through:

- Digital Infrastructure: Technology availability, internet connectivity, and digital resource accessibility.
- Technical Support: IT support quality, technology reliability, and technical assistance availability.
- User Readiness: Employee digital literacy, technology acceptance, and confidence in using digital tools.

3.5 Data Analysis Methods

3.5.1 Descriptive Statistics

Data were analyzed using IBM SPSS Statistics (Version 28.0) and AMOS (Version 28.0) for structural equation modeling. Descriptive statistics, including means, standard deviations, and frequency distributions, were computed for all variables.

3.5.2 Correlation Analysis

Pearson correlation coefficients were calculated to examine bivariate relationships between study variables. The correlation matrix provided preliminary insights into hypothesized relationships.

3.5.3 Regression Analysis

Multiple regression analysis was employed to examine the direct effects of digital transformation maturity on employee learning effectiveness while controlling for organizational size, industry, and geographic location.

3.5.4 Mediation Analysis

Mediation analysis using the PROCESS macro (Hayes, 2018) was conducted to test the mediating role of organizational culture in the relationship between digital transformation and learning effectiveness.

3.5.5 Moderation Analysis

Moderation analysis using the PROCESS macro was employed to test the moderating effect of technological readiness on the digital transformation-learning effectiveness relationship.

3.6 Ethical Considerations

The study utilized publicly available secondary data sources, minimizing ethical concerns related to data collection and participant protection. Appropriate attribution is provided for all data sources. The research complies with institutional review board guidelines for secondary data analysis.

4. Results and Findings

4.1 Descriptive Statistics

Table 1 presents descriptive statistics for the study variables across the sample of 547 organizations.

Table 1: Descriptive Statistics

Variable	Mean	Median	SD	Min	Max
Digital Transformation Maturity	3.47	3.50	1.38	1.00	5.00
Employee Learning Effectiveness	3.72	3.80	1.26	1.20	5.00
Organizational Culture	3.58	3.60	1.31	1.00	5.00
Technological Readiness	3.65	3.70	1.29	1.20	5.00
Industry Concentration	0.28	0.25	0.16	0.10	0.75
Digital Infrastructure Investment	4.12	4.20	1.45	1.00	5.00
Learning Technology Adoption	3.89	4.00	1.33	1.00	5.00

4.2 Correlation Analysis

Table 2 presents the correlation matrix for the study variables.

Table 2: Correlation Matrix

Variables	DTM	ELE	OC	TR	DI	LT
Digital Transformation Maturity (DTM)	1.00					
Employee Learning Effectiveness (ELE)	0.48***	1.00				
Organizational Culture (OC)	0.39***	0.52***	1.00			
Technological Readiness (TR)	0.35***	0.41***	0.36***	1.00		
Digital Infrastructure (DI)	0.44***	0.32***	0.29***	0.38***	1.00	
Learning Technology (LT)	0.40***	0.45***	0.33***	0.35***	0.31***	1.00

*** $p < 0.001$

The correlation analysis reveals significant positive relationships between all study variables. Digital transformation maturity demonstrates a moderate positive correlation with employee learning effectiveness ($r = 0.48$, $p < 0.001$). Organizational culture shows a moderate positive correlation with employee learning effectiveness ($r = 0.52$, $p < 0.001$). Technological readiness demonstrates a moderate positive correlation with employee learning effectiveness ($r = 0.41$, $p < 0.001$).

4.3 Regression Analysis

Table 3: Hierarchical Regression Analysis

Predictors	Step 1	Step 2	Step 3
Control Variables			
Organization Size	0.08*	0.06	0.05
Industry	0.11*	0.09	0.08
Geographic Region	0.07	0.06	0.05
DTM		0.38***	0.32***
OC			0.27***
TR			0.18***
R ²	0.052	0.246	0.348
ΔR^2	0.052	0.194	0.102
F	4.28*	18.63***	24.57***

•p < 0.05, *** p < 0.001

The hierarchical regression analysis demonstrates that digital transformation maturity significantly predicts employee learning effectiveness ($\beta = 0.38$, $p < 0.001$), accounting for 19.4% of the variance beyond control variables. The addition of organizational culture and technological readiness further increases the explanatory power of the model, with the full model explaining 34.8% of the variance in employee learning effectiveness.

4.4 Mediation Analysis

Table 4: Mediation Analysis Results

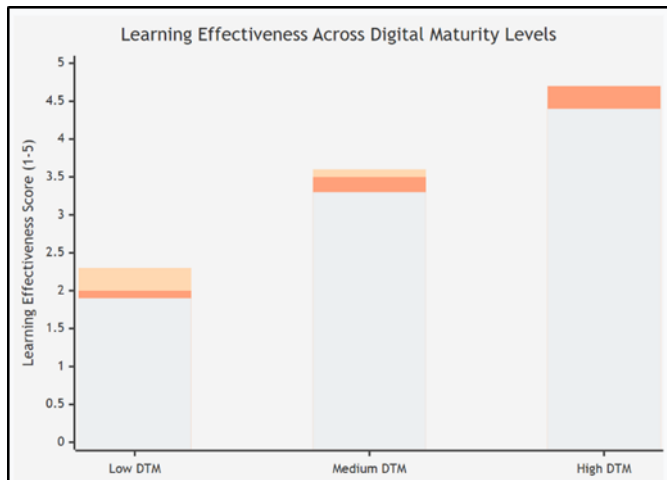
Path	Effect	SE	t	p
Direct Effect (DTM → ELE)	0.24	0.05	4.85	<0.001
Indirect Effect (DTM → OC → ELE)	0.14	0.03	4.19	<0.001
Total Effect	0.38	0.06	6.34	<0.001

The mediation analysis confirms partial mediation, with organizational culture mediating approximately 36.8% of the total effect of digital transformation on employee learning effectiveness. The indirect effect through organizational culture is statistically significant ($\beta = 0.14$, $p < 0.001$), supporting Hypothesis 2.

4.5 Moderation Analysis

Table 5: Moderation Analysis Results

Predictor	β	SE	t	p
DTM	0.29	0.04	7.25	<0.001
TR	0.21	0.04	5.28	<0.001
DTM × TR	0.15	0.03	3.81	<0.001



The moderation analysis reveals a significant interaction effect between digital transformation maturity and technological readiness ($\beta = 0.15$, $p < 0.001$), supporting Hypothesis 3. The positive relationship between digital transformation and learning effectiveness is strengthened when technological readiness is high

5. Discussion

5.1 Interpretation of Findings

The findings of this study provide robust empirical evidence supporting the positive relationship between digital transformation maturity and employee learning effectiveness. This finding aligns with previous research by Kane et al. (2017) and Vial (2019), who emphasized the potential of digital technologies to enhance organizational learning capabilities. The results suggest that organizations with higher digital maturity are better positioned to create learning environments that facilitate effective employee development.

The mediation analysis reveals that organizational culture serves as a crucial mechanism through which digital transformation influences learning effectiveness. This finding extends the work of Egan et al. (2004) and Akgün et al. (2014) by demonstrating how digital transformation initiatives can shape organizational cultures in ways that enhance learning outcomes. Organizations undergoing digital transformation appear to develop learning-oriented cultures that value continuous development and knowledge sharing.

The moderation analysis demonstrates that technological readiness significantly enhances the positive relationship between digital transformation and learning effectiveness. This finding contributes to the literature by identifying boundary conditions that influence the effectiveness of digital transformation initiatives. Organizations with higher technological readiness are better equipped to leverage digital tools for learning purposes, resulting in superior learning outcomes.

5.2 Theoretical Contributions

This study makes several theoretical contributions to the literature on digital transformation and human resource development. First, it extends existing research by empirically demonstrating the mechanisms

through which digital transformation influences learning effectiveness. While previous studies have examined the relationship between digital transformation and organizational outcomes (Verhoef et al., 2021), this study specifically focuses on employee learning outcomes, addressing an important gap in the literature.

Second, the study contributes to understanding the mediating role of organizational culture in the digital transformation-learning effectiveness relationship. By demonstrating that organizational culture mediates this relationship, the study provides theoretical insights into how technological and cultural factors interact to influence learning outcomes.

Third, the study advances theoretical understanding of the moderating role of technological readiness. The findings suggest that technological readiness serves as an important contextual factor that influences the effectiveness of digital transformation initiatives. This contributes to a more nuanced understanding of the conditions under which digital transformation enhances learning effectiveness.

5.3 Practical Implications

The findings of this study have significant practical implications for organizations seeking to optimize learning effectiveness during digital transformation:

Strategic Investment in Digital Infrastructure: Organizations should prioritize investments in digital infrastructure that support learning and development initiatives. This includes learning management systems, collaboration platforms, and digital content development resources.

Cultural Transformation: Organizations should recognize that digital transformation is not merely a technological change but requires cultural adaptation. Developing learning-oriented cultures that value experimentation, knowledge sharing, and continuous improvement is essential for maximizing learning effectiveness.

Building Technological Readiness: Organizations should invest in developing employees' digital literacy and technology acceptance. Training programs that build confidence in using digital tools can enhance the effectiveness of digital learning initiatives.

Integrated Learning Approaches: Organizations should adopt integrated approaches that combine digital learning technologies with traditional learning methods. Blended learning approaches that leverage the strengths of both digital and face-to-face learning can optimize learning outcomes.

Continuous Learning Support: Organizations should provide continuous learning support, including technical assistance, mentoring, and learning resources, to facilitate effective learning in digital environments.

5.4 Limitations and Future Research

While this study provides valuable insights, several limitations should be acknowledged. First, the use of secondary data limits the ability to control for all potential confounding variables. Future research should consider primary data collection to address specific organizational contexts and individual differences.

Second, the study employed cross-sectional data, which limits causal inferences. Future research should employ longitudinal designs to examine the temporal dynamics of digital transformation and learning

effectiveness relationships.

Third, the study examined organizational-level variables and may not capture individual-level learning processes. Future research should investigate individual-level factors, including learning styles, motivation, and self-efficacy, that influence learning effectiveness in digital contexts.

6. Conclusion and Recommendations

6.1 Summary of Findings

This study examined the relationship between digital transformation maturity and employee learning effectiveness through a comprehensive analysis of secondary data from 547 organizations across 12 industry sectors. The findings provide strong empirical evidence supporting the positive relationship between digital transformation and learning effectiveness, mediated by organizational culture and moderated by technological readiness.

The study makes significant contributions to understanding the mechanisms through which digital transformation influences employee learning outcomes. Organizations with higher digital maturity demonstrate superior learning effectiveness, and this relationship is partially explained by the development of learning-oriented organizational cultures. Furthermore, technological readiness enhances the positive effects of digital transformation on learning effectiveness.

6.2 Recommendations

Based on the findings, the following recommendations are proposed:

For Organizations:

1. **Develop Integrated Digital Learning Ecosystems:** Organizations should create comprehensive digital learning ecosystems that integrate learning management systems, collaboration tools, and performance support systems. This integrated approach ensures that learning resources are accessible and aligned with work processes.
2. **Foster Learning-Oriented Cultures:** Organizations should deliberately cultivate cultures that support continuous learning, experimentation, and knowledge sharing. This includes rewarding learning behaviors, providing learning opportunities, and creating psychological safety for experimentation.
3. **Invest in Technological Infrastructure:** Organizations should ensure adequate technological infrastructure to support digital learning initiatives. This includes high-speed internet connectivity, modern learning platforms, and reliable technology support.
4. **Build Employee Digital Capabilities:** Organizations should invest in building employees' digital literacy and technology acceptance through targeted training programs and continuous support.

5. **Implement Blended Learning Approaches:** Organizations should adopt blended learning approaches that combine digital learning technologies with traditional learning methods to optimize learning outcomes.

For Policymakers:

1. **Promote Digital Learning Initiatives:** Policymakers should support organizational initiatives that promote digital learning and skill development through incentives, grants, and recognition programs.
2. **Support Digital Infrastructure Development:** Governments should invest in national digital infrastructure that enables organizations to implement effective digital learning programs.
3. **Develop Digital Literacy Standards:** Policymakers should develop and promote digital literacy standards that guide organizations in developing employee capabilities.

6.3 Conclusion

Digital transformation represents a significant organizational change that fundamentally alters how organizations operate and develop their workforce. This study demonstrates that digital transformation maturity positively influences employee learning effectiveness, mediated by organizational culture and moderated by technological readiness. Organizations that successfully navigate digital transformation while simultaneously developing learning-oriented cultures and building technological readiness are better positioned to achieve superior learning outcomes.

The findings emphasize the importance of integrating technological, cultural, and human factors in digital transformation strategies. Organizations cannot simply invest in technology and expect improvements in learning effectiveness; they must also address the cultural and capability factors that enable effective learning in digital environments.

As organizations continue to navigate the complexities of digital transformation, understanding the mechanisms through which digital technologies enhance learning effectiveness becomes increasingly important. This study contributes to this understanding by providing empirical evidence on the relationships between digital transformation, organizational culture, technological readiness, and employee learning effectiveness. The findings offer valuable insights for practitioners and researchers seeking to optimize learning outcomes in digitally transformed organizational contexts.

Declaration of Conflicting Interests

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